for N.H.W.

FreeFalcon + RedVIPER

4.0 meets 4.0

What you have is a WORK IN PROGRESS.

It is by no means a “Finished Product”. The Team wishes to stress this from the outset.

One may consider this release a “Beginning”. We are relying on our community of Virtual Pilots to ensure that FF4.0/RV1 will develop to its full potential.

Every “patch” could be thought of as a “Work In Progress”, however - this is especially true of the FF4.0/RV1 release. For - with this release - the sim has moved forward to embrace a new Graphics Engine. With the community’s input and testing, we will continue to develop the RedVIPER Engine in order that it may take advantage of later DX versions.

That work is already well under way.

This release is NOT the “end” of development; it represents the BEGINNING of the FreeFalcon/RedVIPER development road. As such, the Team is happy to present you with this product in its current state of development. We trust that you will have a blast with the improvements to date, and we very much look forward to your input in our continued efforts to develop Falcon™

The FF/RV Team is proud of what it has achieved thus far.

We are even prouder, however, of what we will achieve in the future.

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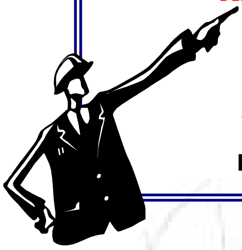


READ THIS → ***This is an "Automated" Document.*** ***Most Pages are ACTIVE…!***

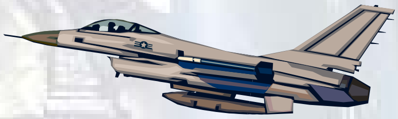
By clicking on the title icons, you will be taken directly to the selected page.

You can return to the Contents of this document by clicking on

various **"Snakes"** **"Pictures"** and **"Icons"** located at the bottom of many pages.

For ease of Navigation, you should also use the BOOKMARKS Tab (*to the left*)

ff4.0/RV Improvements



Improvements

ff4.0/Redviper Features

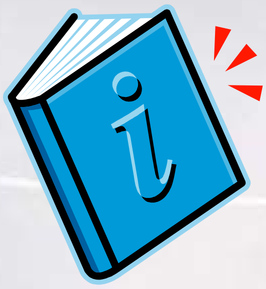
Features

The Redviper Graphics Engine

Cover shows screenshot from ***FreeFalcon***

Manual ©2007

Book #2



Skratch's

RedVIPER Operations Guide

FreeFalcon/RedVIPER is a dedicated group of 3D modelers, skin artists, programmers, campaign builders, tweakers and just plain old enthusiasts. Our diverse group includes people from North America, Europe, Australia, South America, South Africa and Asia. We range from seventeen to sixty-something years old, with former Army and Naval Aviators, computer programmers, lawyers, students, engineers, skilled laborers, writers, educators and Rock Stars.

The one thing we all have in common: The love of the world's finest Aviation Simulator.

Falcon 4.0™ was released eight years ago, and - over the years, we have seen many improvements as different groups have striven to improve our beloved sim.

FreeFalcon/RedVIPER continues the effort with this – our latest production – FreeFalcon 4.0.

***FreeFalcon/RedVIPER's* goal is the continuation of the free development of Falcon.**

Remember – the picures and icons are to help you navigate the document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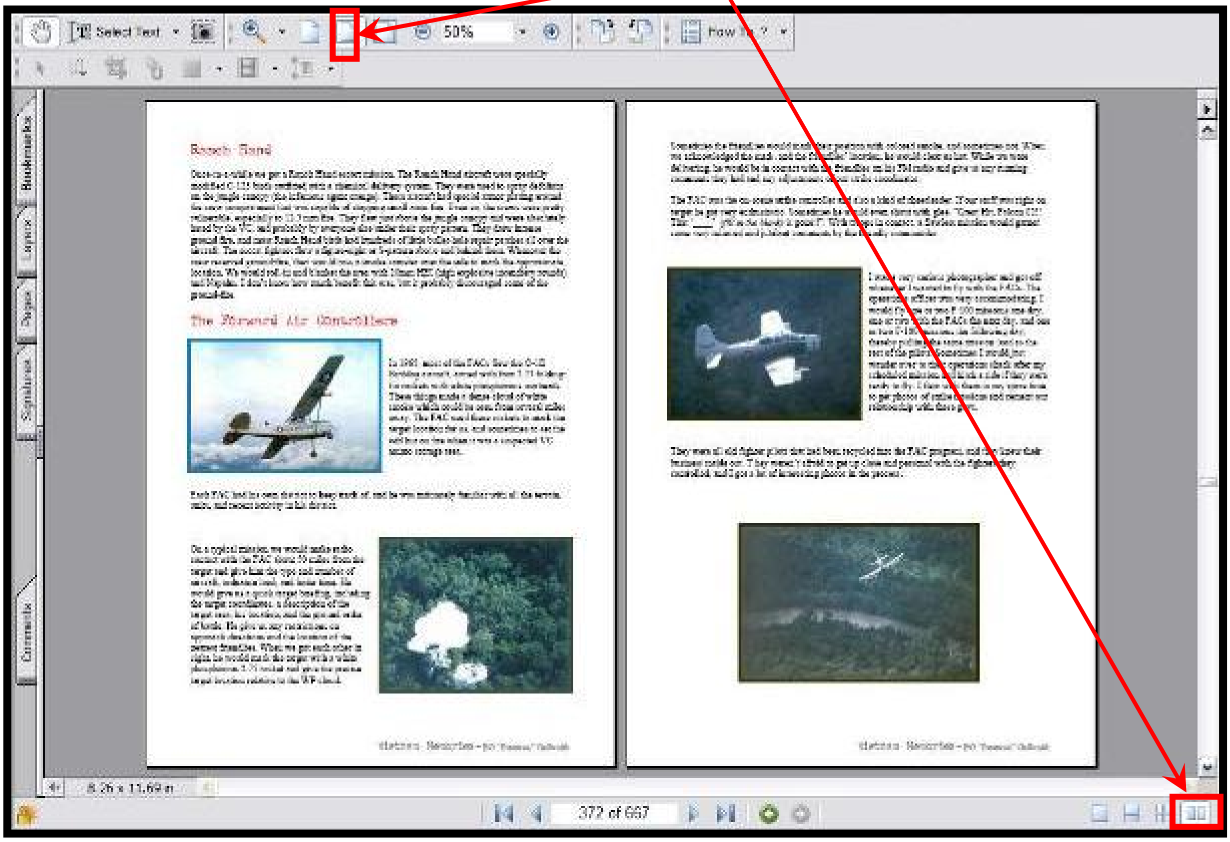
For ease of Navigation, a 2-page spread is recommended.



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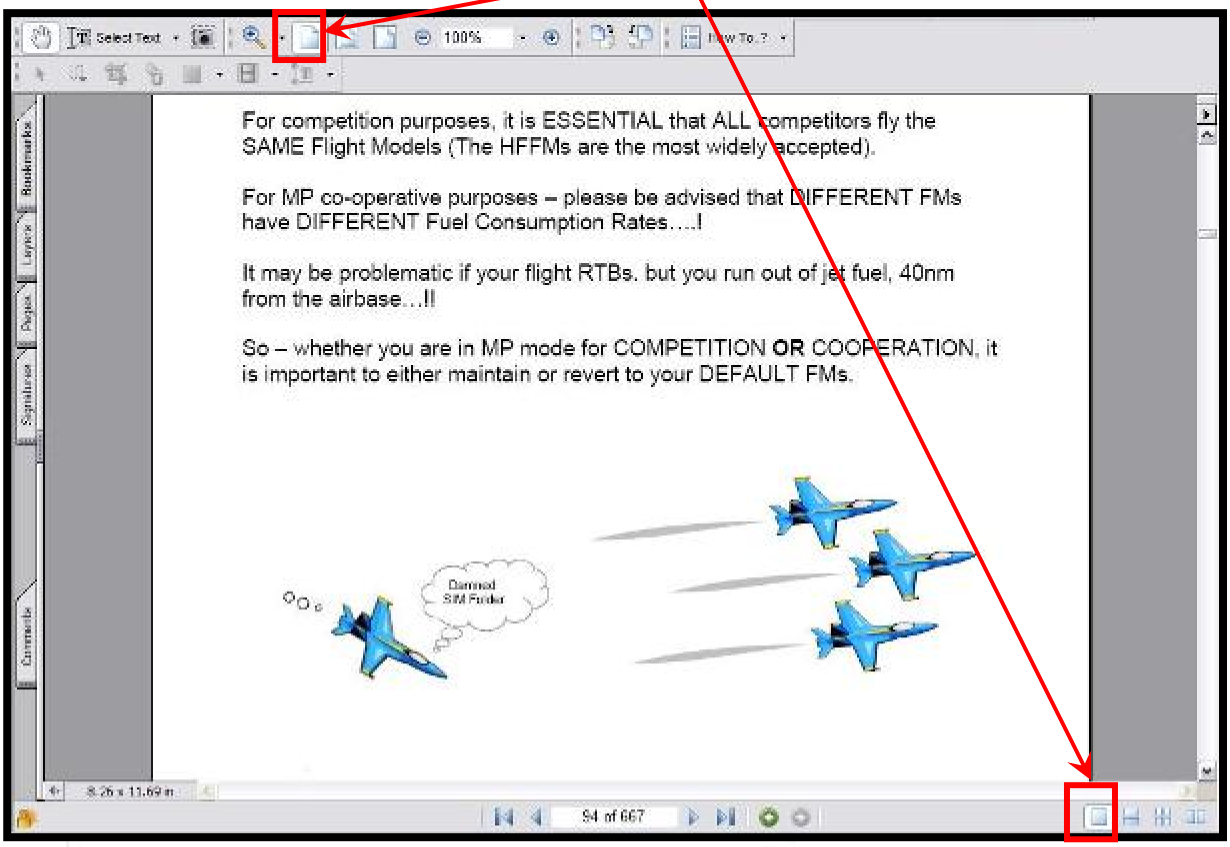


This Manual consists of Two BOOKS *(+ some Handbooks & Guides)*

Book #1 is a ***COMPANION*** GUIDE.   Book #2 is an ***INSTRUCTIONAL*** GUIDE

This Manual aims for edutainment, and an overview of what's new in our beloved sim.

This Manual cannot teach you how to fly the Viper.
It is assumed that you will follow the ***"Study Programme"*** outlined in this Guide.
Book #2 will assist you in this area.

This Manual presents an eclectic variety of Tutorials and Lessons for both n00b & Veteran. These lessons are largely lost on those who have not followed the "Study Programme".

A firm knowledge of Falcon 4.0™ is a 'given' to the serious simmer.

This Manual ***WILL*** introduce you to some of the new features of FreeFalcon/RedVIPER.
It is recommended you read BOTH Books of this Manual.

This Manual will give some description of the processes running in the background; the machinations of the *FreeFalcon 4.0/RedVIPER* simulation experience.

Book #1 will ***NOT*** concentrate on technical details/aspects of the Software.
Book #1 will use **GSST**™ (*Gorny's Special Simpleton Terms*).
Where possible, it will refer you to related technical documents (such as Book #2).

This Manual ***WILL*** provide a variety of TACTICS and TUTORIALS, to hone the skills of both the n00b and the Veteran alike. *(see the Disclaimer Pg. 538)*

In past iterations, solid technical information has usually been combined with the more "User-friendly" information, in the form of a single manual. This has led to the less "tech-savvy" FreeFalconeer having to sift through various levels of information.

For FreeFalcon 4.0, we have decided to provide this Companion Guide. THIS document is intended for the average "Pilot on the Street". For those who wish to access it – more "Flight Operations" type information is available in **BOOK #2**.

Book #2 – *Skratch's RedVIPER Operations Guide* will provide a less sundry approach to your reading. A "Combined Ops Guide"; its purpose is to draw together several disparate sources of vital information into one integrated document. **Consider it a RedVIPER Pilot's Handbook.**

A combination of the Gorny "light" approach with some serious learning; a combination of two Guides into one Manual. An overall theme of something special to mark a special release.

Hopefully, this methodology will make your visitation to this Manual far more relaxed.

And enlightening

And fun.

Book #1

Gorny's (Free)Falcon Companion

Rationale:

This Guide is an exercise in Edutainment. The integration of enjoyment into a Knowledge Base. This author believes that information should never be divorced from enjoyment. This manual seeks to both inform, and entertain. To this end, a certain balance has been struck with regards Visuals, Technical aspects, Tutorials, Lessons, Nature of contributions, and Variety of content.

Book #2 *is inclusive with regards the overall balance.*

Book #1 is an **Eclectic compilation** *of all things Falcon and Falcon-Related.*

Learn. Enjoy.

Frequently Asked Questions

Can I install FreeFalcon 4.0/RedVIPER 1 *over my* Open Falcon *install ?*
No.

In order to install FF4.0/RV1, *do I need the ORIGINAL* MicroProse Falcon 4.0 ™ ?
Yes.

Is it possible for you to answer questions with MORE than one word?
Perhaps.

Is the new 3D Pit fully compatible with my Track IR™ *?*
Yes. The new 3D pit has been re-worked to enable the FULL 6 DOF capability of Track IR™.

How can I attract women the way YOU do, Aragorn *?*
You can't. This level of "cute" is gOD-given.

Where can I find support for this product?
Check the Section of this Guide called: "*Band of Virtual Brothers*".

Is it LEGAL for me to have this product on my Hard Drive?
FreeFalcon has ALWAYS complied with the directives of the IP Owner.

Is it LEGAL for you to be so handsome?
Good question. Please wait, whilst I ask my mirror.

Why doesn't my F-16 have AIFF?
Make sure you are flying a version of the F-16 that has AIFF in Real Life, or for a less realistic approach – check "All Aircraft AIFF" in your *RV Config Editor*

Was Gomer Pyle REALLY gay…?
You'd need to check with Rock Hudson.

There seem to be "Bugs"….!?
Naturally. A commercial product – of course - should not be bug-ridden. Basic business sense dictates such. This release – however - is a labor of love, provided to you free of charge by a group of dedicated volunteers. It is those who provided this gift, whom have borne the cost. We expect "Bugs". And – ***together*** – you and the FF/RedVIPER Team will eradicate them. ***See Page ii***

Refer to – (a) **BAND OF VIRTUAL BROTHERS** *for support information.*

Should I wear my underpants on my head when I fly FreeFalcon?
Most certainly. Unless T-Rex's grandmother is wearing them on HER head, at the same time.

I CAN'T CONNECT TO MP…!! Grrrr….!
DISABLE ***Windows Firewall***.

Who's Rock Hudson?
He was Tom Cruise when Tom Cruise was a sperm.
(Some people speculate that Tom Cruise is STILL a sperm. He is very small.)

May I use 16bit colour in the Graphics Setup?
You may. BUT – it won't work. **Please select 32 bit colour.**

The switches and buttons in my 3DPit "click", but they don't MOVE…!
At this stage, due to limitations of the 3D cockpit model available, the switches and knobs are not animated. Due to this lack of visual feedback, some of the controls were not included.
If problematic, you should use the 2D cockpit to set these controls.

How can I improve my FRAME RATES?
Refer to ***Appendix #2*** in this Guide.

What is a ***UTAR*** *™ ?*
U*p* ***T****ight* ***A****nal* ***R****etentive* – one whom considers robotic technical exchanges as the sole reason for the existence of the Falcon Community; the friendships and camaraderie of which are nothing but a distraction to the importance of one's own inferiority complex.

Should I select Direct3D **HAL** *or* Direct3D **T&L HAL** *in the U.I. Graphics Setup?*
Direct3D T&L HAL.

I'm getting confused with all the terminology and acronyms.
WTF? STFU! IMHO, you should go to the back of this Guide. It's sierra hotel. LOL © *Butcher_SS*

My jet is "sinking" into the runway. It moves okay, but it is only half above ground.
Check that the Vehicle Magnification Slider *(Graphics UI)* has been set to "**1**".

I can't STEER on the ground…! How do I enable my Nose Wheel Steering?
Universally despised, you have no friends; no future. Try: "**Shift**" + "**/**"

I keep getting an **L2 Error** *during installation*
One little space in your install path can cause this. Remove ***all*** the spaces in your install path.

How do I get rid of those blue lines in the 2D pit?
Go to Falcon's User Interface/Setup/Graphics/Advanced - Enable ***Font Texel Alignment*** checkbox.

I wish to fly a ***different*** *aircraft. How can I fly another plane; NOT the Viper?*
"***Campaign***": find a squadron which is flying a different aircraft, and join THAT squadron.

"***TE***": Build your own; choosing the aircraft you wish to fly. *(See the Tutorial Section for details)*

"***Instant Action***": the default A-A aircraft is the F-16CJ, while the default A-G aircraft is the F-15E.
Check your falcon\campaign\save folder and open the folder called "***instant***".
This folder has instructions and samples.

What manuals should I read so I can fly this damned jet…?!
See the following section: "A Study Programme".

Is there a limit to the number of ACMI files I can store…?
Having an EXCESSIVE number of ACMI files can result in a SLOWING of Load times. Just how many ACMIs constitute "excessive" is debatable. Be advised, however, that if you are talking in the vicinity of "hundreds", you will suffer LONG delays. Clean them out, or simply store them in another folder.

Do "Video Drivers" make a difference…? Which should I use…?
See the *"Driving Miss Gorny"* section, in this Guide.

Is it true that FreeFalcon are a bunch of Liars and Thieves?
Depends on which Dev Group you are conversing with.

I got a FAQ about the operation of the jet. I can't see the answer here….
Try the FAQ in ***Skratch's Guide***. Failing that → *Band of Virtual Brothers* Section.

What is the keystroke for the **THRUST REVERSER***…?*
Tap **'k'** twice. *(You'll see a confirmation in the upper right of the screen.)*
Tapping **'k'** once more will end the TR function.
Remember → Like sex: The more thrust you apply, the MORE you'll slow down… ;)

What is a guaranteed pick-up line, that will never fail…?
Try: "Hey, baby – let's go back to my place, and name your breasts."

I find your sense of humour distracting and disturbing. Advice..?
Learn to love me.

When I'm flying the jet, the engine sound suddenly cuts out. It usually happens when I'm above 600kts. Strangely, when I slow down – the sound suddenly starts again. Bug…?
No. This is meant to simulate the breaking of the Sound Barrier.
Although not entirely realistic, it provides an auditory clue for S.A. And – it's kinda' cute, 'eh..?

What is "S.A."?
S.A. refers to Situational Awareness. The pilot's awareness of what is going on around him.

Is it true that mrivers was eaten by a manatee off the coast of Florida?
Not sure. But where can I get me one of those manatees….?


Should I fly with ***Simplified****;* ***Enhanced*** *or* ***Realistic*** *Settings…?*
Of course – your choice.
However, you have just downloaded the *FERARRI* of Flight Simulators.
Should you leave it in the garage…? Use it for shopping…? OR -
Tear down the strip at 300km/h leaving all in your screaming, flaming wake…..?
IF you choose to fly with anything OTHER than Realistic settings, please consider that – at some stage – you're going to have to learn AGAIN when you "step up".
I'd like to think of the Realistic Settings as a long-term investment, as to the Simplified "short term".
You have the greatest Flight Sim on Earth here. Hey → Why not USE it….?

Is Falcon 4.0™ dangerous?
Only if you attempt to ingest the CD or packaging, or if your ego is writing cheques that your body can't cash. Either way, you're quite possibly mental.

Can I install FF4.0/RedVIPER over my **Allied Force™** *Install…?*
Interesting question. Whilst FF4/RV1 is not intended to be installed over AF, and whilst attempting to do so may ruin your existing AF and F4 installs… We can't GUARANTEE that it ***won't*** work.

Does this Sim. glorify war…?
No. It glorifies the abilities of the world's Jet-Fighter Combat Pilots; their skills and bravery.

How can I improve my FPS (frames per second)?
I already answered this on the last page. Pay attention, dude.

Can I do that stunt from Top Gun, where I slam on the brakes and the Mig shoots past me?
Sure. If you want to be Foxtrot Uniform with a missile up your six.

What is Foxtrot Uniform? Where is my "Six" located?
By the time you reach ***Gorny's Mother of all Lists***, I'm sure you'll have worked it out.

Can I install the ***HFFMs*** *Patch.*
No. The HFFMs are the **DEFAULT FM's** for FF4.0.
If you attempt to patch with a 3rd Party add-on, you will render your install unplayable.

Can I install my ***3rdParty*** **Payware** (e.g. Pits and HiTiles) *with FF4.0/RedVIPER…?*

'Pits → At the time of release – 3rd party pits may or may not work correctly. Please visit the FF Support Forums for updates, fixes and information. We expect that 3rd Party Developers will soon modify their products for complete compatibility with RV1.

HiTiles → Refer to the ***How To Section*** on Page100

Where is the **FLY BUTTON...?** *I can't see it in the U.I.*
Have you stopped your clock…?
Re-start your clock, and the "FLY" button should appear.

Will FreeFalcon/RedVIPER break up my marriage?
We'd like to think so. But – we can't make any promises.

Where can I "disable trees"…? I'm looking for FPS.
This is no longer an option in FF4.0/RV1. To do so would have adverse effects on your install.

Can I install **BaZT** *with FF4.0…?*
No. It is incompatible. The stock KTO in RV1 now has an increased elevation to the terrain. Modifying the terrain elevations with BaZT will cause the ***radar LOS calculations*** to be incorrect.

Forget about it…! I wanna' play Falcon 3.0™
See: ***Appendix #3***.

Who's the coolest dude on the boards…?
The Penetrator.

A STUDY PROGRAMME:

This Guide includes the most comprehensive collection of Tutorials and Tactics available.
But – your life in the Virtual skies can't START here.
Therefore - in addition to this Guide - I would suggest the following:

Required:

Falcon4.0™ Manual *(Included with your Original Falcon4.0™ Product)*

Covers EVERY ESSENTIAL.
Absolutely required reading.
Training Missions by Pete "Boomer" Bonanni.
BFM Tactics
Includes ALL facets of the Sim.
Glossary and Index included.

SP3 Manual * *(Covered in* ***BOOK #2****)*

ESSENTIAL Updates.
Covers UPDATED avionics and weapons delivery.
UPDATED Systems & Weapons
UPDATED Wingman commands
Ramp start
Keyboard Reference
Dada's Poem

BMS2.0 Manual * *(Covered in* ***BOOK #2****)*

ESSENTIAL Updates.
Covers UPDATED avionics and weapons delivery.
UPDATED cockpit functions
Sound and Graphics Updates
Weather Updates
UPDATED Autopilot, Systems & Weapons
UPDATED operation of twin-engine jets
UPDATED ATC

* *Skratch's* **RedVIPER Operations Guide** (**BOOK #2**)

COMBINES several existing Manuals into **ONE** convenient document…!

Recommended:

RP5 Manual *(Available for download)*

FF3 Manual *(Available for download)*

CobraOne Manual *(Covered in* **BOOK #2***)*

Falcon4.0™ Checklists *(Produced for the community by* ***Olivier*** **"Red Dog"** ***Beaumont****)*

Art Of The Kill *(Spectrum Holobyte. Pete "Boomer" Bonanni)*

Supplemental:

Hughes/Raytheon AIM-120 AMRAAM Operations Guide

(Written for eFalcon v1.10 by ***Stephen*** **"HotDogOne"** ***French****)*

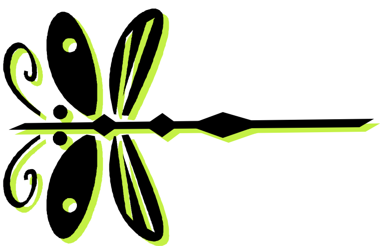
LANTIRN
AN/AAQ-13 Navigation Pod AN/AAQ -14 Targeting Pod Operations Guide
F-16C/D Block 50/52

(Written for the Superpak 3 Series of Falcon 4.0 by ***Wayne*** **"Black Cat"** ***Timmins****)*

AN/APG – 68 (V5) Operations Guide

(written for eFalcon 109 ***by Stephen*** **"HotDogOne"** ***French****)*

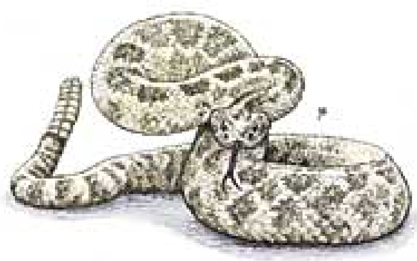
SP4 Manual



For help in finding these (and other valuable resources), please refer to the ***"Band Of Virtual Brothers"*** Section.

ff4.0/Redviper Improvements

- Data Improvements
- Artificial Intelligence
- SAMS & IADS
- Multiplayer
- RedVIPER Enhancements
- PS – *I love you*
- The Campaigns
- Campaign Tips with *“Skratch”*



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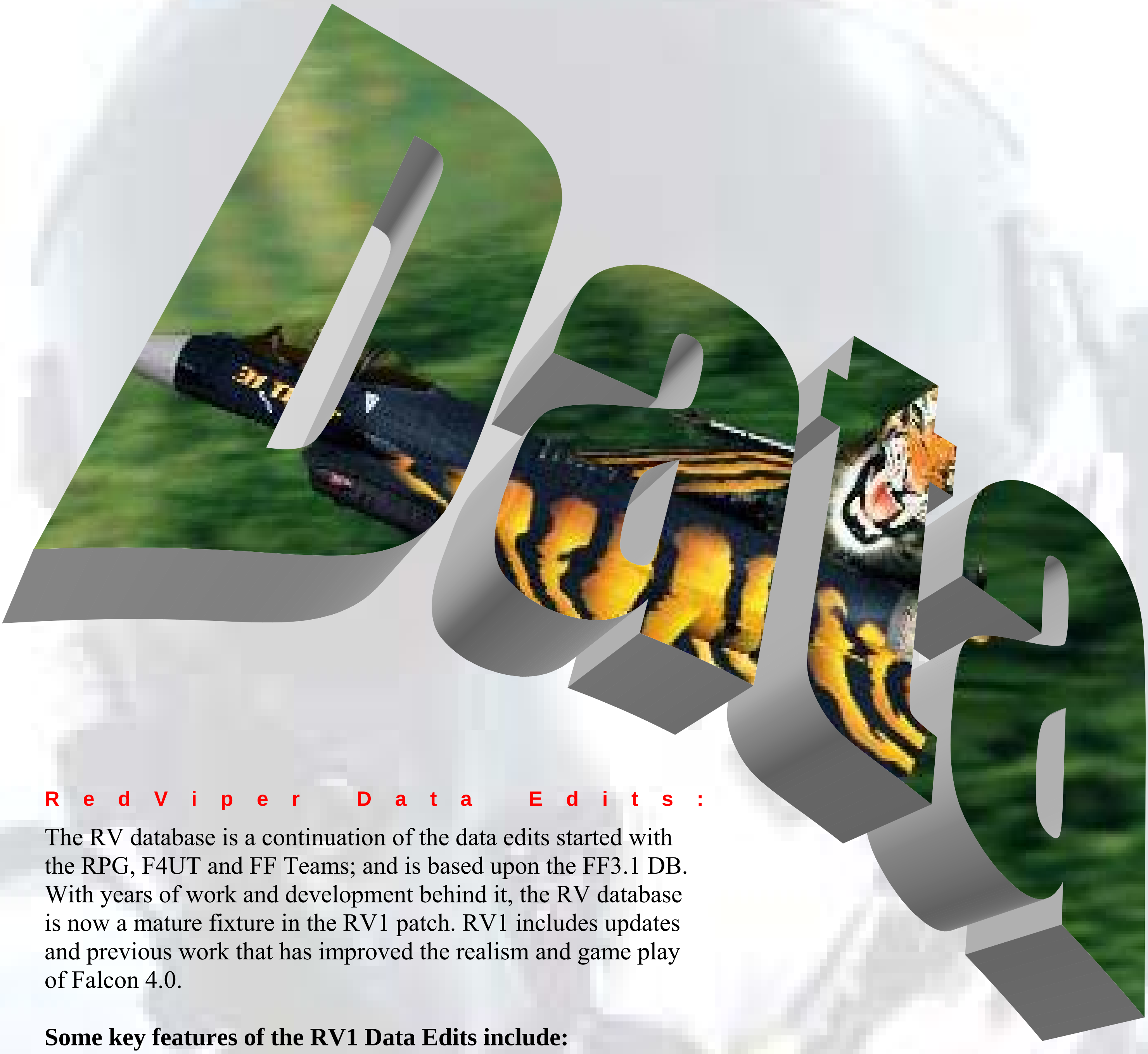


RedViper Data Edits:

The RV database is a continuation of the data edits started with the RPG, F4UT and FF Teams; and is based upon the FF3.1 DB. With years of work and development behind it, the RV database is now a mature fixture in the RV1 patch. RV1 includes updates and previous work that has improved the realism and game play of Falcon 4.0.

Some key features of the RV1 Data Edits include:

- Flight models
- New additions & Updates
- SAM and IADS Updates
- ATO Updates
- Terrain Elevation
- Campaign & Theatre Update
- DPRK Asymmetrical Warfare in RV1 campaigns:
- 2D Scoring Study and edits
- F4 Reserves Test

IMPROVEMENTS

BARCAPs in campaigns:

The FF4.0 Dev Team was finally able to figure out a problem that has bugged Falcon4.0™ for years: Getting the AI to CAP areas of the map *besides* the FLOT. This feature has been added to all of our campaigns in FF4.0. This mostly applies to **OPFOR** aircraft.

They will now fly CAP sorties in different locations all over the DPRK and once they are airborne, the ATO will redirect them to intercept your flight, if you are flying near their area. Whereas in earlier iterations of Falcon, it was highly unlikely, in FF4.0 it is now possible to encounter MiGs deep into enemy territory. Missions become more challenging AND more realistic.

HARMs & SAMs:

FF4.0 has tweaked the behavior of SAMS and HARMS for added realism.

The FF4.0 Dev Team discovered an inherent problem, in that SAMS would automatically go active at MAXIMUM range. They would then remain ON, thereby exposing themselves to certain death via HARMs fired at MAXIMUM range. In Real Life, SAM operators can turn on their radars, acquire a target, and then turn their radars back off. F4 AI does not allow for such tricky operational procedures.

FF4.0 reasons that, whilst the maximum SAM ranges in F4 may reflect the max range of the SAMs in real life; this doesn't necessarily mean that the SAM will start painting your aircraft at THAT range. This is an area of the DB in which we have made some realism tweaks. We have now adjusted the ranges at which the SAMs track and fire at your aircraft. By lowering the overall radar ranges at which the SAM will step through all of its search-track-guide modes, we have reduced the 100%Pk "Magic" HARM Shot.

Effectively, what this now means, is that the range at which the SAM goes active is shorter. So - the human pilot has a smaller window of "free fire" before the SAM starts shooting back. FF4.0 expects this will make SEAD missions far more challenging for the Virtual Pilot.

No more "Free Ride" with SEAD, so to speak...!

F4 Reserves Test

The "Percentage of available aircraft" and "Minimum available aircraft" settings in your configuration utility are commonly known as F4Reserves. These settings affect the amounts of flights generated by the ATO during campaigns. The FF4.0 Team conducted a series of tests on the different sortie rate variables available in the **RV Config Editor**. The effects on the campaign ATO were noted. After testing the different settings under a variety of conditions, the FF4.0 Team discovered, implemented and pre-set the best settings for increased realism in FreeFalcon4.0/RedVIPER.

It is recommended that users leave the stock settings as they are.

(These are:)

- **set g_npercentage_available_aircraft 40** *(see The RV Config Editor Section)*
- **set g_nminimum_available_aircraft 4** *(see The RV Config Editor Section)*

2D Tests of aircraft, weapons and SAMs:

The FF4.0 Development Team spent much time looking at the **2D world**. A detailed study was conducted to review the effects of data edits and how they affect the 2D scoring in Falcon 4.0. While the 2D world in Falcon 4.0 has long been known to suffer from realism problems, our research allowed us to solidly identify various problems. Subsequently, we were able to adjust the 2D effects of weapons to create more overall balance throughout the entire database.

SOME of the findings upon which we based our edits were as follows:

- Higher scores are given for planes that have more weapons. Some aircraft - due to larger weapons loads and some unbalanced scoring values - were able to achieve highly unrealistic damage results in the 2D world. This included a combination of scores from the aircraft files and the weapons file. One example we noted were the F-15Es, since they carry more bombs than most other fighters. With the previous data, a 4-ship flight of F-15Es, for example, was simply too powerful. This data has now been adjusted so the 2D scores are more reasonable. Once some basic parameters were determined, adjustments were made for all aircraft and weapons so that no aircraft is given unrealistic scores
- It was noted that the 2D world does not take into account the blast radius of weapons when scoring, but only the damage amounts. Along with this finding, it was noted that CBU type weapons with high blast radiuses were getting very low 2D scores. These were corrected.
- The SAM 2D performance was disappointing. The SAMs are scored based upon time and distance the flights are in relation to the SAM radius of shooting. The AI in 2D does not perform any type of reaction to SAMs. They just keep flying towards their target and drop their bombs. If the SAM scores are high enough, they might lose one or two planes, but they might not be scored until after they drop their bombs which means they still kill the target. Unfortunately, the AI will not jettison their ordinance in 2D if attacked by SAMS.
- Some weapons were found to have the wrong amount of hard point divisors, which gave them scores higher than normal. These were corrected in RV1.
- A-A 2D performance was deemed to be a little better. The AI may jettison their A-G ordinance in 2D if engaged by enemy fighters. This usually means the interceptors disrupt the strike mission.
- With these edits, AI campaign weapons selection should see marked improvement.

***Note:** Unfortunately, some of our findings were not able to be edited, and – therefore – continue to give unrealistic results. In particular, the scoring of SAMs and the effects on flights in 2D are still considered problematic. While this is an area for future consideration, it will require code edits for improvement.*

FMs - 3 x the choice

FF4.0 has modified the DB so that you – the Virtual Pilot – can CHOOSE to freely interchange THREE (3) different sets of F-16 Flight Models. The FMs are: FF2, FF3.1, and H-F-F-Ms.

FF4.0 uses the High Fidelity Flight Models (Mav-JP & Raptor) as the default set.
(See Flight Models Section for details)

ATO/Mission dat file edits:

The FF4/RV Dev Team experimented broadly with this file. The *mission.dat* file is one of the key files that instructs the ATO what to do with missions. After extensive testing of data changes and observance of broad-term consequences of such, several initiatives we'd implemented were later removed, leaving only the most stable tweaks and edits. FF4.0 has fixed several problems, including number of missions generated, and problems with HAVCAPS.

The FF4/RV Dev Team also discovered what caused the airmobile mission to generate 12 planes in a flight, and why those planes routinely flew on top of one another.

FF/RV Dev Team has also modified the airmobile units in our campaigns.

Changes to the RV1 ATO are as follows:

- SEAD strikes are now called SEAD/DEAD and feature 2 - 2 ship flights of SEAD aircraft with the 2nd flight carrying CBU type munitions. This was designed to emulate the "Hunter-Killer" flights that are common SEAD/DEAD tactics.
- Pilots should see some improvements in escorts for certain types of missions.
- Transport flights now will generate sorties on a normal schedule.
- Low-altitude strike is now a mission feature for certain aircraft assigned these scores.
- SEAD sweep is now a mission available only in TEs for SEAD type aircraft.

New additions & Updates:

Several updates and additions are now a part of the RV1 DB. For more details, pilots should take time to review the updated Tactical Reference Database (Tacref).

Below is a sample of what is new:

- Aircraft updated with newer weapons or capabilities:
  Luftwaffe F-4F, KF-16 Block 52, & F-4ESK.
- AIM-120C: RV1 has several new variants of the AIM-120C missile.
  Several of these variants feature long ranges and some improved capabilities.
- PL-12: The Chinese PL-12 MRAAM has now entered service with the PLAAF.
  It has similar capabilities to the AIM-120B or AA-12 ARH missiles.
- Several new vehicles are now operational, including the ROK K1A1 MBT & the Chinese DK-9 SAM system. Additionally, several vehicles like the Chinese Type-69 MBT were updated or changed to increase realism.
- Most of the ground units of the ROK, PRC and DPRK have been updated to reflect current force levels and unit structures.
- Weapon 2D damage scores were modified as a result of the 2D scoring study.

Artificial Intelligence

INTELLIGENT Artificial Intelligence

RedVIPER *(RV1)* features numerous improvements, bug-fixes and tweaks to many facets of the Artificial Intelligence *(AI).* Whilst some changes are subtle, and others obvious; all are significant.

Take time to read through these changes whilst being aware that not all of the improvements are listed. There are many more surprises lurking "under the hood".

- ***AI Sensors in RV1***
- ***Air-to-Air & Targeting AI Updates***
- ***Air-to-Ground AI Updates***
- ***Additional Fixes and Updates***

Sensor Capabilities:

In previous versions of F4, the AI would respond to A-A threats using "cheats" in the code. These "cheats" gave the AI some unrealistic sensor abilities. This area of the AI code has been revised considerably, and endowed with multiple enhancements.

Some of the changes made to this facet of the RV1.exe are as follows:

✓ The AI have the same sensors as human pilots: RWR, visual and IR sensors.

✓ AI will now respond to RWR spikes, and will use RWR spikes as a form of sensor.

✓ AI has more realistic visual sensor abilities. This includes the AI's ability to see incoming missiles that do not trigger launch warnings (IR). Now, in most cases, AI pilots cannot detect IR missile launches that are fired behind or below their visual sensor ranges. Providing they are not inside the AI's visual sensor range and have been detected by other means, Pilots with their radars off should be able to **sneak up behind enemy aircraft**. Due to the improvements in RV1, you will also notice more "blind spots" in the AI's visual detection abilities.

We've also included sensor adjustments and enhancements for considerations such as: Size of target; Time of day; Use of afterburner; Lights; Flares; Contrails; Smoke *(from damaged entities).*

✓ The AI can no longer detect incoming IR or ARH missiles at long ranges unless the missile is within a certain distance of their aircraft, or if the missile goes active (ARH).

This will make BVR missile shots with ARH missiles more realistic.

- ✓ **AI will no longer respond to radar “bugging” by human pilots**. If you “bug” an AI aircraft with your FCR, it no longer is used as a way to tell the AI of your presence. Additionally, wingmen will not call out *“buddy spike”* if you bug them with your radar.

- ✓ AI will now be aware of SAM spikes and will respond by calling out “Mud Spike” and turning on jammers if available.

- ✓ **AI missile evasion code is now improved**. AI will attempt to perform a variety of maneuvers in an attempt to defeat an incoming missile. In some cases, this may mean the AI is able to defeat some missile shots fired from longer ranges.

Air-to-Air & Targeting AI Updates:

The A-A action in Falcon 4.0™ has arguably been its most exciting feature. Since the Viper has been one of the world’s premier dogfighters for the past 25 years, A-A has always been one of the strengths of this legacy fighter. Combine this with the BVR capabilities of the AMRAAM missile, and the F-16 has become the “complete” fighter.

To reflect this situation, RV1 features improved BVR and WVR AI behaviour.

Some of the updates to the A-A AI are as follows:

- ✓ A-A flights will now take advantage of the new sensor and targeting updates. This includes responding to radar spikes.

- ✓ AI now uses a new scoring system to determine and analyze threats. AI tactics will now change as the threat situation changes. Fuzzy Logic…!!!

- ✓ **AI will react to aircraft using improved tactics**. Whereas in past iterations, the AI might simply have flown straight toward its intended target, RV1 gives your AI the ability to fire and then beam…!! Pilots should also see some improvements in AI intercept tactics when encountering 4 ship flights.

- ✓ Depending on the circumstances, AI flights may now engage targets at longer ranges, and also use missile shots to put opposing flights on the defensive.

- ✓ **The AI will no longer lock up a target when firing an ARH missile**…! Pilots will now need to be more cautious when going against planes like the Su-27 series, which carry the AA-12 missile. The only way you may know you have been fired upon is the RWR warning once the missile goes active.

- ✓ Depending on the conditions, **AI aircraft now have the ability to target more than one aircraft** during combat. This is most noticeable when using ARH missiles (AIM-120/AA-12). Once the AI ARH missile goes active, the AI shooter may move onto another target and subsequently fire upon it. In some situations if the targets are within the active range of the missile, **certain aircraft have the ability to ripple multiple ARH missile shots at different targets** in a short amount of time. Generally this applies to multiple targets that are less then 10 NM away.

- ✓ **AI will now sort targets according to threat potential** and will first attack those that are deemed to be the greatest threat. This means that if flights of F-15s are escorting B-52s, the F-15s will be targeted first and - if destroyed – the bombers will be subsequently targeted.

- ✓ AI fighters on strike flights are now more responsive to A-A threats. If threatened within a certain radius whilst on a strike mission, the AI fighter flight will turn and engage the threat with A-A missiles. They may also jettison their stores, depending on the level of threat. If the AI flight is not capable of shooting A-A missiles *(attack/bomber),* they will perform defensive maneuvers, and may jettison their stores

- ✓ AI Strike mission CAP and SEAD escorts will most likely NOT target non-threat aircraft *(attack / helos / bombers)* if passing nearby whilst escorting Strike aircraft. This should eliminate the past problem of escorts chasing non-threat aircraft whilst on strike missions. However if Escort / SEAD / Strike aircraft encounter enemy fighter types, they will break formation and engage the bandits. This may include all the planes in the strike package if all are fighters.

- ✓ Improvements have been made to the AI IR missile targeting.

Air-to-Ground AI Updates

- ✓ **The "Weapons Free" command now really is weapons free**. If you give your wingmen the weapons free command, the AI will search the area for a target (A/G) and kill it. You don't have to wait until they ask for "permission".

- ✓ **AI is now aware of A/G spikes**. They will call out "MUD spike" and turn on jammers as listed below. This is helpful when AI flights are near SAMs. This also changes the dynamic of jammers v. SAMs in the game. Note the changes to SAMs and their firing ranges as a result of this AI change.

- ✓ **AI will now drop bombs in single, pair or ripple, depending on the bomb type**. In general, 2,000lb bombs will be dropped as singles 1,000lb bombs as pairs and 500lb bombs will be released simultaneously. Additionally, CBUs will be dropped only in pairs permitting the AI to make multiple passes on targets.

- ✓ **AI is now better at sorting targets** when on strike missions.

- ✓ AI targeting and bombing with **CBUs has been improved**.

- ✓ AI flights now show **improvements when using HARMs**. They will fire at longer distances depending on the SAM and will normally space their firings so they do not waste HARM shots as before.

Additional AI Fixes & Updates:

Fuzzy Logic

The AI now takes advantage of a fuzzy logic system *that allows them to react more intelligently to their situation. There are no cheats here. The AI has a scoring system which moves from 0 to 90. The closer to 90 the more defensive; the closer to 0 the more offensive. The tactics they will choose are based upon this score.*

The AI will assess their own group strength, missile range, altitude, speed, position, etc. The great news is that now **as the situation changes so does the AI tactic***.*

For example, consider a 4 Vs 4, F-16 Vs F-16. The initial attitude might be offensive. As the fight progresses and a wingman is killed, the flight is now outnumbered and the "score" is becoming more defensive.

The AI tactics will EVOLVE *according to the evolving situation…! If a speed and altitude advantage emerges, so too will new AI tactics emerge in concert with the new advantage.*

- ✓ Worked a fix for AI climbing too steeply and stalling out
- ✓ Allow AI to keep speed when returning back to base. *Before this fix, the AI would switch to landing waypoint after their target and then fly home at 300 knots. Now they will maintain correct waypoint speed until 15 miles from the airbase*
- ✓ AI will attack from various altitudes, dependant upon ordnance
- ✓ More realistic behavior when the AI feels threatened
- ✓ Fixed problem with other planes not taking flight lead when lead gets shot down
- ✓ Fixed problem with AI aircraft ignoring threats when flying their combat waypoints
- ✓ Fixed DATALINK HSD bug where flight members disappeared after others in the flight were killed
- ✓ Wingman, Element, and Flight command menus will now update real time. A player may keep a menu open and make selections with the FCR or HTS and the appropriate commands will activate. Player no longer needs to cycle the menu for updates.
- ✓ Dropping stores or firing missiles/AGMs will now cause airframe buffet.
- ✓ ALOW now defaults to 10 feet

SAMs & IADs

U p d a t e s :

In the world of your virtual campaign, SAMs are the single greatest threat to your F-16. The SAM simulation in FF 4.0 still operates much as it did with the SP3 Patch, although a few improvements have been made for RedVIPER1 ***(RV1)***. In the real world, SAM systems can be quite complicated and, when integrated into an IADS, will likely perform differently than what is modeled in Falcon 4.0™. But for RedVIPER, a study was conducted of SAM operations and how they functioned in Falcon 4.0.

A few new discoveries were made, which have resulted in the following changes and updates to RedVIPER:

- **Addition of Search Radar to SAM units:**

It was noted that most F4 SAM systems only have one radar in the unit, whilst in real life they usually have at least two types: Search radars and track/guide (fire control) radars. Depending on the type of unit and the way it is organised, some SAM systems may have two or three different radars functioning. After extensive testing and development, most SAM systems in RV1 now have two radars operating in the unit, as follows:

Search/acquisition radar:

Used by most SAM units to provide initial range, bearing and altitude information that is passed on to the Fire Control Radar (FCR).

Fire Control Radar (FCR):

Provides final track & guidance for SAMs (e.g. Fan Song, Low Blow). Pilots now will see a different type of symbology in their TWS/RWR scopes when encountering SAMs. Initially they will see an S or other symbol that indicates search radar is targeting them. As they come closer to the unit, they will see the search radar step through the search, track and guide modes as in earlier versions. When they get within the firing distance of the SAMs, they will see the FCR activate and begin tracking them. In some instances this shows just as the SAM is being launched and is usually a number in the TWS like “2” for the Fan Song radar of a SA-2.

- **Revision of SAM ranges when AI uses jammers:**

SAM systems have not always reacted well when AI has approached with active jammers. In many instances, the SAM radars turned on too early in the engagement. This exposed them to SEAD attacks for extended periods before the SAMs were able to burn through the jammers and fire back. This was considered poor AI, since in real life SAMs are likely to stay turned off until the targets are close enough that their jammers are not effective anymore.

As a result of these facts, SAM radar ranges and engagement distances have been lowered considerably to accommodate the shorter range they have when the target is jamming them. While SAMs in RV1 will now engage at lower ranges than in previous patches, the effects of ECM will be reduced as well, since targets are now more likely to be within the radar burn-through ranges of the SAM units.

- **Placement of SAMs /IADS:**

Comprehensive testing was done to evaluate the effects of the IADS (Integrated Air Defense System) in Falcon 4.0. While SAMs in Falcon 4.0™ generally act independently of one another, they do have the ability to use the search radar of longer range radars to minimize search times required for engagements. While the way this currently works may very well be a bug (or at least buggy), it is known that Falcon 4.0™ uses SAMs that overlap one another as a "form of IADS". This is where the search radar of one SAM supports the search timing of other SAMs within a certain range and placement on the map.

- **Early warning radar units:**

This new unit was added to RV1, and it supports other SAMs by providing search radar functions as listed in the IADS notes above.

Alternative guidance methods for SAMs:

Several SAM systems that have optical guidance capability have now been given this feature in FreeFalcon 4.0. Additionally, **some SAM systems may continue to fire unguided missiles after their radars are destroyed**. Thus, be sure to load the AI with CBUs in case their HARMs become ineffective…!

Gorny's Tips'n'Hints:

Hey – why not PRINT OUT the original F4 Manual..? Then – you can BENCH PRESS it between missions. This way – you can hone your fighter-pilot skills and develop a big chest…! Be the envy of the gym *AND* the virtual skies…!

Multiplayer Improvements:

The FF/RedVIPER team has made a great leap forward with the previously frustrating ***Multiplayer Code***. There are now some major CTD fixes in the code.

Probably the most noticeable for the player will be the fix to the common ***CTD*** which would happen when a units' status was going to be updated in certain situations (like a battalion being bombed, and losing some resources).

There are also some important UI fixes, like, changing munitions, waypoints and flight time. The old code was not updating some of these things.

Another major improvement: There is no longer any need to use the -ip switch in command line (new identification system).

Also – the new code allows for using different ports. One may setup a client using any port above 1024. This - together with the new ID system - makes the following scenario possible:

- Alice opens a server on her private network with 2 machines (A1, A2). She connects them, having 2 players. Bob has a private network also, with 3 more machines. He can connect the first of them (say machine B1) to Alice's server. Then, he can connect the other 2 machines (B2, B3) connecting to B1. This way, B1 will tell B2 and B3 what other machines are connected and all 5 will see each other (A1, A2, B1, B2, B3).

Other LANs could connect to the game in the same way…!

To Summarise:

- The -ip command line switch is no longer required.
- A new command line switch (-port) makes it possible to use different ports and - as a result - multiple clients inside a LAN can play with others outside.
- Multiple CTD fixes
- Improved MP code for detection of failures.
  Great news for debugging and continued development.

Great news indeed for the MP Community

Instructions for Setting up Multiplayer

→ What's different?

To allow multiple clients behind the same router, the falcon ID system was rewritten.

This has produced the following effects:

- *Network card detection is no longer necessary.*
- *The -ip switch in command line is no longer necessary.*
- *A new -port switch was added to command line.*

→ Connection settings: At comms window, select Internet.

Choose the bandwidth setting most appropriate to your system *(and be conservative)*. For example, if you have a 256kbps upload/1024kbps download connection, you should choose 128kbps (always lower than your upload).

→ Connecting as Server: Enter the 0.0.0.0 ip and hit connect.

→ Connecting as a Client: Enter server IP and hit connect.

→ If you are inside a VPN: Falcon uses UDP ports 2934 and 2935. If voice comms are used, 2936 and 2937 are also used. If you are the last client to join the game, you don't need port forwards. Otherwise, forward those ports to your machine.

Server MUST always forward ports to its machine if behind a router.

→ If you have more than one client behind the same VPN: Its possible to have multiple clients behind the same router. For this, it's necessary to use different ports for each client and also to use a different connecting scheme.

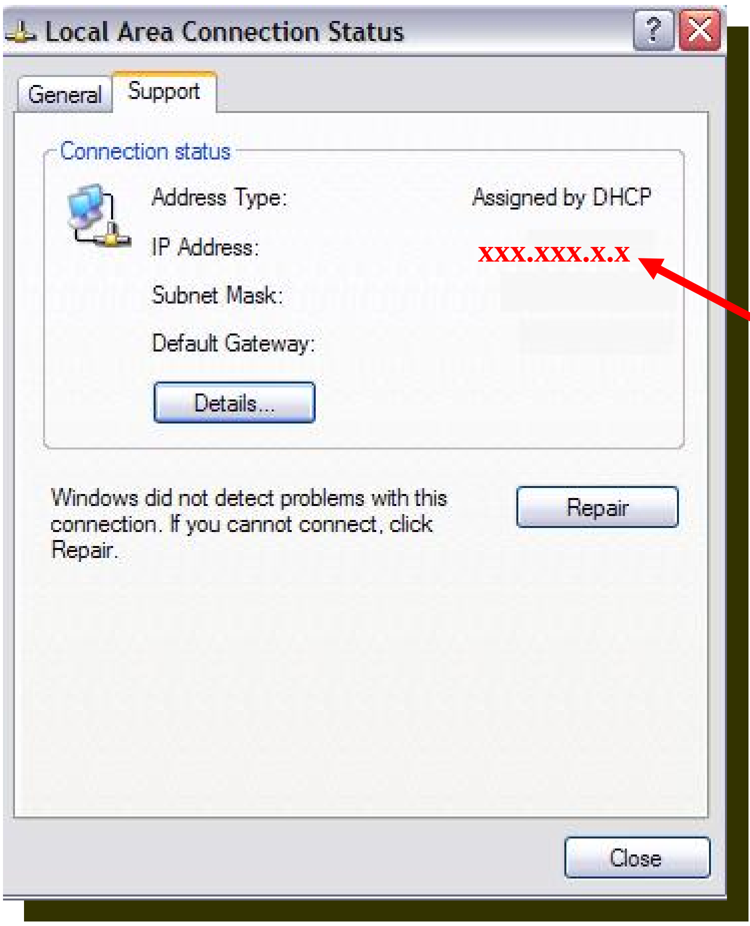
- First client connects normally to server.
- Subsequent clients will need to use *-port switch* at the command line. For example, a second client could use *-port 5000*, meaning falcon will use port 5000, 5001 (and also 5002 and 5003 if voice comms are used).
- All these ports need to be forwarded to the client using them.
- Also, these clients MUST connect to the first client and not to server.

For example:

We have a host H and 2 client machines (A and B) inside a VPN (V), connecting to H.

- The V router needs to be configured to forward UDP ports 2934-2937 to A and UDP ports 5000-5003 to B.
- Machine A connects to H IP.
- Machine B connects to A local IP (inside VPN). If a third client (C) at the same VPN wants to join, router needs to forward 4 more ports *(based on C -port switch)* to machine C.
- C connects to A IP *(like B).*

H O W T O F I N D Y O U R I P



START → Control Panel → Network Connections → Connection Name → Support

Configuring Falcon 4

Make sure that EVERYONE has consistent Falcon 4 configurations & RV Config Editor settings. It is especially useful to ensure that everyone has built-in voice comms either ON or OFF. Likewise, all users should have JetNet Uplink either ON or OFF.

Lots of other options are also significant, and need to be kept **consistent**

Voice COMMS

RV uses DirectX 8 Directplay Voice. Therefore, DirectX 8 or later must be installed on your system *(see: www.microsoft.com/directx)*. In addition, you must initialize your microphone by running Voicesetup.exe (in the *"UTILITIES"* folder).

Real-time voice communication between players greatly enhances online game play. You can now use "real" radio to communicate with other players!
If you want to use voice comms, enable it in the RV Config Editor

(If editing manually→ Go to "*// use voicecom"* and "*set g_bvoicecom "1*)

Communicating in the User Interface

In the User Interface, use the keys "F1" and "F2" to activate radio comms on two different channels (hold the appropriate key while talking - it acts like a transmit button on a radio):

- Channel 1: Guard (Other team members in the UI or the 3D world)
- Channel 2: Everybody who is in UI

Communicating in the 3D World

Once flying in the 3D world, the keys used to transmit are the ones defined in the keystrokes.key file and will radio on whatever channel COM1 or COM2 is set to on the UFC. The audio volume of each channel can be adjusted by using the knobs on the audio panel in the cockpit. The available frequencies in the 3D world are similar to those in the original Falcon 4.0:

- **Flight:** Other flight members who have at least one radio set to flight
- **Package:** Other package members who have at least one channel set to package
- **Guard:** Other team members will hear (even though there is no radio set on guard)
- **Broadcast:** Everybody connected to the server (doesn't matter if in 3D or User Interface)
- **Tower:** Others who have the same takeoff base and at least one radio set to tower.

To change frequency, select COM1 or COM2 from the ICP. Then use [Alt-z] to switch channels.

Fly-Any-Plane In MP Dogfight

The Dogfight module now allows for every online player to fly whatever aircraft is available. For example: If four online players want to fly 2 F-15s vs. 2 MIG-29s *(or any other combination)*, this is now possible…! For this to work correctly, the following procedure must be followed.

Note: **The host alone must make all the changes listed below**. *If any client does this, it will not work and the client or host may CTD. The host is the person who started the Dogfight module from the COMMS lobby.*

To fly any aircraft in Dogfight, the host must:

1. Follow the normal procedures for connection setup and entering Dogfight module.
2. When in the Dogfight lobby with each player on the proper team, right click on a player's aircraft. This displays this player's dogfight menu.
3. On the player's dogfight menu, navigate down Change Aircraft to the desired aircraft.
4. When the cursor is over the desired aircraft, left click the aircraft. The dogfight menu will close and the aircraft icon will change to the selected aircraft.
5. Repeat this for each aircraft as necessary.
6. After all changes are made and each player is ready to fly, the host must be the first one to select "Fly." The other players are to follow only after the host has clicked Fly.

**** Note 1:*** *Changes do not always appear immediately for the clients.*

Though the host sees the changes properly on his computer screen, the clients may take several minutes to update. Everything will still work correctly though the clients do not see their aircraft icon change to the new aircraft selected.

**** Note 2:*** *The following step is mandatory to avoid CTDs for clients…!*

Setting Up A Campaign:

When a host starts a new campaign, the clock stops and the priorities setup screen appears. This allows the host to configure the campaign as desired from the beginning. ***The important thing is that clients must wait for joining until the host has set the campaign priorities!***

Dedicated Server mode:

• Using the option "**MP Server mode**" in the RV Config Editor, you can put RV into a dedicated Multiplayer Server mode.
Clicking the box in the editor next to “MP Server Mode” enables this.

• Using the sub-option "**MP Host all units**", the server will have the full CPU load of all aggregated and deaggregated units and the network traffic they afford. This option is designed to be useful for a fast CPU server with a high bandwidth hosting many players with low bandwidth connections.

Dedicated Voice Server

If you want to host large multiplayer games with more than a few players, it is a good idea to setup a separate voice server (Use the voiceserver.exe to setup a dedicated voice host). No matter how many players, this host will use mixing techniques to reduce bandwidth load to the clients to max 3.2 kb.

To use a voiceserver, the clients need to point to the host's IP address by setting the *g_stvoicehostip* variable in the config file (i.e. *set g_stvoicehostip "130.123.33.23"*)
A mixing server requires some CPU power so it's not recommended to run the voiceserver.exe while playing Falcon on the same computer. In this case, just run Falcon normally - the Falcon built-in host will act as a forwarding server which doesn't require that much CPU power.

Choosing the server

Now decide amongst your online MP buddies who has the best online MP connection to be the server and then calculate how many clients will be possible.

- For the server, you need both high bandwidth and stability/consistency.

- To determine how many clients a server can support, do a rule of thumb calculation and figure ***33 kb for each client***. Therefore, divide the Server bandwidth by 33 to get approximately how many clients can be supported by that server. Do not try to support more clients than the bandwidth can sustain: Major warping and players getting dropped are usually indications that you need to try again with fewer clients, smaller "-bandwidth" settings or both.

Note that the Server host is the person who *HOSTS* the Dogfight or TE or Campaign mission. The Server is *NOT* the person who puts their IP address (or the popular 0.0.0.0 IP) in the UI and has others connect to him. So, the person with the fastest online connection that you want to be the Server must also host the mission. It doesn't really matter much who hosts the connection, since the person hosting the mission will automatically be the Server and all others will be Clients.

About voice-comms

If you use the built-in voice comms in RV, note that - due to MS DirectX features - the voice server host is the connection host person who puts in their own IP address (in the UI) and ***NOT*** the person hosting the mission (This does not apply if you use Roger Wilco or other voicecomms and have disabled the built-in comms).

Also note that the voice comm server does NOT work from behind routers and NAT.
This is a limitation of MS DirectX Direct Voice, so the voice comm. server must be directly on the Internet and cannot be a client behind a router.

Starting a flight

When committing from the UI to the flight to start the mission, one player at a time should enter instead of everyone at once. Note, this can still create chaos on taxiways.
When a player clicks his "Fly" button, the other players will automatically receive the message "is committing now", from him.

Be prepared to stop your aircraft from rolling and be alert for other moving aircraft.
If possible, it's a good idea to stagger flight times so they won't occur too close together.

Router / Firewall Issues

If you have an external router or firewall, you most likely need to open up UDP protocol on some ports to allow Falcon to work through it *(See your router or firewall documentation on how to open up or forward ports).*

• For Online Multiplay: UDP on ports 2935 and 2934

• For internal Voice Comms: UDP on 2936 and 2937 *(Doesn't work..? Perhaps try* Roger Wilco*).*

*** *To fly MP* - DISABLE WINDOWS FIREWALL ***

RedViper Enhancements

- New Gear / Wheel Animations
- Translucent HUD fonts
- Realistic Night Vision
- New Control Surface Animations
- New Exterior / Formation Lights
- New Canopy Transparency

At night, the canopy is now invisible (as it should be), however – when lit from an exterior light source - the canopy reflection becomes evident. *(See GFX Section for more)*

- Animated Pilot/RIO Heads

During flight, the RedVIPER code has 5 different scenarios picked at random.
Each scenario can have up to 9 different pilot head movements.

On the ground the pilot looks right, left, then down at the instruments.

Also both the pilot and WSO/RIO turn their heads in the direction of the stick movement (up, down, left and right), **AND follow your Track IR...!**

- Thoroughly Re-worked Particle System

More realistic and exciting Explosions & Smoke Trails. Featuring realistic shock waves; flying debris; realistic damage effects depending on weapon and target-surface; more transparent smoke; all new textures; and, realistic AAA. All at the most minimal FPS cost in Falcon history.

- Turbulence

FF4/RedVIPER includes a sophisticated turbulence model that takes into account a wide variety of conditions. A player will experience different turbulence intensities and durations depending on weather conditions, time of day, altitude, vicinity to clouds, and terrain.
Also modeled is tropopause boundary turbulence (35k-36k altitude).

- ## Improved Situational Awareness

FF4/RedVIPER includes improved sounds, and FX to aid in your immersion and situational awareness. Deployed Speed brakes will now result in visual turbulence; meaning no more forgetting to retract brakes during dogfights and maneuvers. Also – highly realistic GEAR lowering, retracting and locking sounds complement your virtual flight.

- ## JDAMS

JDAMs are regular Mk series dumb bombs with GPS/INS guidance kits attached. They do not have any type of propulsion systems.

JDAMs work in two different modes: PB *(Pre-briefed)* and TOO *(Target of Opportunity)*.

*(See **Tutorial Section** for the Use of **GPS BOMBS** in RedVIPER)*

- ## JSOWS

JSOWs are a standardised medium range precision guided weapon, especially for engagement of defended targets at ranges outside that of standard anti-aircraft defenses, thereby increasing aircraft survivability and minimizing friendly losses

JSOWS work in two different modes: PB *(Pre-briefed)* and TOO *(Target of Opportunity)*.

*(See **Tutorial Section** for the Use of **GPS BOMBS** in RedVIPER)*

- ## SCAN MODE IFF Scan

Mode IFF is now featured on the FCR (fire control radar), together with AIFF on the NAV HSD. IFF works by sending a signal to other aircraft and then interrogating the return of the signal in order to determine if the radar contact is friend or foe.

*(See **Tutorial Section** for the Use of **IFF** in FF4/REDVIPER)*

- ## Hot-pit Refueling

Anytime you are at a complete stop on any Taxiway or Parking ramp, you can press **T-7** (ATC menu) for "Request Hotpit Refuel" and get Hot-pit refueling. Upon your request, you will hear the ATC reply *"Cowboy X, copy"* and your fuel tanks will begin to be refueled at a reasonable rate. This also works for Guests in Multi-player. Additionally, in the Dogfight arena, all Host and/or Guests have to do is land and come to a full stop on any Runway, Taxiway or Ramp. They do not have to request Hot-pit Refuel, as they will be automatically refueled.

- ## Terrain Elevation

The stock Korea Theatre in RV1 now has an increased elevation to the terrain. Pilots see higher mountain peaks, which will add to both the immersion and realism of your experience.

Note: *Modifying the terrain elevations with other resources such as BaZT may cause the radar LOS calculations to be incorrect*.

Various Improvements in FF4.0/RedVIPER

- All weapons *(except Rockets)* now show correctly in debrief
- Where appropriate, all correct RWR icons have the "hat" over them.
- Fixed collision bug.
- Fixed ACM radar bug: there was nothing in the code to reset the mode if a target blew up while still in gimbal limits. It now returns to search mode if target is destroyed.
- Fixed problem with missiles not self-detonating when missing or losing track on target
- **MUCH improved Afterburner animations.**
- improved FLOT FPS.
- STREAMLINED and improved F4Patch. Renamed: *The REDVIPER CONFIG EDITOR*
- Offensive A-G Option made redundant due to improvements in A.I. behavior…! Offensive A-G is now controlled by AI. This did not work properly before. If the AI are on a strike mission *(Strike/Escort/SEAD escort)*, they **will not engage** attackers. If they are intercepted, or come in contact with fighters within a certain distance, they **will engage** them. Therefore, every mission will be *"Offensive A-G"* depending on what types of aircraft they encounter, and the circumstances under which they are encountered.

WATCH OUT FOR THE:

NEW Canopy Reflections.

NEW MISSILE FLAMES.

NEW TREES.

NEW TACTICS.

Your AI companions will now launch at Multiple Targets…!
Within constraints, your flight will launch multiple AMRAAMS at SEPARATE targets.

- ✓ Improved Light engine, **about 30% faster now**
- ✓ Many of the past AI misbehaviours fixed
- ✓ MP Stability improved
- ✓ AI display more RANDOM behaviour. More like Real Life. Especially in preflight checks
- ✓ AI will tell (Human) flight leader when finished Check In

IMMERSION: 2D/3D Pit Turbulence….!

You'll notice your 'Pit *shake* in reaction to:

AirBrakes, Max VCas, Gs, Terrain,
Sonic Shock Wave, Weapons Release.

Shaking is PROPORTIONAL to – for example – Weapon release weight.

- ✓ Fixed far object view fading toward fog/haze colour with distance
- ✓ Fixed many see thrus of the 3D pit
- ✓ Fixed the missing pit in entering 3D World
- ✓ Fixed the CTD caused by the death of a player in MP
- ✓ Fixed the AI targeting Mavericks to vipers and causing CTD
- ✓ Fixed a potential CTD with Vertex Buffer Manager
- ✓ Fixed Frontal Hud Only view
- ✓ MSL STEP in AG Mode,
- ✓ Fixed the CTD happening sometimes while exiting the 3D world in DF mode
- ✓ **Fixed AI not releasing HARMs**
- ✓ Fixed the Bombing Ripple bugs
- ✓ Fixed CCIP mode Hud getting wrong parameters when TGP aboard
- ✓ Fixed CTD caused by Wheel Brakes activation when ejected
- ✓ Fixed TGP locking other targeting modes in mixed weapons loads

- ✓ MP Fixed the Connection Bug leaving a client stuck in receiving data
- ✓ **MP Fixed ground units movement**
- ✓ MP Fixed the bug cancelling any running flight owned by a captured/destroyed AB
- ✓ **Added a little jittering to Missile Flames/Lights**
- ✓ Fixed AI dropping small Dumb Bombs 2 x 2 *(B52s now will drop all together.)*

Finger On The Trigger - Some new effects

Work your HOTAS like a true Viper Jockey.

MSL Step is now controlled by Pressure Duration.

Short duration steps thru FCC SubModes with AG Bombs *(or thru pylons if not bombs)*, Long duration steps thru weapons…!

Furthermore, Realistic PICKLE is now simulated…!

Pickle pressure time is determined by the FCC SubModes.

- FCC update delay (depress the pickle button until the weapon fires):
  Radar guided missiles & HARMs.
- Instant weapon release upon depress of pickle button:
  IR A-A missiles and IR seeker A-G missiles.

- ✓ Fixed a Bug causing PS SFXs sometimes not starting
- ✓ Some new sounds engineered by “Redneck” and “Maveryck”
- ✓ Added Rotation to the PS polygons
- ✓ Improved Particle System code efficiency and speed
- ✓ New CBUs code; More realistic
- ✓ **HUD Whiteish with NVG**
- ✓ **TO/FROM Navigation bug FIXED…!**

Improvements Carried Over From Previous Release

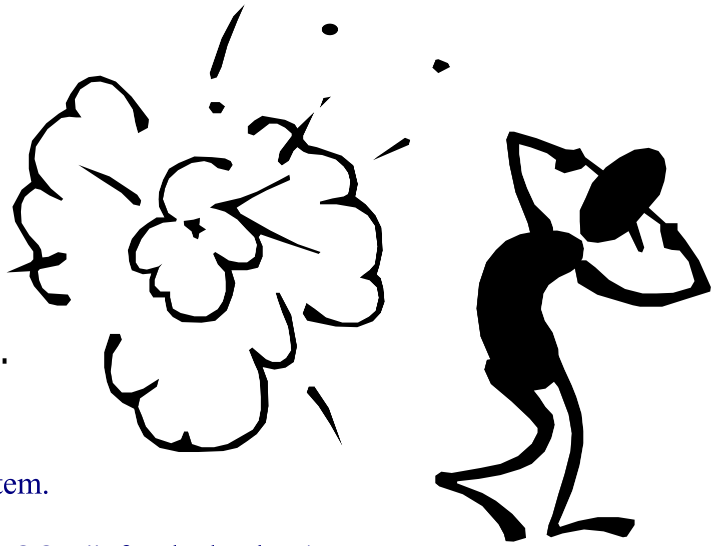
- ✓ Sky-Fix- The tod.lst file can now be edited to affect changes in sky colors and other features affected by this file. The tod.lst file is in the Falcon4\terrdata\korea\weather folder and controls advanced lighting effects and the times of day the various lighting effects are activated. Many star constellations are visible if you fly high at night. For example, Big Dipper can be seen just left of heading 360 degrees.
- ✓ Fixed the engine code issue where thrust was tied to the player's throttle and not the engine RPM. Single and Dual engine codes fixed.
- ✓ Fixed AI engine ramp starts. AI now start correctly. Dual engine AI now starts both engines.
- ✓ Added visible engine smoke while on the ground for planes that have engines that smoke. Additionally, smoke now only turns on from 80% to 100% power.
- ✓ Aircraft engine smoke is now only visible below 10,000 ft. This is more realistic and should help improve frame rates on some systems.
- ✓ Fixed AI so that the AI can fly NOE. This is set to 200’ by default, but can be lowered to 100’ by changing the settings in your RV Config Editor.
- ✓ Fixed AI ground avoidance behavior so that it is no longer jerky or pitches up sharply.
- ✓ Speech Message Voice Inhibit switch now works (Ctrl-v). Shuts up Bitchin' Betty but leaves tone warnings on.
- ✓ Wind speed and your direction shown in the briefing screen is now the same when you enter the 3D world.
- ✓ Contrails will automatically appear on aircraft when they are at proper altitude.
- ✓ ILS for Home Plate now works correctly on takeoff and return.
- ✓ The A-G missile step has been fixed in all aircraft that would stick after one cycle.
- ✓ Multiple CTD fixes.
- ✓ Time to Abort flight is changed so there is less chance of getting kicked out of line in long delays for Takeoff.
- ✓ Respawning of Taxiing jets adjustable in your RV Config Editor.
- ✓ Added player warning and then abort if he is close to landing without gear down. You will repeatedly hear the ATC call gear checks if your gear is not down.
- ✓ ATC now gives departure vector upon take-off.
- ✓ Added ATC command for when a player aborts landing sequence through the ATC Menu.
- ✓ ATC is now aware of human player on the runway and will tell the AI to go around if a player is on the runway while the AI is on final. Also, the ATC will give players or AI a go around if AI aircraft take the runway to takeoff.
- ✓ Player will now be told to resume own navigation.
- ✓ Fixed aborted AI never being allowed back into ATC cycle.

- ✓ Fixed ATC checking for AI on the runway when AI landing.
- ✓ Fixed Divert Airbase code and call-outs.
- ✓ Added display of designated ground targets of wingmen (GDLNK) on the NAV HSD. This will show a circle with the wingman's number over top of it. This is enabled by default and can be turned off by clicking the CNTRL button and then clicking the GDLNK button.
- ✓ Enhanced ADLNK and added ATA (antennae train angle) check for target display. This shows your wingman's bugged target in the HSD. ADLNK targets will now only display if within the radar constraints of the AI aircraft.
- ✓ Air-to-Air radar bug is fixed. This is the bug where your radar could not detect contacts beyond the bubble distance of the contacts.
- ✓ Speed caret on HUD has been changed back to operate on most types of aircraft. HUD specific models of the F-18, F-14 & F-15 remain the same as are described in the BMS 2.0 manual.
- ✓ The HUD Airspeed/Altitude/Radar Altitude readouts will now have a 250 ms delay in updating (like the real jets). This works for Non-F-16 aircraft as well.
- ✓ The F-16 HUD speed meter now reads 000 when under 60 knots and Mach 0.10.
- ✓ Radar Altimeter no longer turns itself off when disabling Combat Auto-Pilot.
- ✓ CTD's should be greatly reduced when using Simplified Avionics in Setup.
- ✓ Added fix for A-G radar ground light intensity being too high and washing out screen and targets.

Gorny's Tips'n'Hints:

Want to REALLY look like a Jet-Jockey…? Well – you're going to HAVE to sport the Viper-Pilot moustache. Check out the photo of Pete Bonanni. This particular model of womb-comb – combined with Aviator Sunglasses – will see your neighborhood popularity soar. ***You're a girl…?*** Don't fret. In these times of equal opportunity, there is nothing to stop a girl from sporting her very own Pete Bonanni moustache™. If it's good enough for Chuck Norris – It's good enough for you.

PS. I love you…



FF4.0/RedVIPER1 features a re-worked Particle System.

What does this mean for the virtual pilot…? More “BOOM” for the buck…!

So – what are ***some*** of the things we’ll see…?

1. EXPLOSIONS →

Explosions have been reworked with new textures, and new fluidity. For the sake of realism, generic explosions have been replaced with explosions of varied sizes specifically tweaked to match differing ordnance - both air and ground. Moreover, explosions behave more like their RL counterparts. You’ll be witness to secondary explosions – the size, nature and duration of which are directly linked to the nature of the target. Expect more violent secondary explosions from flammable targets. The Virtual Pilot will also see debris spiraling away from the impact zone. With RV1, the actual volatility of the explosion has become more realistic; the “cycle” of the explosive event, now following a much more life-like progression.

2. AC EXPLOSION DEBRIS →

Aircraft explosions now feature debris. In order to increase immersion, the mysterious “disappearing jet” phenomenon has been tweaked out of AC explosions. As the exploding jet bursts into flames, pieces of fuselage can be seen spiraling away from the fireball. Even aircraft wheels are sometimes visible in the airborne wreckage…!

3. FIRE →

When compared with our previous release - totally new…! As they burn, destroyed and damaged objects will now produce realistic fire and smoke. Again, the fire/smoke phases and cycles closely resemble real life patterns. For increased immersion, the smoke is visible from a distance. Virtual pilots will see the dynamic campaign unfolding beneath their jet. Further – the size and shape of smoke plumes will vary, and also be subject to the influence of wind direction and speed…!

4. GUN HITS →

Gun-hits are now rendered more realistically.
Gone are the “spreading, multiple small flashes”; this impact effect has been modified in both texture and intensity to appear more like the “flash” seen in real life impact.

5. TRAILS →

A boon for ALL virtual pilots, straining to see those tiny vehicles hidden in the terrain thousands of feet below. These changes to the vehicle dust trails reflect the Real Life experience of a member of the Israeli Defence Forces. Relying on his impressions, the dust trails were re-worked to more closely simulate his own experience in which combat vehicles produced “larger” and “thicker” dust trails than were the norm in Falcon™. The result is a dust-trail which is able to be seen more easily; a fidelity to more closely simulate RL conditions.

Due to precipitation, trails are not evident during INCLEMENT weather.

UTARs may note that not ALL surfaces produce dust trails. However – since the dust trails will appear anyway, we thought it best to make them as realistic as possible.

A-A missile trails have been re-worked, as have SAM trails. SAM launches now offer realistic visual cues for enhanced Situational Awareness.

And what of that old favorite of EVERY Virtual Pilot…? Spiders…?

Yes→ the ground explosion “spiders” have been reworked; looking better than ever; debris spewing outward on the billowing tendrils of smoke, fingers of dust, and tongues of flame…!

6. FPS →

The best news…? These new PS effects do not come with the FPS cost of yester-year.
On any modern machine, the tweaks to the PS mean that you can now enjoy the LATEST effects at very little cost to your FPS.

Virtual Pilots be aware: we did sacrifice a very SMALL amount of “eye-candy” for a very LARGE amount of Frames Per Second. However - in terms of beauty - a small sacrifice in “eye-candy” still leaves your FF4.0/RedVIPER install head and shoulders above any other Falcon™ version. ☺

So – what else needs to be said…?

Perhaps this: *“Let’s go and blow some shit up.”*

Some CONSIDERATIONS →

Our research has shown that whilst using AGMs, Marine Aviators in Iraq have habitually engaged ground targets at a range of about 8nm.

FF/RV decided to use this information as the point of reference for our Dust Trail effects.

Be advised that different versions of Falcon™ have had differing visual ranges for Dust trails. From 16 nautical miles to – well – nothing at all…. ☺

Whilst we believed 16 nautical miles to be unrealistic, we decided upon the real-life tactics of active fighter-pilots to influence our decision.

Therefore, you will get a MkII eyeball at 8nm. Be advised – you *may* still need to squint…

Your MFDs will also display dust trails at this range. There may be a question as to whether these dust-trails are obvious enough in the MFDs.

Whilst this question is debatable, what is NOT debatable is that RV's features and enhancements are STILL being improved.

In the near future, the RV team envisages a radical change in both the rendering of visual FX, and of the MFD display itself.

As Kermit the Frog once said: "It's not easy being Green". This is something which RV has taken to heart.

Both MFD, and Engine development continue.


Rv1
FF4.0

The CAMPAIGNS

FreeFalcon4.0 features NINE (9) complete campaigns, spanning THREE (3) different Korean theatres. Combined with the Dynamic Campaign Engine, this should prove for LONG TERM enjoyment and replayability! All campaigns feature several flyable F-16 variants & a wide variety of aircraft, units and scenarios. Additionally, full use of all of the new features in RedVIPER (RV1) have been taken advantage of.

The "Rolling Fire" campaign was designed to feature all of the updates in the RV1 DB as well as placement of units based upon real life force levels. This should be considered as the "most realistic" campaign in the patch.

Campaigns come with default ATO settings designed to improve play and realism. Pilots need to make sure the "Set by HQ" light is turned **off** when starting a campaign. This will activate the pre-set settings. Pilots need to monitor their ATO slider and PAK priorities settings as the campaign progresses. *(see Skratch's Campaign Guide)*

Pilots need to take advantage of the new Mission and Priority sliders feature in RV1. This will allow them greater control over their sortie types. Also note that the slider for bridge strikes is turned off by default.

- ✓ The IADS in all campaigns has been updated to make use of all of the updated SAM and search radar functions featured in RV1. SAMs have been strategically placed so they form an improved IADS. This includes use of Early Warning radars placed in strategic locations.
- ✓ All campaigns and the stock TE template have had their radar Line-of-sight calculations updated to accommodate the increased terrain elevations in the KTO terrain. This will result in improved NOE flying, especially near mountainous areas.
- ✓ All campaigns that feature the ROK have updates to the KF-16 and F-4ESK aircraft.
- ✓ Pilots will now notice a larger amount of OPFOR aircraft flying CAPs deeper in their own territory. This will require a greater emphasis placed on achieving air superiority before attempting strike missions deeper into enemy territory, since any strike flight is likely to be engaged multiple times by enemy fighters to and from the target area.
- ✓ The Standard Korean theatre features updates of the original Tiger Spirit, Rolling Fire and Iron Fortress campaigns. Starting with Tiger Spirit, the campaigns are aligned in difficulty from easy to hard in descending order.
- ✓ The Iron Fortress campaign now features the Allies going on the offensive depending on the conditions.

- ✓ The Eurowar theatre is designed to feature European aircraft in 3 different scenarios. All campaigns feature Allies v. OPFOR scenarios and have a wide variety of aircraft and other forces in them.

- ✓ The Korea theatre provides a few more interesting campaigns like Korea 1983 & Korea 2005.

- ✓ To reflect realism, most of our new FF4.0 campaigns have earlier start times.
  Rise and shine, pilots.

- ✓ E/W Airstrips are now mini-airbases. This was done to enhance realism, as our research indicated that the DRPK uses airstrips for their air force. Not all planes can use these.

- ✓ As stated in the AIRBASE Chapter, most of the airbases now have fences around them!

- ✓ In campaigns, **SOME** SAMs have a 2nd unit; a “microwave” vehicle hidden in the unit as a *KrAz T 255B* truck. These units are designed to make it more challenging to destroy the SAM radar since there are 3-4 radars showing up in the HTS page.

- ✓ Some SAM units now feature optically fired missiles. Only a few of the missiles in the unit are this type. These missiles **will launch at your plane without any SAM launch warning**, although the SAM will be painting you since their range is the same as regular radar guided SAMs. You may see a few of these being launched along with radar guided but not know it since they are labeled the same. These missiles will not have as high a Pk as the radar guided SAMs, but will **continue launching even if the radar is destroyed**. They can be deadly since chaff and jamming has no effect on them. In real life, many SAM units have TV cameras where they can optically guide SAMs and then detonate them in an attempt to shoot down aircraft without any radar emissions.

  We won’t tell you WHICH SAMs; wouldn’t want to ruin your surprise….

- ✓ The FF4.0 Dev Team has reworked most of the *MANPAD* missiles. This includes *SA-7/14/16/Mistral*. In previous iterations of Falcon, these missiles hardly ever hit anything! We’ve tweaked them for a more realistic challenge…!

- ✓ Added *SA-16* to more units of the DPRK, including the *KS-19* and some of the SAM units. This is in line with information uncovered during our research stages.

- ✓ Modified the following ground vehicles and units: *K1A1 (ROK MBT), K-200 (ROK IFV), K-30 BIHO (ROK AAA)* and *DK-9 (PRC mobile IR SAM)*. Also, several of the PRC and DPRK tanks have new names and some modifications to the unit structures (Type 88/Type 59).

- ✓ Due to very poor past performances, the following A-A missiles have had some modifications:

  a. ***AA-2*** b. ***PL-2*** c. ***PL-5C***

- ✓ To reflect realism, the *AA-8* is now all aspect as it should be.

- ✓ E/W airstrips should now be able to be destroyed at 100%.

DPRK Asymmetrical Warfare Tactics in RV1 campaigns:

RedVIPER has attempted to improve realism in Korean campaigns by making modifications designed to create more asymmetrical warfare for the North Korean side. Additionally, some of these modifications are a result of recent articles on tactics the DPRK has planned in the event of war.

This includes the following contrasts of Red Vs. Blue:

- The Allied ATO will generally follow standard USAF doctrines of attempting to achieve air superiority by use of SEAD/DEAD strikes, sweeps and use of escorted strike packages for strike missions. Additionally, Allied ATO will schedule all missions to be flown at medium and high altitudes to avoid enemy AAA and MANPADs.
- The DRPK will use its fighter force to stay home and defend the homeland while generating strike flights that fly at very low altitudes, are normally unescorted, and are considered "expendable" aircraft. These strike flights are designed to fly under Allied radars and cause air defenses to have more difficulty in stopping their attacks.
- Some of the DPRK fighter squadrons have been made smaller so that they can be dispersed to more locations whilst still preserving a real-life quantity of DPRK planes.
- The Allied side will generally have most of their resources above the ground; the DPRK will have a certain amount of strategic resources located in underground areas, which require more intense bombing to destroy.
- The DPRK will use some airstrips that have been converted to small airbases for staging flights by certain aircraft that are able to use shorter runways.

RedVIPER Campaign Enhancements:

Campaign Priorities Sliders:
The two sets of sliders used to adjust the ATO in campaigns have been revised to be more logical and intuitive. The sliders will now give the pilot a better understanding and control over the types of targets and missions the ATO works with as follows:

Target type: Changes include → Airbase, Airstrips, Radar & CCC, Army Bases, Power plants & refineries, Supply Depots and ports, and Factories and chemical plants.

Mission type: Three sliders in this screen will have the greatest effect on the ATO. They are **OCA** Strikes, **Interdiction** and **Strategic** strikes.

The SEAD/DEAD & Escort sliders will be linked to OCA and Strategic *(as they are support missions for Strikes).*

Addition of Army Bases, Depots and Ports to campaign production-supply system: These objectives have now been added to the production system of both sides in a campaign.

This was done for several reasons.

Ports and depots are generally used as storage sites for supplies & replacements.

In some cases, ports and depots may be very large and would be high value targets in a real war. Their destruction would likely have significant impact on the enemy's ability to re-supply his war effort. Additionally, army bases would be of similar significance due their supply, replacement and repair capabilities. Adding these three objective types to the campaign supply system not only makes them legitimate strategic targets, but their destruction will have a greater impact on the overall war. While these objectives are now part of the supply system of each team, be aware the relative contributions have been scaled down so they would be considered lower priority targets compared to power plants & factories. This is especially true of army bases, where re-supply values are minimal.

Code fixes: Several fixes were made to basic campaign operations code that should result in greater stability in game play.

Campaign Tips with SKRATCH

Settings in your RV Config Editor

**** Do not use airbase relocation unless you need to.***
In most cases, this will cause unrealistic results. The only exception is if your ground troops have made a substantial advancement and now you need helo support to advance to a base that is closer to your troops.

If you use this option, you may find that all of the squadrons that are on the aircraft carrier are now moved to ground bases.

**** Power Plants are now a Target Type Priority Slider.***

Factor strikes against power plants into your overall Campaign Strategy.

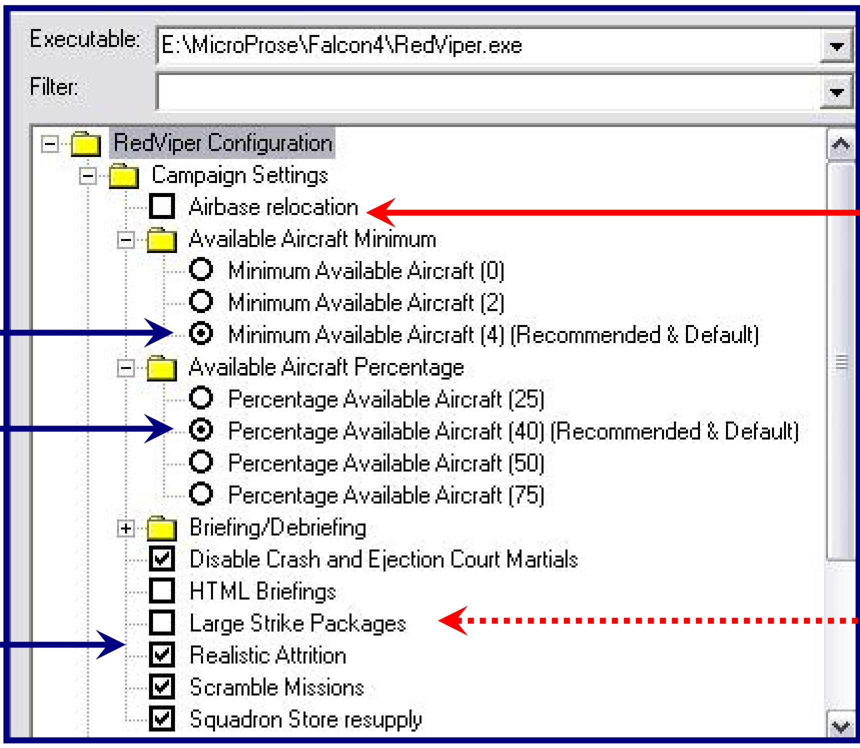
**** Set "Available Aircraft" for a realistic sortie generation.***

"Available aircraft minimum" - **4**.
"Available aircraft percentage" - **40.**

Remember, if you want more sorties, you can always add more squadrons to a campaign.

**** Try using "realistic attrition".***

This will make a big difference in the effects of attrition on your campaign *(and improve FPS).*



See pg.95

Settings upon starting a campaign

For the challenge rating, always select "rookie" settings as you start a campaign. This will set the proper amounts of forces for both sides as dictated by the campaign designer as well as the unit data editors.

"Ace" settings for both *"pilot skill"* and *"ADA skill"* are advised for maximum realism. If you are a new user of F4, you may want to lower these two settings.

When you enter the campaign, make sure you **adjust the PAK sliders** and monitor the sliders as the campaign progresses. These are found on the right hand side of the screen and are opened by hitting the "P" button. Note that you have 3 different pages. The last page is called the PAK page.
In most cases, since strikes against any objectives other than factories, refineries and power plants have little if none strategic values, you might want to move the remaining sliders all the way to the left.
Some campaigns have already had some of their priorities edited while developing the campaign.
Always make sure you click on the "set by HQ" button so that the pre-set priorities will be used and not the ones generated by the game.

Make sure you have the slider for bridges set all the way to the left or otherwise, if your ground units attempt to advance, they will encounter problems since several bridges will have been destroyed.
In some cases, this will prevent you from winning the campaign, since your ground units cannot reach their target objectives.

Strategies as the campaign progresses

Use the PAK priorities to control which areas will be assigned most of the sorties.
If you are in the early stages of a campaign, you might want to use a conservative plan and try to keep your planes closer to the FLOT until the areas beyond the FLOT become more advantageous for your side than the opposing side.
In the PAK priorities section, monitor the priorities that you assign to specific regions. If you allow the campaign ATO generator to plan sorties into areas that haven't been cleared of SAMs, you can expect the strike sorties to encounter problems. Additionally, you may have to cancel flights that you do not want to be launched. You can do this by removing the weapons from the planes in that flight and then saving. This will abort the mission. You may also have to edit the weapons loads for all of the planes in a particular strike package.

Monitor OCA.
If you allow the campaign ATO to plan numerous OCA strikes against air bases, you may find that you campaign will begin to get stale since most of the opposing side's airfields will be destroyed. You might want to lower the sliders so that the amount of the OCA strikes is lowered, resulting in more A-A action for both sides. In some cases, it may be more advantageous to destroy enemy aircraft in the air than to have the airbase destroyed, since this will give your side points and will increase the initiative for your side.

Striking power plants is an acceptable strategy. The campaign ATO will direct strikes against power plants that are close to factories and large cities. However, you may have to redirect some flights from other targets in order to make power plants your priorities.

Monitor enemy Ground Troops! If you find that enemy ground troops are overrunning your friendly positions, you'll have to attack them with CBUs and missiles. This is one of the benefits of having different variants of the F-16 in a campaign. Try using the F-16C Block 30 for CAS missions. This should become your priority until you stall the enemy's offensive.

You can hijack any BARCAP flight and use it as a strike/CAS/SEAD mission. Using RedVIPER, you can change the waypoints and weapons load outs. You can also direct your wingman to attack the targets of your choosing. If the A-A action has subsided and you find yourself with numerous BARCAPs, you can use those to attack ground troops. With the new ATO values, BARCAPs now will remain on station for 25 minutes. This will allow you to use the number 2 aircraft in the flight to attack ground troops without having to worry about a wingman. If you end the mission after using up all of your ordnance, you may still re-enter the flight as the flight lead, which should still have A-G ordnance.

You can have some influence on the movement of ground troops. You can left click on top of the unit, and if it is not committed to a specific objective, a line with a CCIP target will appear indicating the direction that the unit is heading. You can redirect the unit to another objective. Sometimes this works and sometimes it doesn't. But there are times when you can get the flow of ground troops to change by using this tactic. You can also use CAS flights to assist your ground units where they appear to be bogged down with heavy resistance. Additionally, you can use the PAK priorities to pick the areas where you want maximum troop movement. As your ground troops advance, you need to monitor where they are going if too many of them are staying behind to guard an area, it may be because you have your PAK settings too high for that area.

RedVIPER considerations:

- Campaigns come with default ATO settings designed to improve play and realism. Pilots need to make sure the "Set by HQ" light is turned **off** when starting a campaign. This will activate the pre-set settings. Pilots need to monitor their ATO slider and PAK priorities as the campaign progresses.
- Pilots need to take advantage of the new Mission and Priority sliders feature in RV1. This will allow them greater control over their sortie types.
- Note that the slider for bridge strikes is turned off by default.

Remember, the campaigns in Falcon are not perfect, but they can be challenging and fun. Whilst you may simply enjoy the flights that the campaign ATO assigns, you can also take charge and affect the outcome of the war by using some of the strategies I've mentioned above!

"Skratch"

SKRATCH'S WINGMAN COMMAND TIPS

With some of the updates to the AI in RV, a review of wingman commands and their usage is needed. *Remember:* **PB**=*Pre-briefed and* **TOO**=*Targets of opportunity.*

• Firstly, pilots need to understand that the AI uses the combat waypoints to determine their actions. If you are leading a flight with AI pilots, then you need to make sure you are changing your waypoints to the combat waypoints so the AI is on the same page as you. These are waypoints like "CAP", "Strike", "CAS" or "SEAD" as shown in the briefing during mission planning. Otherwise if you give a command such as "weapons free", the AI does not have any targets to attack and will likely do nothing.

• Pilots also need to understand that AI needs targets in order to take actions. If you are on an A-G mission and have pre-planned targets, then the AI has these on its target lists. In most cases, as the AI acquires their targets and you have switched to your combat waypoints, the AI will call out "permission to engage". This is indication that the AI has targets to attack and is ready to engage.

• Unless you want more control over your AI wingmen, the "weapons free" command should be your standard command. Whilst you may use the "attack targets" or "attack my target" commands, pilots should remember that the AI in RV already has sorted PB targets if on a Strike mission, and micro managing their actions is **not necessary**. Normally, during PB A-G missions, the AI sorted target list is set according to importance and the targets are effective.

• When on a TOO mission with either A-A or A-G stores, the "weapons free" command should be used first if the AI has targets (CAP/BAI/SAD). If the AI is unable to comply, then you'll need to target something for them, and may have to use the "attack targets" or "attack my target" commands instead of "weapons free".

• In some A-G sorties, the AI will perform poorly when given the "attack targets" command. This is usually due to the AI is not being able to set up a proper attack profile. Pilots need to remember to assign TOO targets to the AI early enough in the engagement to allow the AI to set up their assigned attack profiles, and be able to deliver their weapons.

• In the case of A-A missions, the AI also sorts targets according to combat type so micro managing A-A missions should not be necessary either.

• Additionally, sometimes the AI still does stupid things when you give them commands. In this case it is good to command them to rejoin formation and try to start over again. This often "resets" the bad AI situation, enabling you to try again with your engagement commands.

DEWDOG SAYS → Gettin' hard to see…?

Useful keystrokes to turn Haze and Advanced Lighting On/Off whilst in the 3D world:

Ctl-x,**h** *and* **Ctl-x**,**g**

I sometimes use them to lighten up terrain when I'm flying near the deck, and it starts to turn dark in the early evening.

Ma, greetings from the base

Time to recycle something which, perhaps, wasn't funny then, and – most certainly – is not funny now.
I've stumbled across one of my oft' read *(by me)* Technical Lectures.

Gorny's VIPER 1.01

The F-16 - also known as the "Fighting Falcon" - is the primary multi-role fighter of several National Air Forces.

What is the term "multi-role"...? It is a convenient excuse for losing A-A engagements.

The F-16: It has two wings, and lots of stuff attached to the wings which kill people.

Many people have been killed by the F-16.

Mainly F-16 pilots.

The General Dynamics' F-16 "Fighting Falcon" is usually grey, but the U.S. Airforce is able to get patches from the internet which feature different colours.

The "Fighting Falcon" is also referred to as the "Viper". "Fighting Falcon" was just a tad gay.

The ***NWS*** (technical term) is used to steer the F-16 on the ground.
Many Virtual Pilots ask me: "WHY do we even need to STEER on the ground...!? It's a JET. We should only need to steer in the sky."

I usually answer: "Yes. I know where you're coming from.
BUT - prepare for a shock...!"

You see, these Pilots belong to that group of F4.0 Flyers who have NEVER EVER had to R.T.B.

It's the classic situation: Airborne; Engage the "Wall Of Migs"; EJECT EJECT EJECT....

EVERY campaign; EVERY mission - yes...?
SO - they assume (as you may), that the only way home is in a HELO.

BUT (are you sitting down??) - SOME pilots actually RETURN TO THEIR AIRBASES..!! (I shit you not!)

These rare pilots (who do not end EVERY mission by ejecting), actually (wait for it) LAND...!!!! Therefore, they need to steer, in order to get to the Bar.

Many Virtual Pilots have asked me: Why are you so cute...?
I answer: "Stop being a tad 'Fighting Falcon'..."

The ***Radar*** (which stands for: "R A D A R") is called the APG with a number after it *(this number changes with each new MicroProse release).*

To fly the F-16, one must use a HOTAS. This involves TWO hands.
This sounds very much like my girlfriend (HOT-ASS).
She also requires Two hands.

There is also a zero-zero ejection seat. It’s called this, because you have a zero percent chance of not fucking up your spine, and a zero percent chance of ever again being taken seriously as a pilot.

There are many buttons and dials and switches in the F-16.
They do many technical things, like open the Canopy (a glass ‘bubbly’ thing)
The F-16's have a canopy that opens. This is so the Pilot can puke after landing.

In some OLDER Blocks (iBeta F-16; RP-F16; SP3F-16), the canopy did NOT open. The Pilot often died from asphyix...asphink...asy...asphichi…

The Pilot often died from lack of air, and/or starvation.

It was also problematic when the pilot needed to use the aforementioned zero-zero ejection seat.

Think “GOOSE”…..

The F-16 has HUD's and HSI's and HSD's and MANY, MANY things beginning with "H". This proved a BIG problem in some countries, in which "H" is NOT featured in their alphabet.

There was an experimental version of the Falcon called the F-XL.
Unfortunately, it was so ridiculous looking, that everybody was too embarrassed to fly it.

Like – here’s a big triangle, so let’s stick a glass bubble on top of it.

So – in closing – what is the FUTURE of the venerable “F-16 Fighting Falcon”…?

Retirement.

The RedVIPER Graphics Engine

FF4.0/RedVIPER features a BRAND NEW GFX ENGINE…!

The new RedVIPER Engine is the first of it's kind for FALCON 4.0™

What does this mean for YOU, the Virtual pilot…?

More true-to-life colours.

More REALISTIC shadow and lighting effects.

More graphical effects.

HIGHER FPS.

More REALISTIC textures: *plastic looks like plastic; aluminium like aluminium.*

More REALISTIC glass:

- *Glass is transparent.*
- *External light sources will render it opaque.*
- *Realistic reflections appearing on the glass!*

DYNAMIC lighting; Shadows which update in respect to the Sun's position; DYNAMIC surfaces - *changes occur in REAL time…;* Night Vision that LOOKS like night vision; affected by external light sources.

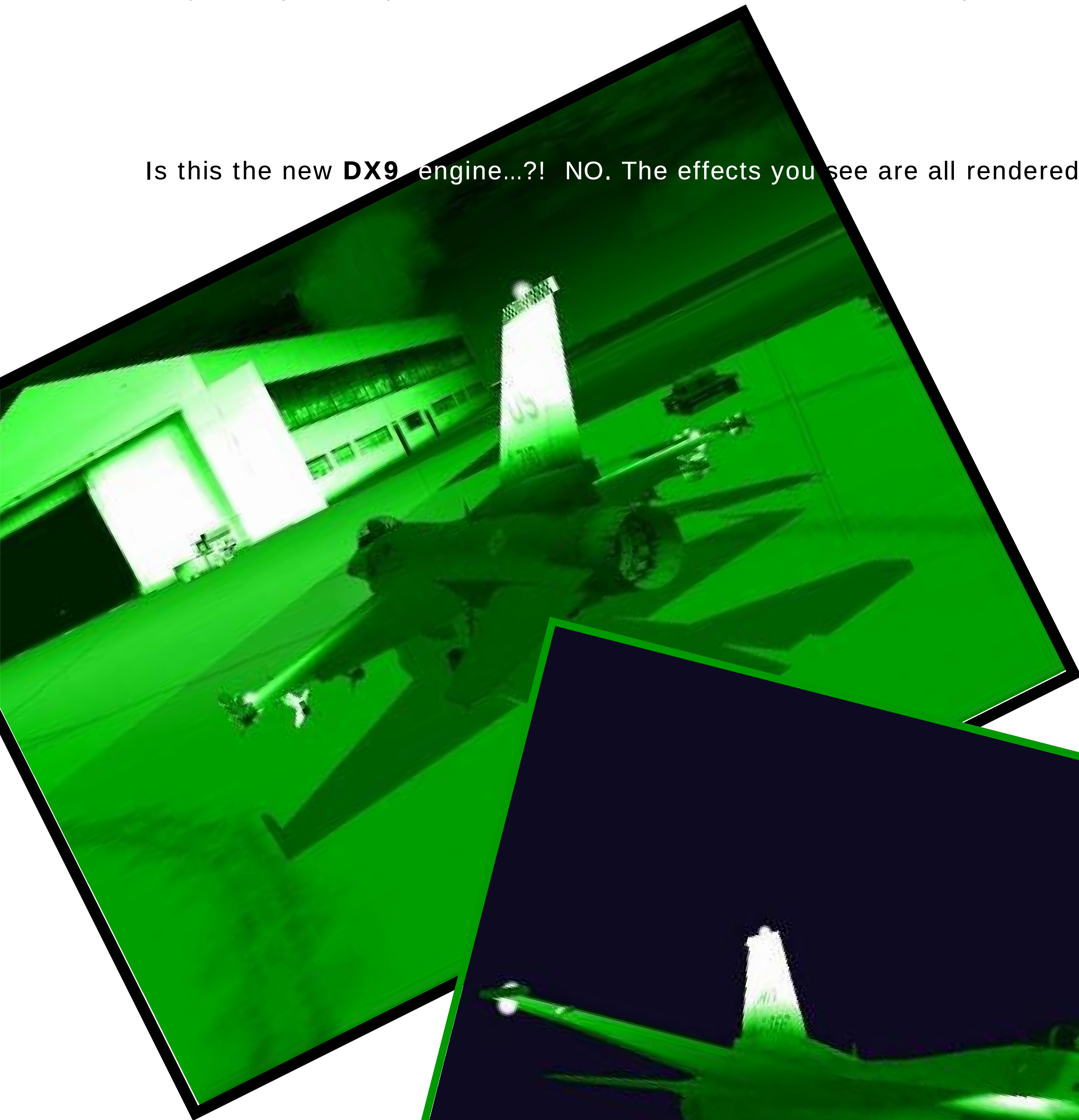
For technical explanations, there is a wealth of info. available elsewhere, but – for this Companion Guide – let's speak in Gorny's Special Simpleton Terms *(GSST™)*.

The new GFX engine works quite differently from the existing Falcon4.0™ engine.
The main difference? Efficiency.

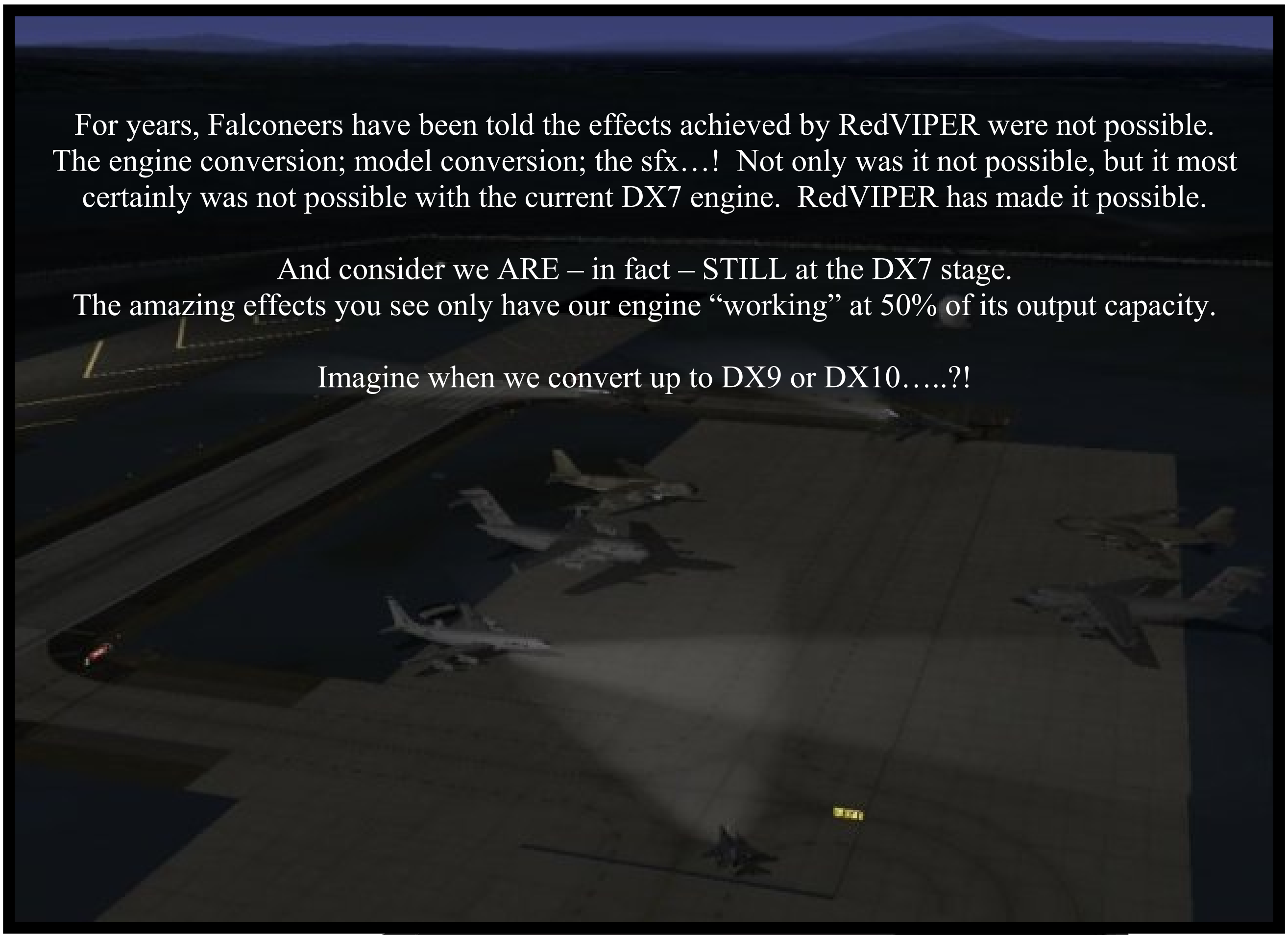
The way in which the RedVIPER Engine identifies and "handles" colours, and ***types*** of surfaces is very different to its predecessor. Unlike before – regardless of surface "type" or "colour" – the RedVIPER GFX collects ALL surfaces together, and makes a single "call".

Another improvement is the way that SFX are "stacked" and "cleared". What does this mean for your flight? Improvement in FLOT FPS. No more "FPS Killing" FLOT...!

Is this the new **DX9** engine...?! NO. The effects you see are all rendered via DX7...!!



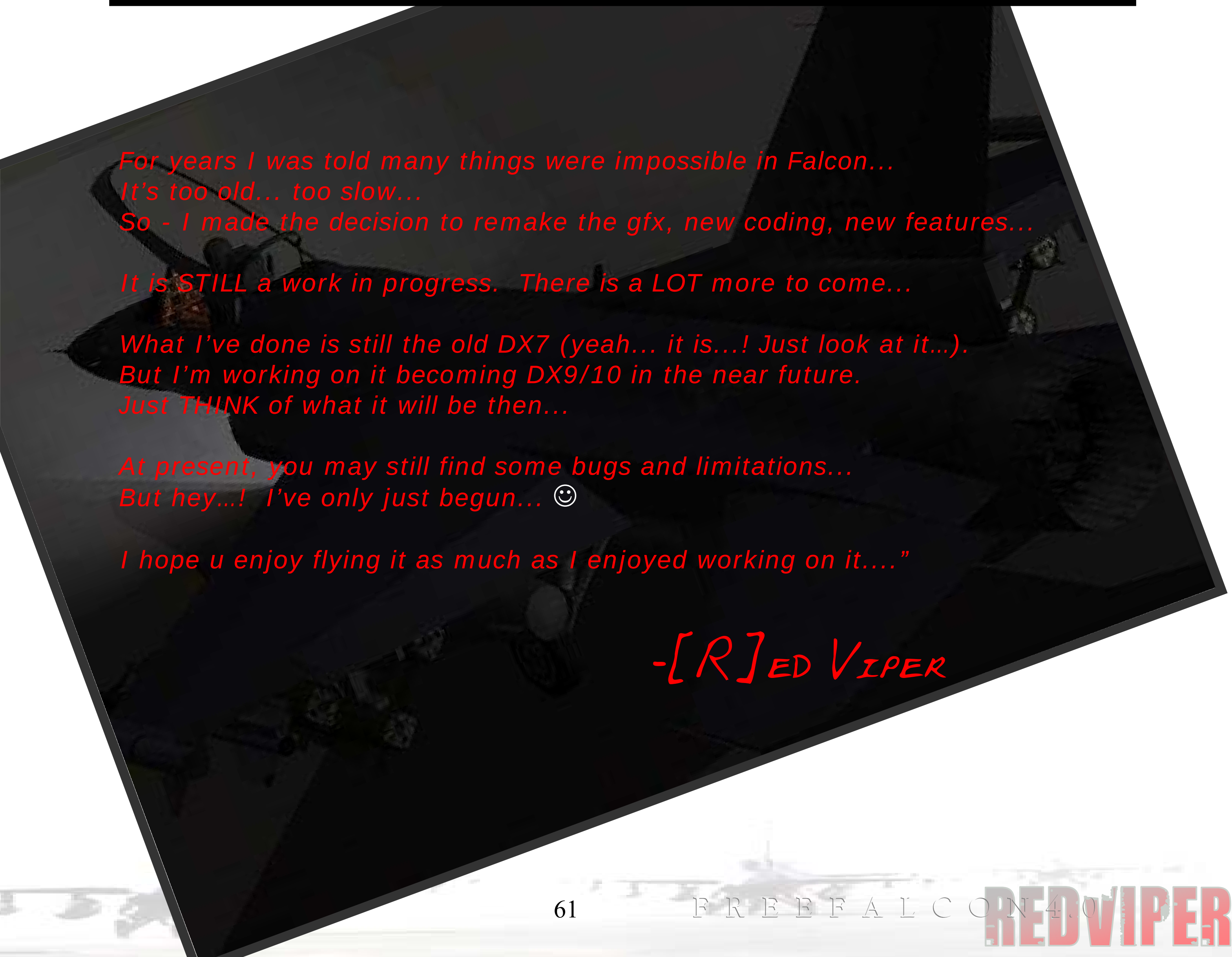
"Starlight" Night Vision a-la *RedVIPER*



For years, Falconeers have been told the effects achieved by RedVIPER were not possible. The engine conversion; model conversion; the sfx…! Not only was it not possible, but it most certainly was not possible with the current DX7 engine. RedVIPER has made it possible.

And consider we ARE – in fact – STILL at the DX7 stage.
The amazing effects you see only have our engine "working" at 50% of its output capacity.

Imagine when we convert up to DX9 or DX10…..?!



For years I was told many things were impossible in Falcon…
It's too old… too slow…
So - I made the decision to remake the gfx, new coding, new features…

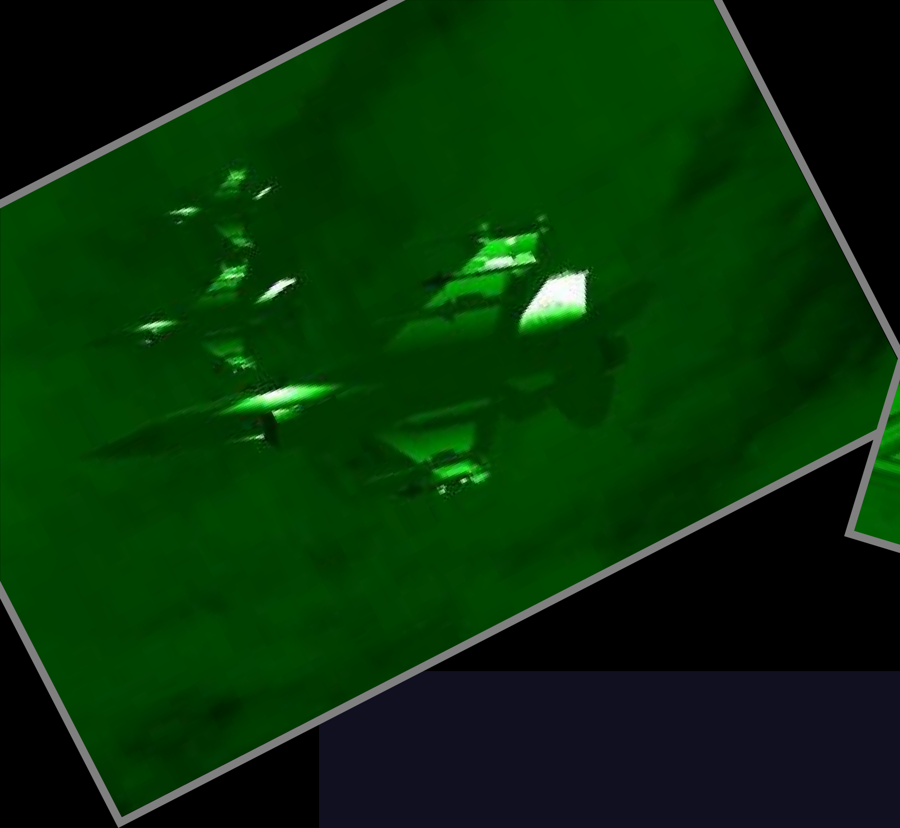
It is STILL a work in progress. There is a LOT more to come…

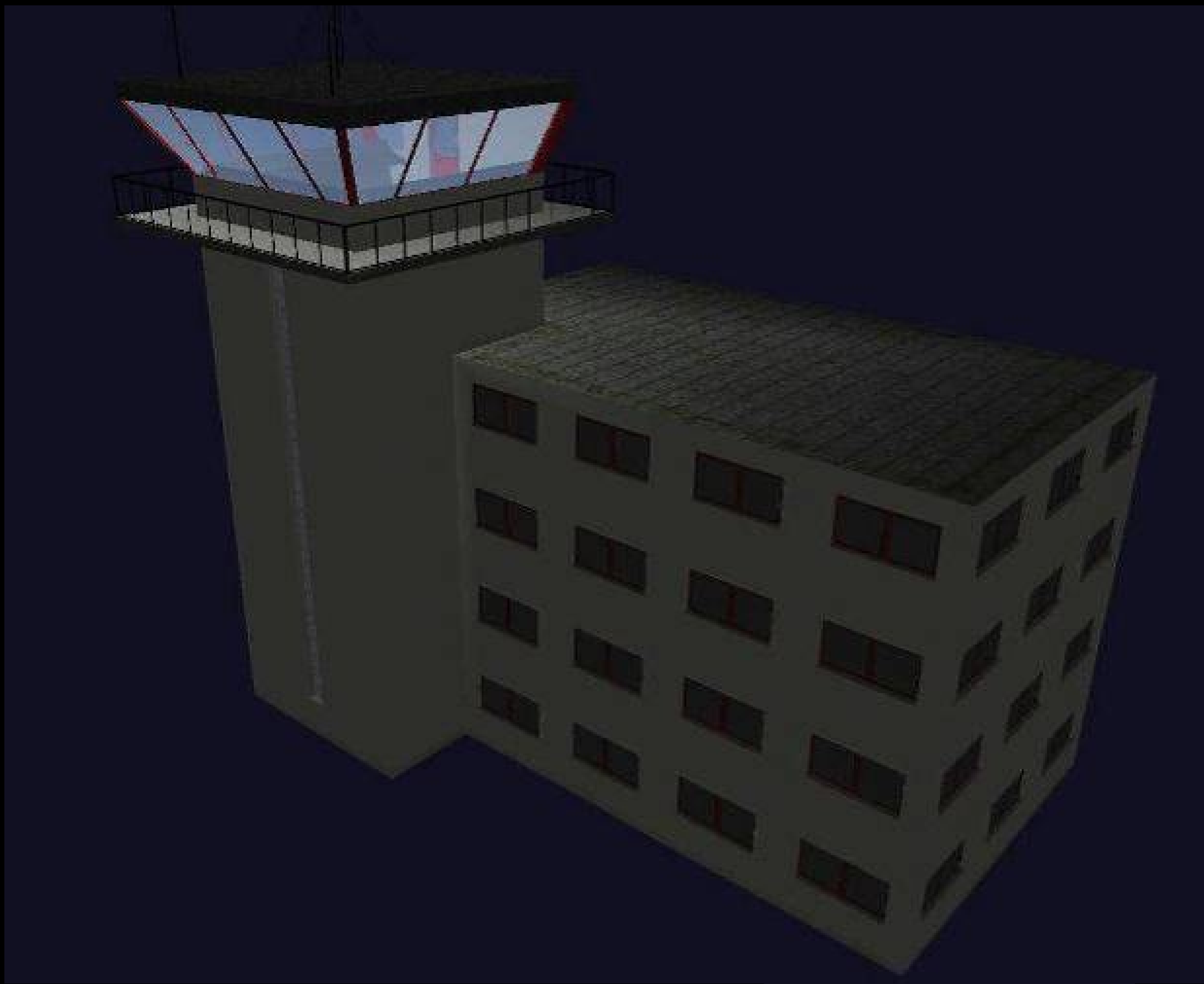
What I've done is still the old DX7 (yeah… it is…! Just look at it…).
But I'm working on it becoming DX9/10 in the near future.
Just THINK of what it will be then…

At present, you may still find some bugs and limitations…
But hey…! I've only just begun… ☺

I hope u enjoy flying it as much as I enjoyed working on it…."

-[R]ed Viper






WW
BOB

3D Modeling and Animation Glossary *written by Aaron Ross*

aliasing - Undesirable artifacts in the form of harsh, jagged lines, edges, or surfaces in computer images.

alpha channel - A channel of data in bitmapped images which stores the transparency of the image, generally used for *compositing*. A 32-bit image has 24 bits of color information and 8 bits of alpha. This allows 256 levels of transparency, from totally transparent to absolutely opaque.

ambient light - General lighting that illuminates the entire scene, without source or direction. It attempts to emulate the effect of light bouncing off all objects to illuminate all other objects, but is not a true simulation such as *radiosity*. A high ambient light setting results in a washed-out scene, since no shadow can be darker than the ambient light.

antialiasing - An algorithm, which attempts to correct jagged, aliased computer images. Blurring the image is one such method. A more advanced method is called *super sampling*.

bitmap - A still image produced by a fixed matrix of *pixels*. Examples of bitmap file formats: BMP (Microsoft Bitmap), GIF (CompuServe Graphics Interchange Format), JPEG (Joint Photographic Experts Group), RLA (Wavefront Run-Length), TIFF (Tagged Image File Format), TGA (Truevision Targa).

DX – DirectX provides the interface to access the frame buffer and advanced features of the display adapter, which are not provided in the standard Windows GDI graphics interface

face - A renderable 2D plane. This term is often used interchangeably with *polygon*, but there is a difference. A face is a triangle, the simplest possible 2D shape. A polygon is any planar (flat) structure composed of one or more renderable faces. All mesh objects are ultimately composed of faces, or converted to faces at render.

gamma - The contrast curve of a recorded image. Increasing the gamma of an image makes it appear brighter (more washed out); decreasing the gamma makes the image darker (muddier).

HAL – *(Hardware Abstraction Layer)* An interface between the hardware and the software. An operating system is essentially a hardware abstraction layer; however, a HAL implies an additional layer between the OS and the hardware.

HAL T&L - *(Hardware Abstraction Layer Transform & Lighting)* T&L reduces processor load by running all the T&L instructions on the GPU. So it's faster, because the processor has more processing power left for other things.

interlaced scan - A video display mode which uses alternating *fields* to create the image. For each video frame, odd numbered scan-lines are drawn, followed by even numbered scan-lines. NTSC video is interlaced; most computer monitors are not.

mesh - A 3D object composed of triangular faces. A mesh object has no true curvature. The appearance of curvature is achieved by increasing the number of faces (mesh density), and by surface smoothing during render time.

pixel - Abbreviation of *picture element*: the smallest possible element of a picture. A digital image is defined by a discrete number of pixels arranged in a 2D grid or mosaic. Many very small pixels blend together in the human eye and brain to give the illusion of a continuous, unbroken image.

pixel ratio - The proportion of pixel width to pixel height. In most cases, pixels are square, giving a pixel ratio of 1 to 1. However, some display formats use non-square pixels, such as the NTSC serial digital video standard, which has a resolution of 720x486, with an aspect ratio of 1.333 to 1. This results in a pixel ratio of 0.9 to 1, meaning the pixels are slightly taller than they are wide. This creates distortion when displaying NTSC serial digital images on standard computer monitors, which are only capable of displaying square pixels. The non-square pixels are incorrectly interpreted as square, resulting in images which are displayed horizontally stretched. (In this case the aspect ratio is no longer 1.333 to 1, but incorrectly displayed as 1.481 to 1.) Hardware designed for serial digital video correctly displays these images on NTSC video monitors.

polygon - A closed 2D plane figure bounded by straight lines. In some computer graphics applications, the terms *face* and *polygon* are used interchangeably, but actually a polygon is a group of connected triangular faces which all lie in the same plane.

rendering - In computer graphics, the process of producing 2D images from a 3D scene. During rendering, the computer “draws” the 3D objects to the screen and/or to a file, usually a bitmap. Real-time rendering occurs when viewing objects interactively in 3D viewports, or in a game or simulation application. Production level rendering draws a much higher quality image, at the expense of speed. A Production render may take anywhere from a few seconds per frame to an indefinite period of time… sometimes hours or even days for a single frame.

specular - The color of the highlight on a shiny object. The color of a specular highlight is often determined more by the color of the light than by the object’s color.

texture map - A bitmap or algorithm used to create surface detail on an object. *Bitmap* textures require mapping coordinates, which tell the renderer how to project the 2D bitmap onto the 3D object. Algorithmic or *procedural* textures usually do not require mapping coordinates, as they already exist as 3D volumetric patterns.

vertex - A fancy word for “point.” Points are merely markers in space; they have no dimension whatsoever – no length, no area, no volume. Vertices serve many functions in 3D graphics, from defining the contours of objects to controlling the shape of curves.

Z-buffer - The distance of 3D objects relative to the camera. Each pixel in a 3D image is a certain distance from the camera. This distance is measured along the Z axis of the camera. Z-buffer information can be stored in an external bitmap or embedded as a channel in a color bitmap. A graphic representation of the Z-buffer displays nearby objects as white, and more distant objects rendered darker. The Z-buffer information can be used to generate special effects in post-production compositing. For example, the distance to a pixel can affect the amount of blurring to achieve a depth-of-field effect.

Aaron Ross

Aragorn’s PETE BONANNI Interview

Aragorn: Hey, Mr. Bonanni.

Boomer: Hello, Aragorn.

Aragorn: Did you notice that I'm wearing my "Bonanni is Uncanny" t-shirt.

Boomer: No, I didn't. That's very cool. Check this out. My "Gorn Loves Porn" underwear.
*(*Bonanni drops pants*)*

Aragorn: er...... dude....? You are - like - completely naked.

Boomer: 'Eh...? *(*looks down*)* Oh - sorry. Laundry day.

Aragorn: Uh-huh. No problem dude. It was always one of my long-term goals to see a grown-man's penis during an informal interview.

Boomer: Get out of here....! Me too....!!

Aragorn: *(*momentary silence*)* ah.. "Boomer"..... Sorry - may I call you "Boomer"...?

Boomer: Sure thing.

Aragorn: "Boomy Bomby Boomster Bomble" - you created Art Of The Kill...?

Boomer: Yep. Proud of that one.

Aragorn: What was it like playing back-up to Tom Jones during the recording of "Kiss"....?

Boomer: Err..... I believe that may have been the "Art Of Noise"....?

Aragorn: Oh. Yes, yes. You're correct. You seem to have an encyclopedic knowledge of Dance Music...?

Boomer: This Disco Mustache is NOT just for show. I'm dangerous.

Aragorn: So - Art Of The Kill. Do you really think that Killing is an art form...?

Boomer: That's a very, very difficult question to answer, Ara'.

Aragorn: Why...?

Boomer: Because, you forgot to turn your microphone on, and I didn't quite hear the question.

Aragorn: Really..? I'm sorry. Hang on a moment, I'll just check.

Boomer: Is your ego able to cash that check...?

Aragorn: *(*turns on mic*)* Testing, two. Two. One, Two. Testes One. One. Testes, One.

Boomer: Shouldn’t that be “One, Two”…?

Aragorn: I’d rather not talk about that. So, "Boombly Bang Bang Bomby Bonannster"....... err... do you mind if I call you "Boombly Bang Bang Bomby Bonannster"...?

Boomer: Yes. Yes, I do.

Aragorn: So, "Boom Boom Boom Let's Go Back To My Room" - what's it like to....

Boomer: Ara'....?

Aragorn: Mmmmmmm...?

Boomer: How would YOU like it if I called you "Ara Farah Dickwad Lame Idiot Who Is Gay Not That There's Anything Wrong With That Gorn"....?

Aragorn: That would be sweet, dude...! Cool. So - what's it like to fly the Viper...?

Boomer: Hmmmmmm.... Well - have you ever had a naked woman tie your hands together, smear honey over your nether-regions, and lick it dry....?

Aragorn: Excluding woman over seventy-five and blood relatives...?

Boomer: Yes.

Aragorn: Well - no. No, I haven't.

Boomer: Neither have I. What was the question; I've forgotten....?

Aragorn: What's it actually feel like to fly the Viper...?

Boomer: Hmmmmmmm.... have you ever made love to two beautiful Asian woman, while snow falls outside the window...?

Aragorn: Yes.

Boomer: Well - it's NOTHING like that.

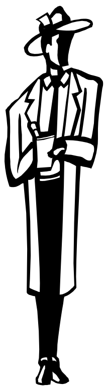
Aragorn: Do you like the fact that in the 2004 version of Battlestar Galactica, they re-cast "BOOMER" as an Asian woman...?

Boomer: Only when it snows.

Aragorn: There's something that the entire Falcon community would like me ask you.

Boomer: What's that...?

Aragorn: An intelligent question.



Boomer: Shoot.

Aragorn: Who...?

Boomer: Who's on first.

Aragorn: Who…?

Boomer: Yes.

Aragorn: Pete' - is it true that pilots have HUGE....

Boomer: ...you just saw it...

Aragorn: ...EGOS....?

Boomer: Oh... ah...egos...? No. NO - that isn't true. If that were true, then it would be an imperfection in an otherwise perfect and flawless human being.

Aragorn: So - "Bonanza", how does flying Falcon4.0 compare to flying the REAL jet...?

Boomer: Well - how does drinking a rice wine made from Aomori rice and Sapporo water compare with a boutique Sakê from Karatsu...?

Aragorn: I have absolutely no idea.

Boomer: No..? Neither do I. I hate Sakê.

Aragorn: Okay. Well - can you describe what it's like to be flying beyond the sound barrier...?

Boomer: Yes. Imagine you are in a very small room; very quiet and warm.

Aragorn: Okay.

Boomer: There is a faint glow from a monitor in front of you; a slight humming vibrates in your ears.....

Aragorn: Okay. Yes....

Boomer: Starts with the letter "T".

Aragorn: Say again...?

Boomer: It starts with the letter "T".

Aragorn: What...?

Boomer: On Second.

Aragorn: What....?

Boomer: Yes. Who's on first.

Aragorn: What starts with the letter "T"...?

Boomer: No. What starts with the letter “W”.

Aragorn: Why did you ask me that question…?

Boomer: Oh. I was playing "Eye Spy With My Little Eye". So - in that room with the monitor and the humming, is something which starts with the letter "T".

Aragorn: Testosterone Enhancer.

Boomer: What the...?!? YES. How did you guess that...?!

Aragorn: I was just thinking of my own room. Anyway - you didn't answer the question...!

Boomer: I DID answer the question. I said "Yes".

Aragorn: So, Pete’ – have you ever made an artful kill…?

Boomer: Excluding orphans and small, cute animals with eyes that are large in proportion to their bodies?

Aragorn: Yes.

Boomer: No. No, I haven’t.

Aragorn: Do you regularly vomit into your own helmet.

Boomer: Yes. Often.

Aragorn: The “G” Forces really affect the stomach, ‘eh…?

Boomer: Sorry, what…? I wasn’t talking about flying. I just think it’s kinda’ cool to regularly vomit into a helmet. I do it at home, whenever we have friends over.

Aragorn: How often do you have friends over…?

Boomer: Since I started vomiting into my helmet – not so often.

Aragorn: Ah… Pete’…? Um….

Boomer: Yes, Ara'…?

Aragorn: Well... since it's been a couple of minutes, I wondered if you wouldn't mind pulling the pants up…?

Boomer: Not a problem, bud. *(*pulls up pants*)*   Ara' - do you know much about Greek philosophy…?

Aragorn: This sounds interesting. Why do you ask…?

Boomer: I have a test next week, and I was hoping you'd teach me a little.

Aragorn: Well, Pete' – thanks very much for your time and wisdom. If nothing else, we've learned that you're an Abbot and Costello fan.

Boomer: I didn't like his Burt Bacharach cover, though.

Aragorn: Huh…?

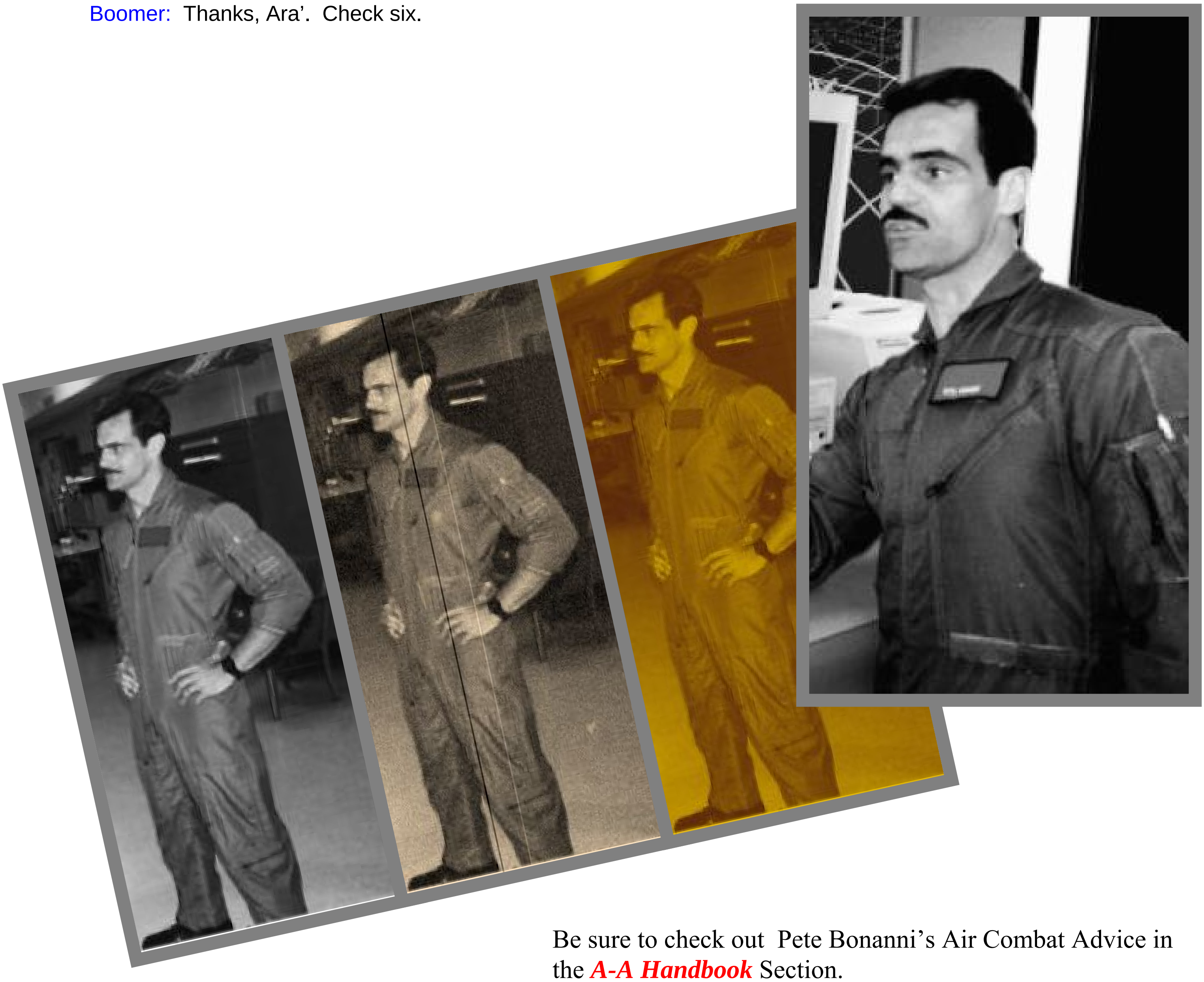
Boomer: Elvis Costello. I didn't like his Burt Bacharach cover.

Aragorn: No – ABBOT and Costello.

Boomer: Who…?

Aragorn: On First. Later, Pete'. Rock on.

Boomer: Thanks, Ara'. Check six.



Be sure to check out Pete Bonanni's Air Combat Advice in the ***A-A Handbook*** Section.

f-18s….?

YEAH…! We got F-18's…!!

Devoted to simming….?

Don't have a life….?

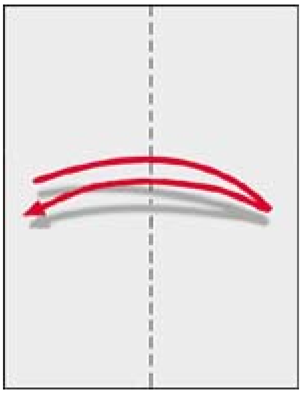
Too much free time on your hands…..?

Relax…! You need to absorb yourself in:

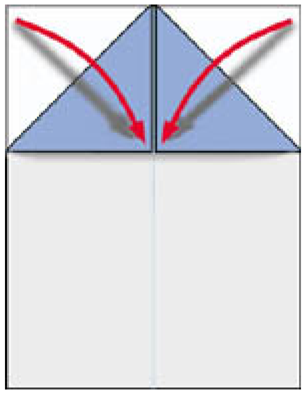
Gorny's

Arts & Crafts

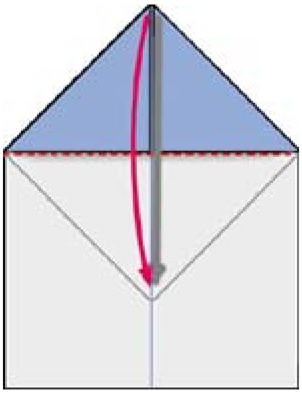
"THE FALCON"



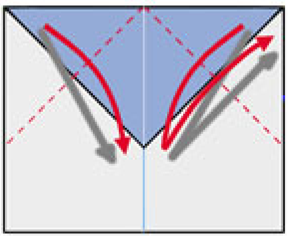
1. Start with 8 1/2"x11" paper.
Fold paper in half vertically and unfold



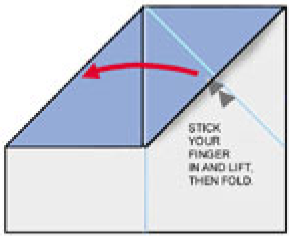
2. Fold the top corners inward to the center crease.



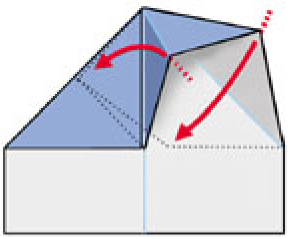
3. Fold the top point downward.



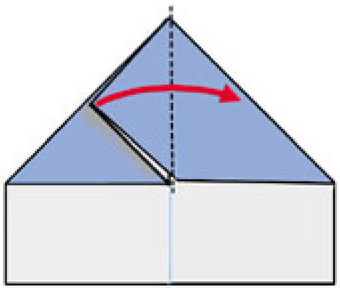
4. Fold the top corners inward to the center crease and then unfold the right side corner.



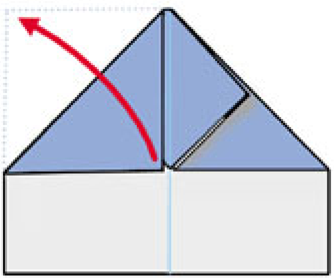
5. Put your finger under the flap, and lift it toward the left



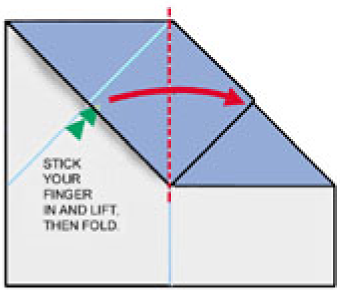
6. Flip the flap to the left.



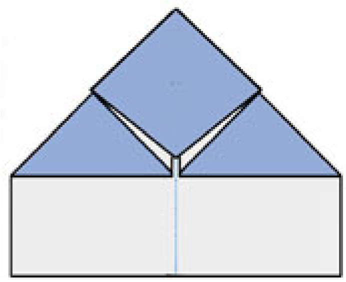
7. Fold the new triangle flap to the left.



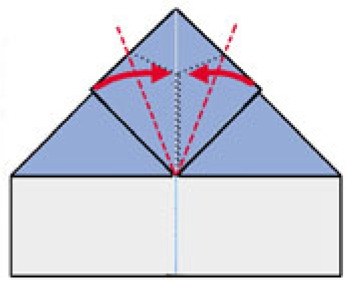
8. Unfold the left side flap.



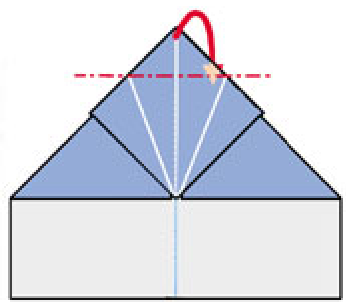
9. Repeat steps 5, 6, and 7 for the left side.



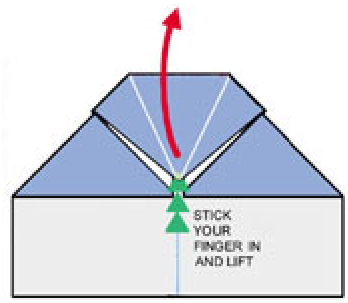
10. The fold should look like this.



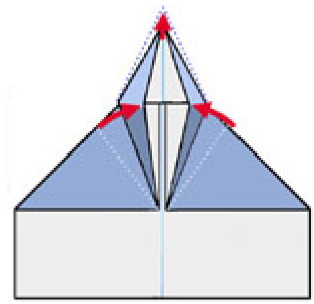
11. Fold both side flaps toward the centre line and unfold.



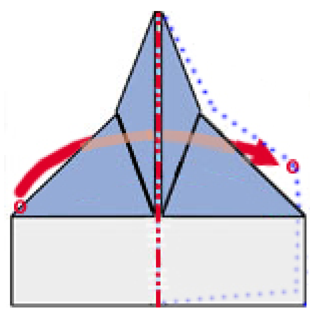
12. Make a “mountain fold” at the top corner section



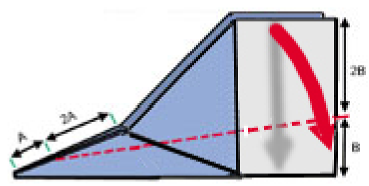
13. Put your index finger under the flap as shown with the green arrow. Pull up the top flap corner while pressing the base part with your index finger.



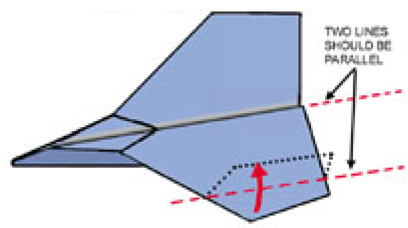
14. Pull up the tip. This part becomes your F-16’s nose.



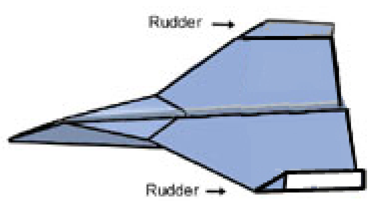
15. Fold the model in half. Use a “mountain fold”.



16. Fold the wind downward. Repeat on the other side. The model should now look like Step 17



17. Add a rudder approx. ¾’s of an inch high. Both sides.



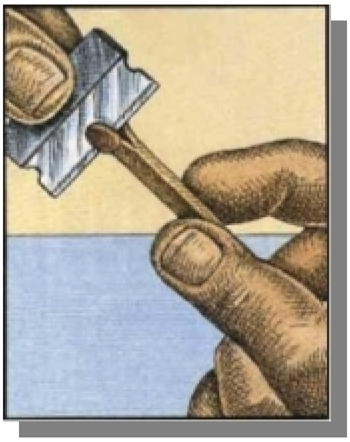
18. Bend the trailing edge of the wings slightly upwards to compensate for the tendency to nose dive.
Your F-16 is COMPLETE. ☺

Design by: *Kyong H Lee*

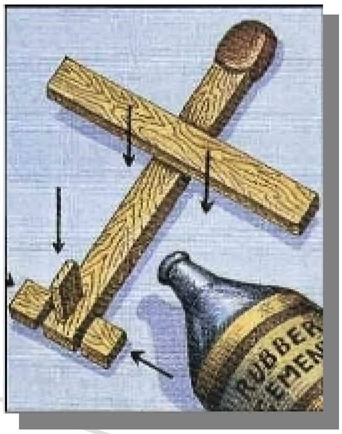
THE "FLY PLANE"

Esquire Magazine, 1990

1. To reduce as much weight as possible, slice a match. Be sure to leave some Sulphur for the nose of your aircraft. If the match is already thin, you can skip this trimming.

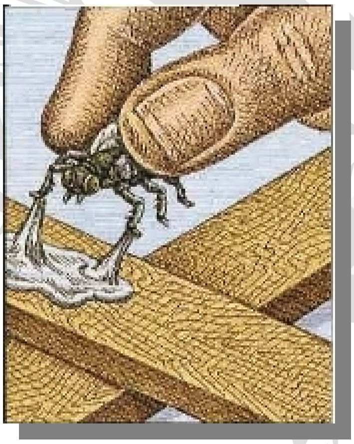


2. Build the airframe using pieces of matchstick. Increase your wingspan to accommodate more engines.

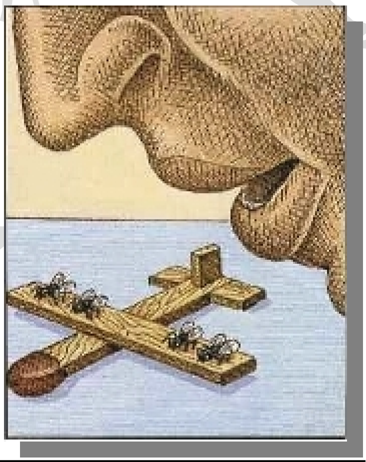


3. Catch some flies in a jar. Put the jar in the freezer. In a matter of seconds, the flies will be motionless. Do NOT cool down your "engines" too much, or they will die. You can use the refrigerator instead, but it will take longer.

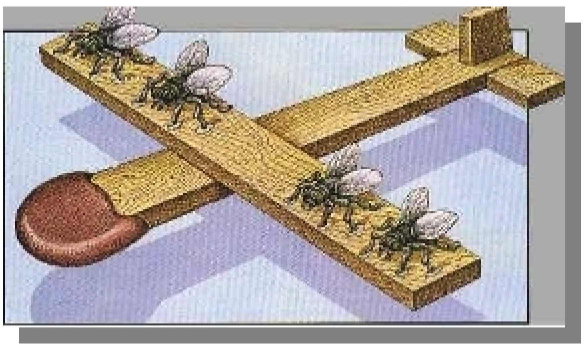
4. Whilst you wait for your engines to cool, place some contact cement at equal intervals upon the TOP of your wing. These drops of glue are the engine fixtures.



5. Take your flies from the freezer or refrigerator. Place them on the glue drops.



6. Breathe warm air on your engines. They will miraculously begin to resuscitate.

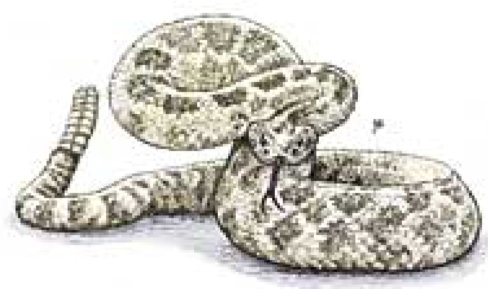


7. Give your aircraft clearance, stand back and enjoy the fun. Be happy that you have given these flies the chance to power a real aircraft. They will be considered the envy of the insect world. Whereas you will be considered completely mental.

REDvIPER1

ff4.0/Redviper Features

- *the* 3D Pit
- *the* Skins
- *the* Flight Models
- *the* Clouds & Weather
- *the* Airbases
- *the* UI
- *the* RedVIPER Config Editor



contents

EN the canopy; **OPEN** for business – *RedVi*… new 3D Pit.

OPEN the next generation of 3D Pits for Falcon…!

Revolutionary ->

Your In-Sim experience is NEVER gonna' be the same….!

- Realistic LIGHTING fx rendered by the new RV1 Gfx-Engine.
- Realistic GLASS CANOPY fx rendered by the new RV1 Gfx-Engine.
- All gauges and dials – FULLY functional.
- FULLY functional MFD's.
- FULLY functional CANOPY.
- 188 clickable buttons, knobs and switches
- Variable head-tilt angle (for TIR tracking)
- PFL Display
- 3D/2D Pit synchronisation
- Functioning AOA Indexer
- Functioning **P**ilot **F**ault **D**isplay
- Most of the instruments are animated

Finally – the dream of every Falconeer. A fully functional 3D Pit; realistically lit & beautifully rendered by our revolutionary NEW RedVIPER Gfx Engine…!
A Track IR™ dream!

At night, you'll notice the cockpit glass is completely transparent; invisible – as it is in Real Life. When an external light source strikes the glass, however, realistic lighting and reflection effects are evident on the canopy!

Open the canopy in the 3D pit, and SEE it open…! Brand new canopy animations mean your canopy now opens from INTERNAL views, and NOT just "external" views, as before.

Whilst in the 3D Pit, clicking on the **ICP WDX** button *(see image)* will display the “click” points for all of the functional switches.

These “Hotspots” represent the button/knob/switch *click area*.
A hotspot area is bounded by 4 white dots with a red dot in the centre.

Clicking on the **WDX** button again turns off the hotspot display. When the cursor is over a hotspot, it turns green. As is the case with the 2D cockpit, some of the buttons / knobs/ switches use the right mouse button to reverse direction.

Pit synchronisation now means that your view will remain the same as you switch between the 3D and 2D Pit environments.

And – of course – you’ll be looking through **Translucent fonts** in BOTH pits….!

Naturally – the ‘Pit features **6DOF**…!

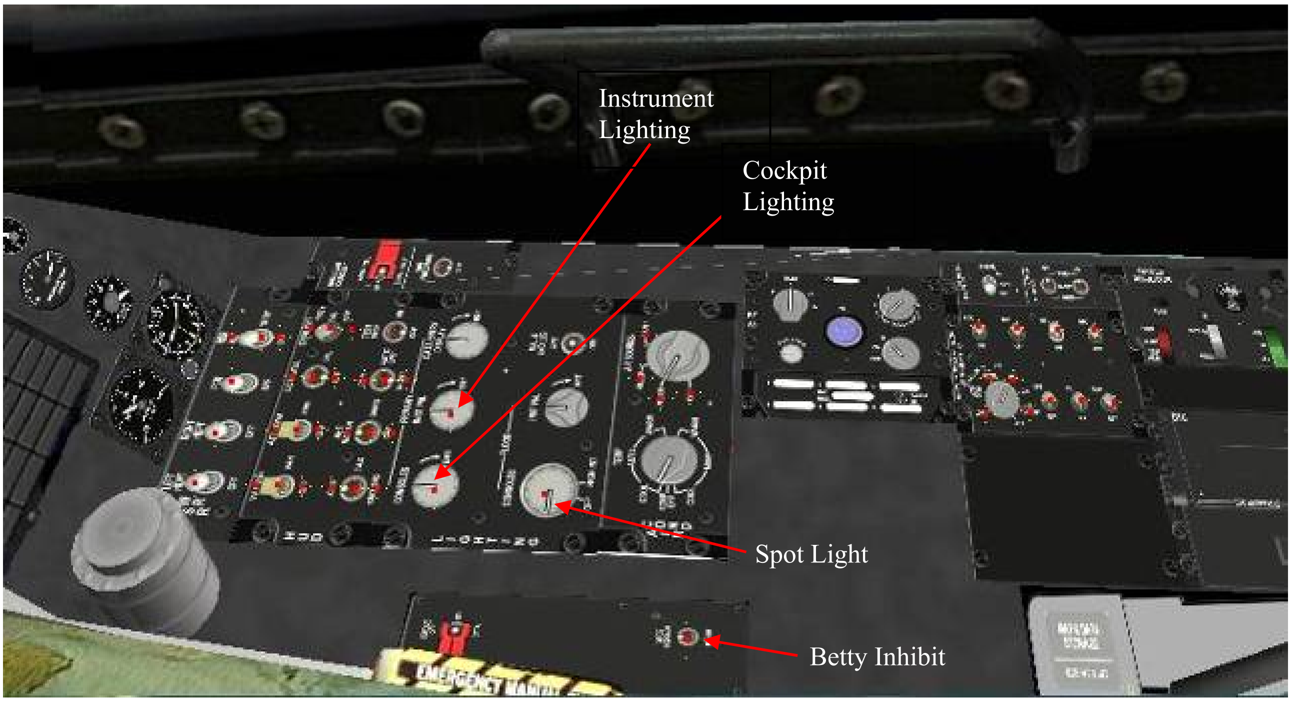
The 3D Pit also has adjustable head-panning options. Select from:

- *+140° / -25°*
- *+140° / -40°*
- *+140° / -90°*
- *+/-180°*
- *+/-180° with wrap around through 360°*

The RedVIPER team are very proud to release this ‘Pit, for your enjoyment.

Be sure to check the relevant choices in your redesigned RedVIPER Config Editor.

Most of the switch positions are easily recognisable from the 2D Pit. Some of the less obvious ones have been labelled below.



Instrument Lighting: 3 way knob → Off / Low / High

Cockpit Lighting: 3 way knob → Off / Low / High

Spot Light: Real Life – used for reading charts. [RV → *as per Cockpit Lighting.*]

Note that both the ***Horn*** and ***Taxi Light*** are obscured by the Gear Handle.

Most of the 3D artwork is from the default SP3 3D cockpit.

Parts of the forward panels are from Paul Wilson's 2D cockpit, with side pannels based on gifs from Pegasus' website.

The model instrument animations were made by Thomas Hamarcak.

BaldEagle did extensive work on the 3D model, including restructuring the node tree, adding animated canopy, pilot legs, and panels, and enhancing graphics.

Side panels were re-worked by Welsh-Madman.


The
SKINS
FREEFALCON4.0
REDVIPER

GI JOE, ANYONE…?

Utilising a fantastic new technique, Ripsaw has created some groundbreaking GROUND TROOPS.

His unique approach involved purchasing a GI Joe™, and a variety of weapon add-ons.

Ripsaw posed GI Joe™ in various positions (according to the original MicroProse™ templates), and photographed the Live Action GI Joe™

Then came the painstaking rendering process.

The result…? Beautiful new REALISTIC ground troops. A ***first*** for FALCON4.0 ™

AIRCRAFT SKINS IN FF4 / REDVIPER

Featuring many talented artists, the FF4.0/RedVIPER skinning team follows the standard set by the man widely recognized as the Falcon community's foremost skin artist – *Ron* "Red1" *Nair*.

Red1 ushered in a new standard for Falcon art, and the FF4.0 team have continued the legacy. FF4.0 is populated by skins unlike anything ever seen in Falcon4.0™.

Before the skins come the models, and FF4/RedVIPER is also lucky to have Falcon's most talented modelers on the team.

512x512 skins mean the finest details are evident on the skins. These 512x512 skins are 4x, 8x, and – sometimes – up to 16x larger than the original Falcon4.0™ skins.

And – with such talented artists – our modelers are free to discard extra polys in the search for extra FPS; these "discarded" polys being easily covered by our high caliber artists.

FF models have always taken advantage of the latest code. FF3 models led the pack with rolling wheels, and many upgrades to utilize spinning DOF's for propellers, animated gear, and opening canopies.

For FF4.0, the allowable number of polys has also been increased. The FPS cost has been offset by the implementation of the new GFX Engine. The new FF4 code has animated pilot heads; intricately detailed, and smoother-operating engine nozzles; and, all models now have fully animated gear.

Furthermore, FF skins also take advantage of the newest code! This code allows the FF artists to create a custom palette of 256 colors; thereby freeing him from the original Falcon palette of 256 colors. This change greatly reduces (and often ELIMINATES) the unwanted effect known as "dithering".

Also, the need for "hi-lighting" has been reduced as – due to the new GFX Engine - many effects which were once required to be "painted on", are now rendered dynamically in real-time, with the new Specular Lighting code.

For the Virtual Pilot, this collaboration between Skinners and Modelers, working in combination with our RedVIPER Engine means that the skins you'll see in THIS release are light-years ahead of anything else you've found - or will find - in the Falcon World.

Many models now feature moving pilot heads to enhance realism, and updated models & skins include: F-16, A-10, MiG-29, MiG-21, F-4, Tu-22M, J-8, J-10, Su-15, and more.

FLIGHT MODELS

The FF4.0 Team fully realised the demand from many sectors of the community for the inclusion of the HFFMs in FF4/RedVIPER. The team was happy to acquiesce to these requests.

In the pursuit of thoroughness, the FF4.0 Dev Team undertook the checking and re-checking of the HFFM's core DIs. The Team was also very aware of the issue of OTHER planes in the sim, and how the HFFMs would affect “balance”. Also, it was determined to fix only what was broken and not to break something that was fixed.

Due to the excellence of the HFFM developers, this task was rendered far more easily.

Effort was also expended in the comparison of F4 DIs and real life DIs.
“DI” = *(Drag index)* the amount of drag effect a missile/bomb/rack/gas tank has on a plane.

During testing, the Team spent a vast amount of time re-checking all values, using the HFFM Team’s core DIs as a baseline. Comparisons were being constantly made between HFFM data, Real Life data, FF3 data and SP4 data. For the most part, the HFFM Team’s edits were used to establish a scale to take into account the size and shape of the item. The results adhere closely to the published data.

The end result is **we have 3 sets of F-16 FMs that should yield similar characteristics in regards to DI, whilst still retaining their individual FM characteristics**. So – whereas the flight characteristics will remain unique to each individual jet, the effect of stores and drag will be constant.

After editing was complete, spreadsheets were produced to reflect the extensive testing of both F-16 and non-F-16 jets. These tests were completed under various conditions.

Additionally – during our testing - the FF4.0 Dev Team removed the drag penalty for aircraft with internal bays. This included the F/A-22. Therefore, FF4.0/RedVIPER features realistic DIs for aircraft with internal bays.

So, then → The stock F-16 flight models in RedVIPER are the popular High Fidelity Flight Models, but The RedVIPER database has been modified to allow you the **CHOICE of THREE interchangeable Flight Models.**

The FMs are interchanged via the renaming of the Sim Folder. **See *HOW TO SECTION* for details.**

The three sets of F-16 flight models available to the RedVIPER Pilot are as follows:

- **HFFMs** *by Mav-jp and Raptor*
- **SP4 & FF3-1 Flight models** *by Raptor*
- **FF2 Flight models** *by Saint*

*(*Note – do NOT attempt to install any 3rd Party HFFM patch. It will render your install unplayable.)*

Clouds & Weather

Combining existing detailed 3D cumulus, stratus, overcast clouds, cloud shadows, heavy cloud transitions, lightning, and rain with *(a choice of two)* “Fair-weather Cumulus” and overlaying thin and wispy “Cirrus” clouds, the FreeFalcon pilot will now find themselves driving through a highly realistic and totally immersive environment.

The FF4/RedVIPER Team feel that immersion is the cornerstone of your sim. experience.
A large part of that immersion must obviously come from your virtual environment.
And – as this is a FLIGHT simulator – we understand that MOST of your time is spent in the air. It is within and above the clouds where your “environment” awaits.

We’re therefore confident that you will enjoy flying in our new-look virtual skies.

For added immersion – ***THUNDER SOUNDS*** are enabled by default, and a selection of Skyfixes are available for the Virtual Pilot to fine tune the environment to his taste.
(Thunder sounds may be turned on or off using the Viper Config Editor.)

In addition, **contrails** will automatically appear on aircraft when they are at proper altitude.

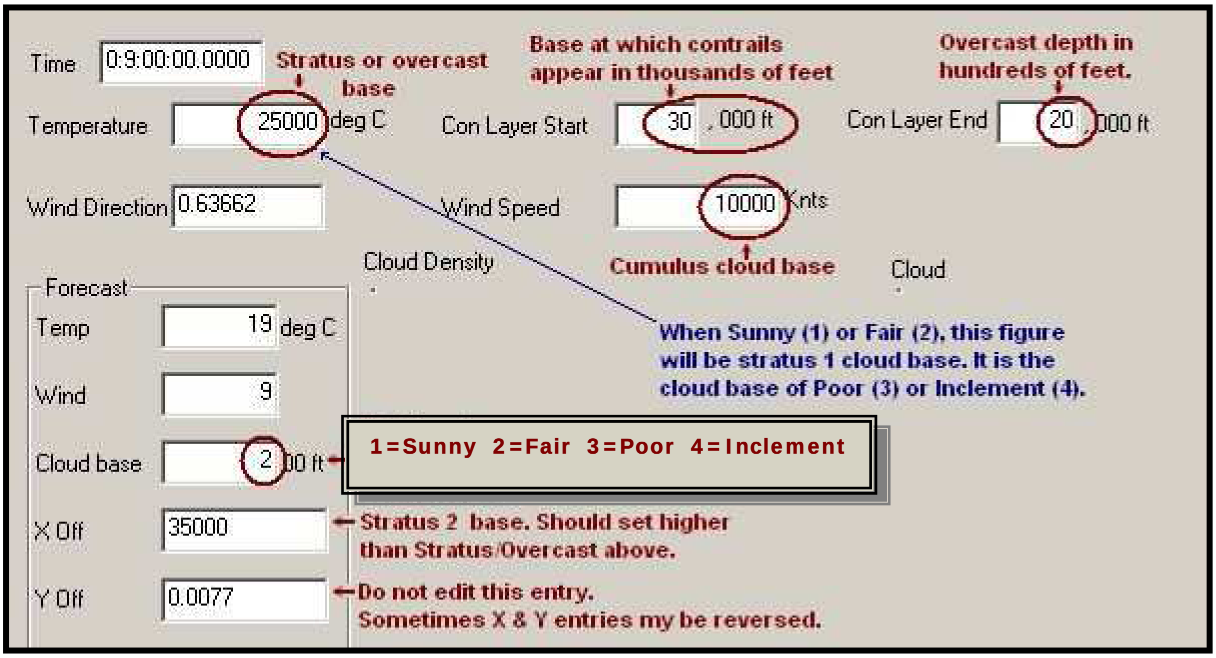
See ***HOW TO SECTION*** for further details on fine-tuning your choices…

Weather features are enabled.

You can select Sunny, Fair, Poor or Inclement weather as the weather type in your graphics set-up menu. The initial weather type is fair which gives you 3 different cloud layers, including cumulus.
If you have a saved TE or Campaign file, you will have to click on the “unlock” window in the weather graphics set-up menu in order to change the weather type.
Additionally, you can only change the weather type once in making a TE, thereafter you have to use TacEdit v2.46.

Cloud heights and weather types can be edited using the weather page in Tacedit.
You can edit Weather Conditions, including Cloud Base, Thickness, Contrail Level, Wind Speed and Direction plus type of Weather.

This picture below illustrates how variables in TacEdit Weather section are used to edit weather. Load your TE, Training or Campaign Save and select the Weather tab at the bottom left of TacEdit.



Box item entries:

1.Temperature - *Cloud Base level of Stratus 1 clouds in Sunny or Fair weather, or Cloud Base level of Overcast clouds in Poor or Inclement weather*
2. Con Layer Start - *Level that Contrails on planes appear, in 1000's*
3. Con Layer End - *Thickness of Clouds (Fair, Poor, Inclement) in 100's not 1000's as shown.*
4. Wind Direction - *Reverse wind heading in degrees. For example above would be wind 'from' 360*
5. Wind Speed - *Actual level of Cumulus Cloud base if Fair weather is selected*

Forecast:

1. Temp - *Temperature in degrees Celsius*
2. Wind - *in Knots*
3. Cloud Base - *Enter digit for weather type: 1 = Sunny, 2 = Fair, 3 = Poor, 4 = Inclement*
4. X Off - *Do not edit any entry that shows 0.0077*
5. Y Off - *Stratus 2 Cloud Base, should be set higher than Stratus 1 Base*
(Note: Entries in *X Off* and *Y Off* are sometimes reversed and that is ok)

When finished editing click on the Update tab in upper right corner then Save.

Airbases

FF/RV1 features a NEW LOOK for Airbases

- New re-textured Runways and Taxi-ways.
- Improved ATC.
- New 3D VASI Lights, Taxiway and Taxi-Direction signs.
- Some "Humans" visible for immersion
- REALISTIC Airbase LIGHTING
- More intelligent AI taxiing behaviour
- Re-textured RAMPS
- Improved Z-buffering
- New textures & models for many airbase support vehicles
- New Airbase look (including some new tiles, textures, Airbase fences, A better integration of taxiways and runways Amazing lighting effects rendered by the new RV1 Gfx Engine…!)
- Some major re-mapping of structures to reflect Real Life visuals! These include: *RADARs; Hangars; Ammo Dumps; Storage Sheds; Antennas; Antenna Shacks; Terminals; Control Towers; Weapons Loaders; Revetments; Generators; Cargo Buildings.*
- Improved Baggage Handling
- Streamlined Passport Control Procedures
- In order to ensure compatibility with *RedDog's Charts*, overall dimensions and building placements remain unchanged.

THE USER INTERFACE

With the injection of a new and unique flavour into this yardstick release, you will be struck at once by the utilitarian and aesthetic changes to the User Interface.

Building upon the fine work of "Nodo", the FreeFalcon Team has opted for both an Auditory and Visual upgrade. Designed to put you into "mission mood", the striking new UI opens to the original "Falcon re-mix" of a Powerman5000 tune.

After the inspirational new tune and dazzling background, the next thing you'll notice is that ALL buttons have been placed along the bottom of the UI.

Here they are grouped for ease of access.

The most important change concerns the UI Windows.

You may now move them, and drag them freely around the UI, repositioning at will. This should make campaign planning and pre-flight operations far less complicated. NOTE that if you have trouble with certain buttons not executing, try moving adjacent windows which may be interfering.

Also for your convenience → in the Munitions Page, the 'hot zone' for the rotation button has been moved to the center of the aircraft.

Heeding community requests, FreeFalcon have also included a FULL SCREEN MAP...!

This addition gives you a clearer awareness of the overall campaign situation, and helps greatly in route planning and Pre-planned threat recognition.

UI

THINGS TO CONSIDER:

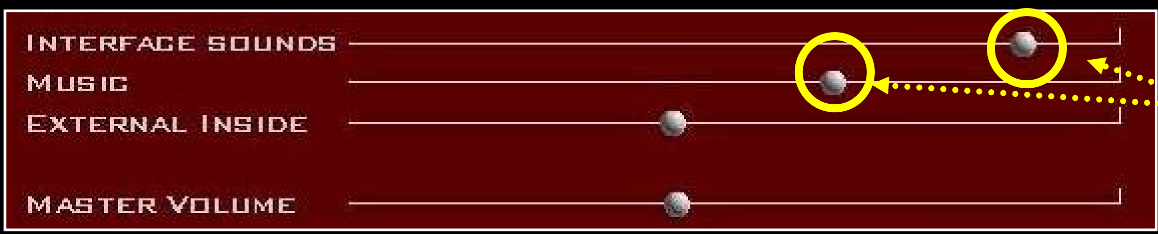
Go into the UI and set up your preferences. You may not hear Sound. You may hear too MUCH sound. After setting your preferences (for the Default "Joe Pilot"), be sure to SAVE and then EXIT the sim.

Now – Re-enter the sim.

Import your OLD pilot (having pasted the .lbk file into your /falcon4/config folder) , and again – check that all of the preferences are correct.

OR - go ahead and create your NEW Virtual Personae.

The preferences you've already set will now be "Sticky", and Powerman5000 should be clearly audible.

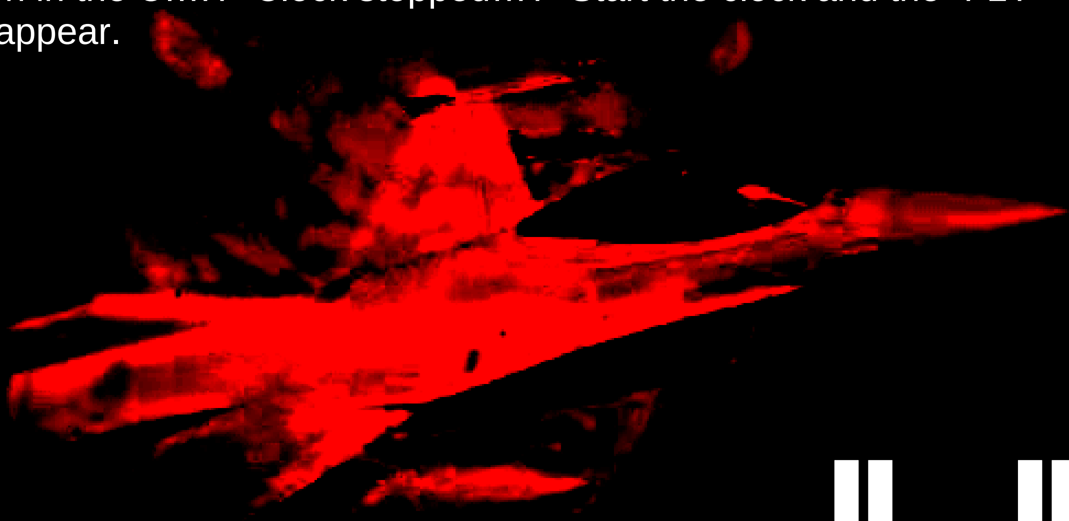


UI Sound

It seems to you that a BUTTON is not "clicking"…? The Button seems non-functional…? It's probably BEHIND one of the windows. But – as the windows are transparent, it's difficult to tell…! So – go ahead and close one of your open UI Windows. Or just "drag" them away from the box. Now you'll be able to access the Button.

The BIG UI Map is scrollable, and zoomable with the mouse-wheel…!

No "FLY" button in the UI…? Clock stopped…? Start the clock and the "FLY" button should appear.



Ensure **T&L**

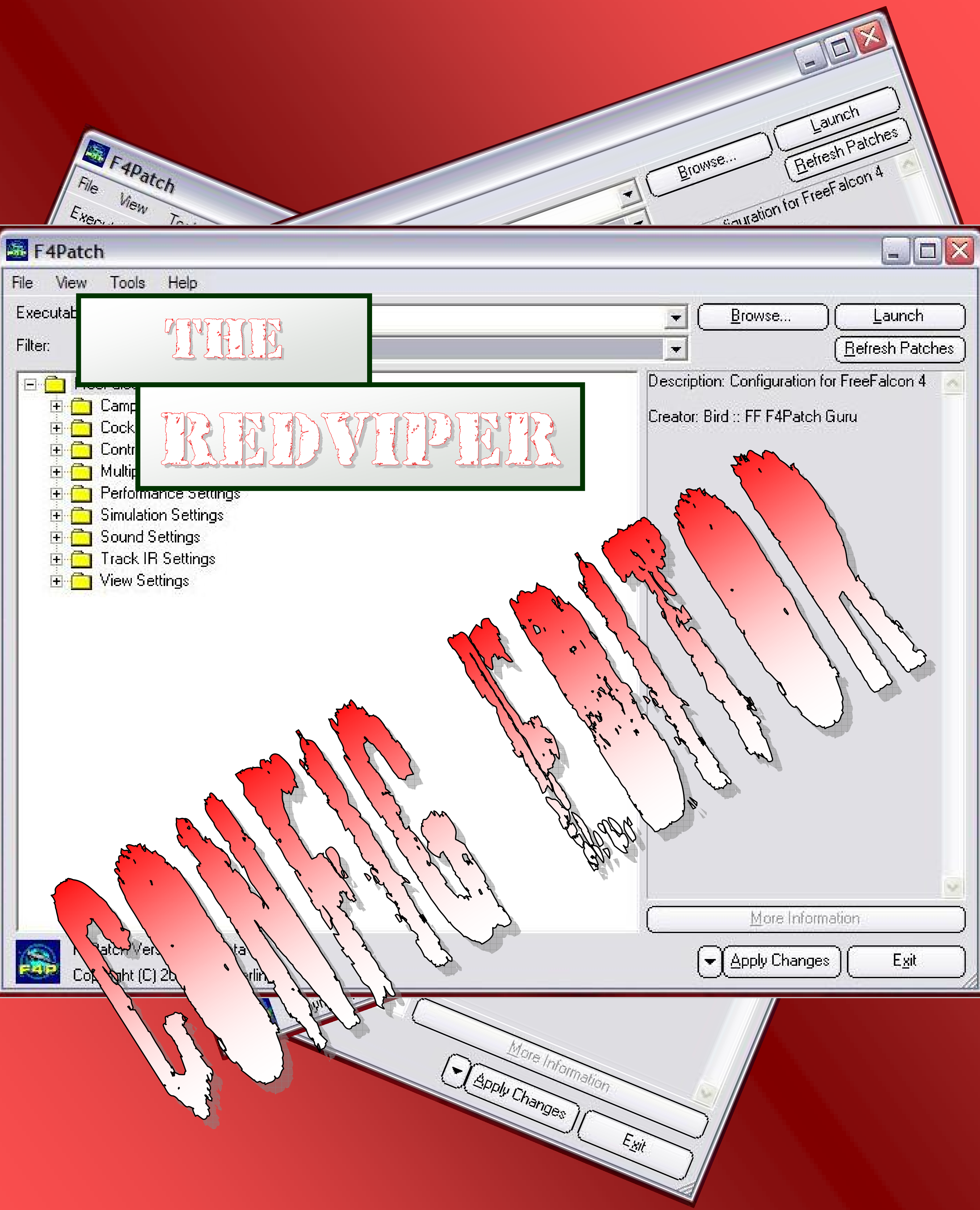
Ensure **32 Bit**

Must be set to “**3**”

Should be set to “**1**”

Can’t rotate the jet in the Munitions Page…?

Simply place your cursor in the **CENTRE** of the jet.


THE
REDVIPER
CONFIG EDITOR
F4Patch
File
View
Tools
Help
Filter:
Browse...
Launch
Refresh Patches
Description: Configuration for FreeFalcon 4
Creator: Bird :: FF F4Patch Guru
Simulation Settings
Sound Settings
Track IR Settings
View Settings
More Information
Apply Changes
Exit

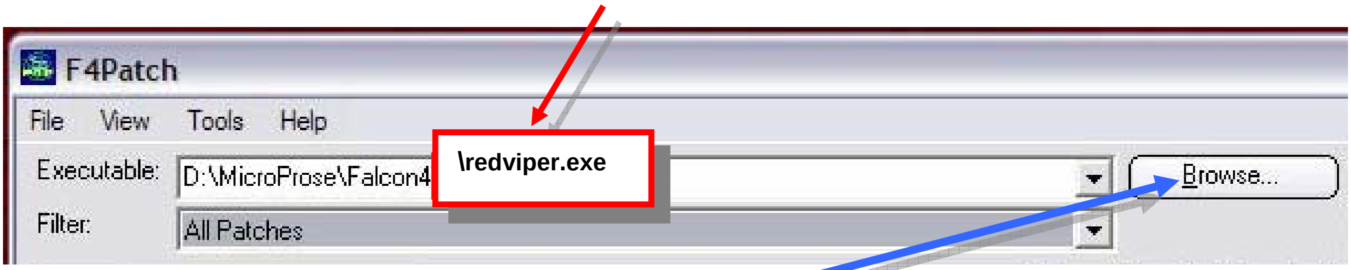
The FF Team have streamlined the F4 Patch into the RedVIPER Config Editor.

NOTE: The RedVIPER Config Editor will sometimes be referred to the Viper Editor.

* Options are now grouped into more logical categories.
* For simplicity of use, redundant options have been removed.

A few things to note →

Ensure that the RV Config Editor is pointing to your **RedVIPER** executable.

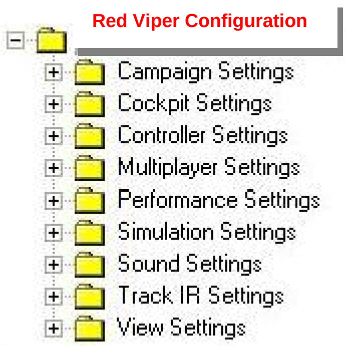


This can be selected using the BROWSE button

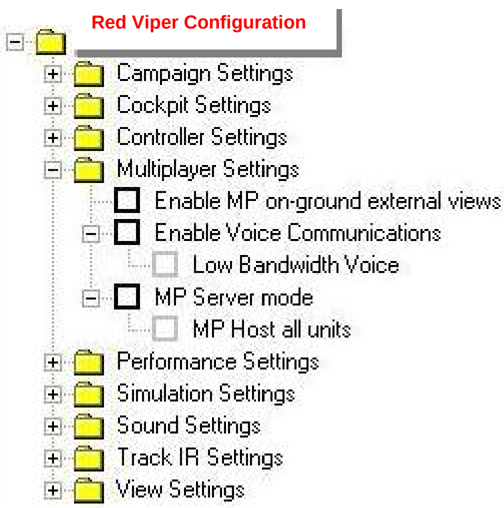
To "EXPAND" or not to "EXPAND" →

It is recommended **NOT** to "expand" the Patch.
If you are unsure of what this means, please do not be concerned.
Just open your RV Config Editor and make your choices. SIMPLE. ☺

FINDING YOUR OPTION →



In addition to the nine BROADER Settings Categories, there are also many SUB-Categories to explore.



Make note of the "+" signs in some options.

Clicking on this will EXPAND the Option "tree".

When setting your RV Config Editor, make sure you have expanded every branch and made ALL of your choices before Saving and Exiting.

Some RedVIPER Config Editor Options Explained:

- **Airbase Relocation:** *As stated elsewhere in this Manual, it is better if you do NOT make this selection. However – if you MUST relocate an Airbase, do the following: Check this option. Enter your Campaign and relocate as applicable. Exit and SAVE campaign. Exit sim. Open RV Config Editor and UNCHECK the Relocate Option. Resume your campaign.*

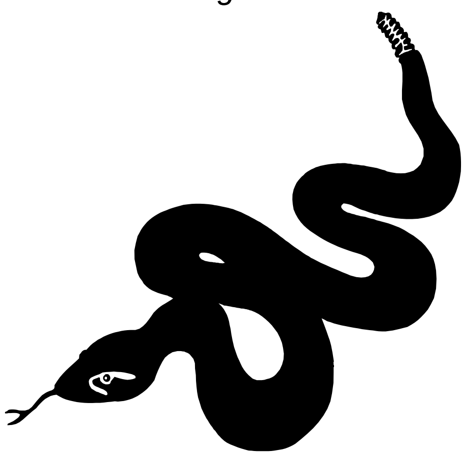
- **Large Strike Packages:** *This option will cause the ATO to generate 16 ship strike packages if it can. You should use this option* **only if you have enough planes** *to generate these larger strike packages. Otherwise you may find the ATO will not generate many missions.*

- **Radar Jam Chevrons:** *Normally, if an aircraft is Jamming your radar, you will see a large "X" on your MFD. However, checking the Chevron Option puts a different type of icon on your Radar A/A MFD. It looks like a 'chevron'. In military terms the 'chevron' is the stripe on your sleeve. In your MFD, the 'stripes' will appear upside down...*

- **Disable Hi Altitude Fartiles:** *Select this option to reduce the "stair-step" line which appears on the terrain at far distances from High Altitudes. With this checked, "real tiles" are rendered instead of the less detailed "fartile". The CPU has to work harder to display "real" tiles* (rendering images that you cannot even see at that distance). *With this option checked, your FPS/draw-time will be better at the expense of the "stair-step".*

- **Smart Combat Autopilot:** *With this option selected, your jet will follow steerpoints and engage in combat – launching missiles at enemy jets, and generally tooling about the skies fighting things. NOTE: In addition to selecting this option, you'll need to enter the U.I. Setup, and choose "combat" from the Autopilot Dropdown Menu.*

- **Throttle Direct ID Workaround:** *This enables the "built in"* ***throttle*** *found on some joysticks. If you have a stick like – for example - the Sidewinder Precision 2, enable this Option so that Falcon™ recognizes your joystick's* ***throttle****.*



Q: How many fighter pilots does it take to change a light bulb?
A: Just one. He holds the bulb and the world revolves around him.

Q: What's the difference between God and fighter pilots?
A: God doesn't think he's a fighter pilot.

Naomi Campbell, Claudia Schiffer, and Cindy Crawford are flying to a super models conference in Paris, when the captain of the plane announces: "We have just lost power to the engines and are going to make an emergency crash landing - assume the brace position immediately!"
Immediately the three models start preparing for the worst.
Claudia pulls out lipstick and make-up and starts fixing her face.
Bewildered, Naomi & Cindy ask: "What the hell are you doing fixing your make-up when we are about to freaking crash!" Claudia responds: “I know for a fact the rescue workers will FIRST search for and save the ones who have the best looking faces. Which is why I am putting on my make-up."
Cindy Crawford rips open her blouse to expose two beautiful mounds of flesh which inexplicably defy the law of gravity. Totally confused, Naomi and Claudia shout: "Cindy, have you lost your senses? Why are you baring your breasts for everyone to see when we are about to die!"
Cindy responds: "I have it on good authority in plane crashes, the rescue workers look to save first the women with big beautiful breasts- which is why I am exposing my tits!"
Not hesitating, Naomi Campbell pulls down her skirt and panties to expose her "love triangle."
Freaking out, Claudia and Cindy yell: "Naomi - Are you crazy?? Why are you exposing your crotch for everyone to see??" Naomi responds: "PLEASE…! I know for a fact the first thing rescue workers look for in a plane crash is a black box!!"

The HOW TO section

How to Change the Flight Models:

What is a Flight Model, and why change it…? The Flight Models (FMs) dictate how your virtual jet performs in the virtual sky. Things like acceleration, deceleration, top speed, turn rate, time to altitude. Basically – the time and path your jet takes to move from point A to point B in the virtual skies, should be mirrored by the same Real Life jet taking the same time and path in the Real Life skies. The default HFFMs *(High Fidelity Flight Models)* resemble VERY closely the real life performance of the F-16. However – different FMs have a slightly different "feel", and – whilst most n00bs AND veterans would be hard-pressed to tell the difference – FreeFalcon has always been about choice. So – if one could detect the subtle nuances of the different FMs – based upon preference, one could freely substitute one FM for another.

Procedure: Currently, FF4.0/RV1 looks to the *SIMDATA.ZIP* file in order to access FMs. This *SIMDATA.ZIP* file contains the HFFM set. This makes the HFFMs the default FMs. In your ***falcon4\Docs\Unnecessaries*** folder, you will find two "SIM Folders". They are the "FF2 sim" folder and the "FF3-1 sim" folder. To choose a different set of Flight Models, simply copy your chosen FM folder to your Default "\falcon4" folder", and rename the FM sim Folder to ***"sim"*** . This will cause F4 to use **these** files (***instead of*** the ones in the simdata.zip).
(Please read Page 98 for further considerations.)

If you decide to REVERT back to the default FMs, simply delete this "sim" folder. Should you wish to try again at a later stage, you'll still have the files in your *Unnecessaries folder*.

How to Change the Sky Fix:

What is a Sky Fix, and why change it…? The "Sky Fix" is the general "look" of your Sky background. A nuanced lightness or darkness. We are aware that a "Summer" sky will look or "feel" different to a "Winter" sky. So it is with Sky fixes. Each one offers a subtle difference in "feel". The choice is personal and of a purely aesthetic nature.

Procedure: Locate the following folder: ***MicroProse\Falcon4\Docs\EXTRAS***
Inside this "EXTRAS" folder will be a folder named: *FF4/RV Tod Files*. In the *FF4/RV Tod Files* folder is a series of FIFTEEN JPEG files, and FIFTEEN .lst files. From the names, you can see that each .lst file has an accompanying JPEG. By looking at the JPEGs you can "preview" your skyfix. After you have chosen the one you prefer, do the following:

- ✓ Backup your chosen .lst file.
- ✓ Now, rename your chosen .lst file to TOD.LST.
- ✓ Move that file into your: *MicroProse\Falcon4\terrdata\korea\weather* Folder

Some CONSIDERATIONS for FMs

Changing FMs…? You'll need to consider the following:

- Do you fly MP…?
- Do you fly DOGFIGHT against other human pilots…?
- Are you involved in any kind of DF Competition…?

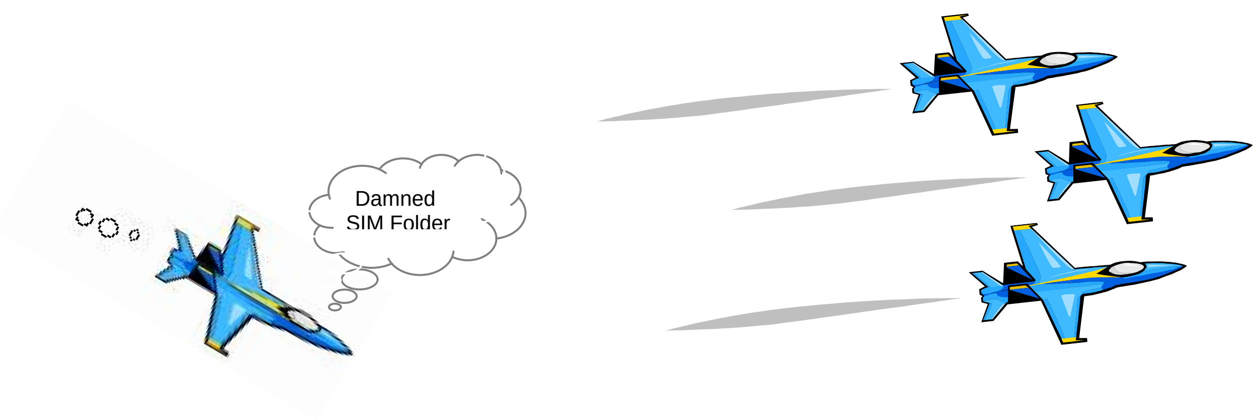
IF SO → You may be "cheating", by changing from the Default FMs.

For competition purposes, it is ESSENTIAL that ALL competitors fly the SAME Flight Models (The HFFMs are the most widely accepted).

For MP co-operative purposes – please be advised that DIFFERENT FMs have DIFFERENT Fuel Consumption Rates….!

It may be problematic if your flight RTBs. but you run out of jet fuel, 40nm from the airbase…!!

So – whether you are in MP mode for COMPETITION **OR** COOPERATION, it is important to either maintain or revert to your DEFAULT FMs.



How to *Change the Clouds:*

What is the difference, and why change them…? The "Stock" clouds are rather plain, yet – due to this very trait – are rendered effectively by the new RV Engine. The "New" Clouds are more detailed, and display a very realistic transparency, yet they are not rendered as well by the new RV Engine. Your choice, then, is between the default plain clouds - which will act as expected - or the more artistic, more aesthetically pleasing "New" clouds which – due to the more advanced techniques of the RV Engine - will tend to "pivot" around a point in space, and sometimes appear two-dimensional. These vagaries are especially apparent whilst viewing from the 3D pit. Again – one's choice of Clouds depends upon one's own aesthetic sensibilites. We have included them both, that one may have a choice.

Procedure: In your ***\falcon4\Docs\Extras*** folder, you will find a "Clouds" folder. In this are two different folders. They are: the "Stock Clouds" folder and the "New Clouds" folder. Inside each is a single DDS file, representing Cumulus Clouds.

Based on personal preference, one may simply copy and paste the DDS file you wish to try into your ***falcon4\terrdata\misctex*** folder *(overwriting the current file).*

How to *Have a Nude Co-Pilot in the B-52:*

What is the difference, and why change it…? The Buff 'pit offers the option of a "buff" female co-pilot. Why would you choose this…? Perhaps you are a sexual deviant, or perhaps it's always been your life's goal to fly a B-52 with a nude female co-pilot. Regardless, it is now possible to do so in the Sim. If you would like to cavort around the 'pit with a co-pilot striking provocative poses, simply follow the procedure below.

Procedure: In your ***\falcon4\Docs\Extras*** folder, you will find a "BuffBuffPit" Folder. It contains a *"DropIntoB52Pit"* zip. Unzip this archive to create another "BuffBuffpit" folder. Within this folder, you will find four (4) Gifs. Simply "copy" these gifs and "paste" them into your **/art/ckptart/b52** folder. If you find you no longer want a naked co-pilot, simply delete the four gifs from the *b52 folder*.

Use: In order to observe your "buff" Buff co-pilot, you'll need to use the "Down" views. Repeated down views will result in various poses, hairstyles and fashion statements. As far as the nude co-pilot is concerned, I trust you'll enjoy *going down* in this fashion.

The same principle is true of your fully clothed (full lipped) co-pilot, whose helmet may be donned by using the "Up" view.

How to *Have an AWACS Background:*

See: ***"RANDOM CONSIDERATIONS** Section"* (Page 110)

How to *Change the Gear Sound:*

What is the difference, and why change it…? The new gear sounds more accurately reflect the sound of gear extension, retraction and locking. They have also been tweaked to ensure that they are audible in both 3D and monoaural environments. Some Virtual Pilots may wish to increase the volume of the Gear Sounds. If this is the case, and you would like the gear sounds to be louder, simply follow the procedure below.

Procedure: In your ***\falcon4\Docs\Extras*** folder, you will find a "Gear Sounds" Folder. It contains two folders. One is the "Default Gear" folder; the other is the "Volume Gear" folder. The "Default Gear" – naturally - contains the sounds which were shipped with your install. The "Volume Gear" contains the louder sounds.

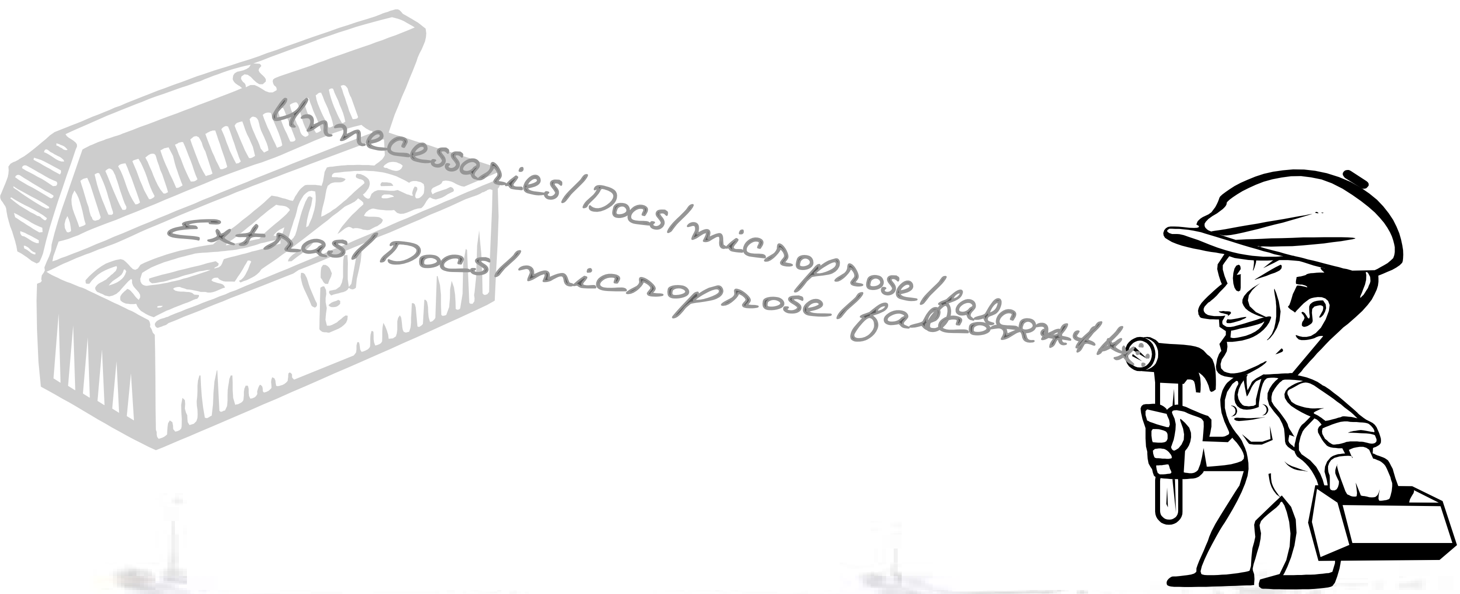
Based on personal preference, one may simply cut and paste ALL seven sounds into the ***\falcon4\sounds*** folder *(overwriting the current files)*

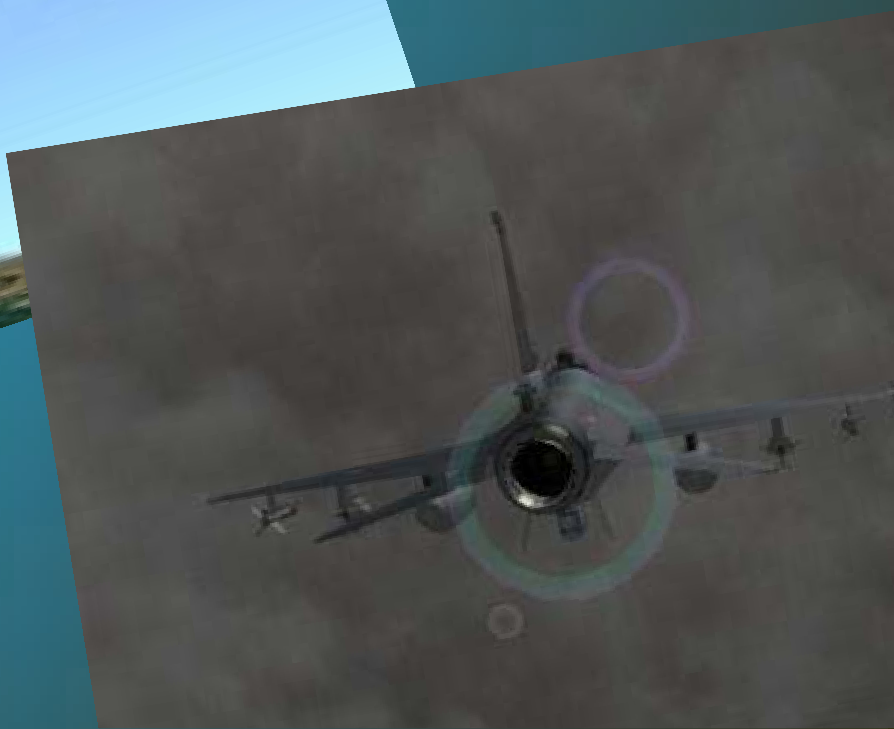
How to *Install Payware Hi Tiles:*

1. Run your HiTiles installer as per normal.
2. In your ***\falcon4\Utilities*** folder, run "**TerrainMerger01d.exe**".

   *It will prompt you to run "*TerrainTexCompress*". Follow that prompt, and chose your season. "**0**" (summer) is usually considered the default, though some prefer the slightly more understated colours of Autumn ("1").*
3. In your ***\falcon4\Docs\Extras\TerrainTiles*** folder, unzip the *OlympicPark.zip* and *OsanKusanDDS.zip* files.
4. Paste these seventy-two (72) unzipped dds files to your ***\falcon4\Terradata\korea\texture\texture*** folder

   This will restore the new Tiles for several airbases and Seoul Stadium *(see P.537)*





Driving Miss Gorny

The video drivers you choose will have an effect on your install.

Gorny's Hints For NVIDIA Drivers

There are three types I'd recommend. Each has it's own advantages.

However - the first thing you need to understand about your Video Drivers is that different drivers will perform DIFFERENTLY on DIFFERENT machines. So – unless your PC has EXACTLY the same configuration as your friend, HIS drivers WILL have a different performance from yours.

This relates not only to FPS, but to whether or not the software will ACTUALLY RUN…!

NVIDIA (http://www.nvidia.com) hypes ALL of it's drivers as 100% backwards compatible. This is not always the case. Some people find rolling back to OLDER drivers to be more effective than the latest driver. This may especially be the case if you have an earlier nVidia card (pre-FX).

As a general rule, however – I would advise you to use the LATEST drivers available.

Be further advised: **This does NOT mean BETA drivers**.
I advise you use the latest **RELEASE** version.

Before installing your New Drivers, make sure you have COMPLETELY erased the previous version.

I suggest you use the freeware **"Detonator RIP"**.
*(This program will not work unless you have the **.NET framework** be installed on your PC.)*

1) Use Add/Remove Programs to uninstall your nVidia display drivers.

2) Reboot

3) Windows may try to automatically install drivers. CANCEL OUT…!

4) Start **Detonator R.I.P.** and press the 'Remove Remains' button.
This will remove the stray information from the Windows registry and your hard disk

4b) *(OPTIONAL)* Reboot.

5) You should be able to safely install your new video adapter drivers

Gorny ALSO recommends: DRIVER CLEANER PRO *(freeware)*

Variations On A Theme: I recommend the following three drivers.

Forceware – Released by nVidia. Official. SOLID and RELIABLE.

Nvodngov – These are tweaked for BETTER performance ***and*** Image quality.

Z-Tweaked – These are tweaked for BETTER performance.
Purely for gamers, they are only interested in FPS.

Older rigs → I'd recommend the Z-Tweaked, and using the "High Performance" option.

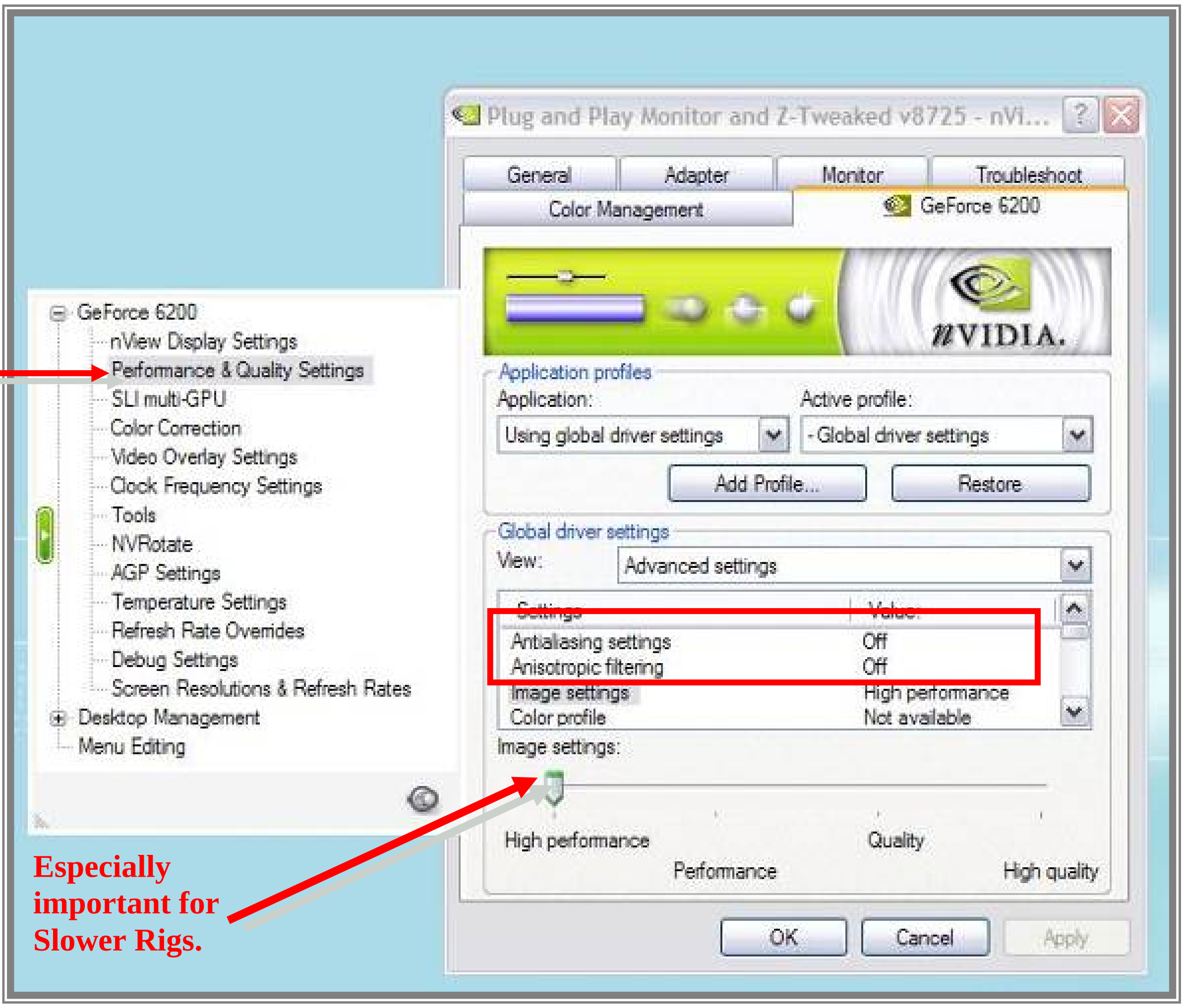
Newer rigs → I'd go for the Nvodngov. Experiment with Image Vs Performance.

Latest rigs → I'd go for the Forceware drivers.

Where to find the Latest drivers….? Central location → **Guru 3D**. (http://www.guru3d.com/)

They have convenient downloads for all of the above drivers.

You can also download *"Detonator RIP"*, and a host of free "tweaking" utilities from **Guru 3D**.



Brief notes on the Nvidia GUI

Antialiasing Settings: In general, the higher the sample rate of Antialiasing used, the smoother jagged lines in games will appear, but the lower your performance.

Nvidia graphics cards - any Antialiasing modes ending in 'Q' - provide a higher level of visual quality for a lower level of performance loss. Any Antialiasing modes ending in 'S' provide greater quality of Antialiasing, however performance may be lower. Any 'G' mode Antialiasing provides better image quality than the equivalent standard Antialiasing, but at a lower performance level.

If you tick the 'Application Controlled' box, the level of antialiasing is determined by your game's in-game antialiasing settings (if such settings exist in the game). If you want to guarantee the fastest performance in all games you should untick the 'Application controlled' box and manually set the Antialiasing slider to Off, and also ensure Antialiasing is set to 1x or Off in all the games you play.

Anisotropic Filtering: The possible sample rates of Anisotropic Filtering here are Off, 2x, 4x, 8x and 16x. In general, the higher the sample rate of Anisotropic Filtering used, the clearer textures remain as they fade into the distance.

Image Settings: The available options are High Performance, Performance, Quality and High Quality. This setting determines the level of Anisotropic and Trilinear texture filtering optimizations applied by the Forceware drivers. You can manually adjust these settings by firstly making sure the 'Advanced Settings' option is enabled in the View menu, and then going to the relevant setting to adjust manually.

Vertical Sync: VSync is the synchronization of your FPS with your Refresh Rate. If VSync is enabled, your maximum FPS cannot exceed your monitor's refresh rate. If Vertical Sync is disabled, your FPS will improve, and it can exceed the refresh rate cap, however you may notice some screen "tearing". It is strongly recommended that Vertical sync be disabled to improve performance.

Force Mipmaps: In general, "None" is the recommended option as it provides the best performance and the least possibility of visual anomalies.

Trilinear Optimization: I recommend Enabling Trilinear Optimization, which will result in better performance, but can reduce the quality of textures slightly. If you have a monster rig, and you want the highest quality graphics you should set this option to Off.

Anisotropic Mip Filter Optimization: If you want the highest quality graphics set this option to Off, otherwise set it On for best performance.

Anisotropic Sample Optimization: If you want the highest quality graphics set this option to Off, otherwise set it On for best performance.

Negative LOD Bias: Change this setting to Clamp if you use Anisotropic Filtering.

For detailed information, try: http://www.tweakguides.com/NVFORCE_1.html

Falstar says: **Laptops** have become very popular. For customized lappy drivers, try:
http://www.laptopvideo2go.com/

Yoni's ATI Graphics Card Advice

My experience is limited to the **ATI RADEON 9800 PRO 128MB** video card.

Regardless, I do think newer ATI RADEON cards will perform better with the settings I'll be offering in this article.

Video card drivers:
I recommend TWO sets of drivers for ATI cards:

1. *(ATI's official)* **CATALYST** drivers 2. **OMEGA** drivers.

CATALYST drivers

Perhaps the most popular with ATI users, this set of drivers promises **stability**.
Performance is pretty good in Falcon.

It's a good practice to keep track of newer versions and update.
You can get these drivers at: http://ati.amd.com/support/driver.html

OMEGA drivers

This drivers are actually a tweaked version of the official CATALYST drivers. I found the performance and quality to be much better in Falcon. With these drivers I'm getting better FPS (probably about 10% more than the CATALYST drivers).
I also found it provides a cleaner "picture" in falcon.
On the other hand these drivers tend to be less stable than the official ones.

At this time, I'm using the 26.05 version of the Omega drivers.
It's not the latest version, but I do find it better for falcon than the newest set (38.25).

You'll find these drivers at: http://www.omegadrivers.net/

Recommendation → test the Omega drivers with your card, if it gives you no problems I suggest you keep using it at it'll probably get you better overall video card quality in falcon.

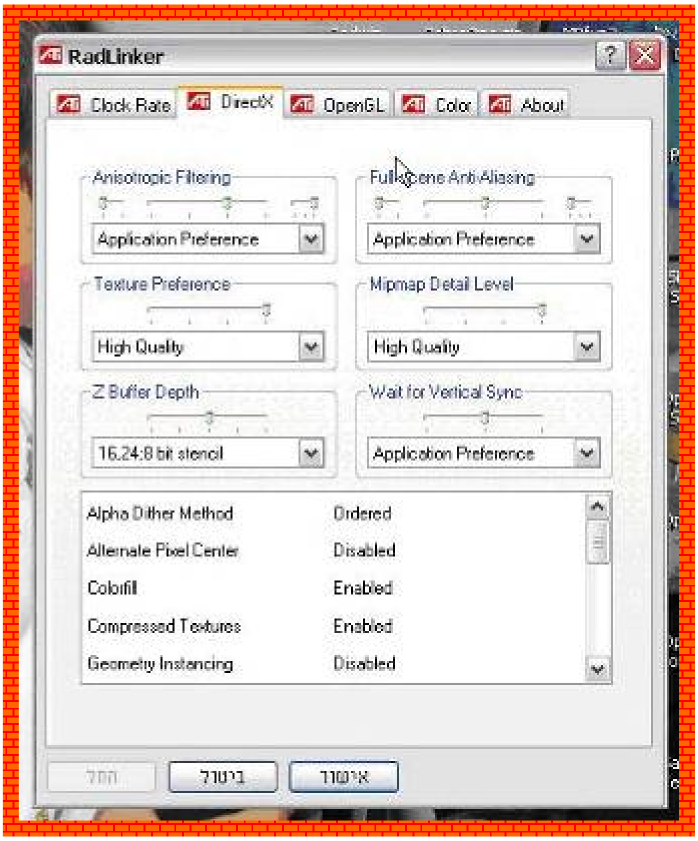
ATI Video card settings

This is the more important part of this guide. The settings I'll offer here should work with either set of drivers you decide to use.
For this part we will need a little utility. It's called RadLinker.
Why this? Because it's small and simple to use, but most important is the settings you can easily change by using it.
You can d\l it at this address: http://www28.brinkster.com/chrisww1942/

AFAIK latest version for win XP is 2.033.
install the software.
After installation right-click an empty space on your desktop and choose RadLinker .

The most important part for you is the "DirectX" part. Just click the button and you'll get a screen with video card settings in it. In the next page I'll go over this settings and try to explain each one and its importance to falcon.

This is how the DirectX screen should look after you click the button →:



AntiAliasing or AA

This setting determines how much GPU computing power you are willing to give up for smoothing curves. Basically the graphics card can't draw curved lines so it uses straight lines to create curved lines. You can imagine that this task can never be accomplished, due to mathematical reasons. As you will choose a higher number for this setting, your curves will be smoother but you'll pay for it in expensive FPS, as the GPU has more calculations to perform. Just set it to x4, load a mission, take a close screenshot on some AC. Then get out of falcon and set it to application preference, take the same screenshot and note the difference. With x4 setting the model will look much smooth, the end parts will have almost no jags on it.
A strong video card with a strong GPU can deal better with AA than an average or weak video card. Remember this when you go purchase your next card.

Recommended setting- there is none actually, since it depends on your video card performance. I suggest you to try x2 first, note the FPS and consider if you can go to x4 or x6, or maybe x2 is too hard on your card and you have to completely give up AA.

Anisotropic Filtering : This setting determines how much GPU computing power you are willing to give up for smoothing distanced textures on objects, it affects mostly objects which are far away from the camera. Just like with AA, AF requires lots of GPU processing.

Recommended setting - I suggest you set it to application preference since Falcon already includes a check box for it in setup\graphics\advanced UI menu. You can set it via RadLinker to x16 quality and you'll notice some difference but I found it to costly in FPS with not much improvement.

Vertical Sync: Set it to "always off"!! Otherwise it'll limit your FPS to your monitor's refresh rate. Change this setting only if you encounter a problem and this setting cures it.

Z-Buffer Depth: Z-Buffering is the 3D depth effect interpreted by the human eye when looking at a computer rendered picture.

Recommended setting - I'm using 16,24,32;8 bit stencil setting in RadLinker.
I've found it to lowers the Z-buffer fighting in Falcon to minimum.

Texture Preference & Mip Map Detail Level: I set these both to High Quality - it'll produce a better overall picture in cost of performance (FPS). You can change this settings if you need more FPS.

OTHER: Alpha dither method: set it to **ordered**. Enable the geometry instancing setting. Make sure compressed textures is **enabled** (or you'll see very weird textures while entering the 3d world)

Note- you can probably use some other utilities than RadLinker or even use the driver interface to change settings. RadLinker is a simple utility which I found to be very valuable when looking to improve Falcon performance.

Other recommendations

If you need some more FPS you can try the latency tweak utility called Latency Adjuster (LtcyCfg). Google and you'll probably find it. With this utility you will be able to change the latency setting on your card and effect performance in falcon, you can try difference settings and note the changes in FPS. Anyway bar in mind that this utility also affects the heat temperature of your card\system. Use it with extreme cautious! **NOTE: Will not work with PCI express cards.**

(**GORNY SAYS:** ***Latency Adjuster is available at 3D Guru. I recommend a setting of "64")***

Final Notes- I wrote this based upon my personal experience. You may find better settings for your hardware. I found these settings made a good balance between FPS and picture quality.

If you need some help with your graphics card or other hardware device, you can always contact me in the **FreeFalcon forums**. Look for "I-Hawk".

For detailed information, try: http://www.tweakguides.com/ATICAT_1.html

Gorny's List of Commonly Mispelt* Forum Words

Ordinance	= WRONG	Your	= Possessive ("own")
Ordnance	= CORRECT	You're	= You are
Wierd	= WRONG	i'm	= WRONG
Weird	= CORRECT	I'm	= CORRECT
Segway	= WRONG	*Mispelt	= WRONG
Segue	= CORRECT	Misspelt	= CORRECT

How to say "f**k off" in a variety of languages

(thereby cleverly avoiding a forum BAN)

yop tvayu mat *Russian* kie usero *Japanese* va te faire foutre *French* lech tizdaien *Hebrew*

vaffanculo *Italian* Yumago *Korean* fok jou *Afrikaans* kanith *Arabic* doolay *Cantonese*

fick dich *German* ay gamisou *Greek* ngentot lu *Indonesian* hacete cojer *Spanish*

Gorny's Collection of Useful Forum Insults

Are your parents siblings…?

Do you still love nature, despite what it did to you…?

I'd like to see things from your point of view but I can't get my head that far up my ass.

Who picks your clothes - Stevie Wonder…?

Can I borrow your face for a few days…? My ass is going on holiday.

I like you. You remind me of when I was young and stupid.

I'm not being rude. You're just insignificant.

I don't think you are a fool, but what's my opinion compared to that of thousands of others…

If assholes could fly, this forum would be an airport

You are depriving some poor village of its Idiot.

I want to reach your mind – but I'm worried about touching your butthole.

Your posts are a good example of why some animals eat their young.

I'm glad to see you're not letting your education get in the way of your ignorance.

Perhaps your whole purpose in life is simply to serve as a warning to others.

Your posts are about as useful as a windshield wiper on a goat's arse.

Forum Survival

Random Considerations...

AI TARGET THEFT: Falcon™ has an old problem, wherein an AI flight may destroy one's assigned target BEFORE one arrives, and – consequently – one will receive a Mission Failure… ☹

Of course, in TE Creation, one can simply be quite careful when creating missions, in order that one's squadron avoids any AI flight accidentally hitting the assigned target.

Campaign – however – is more problematic. One tactic may be to avoid taking flights that have other AI flights attacking adjacent or close proximity targets.

SITUATIONAL AWARENESS: This release has taken a global look at tactics in F4, and made some adjustments based on that. In FF4/RV1 - like in real combat - F4 combat has evolved. Now, the AI tactics have adjusted more than ever - microwave transmitter dummies, powering up radar at less than maximum range, firing optically with IADS support, low flying Migs using terrain masking. This release sees an evolution in tactics which somewhat mimics the real evolution of combat. So – be aware of what's going on around you. Adjust your Situational Awareness up a notch to fully enjoy this release.

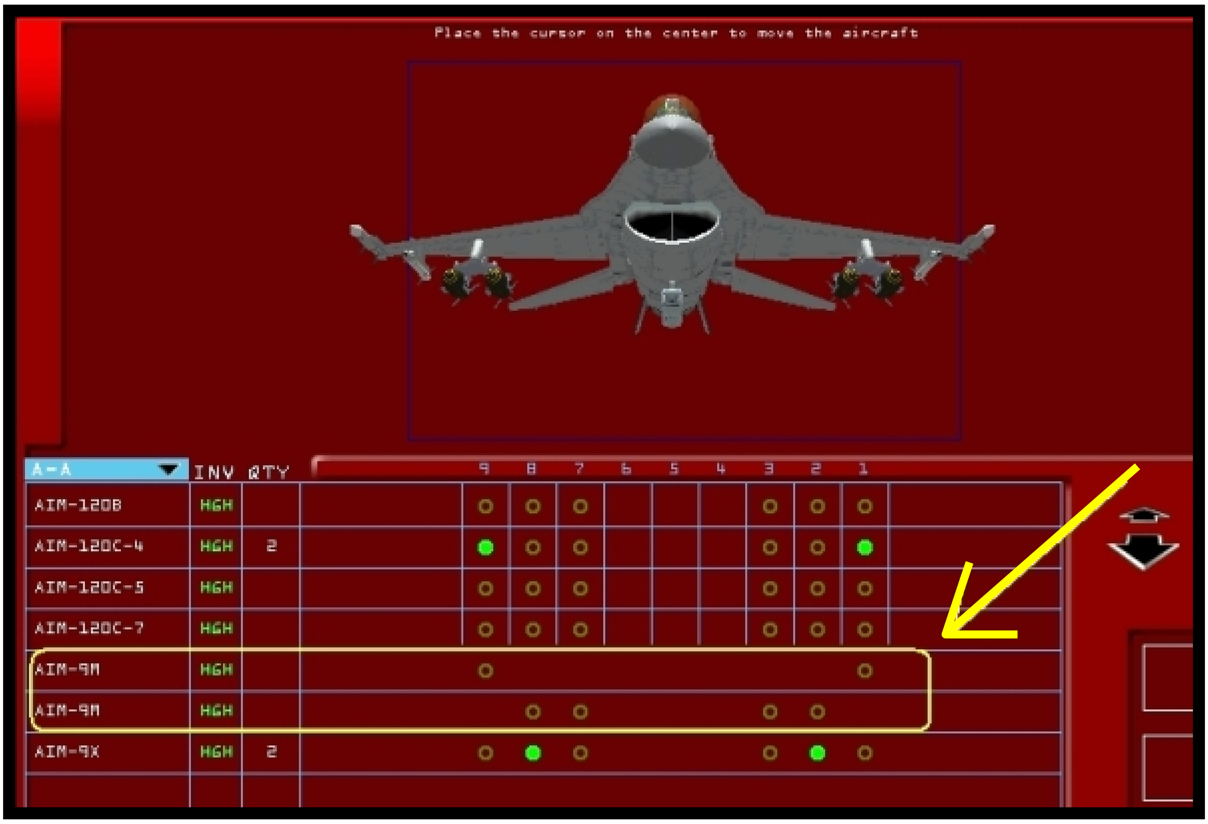
CHANGING WEATHER: Before flying a mission it is possible to change the weather conditions in which one will fly. AFTER having hit the "Commit" button, push the "Setup" button. Now – choose the Graphics Tab. Here one will note the Weather Condition is "locked". Click there, and select "Unlocked". Now – one may choose their desired weather condition, before hitting "Fly" to begin the flight in the weather conditions just chosen.

UNRESPONSIVE THROTTLE: Throttle won't respond…? If it's a joystick throttle, try pulling it all the way back to idle, and *THEN* push it forward. If it's a keyboard, try the following advice from *Mr_Pyro*: The sequence is "Shift" + "\", followed by "=". After this "\" increases throttle, whilst "=" decreases throttle.

DRIFT: Make it a habit to centre the joystick every time you enter the UI. Simply click the Controller Tab, and hit the "center" button.

FALCON MOVIES: If you update to Service Pack 2 of Windows XP, the Movies won't play during your campaign. One needs to reinstall the Cinepak codec for the Falcon 4.0 movies to show. For convenience, we've included the *ICCVID.DLL Cinepak Codec* in the "falcon4/Docs/EXTRAS" folder. Just copy and paste the file into your "windows/system32" folder.

MULTIPLE LANDINGS: Did you ever notice in your debrief that you landed MULITPLE times…? BEFORE you took off…? Don't worry. It is a well-known issue with Falcon. It only affects aircraft with more than one set of wheels on the main gear. So – you may experience it with such a/c as – for example - Viggens and Buffs.



MULTIPLE AIM-9Ms: Do you notice multiple AIM-9Ms in your Munitions page…? This has been done intentionally to prevent the AIM-9Ms being loaded on the outer HPs so often. This reflects the real-life practice. There are two AIM-9M weapons in *squadron stores*, and the one for the wingtips has a low availability. It will not – therefore - be used that often...

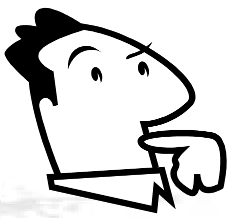
AWACS Background: You used to like that AWACS background in the UI - the Black screen with the green icons that – perhaps – simulated an AWACS screen…? You'd rather have that than the Campaign map…? **You'll need to edit your .cfg file**. Go to the falcon4 default folder, and find the redviper.cfg file *(about 17.5KB*). Open this file with *Notepad* or *Wordpad*.
Now edit the following line, by changing the "0" to a "1" →

// This option switches the UI background map to an AWACS version
set g_bAWACSBackground **0**

So – after you change it, it will NOW look like this →

// This option switches the UI background map to an AWACS version
set g_bAWACSBackground **1**

OPEN Canopy: FF4/RV1 is the only version of Falcon in which your Canopy is OPEN upon entering the 3D World. Don't forget to close it… ☺ Furthermore, you will notice blood on your canopy in the Mig-29. Close your canopy, and it will disappear. *(Blood appears when your cabin depressurizes. This 'pit was made in the days before Ramp Starts and opening canopies, so – the only time a cabin depressurized was due to damage. Thus, the blood..)*




A European Flavour
FREEFALCON + REDVIPER

FreeFalcon/RedVIPER has always been about choice. The choice to fly the plane YOU want; the theatre YOU want; the cockpit YOU want.

Whilst acutely aware that Falcon4.0™ is a Study Sim; that this Sim is an F-16 Simulator, the FF/RedVIPER Team has nonetheless been loath to FORCE your hand.

Our team respects the desires of ALL our virtual pilots.

To this end, various European Dev Teams have been hard at work to bring you a European Flavour!

- DEDICATED models
- DEDICATED 2D and 3D Pits
- DEDICATED Flight Models
- DEDICATED Animations
- DEDICATED Avionics *(within code constraints)*

Detailed, flyable European Aircraft include:

- **Viggen AJS-37** *(Attack/strike)*
- **Viggen JA-37** *(Interceptor)*
- **Viggen SK-37** *(recce)*

- **Mirage 2000- 5F**
- **Mirage 2000- 9**
- **Mirage 2000-C**
- **Mirage 2000-D**
- **Mirage 2000-N**

- **Rafale-M**

Viggens

The Swedish Air force has had five different types of SAAB Viggens in active duty:

AJ37 *(primary role attack, secondary fighter)*
SF37 *(reconnaissance)*
SH37 *(maritime patrol and attack)*
SK37 *(two seater, designed for pilot training, in the last years when no more training was needed, some were converted to an electronic warfare platform, designated as SK37**E**)*
JA37 *(primary role fighter/interceptor, secondary attack, developed later than the first four variants)*

Sweden was the only country to buy the Viggen. This was partly due to the fact that the Viggen was designed to meet uniquely Swedish demands *(e.g. the dispersed base)*, but also because the Swedish government didn't grant permission to sell the plane to just any country. A ***SAAB*** representative was quoted as saying that he was only allowed to sell the Viggen to countries who could prove that they wouldn't use it for waging war….! A possible sale of JA37's to India was not to be, because the US didn't approve it at the time *(the US had a say in the sale, because the Viggen has an engine of American origin)*.

The Viggen was also a contender against the F16 in the 'deal of the century'; eventually won by the F16. At the time of printing, a total of 329 Viggens have been built.

Aside from the distinctive looks, the Viggen has some special features:

- *It is a true STOL plane, which needs only 500 m. runway. Three elements are important for the STOL characteristics: the wings configuration* (canards)*, the powerful engine* (26,000 and 28,000 pounds of thrust in full AB) *and the thrust reverser.*
- *It was the first plane with a digital computer instead of a human navigator* (as early as mid-60's)
- *The sturdy main gear has two relatively small wheels, which give enough pressure, and reduce drag in snow, because the second wheel runs in the track of the first.*
- *A short turn around time* (Officer + 5 men: 10 minutes) *for full refuel and rearming*
- *No in-flight refueling possibility. This was related to the Swedish defense doctrine: no need to fly deep into enemy airspace; instead a high sortie rate from dispersed bases for defence purposes.*
- *A very sophisticated link system, part of the STRIL 60 defence system, which, many years earlier than NATO partners, gave Viggen pilots a constantly updated and filtered view of the battlefield, ground and air. E.g. in the JA37Di a Viggen pilot can see which plane is locked by his wingman, and also if a missile is fired.* (This 'link' is currently N.I. in FreeFalcon4.0)

in FreeFalcon / REDVIPER

In FreeFalcon two variants of the five are present, the AJ37 and the JA37; both representing the most upgraded versions, designated as the AJS37 and the JA37Di, respectively.

The AJS37 is used primarily for **A2G** tasks. You can carry bombs, mavericks, rockets and the ***mjölner*** - a gliding stand off submunition dispenser. For air defence the Aim9J (RB24J) and Aim9M/L (RB74) missiles are available. *In RL, the AJS has a very important anti shipping role and carries RB-04 or RBS-15 anti shipping missiles.* Although not attached to the model at present, your Aden cannon pod can fire off 150 rounds. Chaff and flares are also available to the Virtual Pilot.

The AJS37 in FreeFalcon4 has a splinter camo skin. This used to be the skin of all variants.
The skin in FreeFalcon4 is made by Snail, on a base provided by MagicV4.2.

The JA37Di is a pure fighter; the attack role being virtually non-existent.
It can carry a range of **A2A** missiles; well-known missiles with Swedish designations:

- Aim 9M/L sidewinders ***(RB74)***
- Skyflash semi-active medium range ***(RB71)***
- Aim 120b Amraam ***(RB99)***

Other loadouts include Jammer *(erijammer)* and a centerline tank; usually present to extend the range of the plane. In Real Life, the BOL chaff/flare dispenser is an optional loadout. In FF, the BOL is a standard loadout on the JA37. It has been integrated into the 3D model. We have ensured no detrimental effect, as the dispenser is attached to a pylon which has no other uses.

The JA37 also has a belly-mounted Oerlikon cannon. In the real Viggen it is automated in such a way that the pilot can simply acquire a radar lock on the target, and the flight computer moves the plane in the optimal direction and for that shot. *(Though effective, this can result in a very uncomfortable and bumpy ride.)* Because of this automation, the real Viggen pilot can open fire at a relatively large distance, with maximum Pk. *(At present, this feature isn't implemented in F4.)*

In FreeFalcon4.0, the JA37 has a grey and white camo. Base skin by Snail; weathering by Donky.

The Flight model

Both Viggens have their own dedicated flight models: As in real-life, the JA37 being a bit more powerful than the AJS37. The FMs have been benchmarked against published specs
(e.g. from stand still to 10 km in 100 seconds). Another feature is the **thrust reverser**: After the nose gear has touched the ground, activate with the keystroke "k k". Applying thrust reduces speed until the aircraft comes to a standstill. Tapping "k" again de-activates the thrust reverser.

The 3D models

The basic 3D model of both Viggens was created by Swede. BaldEagle has tweaked them for FreeFalcon. Pumpyhead has also done a lot of work to get the details right, such as movements and lights. The model is very detailed, especially when the landing gear is out. Due to the amazing complexity of the model, there MAY be an FPS hit if too many Viggens are present on an airbase. Be advised, however - it's a joy to see the FreeFalcon Viggen taxi and take-off, and watch the seamless animation of the gear retracting into the bay.

VIGGEN WAR STORY

Squadron nr. 13 *(F13 in Norrköping)* could practice the intercept role with it's *JA37's* twice a week when an **SR71** would fly over: a free & fortuitous opportunity to exercise. The Blackbird approached usually at Mach 3.2, but had to slow down to Mach 2.3 to make a turn over the Gotland area. Using GCI warning, the Viggens were regularly on time in the air, and climbing to meet it. When they got by, they would have about 10 seconds to get a lock and "*fire"* a missile. *[The sidewinder would have been an ideal choice because the SR71 was so hot.]* The pilots from the Recce Viggens *(SF37)* became quite fed up with this bragging of the fighter jocks, and determined to get better results! They managed to show some photo's taken by a Recce Viggen, **looking down** on the top surfaces of the passing SR71. Despite the fact the SR71 was slowing down to exceute a turn, it still quite an amazing feat…!

"BANG BANG"

The Oerlikon KCA 30mm cannon is the world's most powerful jet fighter cannon.

The projectiles weigh 360g and the propellant weights ***twice as much*** giving a very high muzzle velocity, short flight times, and a very flat trajectory.

A joke among Viggen pilots is that the cannon is so accurate that you have to pump the joystick while shooting to avoid hitting the same hole.

VIGGEN PRON STORY

During an air show at F10 a SF37 *(recon)* Viggen took a photo over the airbase to display to the air show visitors later that day. When base personnel checked the photo for display, it looked very nice, but for one detail…. The couple screwing in the forest next to the base…!

VIGGEN WAR STORY

A bunch of JA37 pilots were competing over who could fly lowest over the hangar roof at the F7 airbase.

The competition ended when one of the pilots overflew the hangar, dropped the landing gear and made two straight lines in the snow lying on top of the roof…!!

VIGGEN BALLS STORY

During an exercise, an SF37 was tasked to take some recon pictures of a bridge.
The plane returned and the information analysts examined the photos. They were all knife sharp. But the last picture was rather blurry, and they couldn't make out what it was.
So – they called in the pilot, and asked him...

He explained it was a photo of the underside of the bridge.
"How did you get this photo," they asked?
"Very low and inverted under the bridge," he calmly responded.

http://www.canit.se/~griffon/aviation/text/37viggen.htm
(detailed information on all variants and weapons)

http://members.chello.nl/~f.vanvoorst/
*(**Snail's** Dutch Viggen page)*

MIRAGES

The Mirage 2000C is primarily tasked as an INTERCEPTOR.
The “D” version is an ALL weather, day AND night platform.

Powered by an SNECMA M53 P2 / 9.7 t with afterburner, the Mirage 2K is built by the French DASSAULT company.

At a little more than 50ft in length, the Delta wing has a span of 29ft, 5 in.

Clean, the Mirage 2K is capable of speeds in EXCESS of 1,453 mph (2,338 km/h)
The Mirage 2K can operate at altitudes in excess of 50,000 ft, and has a combat range of over 920 miles. Maximum take-off weight is 37,478 lb

Apart from it’s home in France, the Mirage2000 is currently employed by many air forces, including India, Taiwan, UAE, Egypt, Peru and Greece.

(Additionally, the Mirage F1 formed the elite of the Iraqi Air-Force…!)

Export versions of the Mirage2K were fitted with differing RADAR, as the French version was judged too advanced for export. Export versions were also fitted with other less sophisticated avionics.

Versions

The Mirage 2000 family contains the following versions, available in FF4.0:

- *Mirage 2000-B* Twin Seat French Air Force training version
- *Mirage 2000-C* (RDI) Single Seat AA for French Air Force
- *Mirage 2000-N* (N for Nuclear) Twin Seat French Air Force with Nuclear capacity
- *Mirage 2000-D* (D for Diversified) Twin Seat AG for French Air Force.
- *Mirage 2000-5* (F) Single Seat AA for French Air Force
- *Mirage 2000-5 Mk2* Export version of –5, Single or Twin Seat.
- *Mirage 2000-9* Single or Twin Seat Export version

The main differences are:

- Mirage 2000-C and –5 are mainly AA, -C is limited to Fox-1 capacity when –5 has Fox-3 (MICA-EM) with multiple target tracking. ECM of the –5 has been significantly improved versus –C

- Mirage 2000-B is a twin seat version dedicated to training and pilot transformation, both seats are dedicated to pilots.

- Mirage 2000-D and –N, are twin seat, one pilot, one Weapon System Officer (WSO, called NOSA in French), they do not have internal DEFA gun, nor air intake mobile devices, so, mach number is limited to 1.45. As they are mainly dedicated to AG, they host the Antilope-5 TC (Coherent Processing) radar, with few little AA capabilities.

Basic data

- Dry weight (-D, -N) : 7,900 kg (17439 lbs)
- Dry weight (-C, -5) : 7,500 kg (16556 lbs)
- Internal Fuel Capacity : 3150 kg (6966 lbs)
- External additional tanks CAPACITY (-D,-N,-5):
    - 2 wing tanks RPL-542: 6975lbs (3160 kg)
    - 1 fuselage tank RPL-522: 2,156lbs (980KG)
    - 3 tanks (2xRPL542 + 1xRPL-522) : 91540lbs (4140 KG)
    - Asymmetric (1xRPL542 + 1xRPL-522) : 5,650lbs (2560 Kg)
- Fuel Type: F-34 / F-35 / F-40 /F-43 / F-44.
- Maximum Take Off Weight : 38,500 lbs
- Maximum Landing On Weight : 24,000 lbs
- Max Mach Number : 2.2 (-B, -C, -5, -9), 1.45 (-D, -N) (36,000 ft)
- Max Indicated Air speed : 750 Kts
- Operational Ceil: 57,500 ft (FL500 without stratospheric equipment)
- Unofficial maximum altitude reached: 720,000 ft
- Approach speed: between 140Kts (min. weight) and 200Kts (max. weight)
- Max. Load Factor:
    - CAT-I +9 (Ultimate +11) / -3.2G, AoA 29deg (Ultimate +31);
    - CAT-III +5.5/-3.2G AoA 20deg
- Reference Area: 441 ft^2 (40.5 m^2)
- Length :14.94 m
- Wing Span : 9.13 m
- Height (with weight less than 25,000 lbs) : 5.20 m
- Maximum AoA for hard landing (rear contact) at weight of 21,800lbs :15°30'

Power Plant: 1 SNECMA M53-P2

- Dry Thrust : 65 kN
- AB Thrust:
    - Nominal: 97kN (21,800 lbs)
    - Null Air Speed, FL0 : 75kN (16,900 lbs)
    - Mach 0.9, FL0 : 106kN (23,850 lbs)
- Specific fuel flow with full AB: 2,12 kg/DANH.H
- Specific fuel flow with MIL power: 0.92 kg/DANH.H

Radar:

- 2000-C : RDI: AA mode, Single target tracking , Look down-Shoot down, high range (60 Nm / 360 656 ft for SER of 5 m^2, over or under flight level) .
  Compatible with MATRA Super-530D (Fox1). **No TFR nor TWS**

- 2000-5 : RDY: AA mode, Multiple targets tracking , Look down-Shoot down, high range (70 Nm / 426 230 ft for SER of 5 m^2, over or under flight level) . Compatible with MICA ER (Fox-3) with LAM allowing shoot of 2 MICA before missile lock, others in Mad-Dog or Pit-Bull mode, **TWS capable**, but **no TFR**

- 2000-9 : RDY-2: AA mode, Multiple targets tracking , Look down-Shoot down, high range (80 Nm / 491 803 ft for SER of 5 m^2, over or under flight level) . Compatible with MICA ER (Fox-3) with LAM allowing shoot of 2 MICA before missile lock, others in Mad-Dog or Pit-Bull mode, **TWS and TFR capable**

- 2000-D : DASSAULT ELECTRONIQUE Antilope-5, mainly AG, allowing low altitude / high speed ground following (200 ft , 600Keas, +5.5G) with heavy loads (2 RPL-541/542 + 2 Magic-2 + 2 BGL-250 or 4 Mk82) but with few AA capability : AG range of 27Nm (163934 ft), AA range limited to 10 Nm in a mode close to F16's ACM), **no TWS**, **nor NTCR** capabilities.

Electronic Counter Measures **deployment in FF4/REDVIPER**

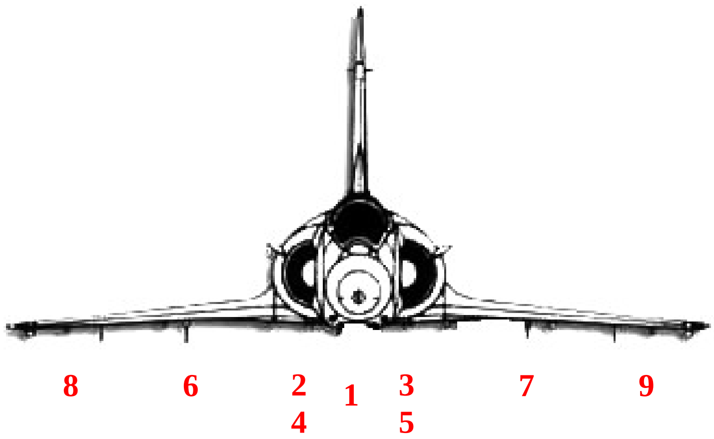
Radar cross section *(RCS)* was assumed to be less than the F-16.
→ A setting of 80% was judged most realistic.

ECM are internal, and combine passive sensor, active jamming and chaff / flare dispensers

- Maximum chaff number set to **112** for all French 2000 variants
- Maximum flare number set to **64** for all French 2000 variants
- 2000-D has additional dorsal equipment allowing 48 more flare or chaff (160/64 or 112/112)

Real Life ECM Systems also include:

- Thomson-CSF Serval radar warning receiver (antennae at each wingtip and on trailing-edge of fin, near tip, plus VCM-65 cockpit display);
- Thomson-CSF Caméléon (2000N), Caméléon C2 (2000D) or Sabre (2000C) jammer at base of fin (detector on fin leading-edge);
- Matra Bae Spirale, comprising chaff dispensers in Karman fairings at wing trailing-edge/fuselage intersection and flares in lower rear fuselage.
- French Air Force DDM (Détecteur Départ Missile) missile plume detector requirement satisfied by 1994 purchase of SAGEM SAMIR system for 1995 fitment in rear of Magic launch rails (2000D/N first, but also to 2000Cs patrolling Bosnia).
- Spirale fitted to 2000N-K2; retrofitted to 2000N-K1 and installed on 2000Cs from No. 93;
- Thomson-CSF Eclair system (Alkan LL5062 chaff and flare launcher) in place of braking parachute, lacking automatic operation on 2000C before Rank 93, can be installed on 2000-D and N if necessary



M2000-D Loads by Hard Points

Load	8	6	4	2	1	3	5	7	9
Max weight (kg)	*300*	*1800*	*400*	*400*	*1800*	*400*	*400*	*1800*	*300*
R 5 5 0 Magic-II	1								1
RPL-541 /RPL-542 (2000L)		1						1	
RPL-501/ RPL-502 (1700L)		1						1	
RPL-522 (1300L Supersonic)					1				
Mk-82 / BSU-49		4	1	1	4	1	1	4	
BGL-1000 / GBU-24		1			1			1	
BGL-250 / GBU-12		2			2			2	
BLU-107 DURANDAL			1	1	4	1	1		
BAP-100 / BAT-120					18				
BLG-66 BELOUGA		1	1	1	1	1	1	1	
Targeting Pod				1					
AS-30L(*)		1						1	
APACHE					1				
ARMAT AS-37		1						1	
EXOCET AM-39		1						1	
FLIR Pod				1					
SCALP-EG					1				
Recce Pod					1				
2x DEFA 30mm					1				
Refueling Pod					1				

2000-C loads by Hard Points

By Mirage 2000-C we mean French Air Force aircraft –C RDI with Fox-1 capacity by Matra Super-530D missile. Internal loads are 2 DEFA-554 30mm guns with firing rate of 1500/1800 round per minutes each (30 per sec), so with 125 rounds per gun, firing time is about 4 to 5 seconds.

Load	8	6	4	2	1	3	5	7	9
Max weight (kg)	300	1800	400	400	1800	400	400	1800	300
R55 0 Magic-II	1								1
Super 530D		1						1	
RPL-541 /RPL-542 (2000L)		1						1	
RPL-501/ RPL-502 (1700L)		1						1	
RPL-522 (1300L Supersonic)					1				
Mk-82 / BSU-49		4	1	1	4	1	1	4	

M2000-5 loads by Hard Points

Load	8	6	4	2	1	3	5	7	9
Max weight (kg)	300	1800	400	400	1800	400	400	1800	300
R55 0 Magic-II	1								1
Mica EM			1	1		1	1		
RPL-541 /RPL-542 (2000L)		1						1	
RPL-501/ RPL-502 (1700L)		1						1	
RPL-522 (1300L Supersonic)					1				
Mk-82 / BSU-49		4	1	1	4	1	1	4	

See ***APPENDIX #7*** for Further information on FF4.0/RV1 Flight Models

FF4.0

RV1.0

Mirage 3D Pit

RAFALE in FF/RV

General Description.

The Dassault Aviation Rafale is a light (10 tons) Omni-Role (AA and AG) fighter, twin engine (50 / 75kN each), with high-end weapon and navigation system (Multi target BVR, data link, Optronic sensors, Stand Off and Laser Guided AG weapons capabilities)

Its advanced aerodynamic configuration and full digital flight control system provide a very high level of maneuverability.

Its Speed range (750 Knots IAS , Mach 1.8) is more affordable (with supersonic capabilities without After Burner and/or with external tanks), than wide in itself (compared to Mach 2.2 of Mirage 2000-5 for example)

Versions

The airframe of the Rafale is currently defined by four (4) versions:

- Rafale C : single seat, Air Force
- Rafale B : two seats, Air Force
- Rafale M : single seat, Navy
- Rafale N : two seats, Navy

Main differences are:

- The difference between the Air Force and Navy FM is very minor, and does not need to be taken into account in F4.
- Naval versions (N,M) have only 13 hard points, whereas Air Force versions have 14.
- Naval version (N,M) has a front landing gear which is different from the land based one, and also has a landing hook.
- Two seater navy version (N) does not have an internal gun (DEFA 30mm).

Any plane of any airframe version can be operated with a given "System level". This concept is different from the U.S. Block system: A F16-C block 40 is the frozen combination of a given airframe and system. This will not change until a complete retrofit (system and airframe).
A Rafale M/F1 can be upgraded to F3 standard with hardware changes; an F2 to F3 with only software changes.

As of today, 3 standards are identified:

- **F1**: AA only. Today's (2003-2004) standard of Rafale M (French Navy)
- **F2**: F1 AA + MICA-IR + AG stand off weapons (Scalp-EG and AASM) - The standard for B and C versions (French Air Force)
- **F3**: improved AA with Helmet Mounted Cueing System (High Offset Boreseight for MICA-IR), improved AG with Laser Guided weapons (with Damocles Pod) and Nuclear missile ASMPA, Air-Sea capabilities…

Basic data

- Dry weight : 9,060 kg / 19,973lb (B/C), 9,670 kg / 21,319 lb (M/N)
- Max Take Off weight: 24,500 kg
- Internal Fuel Capacity : 4,750 kg / 5,650 l / 10,500 pounds
- Reference Area : 45.70 m2 (498 sq.ft)
- Max Mach Number : 1.8
- Max Indicated Air speed (VNE) : 800 Keas
- Ceil: 55,000 ft
- Approach speed : 120 Keas
- Max. Load Factor : +9 / -3.6G (CAT-I); +5.5/-3 (CAT-III)

Engine: SNECMA M88-2

- Dry Thrust : 50 kN (11,250 lb)
- AB Thrust: 75 kN (17,000 lb)

Radar: THALES RBE-2, AG (TFR) and AA mode, Multiple targets following (with missile data link allowing firing 2 fox-3 without missile seeker lock, and 6 other fox-3 with lock prior to launch), Look down-Shoot down, high range (60 Nm for SER of 5 m^2, over or under flight level) .

Electronic Counter Measures: Internal (no Pods): SPECTRA combining passive sensor, active jamming and chaff / flare dispensers (4)

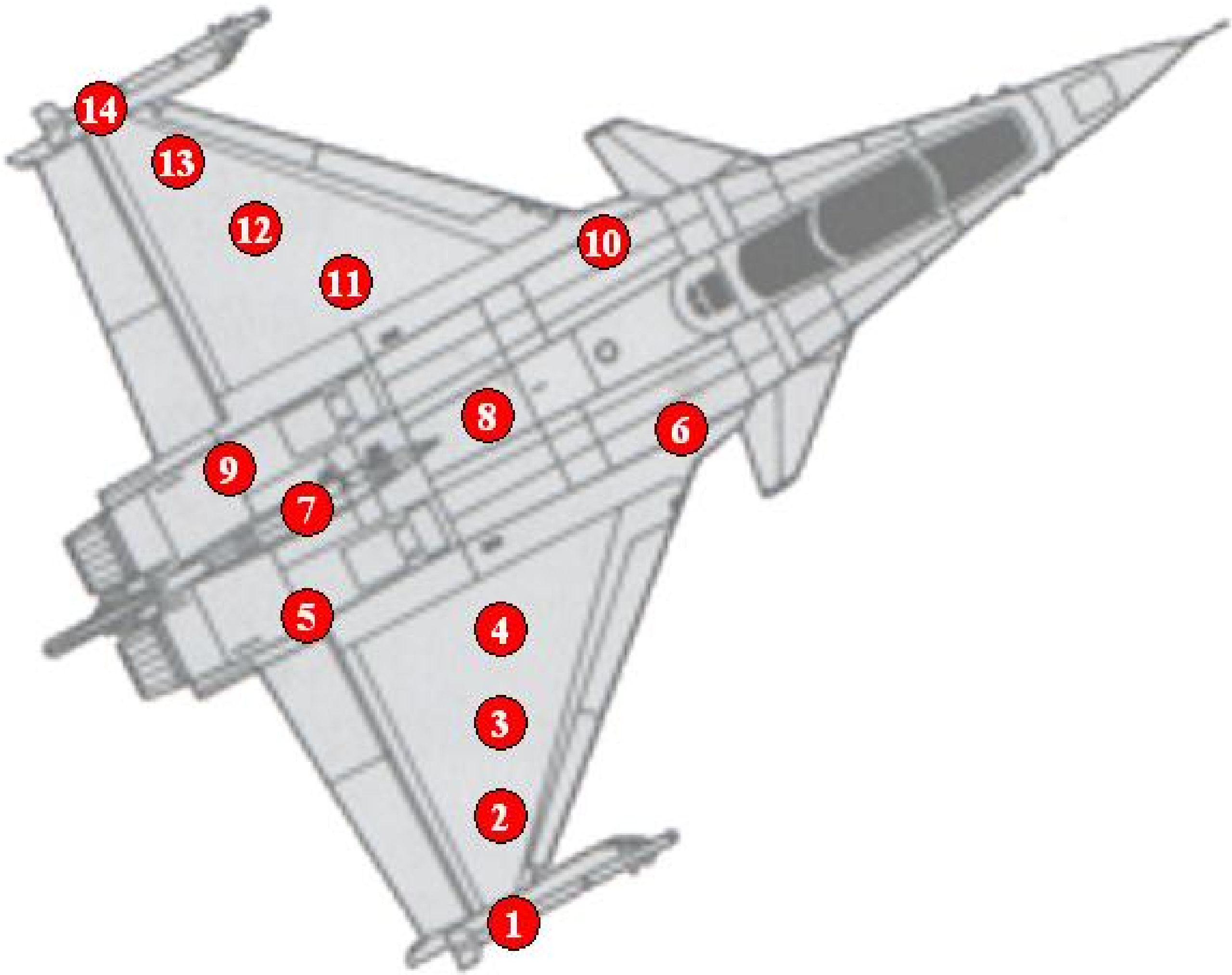
Weapon Loads

Internal Gun: one (right side) DEFA 791B with 125 rounds (fire rate of 2,500 rd/min), for all versions excepted navy twin seat (N).

14 hard points for B and C, 13 for M and N (HP-7 not available)

Rafale F1

HP	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Magic-2	1													1
MICA-EM	1		1		1				1			1		1
RPL-711 1250L				1				1			1			
RPL-751 2000L				1				1			1			



Rafale F2

HP	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Magic-2	1													1
MICA-EM	1	1			1		1		1				1	1
MICA-IR	1	1			1		1		1				1	1
AASM			3									3		
SCALP-EG			1					1				1		
Mk-82			3									3		
BSU-49			3									3		
BLU-107B			3									3		
RPL-711 1250L				1				1			1			
RPL-751 2000L				1				1			1			

Rafale F3

HP	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Magic-2	1													1
MICA-EM	1	1			1		1		1				1	1
MICA-IR	1	1			1		1		1				1	1
AASM			3									3		
SCALP-EG			1					1				1		
Mk-82			3									3		
BSU-49			3									3		
BLU-107B			3									3		
BGL-250			3									3		
BGL-1000			1									1		
Laser POD (DAMOCLES)						1								
AM-39			1									1		
AMSP-A			1					1				1		
RPL-711 1250L				1				1			1			
RPL-751 2000L				1				1			1			

See ***APPENDIX #7*** for Further information on FF4.0/RV1 Flight Models


An African Flavour
FF/RV + SAAFOPS

Before discussing the exchange of expertise between the FreeFalcon/RedVIPER and SAAFOPS teams, let us turn to South Africa's Largest gaming magazine – ***NAG*** – to find out some background on SAAFOPS →

"In the world of combat flight simulation, Southern Africa must be the world's most peaceful region. Hardly ever is a shot fired in anger in our virtual skies. Thanks to a small team of enthusiasts working under the name combat360 this is about to change. It will soon be possible for virtual fighter jocks to participate in a historically accurate war over terrain that, for South Africans at least, will be familiar.

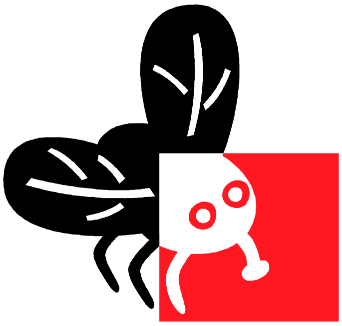
Although based on Falcon 4.0, SAAFOPS: Angolan Theatre is for all intents and purposes a completely new game. The combat360 team… used an upgraded Falcon 4.0 engine and stripped out just about everything to start from scratch. Aircraft, ground equipment, weapons and structures (down to the infamous "cuca" shops) were recreated to remain true to the Southern African location of the game. Wanting the terrain to be visually recognisable, the team opted for terrain textures based on one meter resolution satellite pictures. This attention to realism is also evident in the aircraft. Greg estimates that they have used between 30,000 and 40,000 close up photos, whilst research into weapons ballistics and aircraft flight dynamics took well over two years to accumulate. SAFFOPS will have two scenarios: the historical conflict, based on actual sorties flown (down to the exact weapons load), and a modern "what-if-the-war-continued" scenario. The latter will pit aircraft like the modern-day Cheetahs and Saab Gripens against SU-27s and the like. One groundbreaking feature in Angolan Theatre is the inclusion of flyable helicopters. Although AI helicopters (and thus support for helicopter flight modeling) are present in Falcon 4.0, the 3D models only consist of some 500 polygons, whereas the new models boast 6,000 to 7,000 polygons…."

NAG *– March, 2006*

The FreeFalcon and RedVIPER teams have been extremely lucky during development, to have been associated with the SAAFOPS Dev. Team. Through collaborative efforts, both teams have benefited from each other's experience, and have shared many insights – both motivational and practical. This sharing process continues. Whilst we have been awestruck by some of the SAAFOPS development – particularly with regards their breathtaking terrain, we have also offered RedVIPER as a base upon which the SAAFOPS team can continue to develop their amazing Falcon Vision.

We hope that the RedVIPER Pilot will benefit from this cooperation, and we hope that this spirit of cooperation will spread outward through the community, prompting both a resurgence in community input, and a heap more "goodies" for the Virtual Pilot.

RedVIPER are extremely happy to have rediscovered the spirit of active cooperation between Dev Teams, and we look forward to a continued healthy working relationship with the SAAOPS Team.

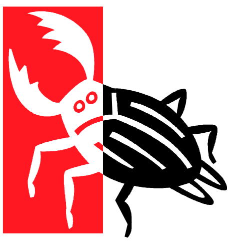


Shipping BUGs

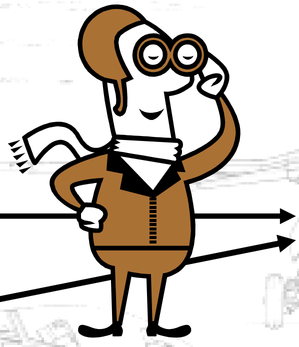
As stated previously, FF4.0/RedVIPER is very much as work in progress. With this in mind, it was decided to ship the product with "bugs" which were not considered "show-stoppers", but which were considered time-consuming enough to have held up release for an unreasonable period of time. These "bugs" will be *(and are being)* addressed.

Be aware that you will come across certain issues as you fly.

We may very well be aware of them, but feel free to share them with us in an appropriate forum.



TUTORIAL SECTION



- Using IFF
- GPS Bombs

REDVIPER

- Markpoints - MVS-VIPER
- Gorn's Need for Airspeed - GORNY
- Approach Speeds Chart
- Landings - PAUL WILSON
- Staying Trim - GORNY
- Illuminating Ext. Lights - GORNY
- BARCAPS - GRMCLE
- Sitting on the "FENCE" - GORNY

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IFF in FF4/REDVIPER

IFF in FF4/RedVIPER is powered On by default. To turn power Off/On you will have to add a keystroke *(see below)* to your keystrokes.key file and use Ctrl-I to cycle On and Off.

You can also use the switch located on the left side of your cockpit to turn IFF on and off. *(Note: Some 3rd Party pits do not support this switch)*.

With IFF on and FCR selected on the L-MFD, you can scan Radar targets for friendly Vs. unknown by selecting Ctrl-Left_ARROW on your keyboard. You will see a green 4-second countdown on the FCR screen as the IFF scans the radar contacts *(see Figure 1)*.

When finished, all targets it interrogates as friendly will be shown as small green circles and contacts it interrogates as unknown will remain as yellow squares *(See Figure 2)*.

While green circles are friendly aircraft and yellow squares are generally enemy aircraft, pilots need to use AWACS to verify the IFF interrogation authenticity since some of the contacts may have missed the IFF scan**.**

Figure 1. IFF in scan Mode 4

Figure 2. IFF showing friendly & unknown returns

It is necessary to refresh this from time to time as radar conditions change.

To reflect realism, Scan Mode IFF is not fool-proof, and if your FCR drops radar track of any contact, then you will have to re-send the IFF signal for re-interrogation.

Also, if a new target appears after you perform IFF, you'll have to re-interrogate.

On the your FCR screen there is a CPL and DCPL mode which you access by pressing CNTL *(OSB 5)* and then OSB 10. CPL interrogates what's showing on the FCR screen.

DCPL interrogates the whole 60x60 area in front of the plane and gives the pilot a snapshot of what is in the distant field of view *(See Figure 3, below)*.

DCPL returns stay active for 5 seconds before being wiped.

On the HSD *(normally right MFD in Nav Mode)*, the AIFF is active as well and will display friendly interrogated returns based on the CPL and DCPL in the FCR *(See Figure 4)*.

If you do not want the AIFF to display, on the HSD, press CNTL *(OSB 5)* and then OSB 3. This turns AIFF On/Off.

Figure 3. IFF shown in DCPL mode

Figure 4. IFF showing returns on HSD

To return either or both MFDs then back to normal hit the CNTL (OSB 5) on each again.

NOTE → To enable **ALL** aircraft to have IFF, simply check the *"ALL AIRCRAFT IFF"* box in your **RV Config Editor**.

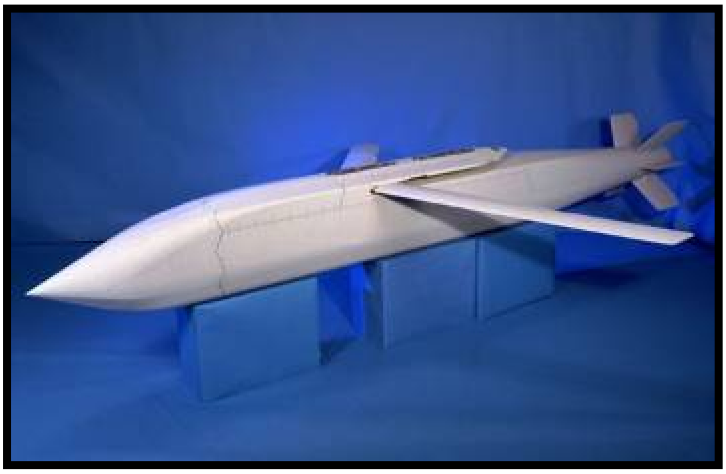
JDAMs & JSOWs

The RedVIPER (RV1) patch features significant changes to the use of GPS type weapons.

DISCLAIMER: *While these changes are exciting and add functionality to Falcon 4.0™, please be aware that they are a Work In Progress. We would ask your understanding of this, and your acceptance of the current limitations of development in this area. Naturally, if you feel the implementation of these weapons is not "realistic" enough for your tastes, you may simply elect not to use them at this time.*

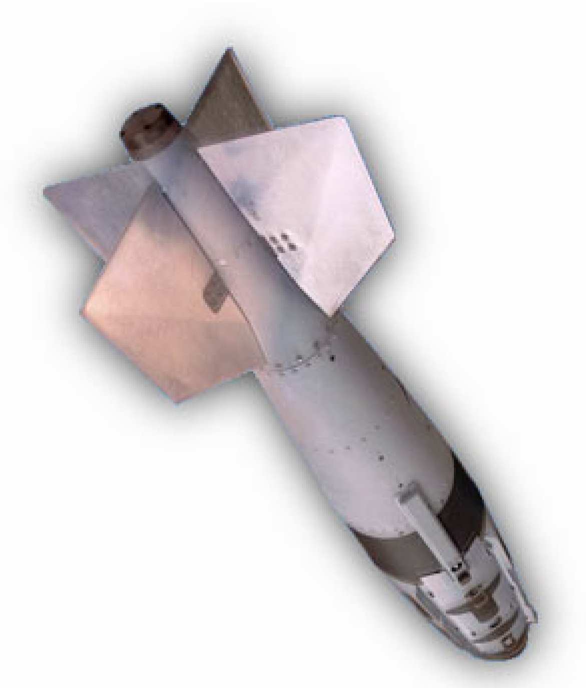
The following tutorial is designed to show you how to properly target and deploy JDAMs and JSOWs in RV1. Both JDAMs and JSOWs are GPS guided munitions and are able to only target stationary targets. They cannot be used to attack moving targets.

Both weapons operate in two (2) basic modes:



1. **PB** (Pre-briefed targets): PB targets are those targets that have their GPS coordinates pre-loaded into the FCC and are then transmitted to the bomb by selecting the relative target from the scrolling target list in the MFD.

2. **TOO** (Targets of opportunity): TOO is used when targeting something that is not a PB target and requires the use of the GM radar in CCRP mode in order to successfully reset the GPS coordinates on the weapons for a new target.



Additionally, **PB** operates in 2 sub-modes as follows:

1. **Single target** (**ST**) delivery: This mode is used to attack a single target in one pass when SGL and RP are both set to one (1).

2. **Multi-target** (**MT**) delivery: This mode is used to attack multiple targets in one pass, and either SGL or RP settings control the number of targets.

While the delivery methods of each weapon differ in some aspects, the targeting functions are the same.

As long as they remember some of the basic rules of GPS deployment, Virtual Pilots will be able to enjoy this upgrade to Falcon 4.0™ and integrate these weapons into their mission loadouts.

Quick Start / Basic Rules:

1. For PB targets (TGTs), both weapons can be delivered in CCRP, CCIP or MAN delivery mode (although CCRP & CCIP are not desired delivery modes for JSOWs). In PB mode, the scrolling list of targets is used to select targets that have their GPS coordinates pre-programmed. These are the only targets available in this mode and if you release the weapons away from the target area, the bombs will attempt to “fly” towards the GPS coordinates.

2. Once you release a weapon on a target, the scrolling target list will automatically switch to the next PB target. If you want to release another weapon on the first target, you can switch back to the first target and release another weapon.

3. If you want to release bombs on multiple targets in one pass you can either pickle multiple times or set your SGL or RP settings to 2 or more.

4. For TOO modes, currently only MAN delivery mode can be used to deliver weapons to updated GPS coordinates. CCRP and CCIP modes are switched to normal delivery as in regular dumb bombs.

5. DTOS mode is not affected by GPS in either mode and can only be delivered the normal DTOS delivery method.

6. In order to successfully set new GPS coordinates in TOO mode, the TGTs must be locked up using GM radar in CCRP mode first using SP mode. If not in CCRP mode, the weapon will attempt to fly to the previous PB target or waypoint if no PB target. You will need to switch from STP to SP mode in your GM radar and click the lock button one time in order to move your radar cursors over the target area.

7. Once the TGT is locked up in CCRP, pilots can switch to MAN modes to deliver the weapons. Once switched to MAN, the radar lock will show as being lost in the MFD, but the GPS coordinates are retained in the weapon. Remember, MAN is the only delivery mode that currently works as GPS weapons in TOO mode.

8. Since there are no targeting cues for MAN delivery mode, pilots should use CCRP mode until the TGTs are within range of the weapons then switch to MAN mode for delivery.

9. Using MAN delivery mode is useful for the following:
    a. When pilots want to deliver multiple bombs on one pass at PB TGTs. Each time you release a bomb, you’ll see the scrolling list switch to the next target.

    b. When using JSOWs. MAN delivery mode is the only mode that allows launching of JSOWs from long range.

GPS Weapon MFD Symbology:

The following images show the different functions for operating GPS weapons.

Image 1

***Image 1:* Note that in this image, all of the OSB functions are circled as follows:**

1. PB/TOO selector
2. TGT Selector for scrolling list of targets. Pilots and scroll up or down through the list by clicking on the corresponding OSB.
3. On/Off button used to initialize the weapons. This takes about 4-5 seconds for the GPS system to completely initialize. **Note the weapon has been initialized and is now "RDY" for use.*
4. The TGT list shows the applicable PB Objective as selected in the mission planning map.
5. The OBJ field shows the current TGT selected (Generator)
6. The RNG field indicates the slant RNG to the target in NM.

Image 2:

JDAM MFD in TOO mode.

Image 3:

JSOW showing that TGT is a unit *(Air Defense Battalion).*

Image 4:

JSOW without any PB targets. TGTs will have to be acquired via CCRP & GM radar functions.

Image 5

Image 5: ***Shows full HUD and MFD views.***

1. WPN is JSOW-A
2. TGT was not a PB, so TOO was required.
3. TGT was acquired using GM radar in CCRP mode.
4. Targeting cues are shown only in the HUD and not MFD.
5. At this altitude and distance, the JSOW should easily glide to the TGT.

JDAMs (GBU-31/32/34/35/38):

JDAMs are regular Mk series dumb bombs with GPS/INS guidance kits attached. They do not have any type of propulsion systems and are therefore – due to being free fall weapons - limited in range.
Just like regular dumb bombs, JDAMs dropped at lower altitudes will have lower ranges that those dropped at higher altitudes. ***The maximum range of any JDAM when dropped in level flight at cruise altitude should be around 6 NM*** *from the target. Under some conditions and altitudes, ranges can be extended, especially if the bomb is lofted during release.*

JDAMs work in 2 different modes: PB *(Pre-briefed)* and **TOO** *(Target of Opportunity).*

In the **PB** mode, the JDAM will be pre-programmed to attack any of the targets listed in the scrolling list in the MFD. **This allows the pilot to attack multiple targets in just one pass** by selecting different targets after the previous one has had a bomb released towards it.

Whilst you may only select and target one target at a time, you can sequentially move through the list in a short amount of time and target several targets during one pass, releasing bombs each time you re-select a target. **You can also drop more than one JDAM on an individual target**.

JDAMs in PB *(Pre-briefed)* **Delivery Method:**

This method is used when the primary and secondary targets have been pre-briefed and the target data has been loaded into the INS/GPS systems. The PB target will show up in the MFD as – for example - “Runway 22” or “Factory 07”.
You can also **step through the PB target list** and select another target by depressing the **OSB button next to the TGT STEP** listing in the MFD. You will see the different targets listed as you depress the button.

Note: *Ground units such as air defense units* ***will not allow*** *you to “target step” if you have chosen to use JDAMs for strikes against ground units.*

JDAM Basic Operations:

If target is PB and is an objective:

1. **Make sure you are set to the target waypoint and the *>AGG* text is not showing in the MFD.**
   If you see ***>AGG*** in your MFD, it means you are beyond the target’s bubble and the weapon will miss if you fire *(since it cannot target something outside of the target bubble).*

   In order to get into your target’s bubble, you have to either select the target waypoint or move your GM radar cursors over the area where your target is located.

   Once the >AGG disappears, the GPS weapons will be able to target their targets.

2. Turn on weapon.

3. Select PB target from target list.

4. Select delivery mode *(CCRP/CCIP/MAN)* for weapon release.
   a. **CCRP** requires you to fly the standard CCRP flight profile in order to release the weapons.
   b. **CCIP** allows you to point your pipper on or near the target area and release while generally in a dive. In this mode you can make multiple releases of bombs as your FCC steps through the target list.
   c. **MAN** allows you to perform similar actions as CCIP, but you can do this in level flight.

Note: *MAN bombing gives no targeting cues in the HUD. Since there are no targeting cues for MAN, use CCRP mode to get within the normal range of the target, then switch to MAN for final release.*

5. Upon weapon release, you will automatically be switched to the next target. If you want to launch another weapon at the first target, you will have to **manually switch the target selector** to the previous target or **set either the SGL or RP settings to more than one**.

The following delivery modes are recommended for this type of mission using JDAMs.

CCRP: Using CCRP gives the pilot the necessary bombing range and delivery cues required to tell if the target is within range of the JDAM. Since JDAMs are free fall bombs, they will have similar ranges as LGBs or regular dumb bombs. You will still have to fly the standard CCRP delivery profile in order to get the JDAMs to release.

CCIP: Using CCIP gives the pilot a view of the target below and will allow the pilot to release the bomb within the correct range so it can guide itself to the target. **The pipper does not have to be on the target since the target has been pre-programmed into the targeting system.**

DTOS: JDAMs can be delivered using the DTOS mode the same way they are for regular dumb bombs.

MAN: The Manual bombing mode is **useful when bombing multiple targets in one pass**. Pilots can fly level at cruise altitude and **use CCRP mode to make sure they are within range of the targets**. Once in range, switch to MAN and then begin delivery by either manually hitting the pickle button or by setting either the SGL or RP settings to delivery multiple bombs during one pass. **This is best accomplished while flying in level flight at cruise altitude**. *(In general, if at cruise altitude weapons can be released from ~6 NM and successfully reach their targets.)*

JDAMS in TOO *(Target of Opportunity)* Delivery Method:

This method is used when targets of opportunity are available that are not a part of the Pre-briefed mission.

The following delivery modes are recommended for this type of mission using JDAMs.

CCRP: *TOO re-targeting GPS does not work in this mode so JDAMs should be delivered the same way as regular dumb bombs.* Using the A-G radar, lock up your intended target. The JDAM will now be programmed with the coordinates of that target. Once you are within range in CCRP mode, you can pickle the bomb(s). You will still have to fly the standard CCRP delivery profile.

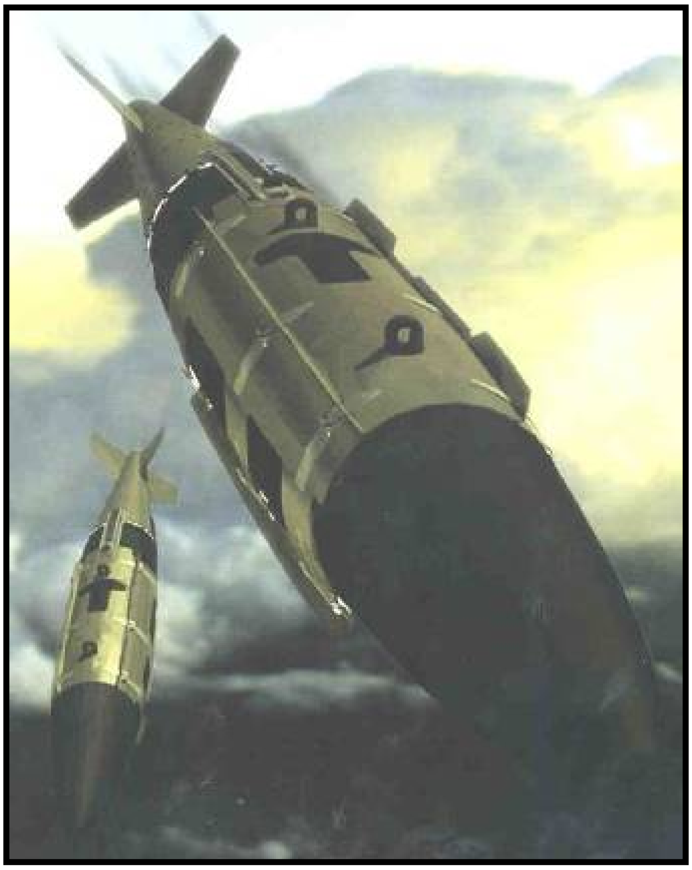
CCIP: *TOO re-targeting GPS does not work in this mode so JDAMs should be delivered the same way as regular dumb bombs.* You can use your CCIP pipper as target designator just like regular dumb bombs.
The delivery method is the same as normal CCIP methods.

DTOS: *TOO re-targeting GPS does not work in this mode so JDAMs should be delivered the same way as regular dumb bombs.*

MAN: The Manual bombing mode can be used **only** after you have designated a target using your GM radar in CCRP mode. Otherwise, the bomb will default to the previous target since it has not been reprogrammed. If you target something using CCRP, you can switch to MAN and then pickle the bombs.
You should stay in CCRP mode until you are sure you are within range of the target. If you fail to do so, your bombs are likely to fall short of the target.

Note: Make sure when re-targeting in TOO, you target using *SP mode* in the GM radar.
(Otherwise you may just re-target the pre-planned waypoint and not your new intended target.)

→ ***LADD** mode is not operational for any type of bomb.*



JSOW (AGM-154):

JSOWs currently come in two different types: CBU dispensers and Penetration type bombs. The AGM-154 JSOW is a gliding bomb munitions dispenser is designed to allow the launching aircraft to strike from long distances against PB targets or TOO in high threat areas.

- The ***AGM-154A*** is a CBU type gliding bomb cluster munitions dispenser, designed to primarily provide an economical way to strike air defenses beyond their threat ranges. The F-16CJ was the first operational and primary user of this weapon, although several other types of aircraft are able to carry it as well. JSOW-As are not recommended for use against hard targets and will likely produce only minimal damage to non-vehicle targets.

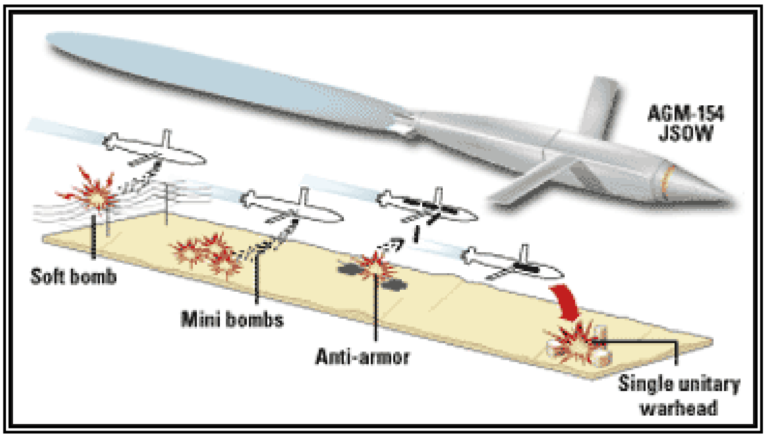
- The ***AGM-154C*** is a penetration type version designed to allow the launching aircraft to strike from long distances against PB targets or TOO in high threat areas. The USN F/A-18 fleet is the primary user of this variant.

- The ***AFDS***, which is used by several European aircraft and the ***Bombkapsel m/90 (Mjolner)*** used by SAAB aircraft, are similar to the JSOW-A. They are gliding bomblet dispensers with GPS guidance for use against soft targets like vehicles and air defense sites. They also are likely to have a shorter range than JSOWs.

Developers notes on JSOWs:

The operation and deployment of JSOWs depicted in this patch is considered a "Work In Progress". They are in no way considered "complete". While the ordnance functions in a similar way to the real weapons, realistic HUD and MFD symbology is not implemented. This is due to the lack availability of real-world information at the time of development. Additionally - in order to get the bombs to glide realistic distances - the flight profiles of JSOWs are not considered realistic. Should they chose to view the bomb during it's flight path (we recommend staying in the pit), pilots will likely notice some odd behavior.. Much of this will depend on altitude, release angle, speed of aircraft and range to target. In most cases, the JSOW will tend fly up to the target at high altitude, then make a slow turn down for its final descent.

For best results, it is recommended that pilots release JSOWs in ***level*** *flight while at 25k' AGL for targets 30NM away or less. For targets from 30 NM to 50 NM in distance, a* ***nose pitch of 10-15 degrees*** *in the HUD is recommended upon release. This will provide some lofting of the weapon and should help it reach the target.*



Please note that higher pitch angles will likely give unrealistic flight profiles for the JSOW. Tipping the nose down or up may cause the bomb to fall short or loft into an unwanted flight profile since the AoA of the aircraft basically is used to aim the JSOW during its flight.

As always, should the virtual pilot find the realism attributes of the JSOW to be less than satisfying, they may simply elect to not use the weapon, and substitute it with alternate ordnance..

Using JSOWs:

JSOWs operate in 2 different modes: PB *(Pre-briefed)* and **TOO** *(Target of Opportunity).*

If target is PB and is an *objective*:

1. Make sure you are set to the target waypoint and the >AGG text is not showing in the MFD. If you see >AGG in your MFD, it means you are beyond the target's bubble and the weapon will miss if you fire *(since it cannot target something outside of the target bubble).* In order to get into your target's bubble, you have to either select the target waypoint or move your GM radar cursors over the area where your target is. Once the >AGG disappears, the GPS weapons will be able to strike their targets.

2. Turn on weapon.

3. Select PB target from target list.

4. Select delivery mode *(CCRP/CCIP/MAN)* for weapon release. Due to the range limits of FCC release mechanisms, **CCRP & CCIP are *not* recommended** release modes for JSOWs. RedVIPER Pilots should **use the CCRP mode first** to get the targeting cues to determine the range of the target, and **then switch to MAN delivery for release of the bombs**.*

   ***Note:** *MAN bombing gives no targeting cues in the HUD. Since there are no targeting cues for MAN, **level release** is suggested when the target is within **30 NM** and a loft release of **10-15 degrees** is suggested when within **30-50 NM** of the target.*

5. Upon release of the weapon, you will automatically be switched to the next target. If you want to launch another weapon at the first target, you will have to manually switch the target selector to the previous target or set either the SGL or RP settings to more than one.

If target is PB and is an air defense *unit* or other *non-objective* target:

Non-objective targets are always vehicles, which are part of a unit. This will primarily be air defense units, but other types may be targeted as well. **Units do not appear on the target list and the PB target coordinates may not be the desired target if a JSOW is launched at the coordinates.**

There are several options for pilots to use in this scenario.

The first is to recon the target(s) in the recon map during mission planning and determine the location of the main targets before the flight. For a PB target, you can change the waypoint to "Strike" and then select your intended target from the target list. In the case of air defense units, this will not likely place your JSOW on the exact desired target, but will cause it to be close enough to likely destroy several of the vehicles in the unit if the bomb is delivered correctly.

A second option is to use the TOO method as listed below and target specific points where the vehicle(s) you want to destroy are located. In most cases, your SEAD/DEAD target will be the unit's FCR radar vehicle. The location of this vehicle can be found in the recon screen. Once you know the location of this vehicle, you can use this information when acquiring the target using DSB-2 sub-mode of GM radar.

So, the **PB (Pre-briefed) Delivery Method** *is used when targets are in the PB TGT list.*

If the TGT is an objective, then the only difference between JSOWs and JDAMs is the release distance.

In order to release at longer distances, JSOWs will have to be released in MAN mode.

TOO *(Target of Opportunity)* **Delivery Method:** This method is used when targets of opportunity are available that are not a part of the Pre-briefed mission. The following delivery modes are recommended for this type of mission using JSOWs.

As with JDAMs, **TOO mode is used when the pilot wants to re-target while in flight** as follows:

1. Switch to **TOO** mode
2. Stay in **CCRP** mode
3. Using your GM radar, switch from STP to **SP mode** and find your target. If you have the waypoints set over your target, you can slew the cursors over the target where your waypoint is.
4. Once you slew your cursors, you can use **DBS-1 or DBS-2** to provide enhanced definition of the target area and can target an area on or near the objective or feature you want to destroy.
   (This is where a sketch or map of your targets will come in handy.)
5. Lock up the target and the GPS coordinates will now be set for your weapons.

   * Note: *Unless you use TOO and CCRP to reset your GPS targets your weapons will fly towards your previous targets.* ***You must use CCRP to re-target*** *in order for your GPS to update the target coordinates to the weapons.*

Some Final Notes:

You need to understand the difference between “units” *and* “objectives”. *The target list is gotten from the objectives, and is comprised of features. Units do not have a target list since they do not have any features. They only have vehicles. So if you target a unit using PB, you* **will not** *have a target list and if you target an objective using TOO* → **No list**.

The only time you get a target list is when you have placed a "strike" or "bomb" waypoint over an ***objective*** *and select the objective, which is how you get PB. Or you fly a strike mission in a Cam or TE. Then the individual features in that objective are placed on the target list.*

Remember – the >AGG cue is a warning that you are BEYOND striking range. Wait for this cue to disappear.

USING MARKPOINTS *Instructor:* ROB "MVS-VIPER" VARGAS

The use of "Markpoints" is probably one of the least utilized features in Falcon 4. However, once you understand what a markpoint is, and how simple they are to set-up; you may decide to make them a regular tool in your bag of tricks.

So what is a "Markpoint?" According to the Lockheed Martin F-16 A/B Mid-Life Manual[1], markpoints are: " . . . *steerpoints that the pilot wants to identify for future use by either flying over the (selected) point or designating it using the FCR (Fire Control Radar) or the HUD to identify the location. For example if the pilot encounters an uncharted terrain obstacle and wants to establish the (GPS) coordinates of the location, he may fly over the obstacle, activate the MARK button, and those coordinates will be stored . . . All markpoints selected throughout the mission, including those written over, will be retrievable from the DTC (Data Transfer Cartridge) on mission completion."*

Real F-16 drivers often use markpoints to pinpoint the (GPS) coordinates of a downed pilot or a target of high value. The data can be shared between pilots via the data-link function in F-16. The data is stored in the DTC, and later retrieved by maintenance crews.

Many of you may have heard the audio of United States Air Force Captain Scott "Spike" Thomas (call sign Benji-53) punching out over Iraq during the first gulf war. If you listen closely at the end of the audio you will hear the AWACS controller declare "marked" in reference to marking the location were Captain Thomas ejected. A partial transcript of that conversation is as follows:

BENJI-53- *"Okay, just tell me if you see a fire."*
BENJI-31- *"Okay. Stay with it dude."*
{Fire Begins}
BENJI-31- *Okay, you're-"*
BENJI-53- *"I-I'm getting out!"*
BENJI-31- *"Okay, you're on fire."*
{Ejection seat}
BENJI-31- *"Okay, Bulldog, we've got him out, we've got him out! He's out of the --"*
{Unknown Horn} Possibly stall horn, or engine-out horn in Benji-53 cockpit (plane is now gliding pilot-less)
BENJI-31- *"Bulldog, we have a good chute. Bulldog, Benji, do you copy?"*
BULLDOG- *"I copy, **marked**."*

This is a good example of how markpoints are utilized in the real world.
To read the entire transcript or listen to the audio, visit the following site:
http://www.flight-level.com/dogfight/benji.html *(Active Link)*

In Falcon 4, markpoints are a great tool to use if you are on a mission and you locate a nice column of tanks or other moving vehicles. You can mark the location of the movers, and anytime during the mission you can call up that specific markpoint(s) and navigate back to the target. The markpoint will be displayed as an "X" in your MFD in HSD mode; as a diamond (like a steerpoint diamond) visible through your HUD.

Used in concert with your air to ground radar, markpoints can become your best friend in inclement weather and at night. You can, in zero visibility, spot some movers while in GMT/CCRP mode. Put a markpoint at the beginning and one at the end of the moving column. Switch to CCIP mode, come back to your first markpoint, and begin dropping your CBU's at the markpoint diamond. If the bombs are set at an appropriate burst altitude (1,200 for CBU's and 600 for Rockeyes) and properly spaced, you should score some kills.

[1] Lockheed Martin F-16 A/B MLU Manual dated: 15 November 1998

To set up a markpoint, make sure the display on the Data Entry Display (DED) is set to default. You can do this by left clicking once on the RTN side of the Data Command Switch (DCS) found at the bottom (center) of the Integrated Control Panel (ICP).

Press (left click) the MARK (#7) button on the ICP. Note if you are in Air to Ground (A-G) Mode the markpoint will reflect ***the current position of your radar cursor*** (brackets). During NAV or Air to Air (A-A) mode the markpoint will reflect ***the current position of your jet***.
Now press (left click) on the enter (ENTR) button of the ICP to complete the entry.

You can continue adding markpoints (up to ten) by pushing (left clicking) the up arrow on the "Next/Previous" switch of the ICP. You will now see MARK 2 displayed on the DED. Pushing (left clicking) on the ICP's enter button will select the new markpoint.

In the picture below, you will see that the pilot selected a markpoint while in NAV mode. Notice that markpoint #1 or MARK 1 is displayed on the DED.

Now press the ENTR button on the ICP to mark your location. You should now see the coordinates on the DED, and an “X” on your MFD if you are in HSD mode.

After pressing the enter button on the ICP, the DED will list the GPS coordinates for the markpoint you just created.

Note the position of the aircraft symbol *(MFD - above right)* when the markpoint was selected. You can see that the markpoint was selected in Air to Air or NAV mode by the letters "**POS**" on the upper right of the DED. As stated, earlier when you select a markpoint in A-A or NAV mode, the markpoint will reflect ***the position of your aircraft*** at the time the selection was made.

Conversely, if the markpoint was selected in A-G mode, the letters “**GM**” will appear next to the selected markpoint number in the DED.

To select another markpoint, (left) click the Up arrow on the Previous/Next switch on the ICP.

You should now see “MARK 2” (or the next sequential number) appear on the DED.

In the example below, you will see that the pilot has selected the A-G radar. The radar is set to “GM” (for ground mode) and the sub-mode “SP” (for snowplow) is also selected.

Notice that the yellow box on the HUD is far ahead of the aircraft. That is the position of the radar cursor (approximately 20NM ahead of the current aircraft position).

To set the markpoint, (left) click on the enter button of the ICP. Now you should see a steerpoint diamond in the HUD and the coordinates for your new markpoint in the DED.

Now let's go back to NAV mode by left clicking on the A-G button of the ICP, and look at your right MFD. It should be in HSD mode, but if it is not, just left-click the OSB button below the letters "HSD" and that should switch you back. *(In the example below, the MFD's are enlarged and in "Ghost mode" to facilitate viewing the symbols in the MFD's.)* The two "X's" in the right MFD symbolize the location of the markpoints you just created, and their relationship to your current position.

The diamond on the HUD is the position of the last markpoint location.

Now, let's pretend that you are flying in zero visibility, and you are near your target, a bunch of T-72's on the move.

You switch back to A-G mode, and slave your ground radar to Ground Moving Target or GMT. You keep the radar sub-mode slaved to snowplow or SP. You spot your target, the bright line on the display to the right.

You put the radar cursor on one end of the line, and enter a new markpoint.

Once entered, you move the radar cursor to the opposite end of the line and enter another markpoint.

Now you have created a window in which you can deploy you're A-G ordnance and you are almost assured to get some hits *(providing the movers do not deviate from their current path)*.

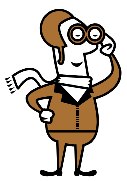
So, even though you may not be able to see your target, if you drop your ordnance between the two markpoints, you should hit a target. Do not wait too long to make your move, because the targets will move outside the area you just created in due time. They are moving!

You can click on the "EXP" mode to zoom in on the area you are scanning with your air to ground radar.

Keep in mind that you cannot delete the markpoints you have created, but you may override an existing markpoint by creating a new one in its place.

Good luck!

I hope that you have a better understanding of markpoints, and how to use them.



Rob

Gorny's need for Airspeed

There are several different “types” of airspeed measurement.

Use the Acronym **I.C.E.T.** to help you differentiate.

(Remember: **“Ice Tea”**.)

I.C.E.T. will show you the progression from Indicated to True Air speed.

- IAS *(Indicated Air Speed)*

…is the speed you read directly from the face of the indicator

- CAS *(Calibrated Air Speed)*

…is IAS corrected for installation error (pitot tube***** misalignment, etc.)

*****pitot tube → *(pronounced pē-tó)* A device for measuring fluid flow velocity.

- EAS *(Equivalent Air Speed)*

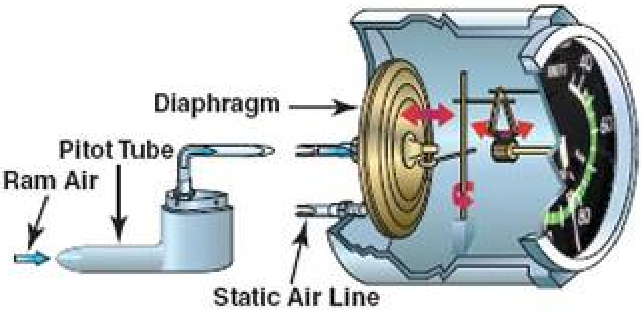
…is CAS corrected for the compressibility of air

- TAS *(True Air Speed)*

…is EAS corrected for non-standard temperature and pressure altitude

- GS *(Ground Speed)*

…is TAS corrected for wind effects



Why IAS…?

Unless an aircraft is at sea level at15°C, 1013 hPa, 0% humidity, and no wind, **the IAS bears little relation to how fast an aircraft is moving in reference to the ground**; however, because the air pressure and density affect IAS/CAS and an aircraft's flight characteristics in exactly the same way, the critical V speeds* are usually given as IAS.

In this way, a pilot can easily read them directly from the airspeed indicator

*(****V speeds** are speeds that define certain performance and limiting characteristics of an aircraft. They are established by the manufacturer during design and testing, and are specific to the aircraft model)*

Why CAS…?

For aircraft control, **CAS is the primary reference point**, since it describes the dynamic pressure acting on aircraft surfaces regardless of density altitude, wind, and other conditions. At the same weight, an aircraft will rotate and climb at the same calibrated airspeed at any elevation, even though the true airspeed and groundspeed may differ significantly.

Why EAS…?

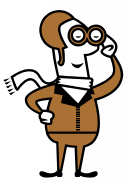
As above. However, **for high speeds and altitudes**, calibrated airspeed is further corrected for compressibility errors and becomes equivalent airspeed → EAS

Why TAS…?

TAS is the **speed of an aircraft relative to the air-mass in which it flies**. Under zero wind conditions this is equal to the speed over the ground. Under wind conditions an estimation of the wind is used to make a wind-speed vector calculation that computes an estimated ground speed from the true air speed. Indicated airspeed will differ from true airspeed depending on air density.
Air density is affected by temperature, moisture content, and altitude.
IAS is used in aircraft *operation* (as the aircraft stalling speed and structural limiting speeds are dependent on indicated airspeed), however, **proper navigation** *(without constant ground reference)* **requires the use of true airspeed and wind corrections.**

Why GS…?

Ground speed **is the speed of an aircraft relative to the ground**.
It is the sum of the aircraft's true airspeed and the current wind and weather conditions.
(e.g. a headwind subtracts from the ground speed, while a tailwind adds to it.)



Approach Speeds

DATA BASIS FLIGHT TEST — ENGINE F100-PW-220

CONFIGURATION:
- ALL DRAG INDEXES

CONDITIONS:
- ALL TEMPERATURES
- ALL ALTITUDES
- 13 DEGREES AOA (INDEXER ON SPEED)

GROSS WEIGHT	AIRSPEED (KIAS)
17,000	125
18,000	129
19,000	132
20,000	136
21,000	139
22,000	142
23,000	146
24,000	149
25,000	152
26,000	155
27,000	158
28,000	161
29,000	164
30,000	166
31,000	169
32,000	172
33,000	174
34,000	177
35,000	180
36,000	182
37,000	185
38,000	187

NOTE: Add 8 KIAS for an 11° AOA approach.

Having looked at the Approach Speed Chart, be aware that Paul *"Shatterer Of Worlds"* Wilson is about to make it redundant in the following Tutorial…!

Check out S.O.W's ***"Landing the Viper"***

LANDING THE VIPER

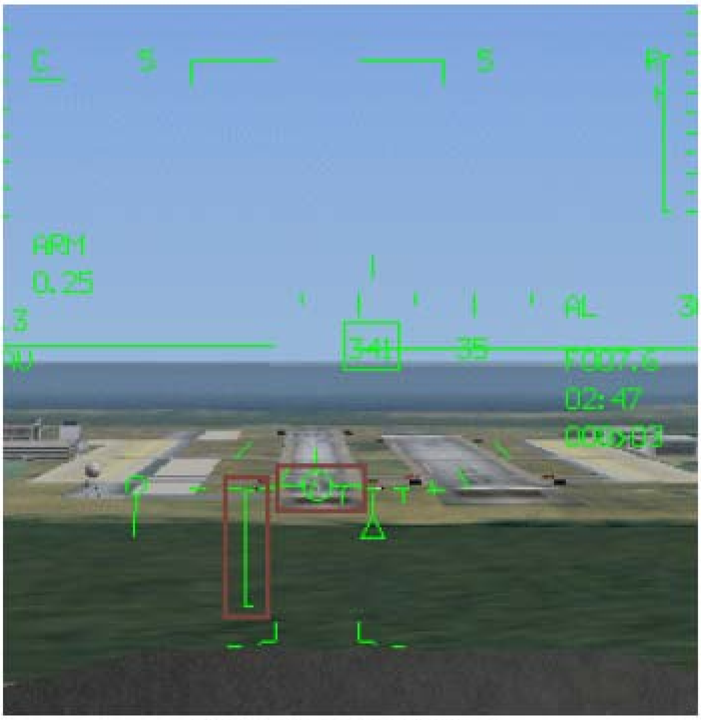
Instructor: PAUL "S.O.W." WILSON

Ever since Falcon 4.0™ came out, one of the most difficult tasks for people new to the program has been figuring out how to land properly. This tutorial was written for those people who are looking for a landing technique that they can use for their F4.0 experience.

Still, don't get the idea that this is only a tutorial for beginners. Many people are able to land just fine but they may not be landing in a way that is safe or easy. I personally had a great system for landing that I used for almost a year before learning of another system that worked better. I took it upon myself to learn how to land using this new system.

The system I refer to is based on the approach that *real* F-16 pilots use to land the *real* aircraft.

Some of you may find that this approach is much different from the one you have used in the past. If you are interested in landing properly like a real F-16 pilot, or if you are simply interested in seeing how it is done, read on!



FPM AND AOA BRACKET

Perhaps most people who land using Falcon 4.0™ monitor their Flight Path Marker (FPM) and airspeed above all else. The approach that I outline below ignores airspeed and places emphasis on the AOA bracket. By using the FPM and AOA bracket, you can do very nice landings at any weight without having to monitor airspeed at all. In fact, you will notice that the airspeed isn't displayed at all in any of my screenshots below!

Once you are on the glideslope and your speed is low enough to drop your gear, you can ignore airspeed and focus on landing using the FPM and its relation to the runway and the AOA bracket. Once you follow the proper procedure for landing, your airspeed will be exactly where it should be automatically.

The image above shows both the FPM and the AOA bracket. They are both outlined inside of a red square.

You will all be familiar with the FPM but you might not be familiar with the AOA bracket.

The AOA bracket is a bracket shaped item on the HUD that indicates your angle of attack *(the number of degrees between the direction of travel - the FPM - and the direction your nose is pointed - the gun cross)* .

It generally appears on the HUD after you lower your landing gear -

- If the FPM is above the AOA bracket then your angle of attack is lower than 11 degrees.
- If it is at the top of the bracket *(see image above)*, then you are at 11 degrees angle of attack (AOA).
- If in the middle you are at 13 degrees AOA *(optimum AOA for landing)*
- If at the bottom then you are at 15 degrees AOA *(too high of an AOA for a safe landing)*.

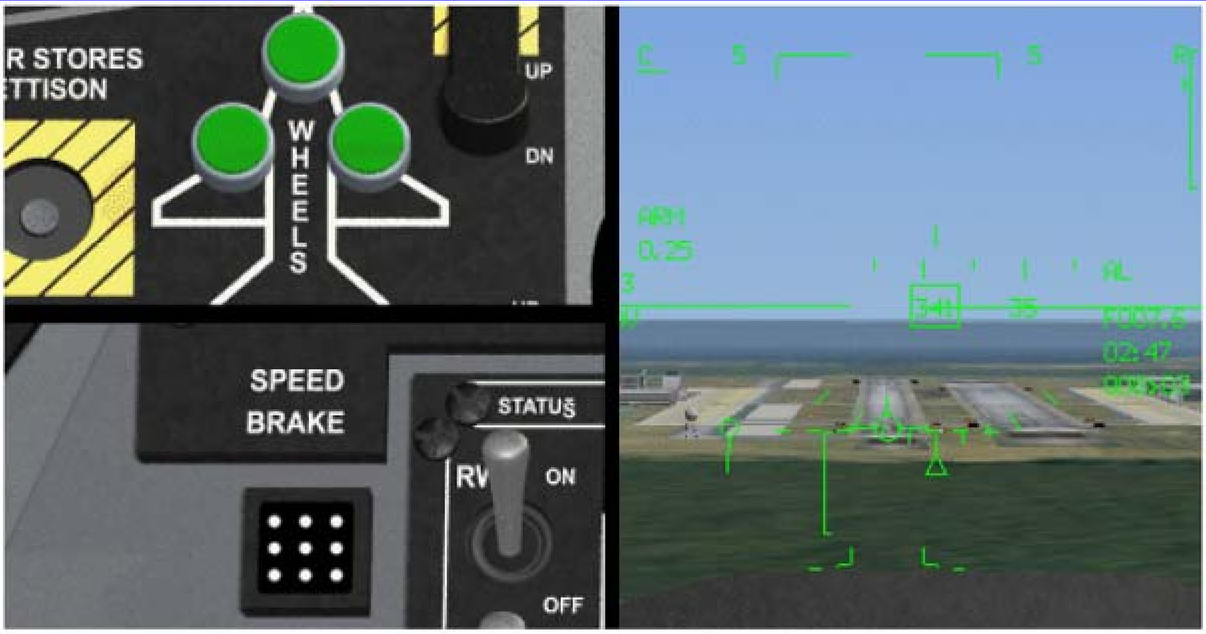
Okay. Hopefully you have an understanding of what we've discussed above, so – let's move on to:

LANDING THE F-16

When approaching the runway and within a few miles distance, lower your brake and get your speed below 250kts. Lower your gear when it is safe to do so.

You will want your glideslope to be 2.5 to 3 degrees. If the front of the runway lies in the middle of the 0 and -5 degree pitch ladder on the HUD then you will know that your glideslope is correct.

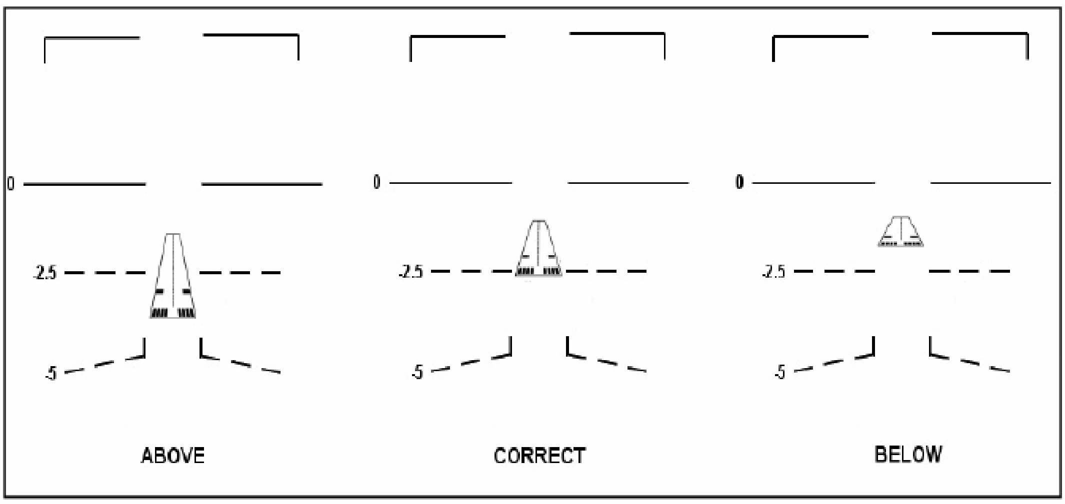
A dotted line can be seen in between the 0 and -5 pitch ladder. This is the 2.5 degree Pitch Indicator Line.



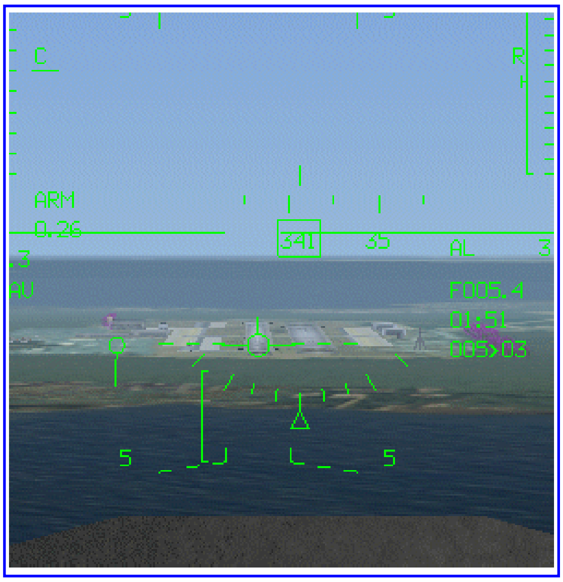
INTERCEPTING THE GLIDESLOPE - BRAKE OPEN AND GEAR DOWN

This **2.5 degree line** can help you make sure you are on the glideslope:

- If you are *above* the glideslope then the runway threshold will be *below* the 2.5 pitch line.
- If you are *below* the glideslope then the runway threshold will be *above* the 2.5 pitch line.



Once you are on the proper glideslope, place your FPM on the front of the runway using the control stick.



This event can be seen in the image at left.

There is another way to know whether you are on the glideslope or not. You can use the **VASI lights** which are located at the front of the runway.

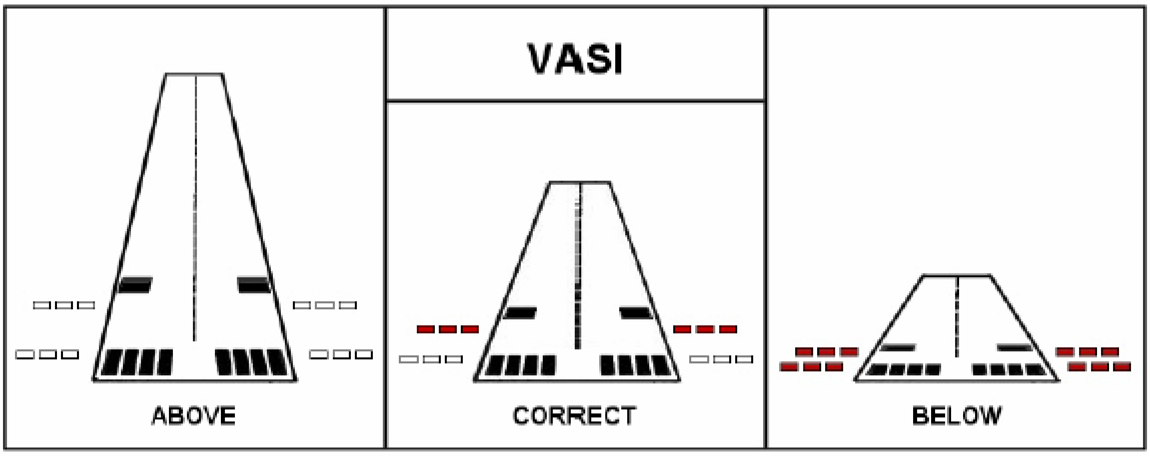
On each side of the runway you will see two sets of lights. One set sits in front of the other.

If both sets of lights are "white" then you are too high. You need to lower your altitude and get back onto the glideslope.

When you are on the glideslope the far set of lights will be red and the close set will be white.

If you are low then both sets of lights will be red. You will need to gain altitude to get back onto the glideslope.

"WHITE OVER WHITE" → Too MUCH height.
"RED OVER WHITE" → You're ALL RIGHT.
"RED OVER RED" → You're DEAD.



Very good. Two things have now occurred:

1. We are now on the 2.5 degree glideslope *(the runway threshold is on the 2.5 degree pitch ladder line)*.
2. The FPM is sitting on the front of the runway.

There is now a third thing we need to do. **We need to get the FPM to the top of the AOA bracket**.

We can control our angle of attack using the throttle. If the FPM is above the AOA bracket then you will need to reduce power so that your AOA increases. I will usually drop the throttle completely to idle.

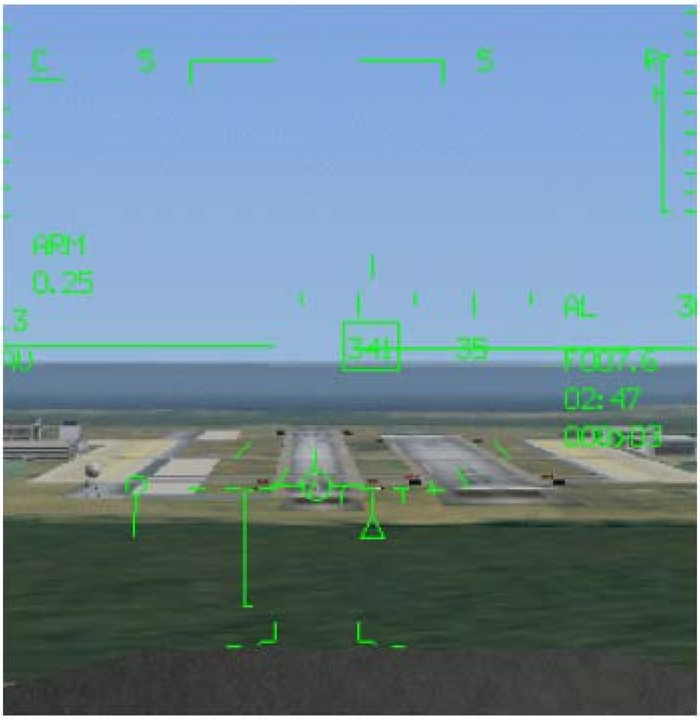
Remember to keep the FPM on the front of the runway while you increase your AOA. With your throttle at idle the separation will happen quickly.

In the image above the FPM would meet the top of the bracket on idle in about 10-15 seconds. Once you have gotten the FPM near to the top of the AOA bracket you will need to increase your power to keep the FPM at the top of the bracket.

Usually a setting of 6000 fuel flow for light aircraft or 6500 fuel flow for heavy will keep you on the top of the bracket with no real problems.

The image below is probably the most important image in this tutorial.

It shows an F-16 properly aligned for landing:



You will notice that all three conditions are now met*:*

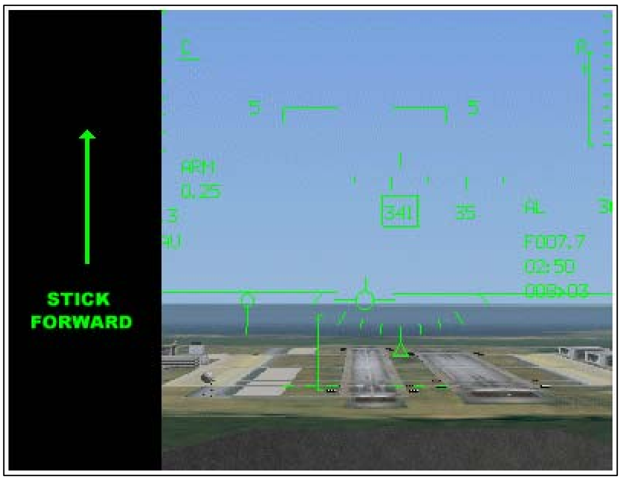
- We are on the glideslope. The dotted 2.5 degree ladder is at the front of the runway.
- The FPM is at the front of the runway.
- The FPM is lined up with the top of the AOA Bracket.

In other words, the front of the runway, the 2.5 degree pitch ladder, the FPM and the top of the AOA bracket are all lined up with each other.

Now all you need to do is HOLD IT THERE…!

Gorny's Tip: So – you've found the Aces II Ejection seat…? Listen up. Hands are sweating; facial muscles are twitching; you shift uncomfortably in your seat – you're on FINAL APPROACH…! What could be worse? Your lover appears behind you and says: "Wow. You're gonna land. Can I watch…?" Now, you just KNOW you're gonna "lawn dart"! FEAR NOT. Say excitedly: "Land…? No way. Watch THIS…!" Now, pull the Ejection Handle and exclaim: "WOW…! Para-Gliding…! FreeFalcon has EVERYTHING…!"

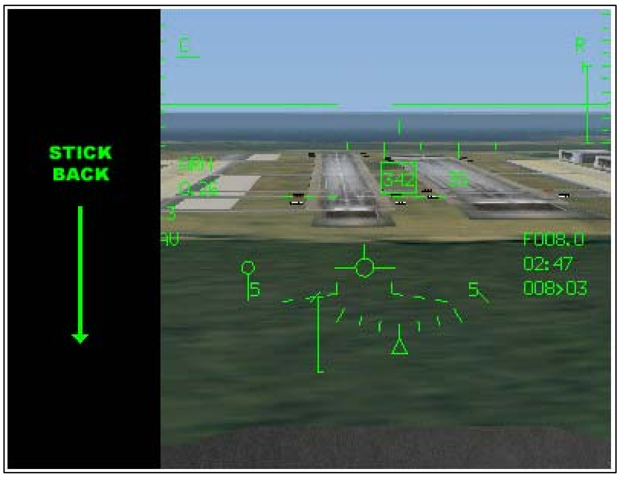
On the following page are four (4) images showing the glideslope alignment problems, and their solutions.



In this image, the FPM is above the Runway Threshold.

All you need to do is push forward on the stick to get yourself back on the runway.

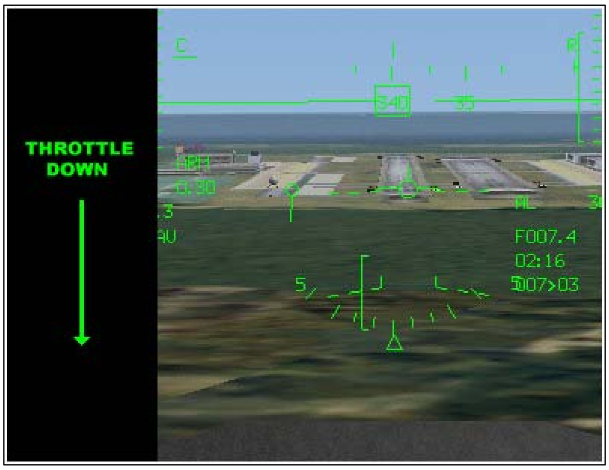
Make sure you are still on the Glideslope.



This image shows the FPM too low in relation to the runway.

The solution…? You guessed it…!

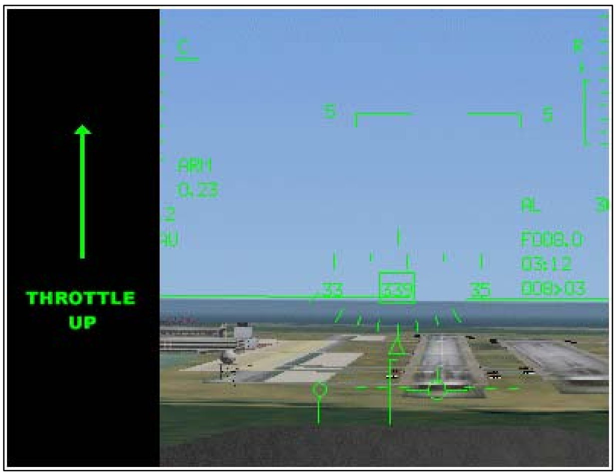
STICK BACK.



This image shows the AOA too low.

(The FPM is above the bracket)

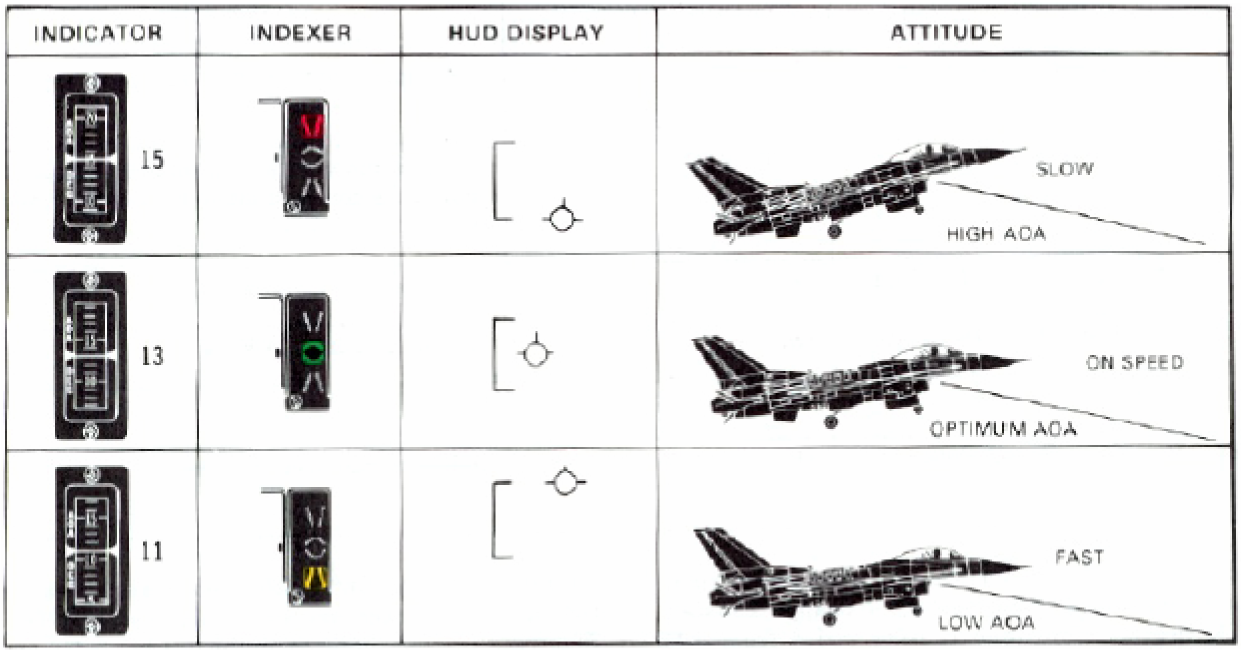
Decrease power slightly to get your AOA up.



This image shows the FPM deep in the AOA bracket.

Here the FPM isn't in a really bad position, but you may want to think about adding a touch of power if it begins to drop anymore.

Here is a final image for reference purposes. It comes from the F-16C/D FLIGHT MANUAL *(T.O.1F-16C-1)*. This particular image shows the 11 degree AOA as being fast, but that is **OK** for the approach.



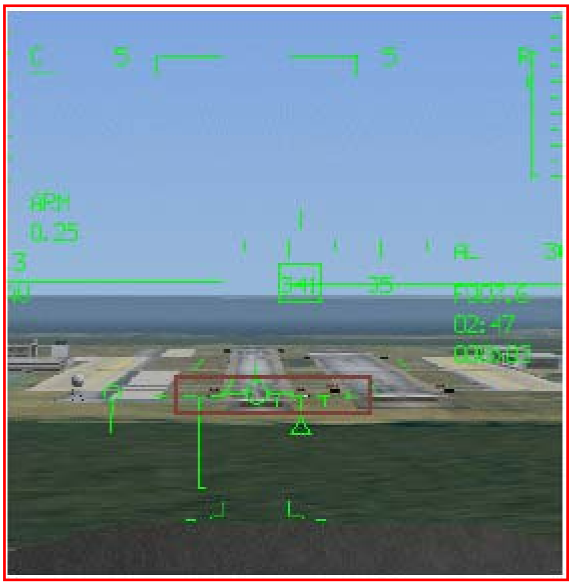
OK, so that is basically it.

You will want to control the location of the **FPM with the stick** and the **AOA with the throttle**.

Once you get used to this then landing becomes easy. Once all three conditions are met, and you are on a proper approach, your speed will be exactly where it should be (about 160 kts for a light aircraft and 170-180 kts for a heavy one).

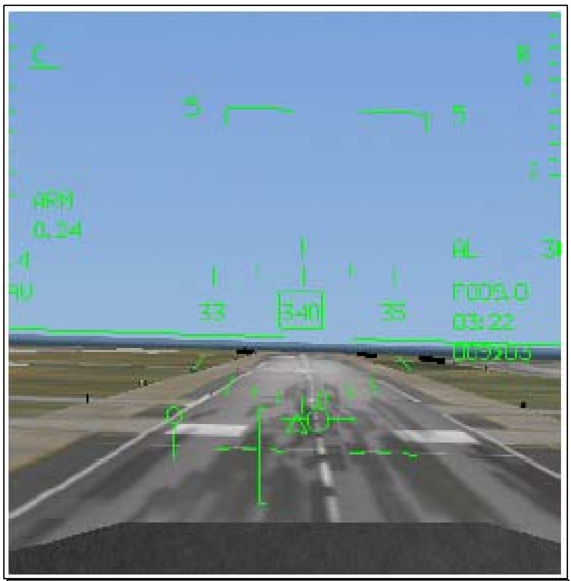
This approach of monitoring the FPM marker and the AOA bracket is helpful in that you don't have to worry about proper speeds for proper weight. Many F4.0 pilots find themselves falling out of the sky because they attempt landings using speed and get their speed wrong (too slow). A high airspeed results in lower AOA landings that could have dire consequences in the form of bouncing or crashing. Staying on the glideslope with a proper AOA keeps you from having to worry about airspeed at all.

Here is that important image again showing an optimal glideslope approach with all three conditions met.

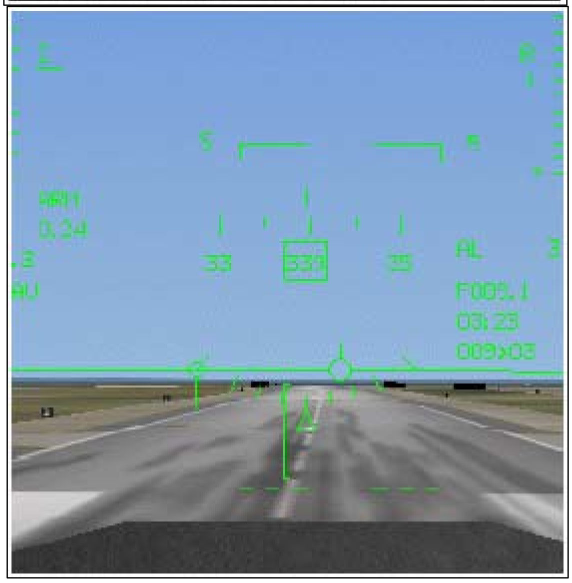


I have placed a red box around that area of the screen showing what you will want to look at clear up until the point where you flare.

You can basically ignore looking at airspeed, altitude, fuel flow, the AOA light, etc. Still, there is certainly no problem with looking around the cockpit occasionally. I personally have a habit of taking glances at the fuel flow but that is just me. The great thing about using the FPM and AOA bracket almost exclusively for landing is that airspeed magically takes care of itself and you can keep your eyes on a small area of the HUD at almost all times. This helps decrease the workload while keeping SA high.



Over the threshold and ready to flare.



I'm now within seconds of landing. I gently flare a little by pulling back on the stick. This causes the FPM to move down the length of the runway. You need only a **TINY flare** *(as you are only transitioning from 11° to the optimal AOA of 13°).* I also decrease my power as I pull back, and let the aircraft settle those last few feet to the runway.

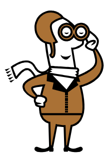
TOUCHDOWN…!

12° – 13° AOA. Your jet will "stick" to the ground.

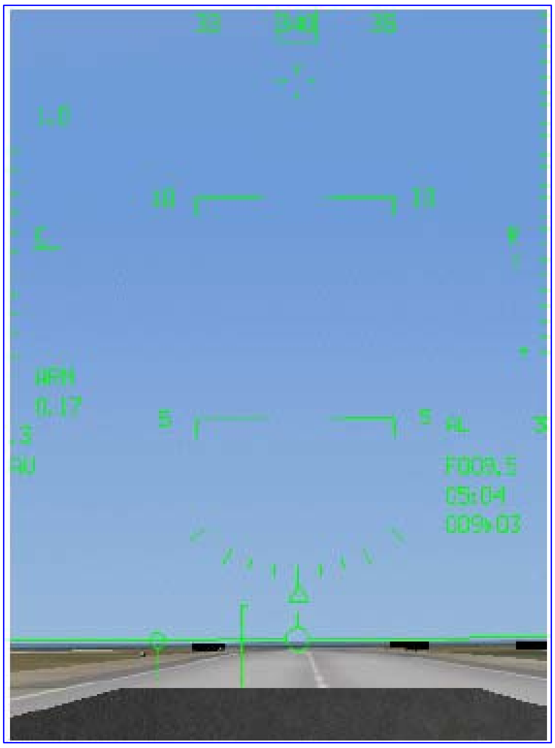
Be careful with the FLARE. It is easy to flare too much and find yourself floating above the runway without settling. Cutting the power helps a lot. Try a few different Flares, and see what works for you.

Be careful. It is easy to flare TOO much, and find yourself at 15° of AOA.

Once you become proficient at this landing technique, you will be able to drop your tires to the pavement at the correct AOA, Speed, and Location on the runway.



Paul Wilson



KEEPiNG TRiM WiTH 'GORNY

With Landing Gear extended, your Trailing Edge Flaps are **automatically** extended to put you in take-off/landing gains. Creating a bigger wing-surface area, provides more lift for slower landing approaches, and heavy-load lift-offs. This is modeled in Falcon4.0™.

When you retract your gear, your TEFs retract and will not come down at all unless you extend your gear, OR command them to with the **ALT FLAPS** switch. With this switch you can extend your TEFs **regardless** of LG handle position.

ALT FLAPS	2-Way switch *(lever lock)*	EXTEND	Trailing edge flaps (TEF) extend regardless of LG handle.
		NORM	Trailing edge flaps (TEF) operation controlled by LG handle.

As in the REAL Viper – you **can** control the TEFs position. **Why** use the alt flaps switch?

Actually, there's **not** much reason to use it. In Real Life, it would be used mostly in emergency or abnormal operations. Perhaps an F-16 would want to use it if they were intercepting aircraft flying at very slow speeds (like a propeller aircraft).

This is where the extra lift would come into play.

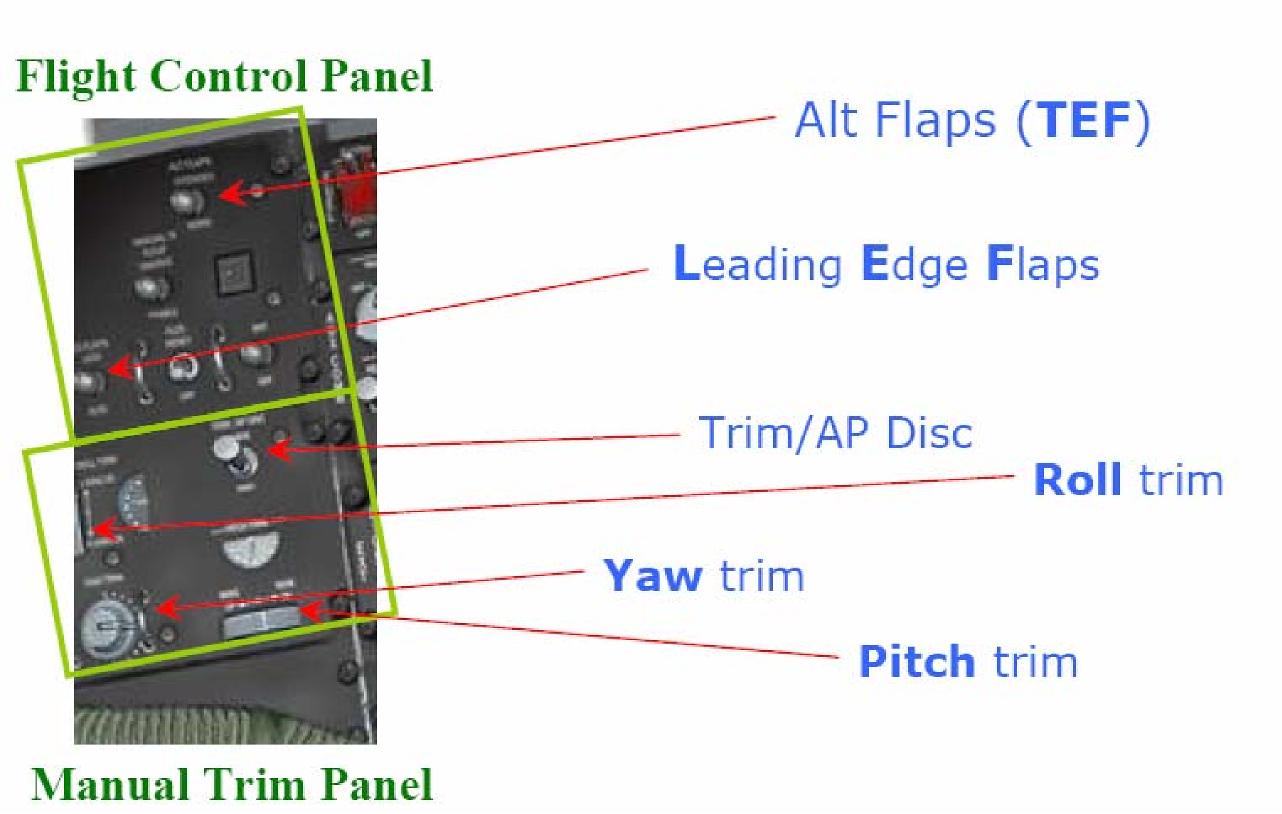
And – of course: BATTLE DAMAGE may necessitate TEF deployment…!

Similar to the alt flaps switch, The LEF switch is **used only in emergencies.**
As in real life, the Virtual pilot would engage the LEF in situations where hydraulics have failed due to **battle damage**, engine failure, or lack of fuel.

Manual Trimming should be applied to counteract irregular or erratic flight.

This can occur due to battle damage, or overstressing of the aircraft. Determine the plane of irregularity (e.g. Pulling to the left or right in the horizontal plane would require Yaw Trim), and manually apply trim using the relevant dial.

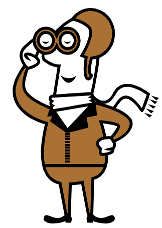
When the aircraft is able to achieve straight and level flight without stick input, you have dialed in the correct level of Trim.



Trim/AP Disc: Basically - when you have the switch in **NORM**, the HOTAS (hat) trim functions are **enabled**.

When you have the switch in **DISC** *(disengage)*, the hat switch is not operable, and you will not be able to engage autopilot (it disengages if you had the AP running when you move the switch to **DISC**).

In either state the **manual** trim controls should work normally.



EXTERNAL LIGHTING PROCEDURES

Want to inject a little realism into your Viper Activities…?

Follow some REAL LIFE Lighting Procedures…!

Anti-collision (strobe) lights must be on from just prior to engine start until engine shutdown. From sunset to sunrise all moving aircraft shall display position lights and lights to clearly illuminate the extremities of the aircraft.

(From AFI 1-218, "Aircraft Operations and Movement on the Ground.")

The anti-collision (strobe) light may be OFF and the position lights STEADY if they prove to be a distraction.

The taxi light will normally be used during all night taxiing.
Exception: When the light might interfere with the vision of the pilot of an aircraft landing or taking off, the taxiing aircraft will come to a stop if the area cannot be visually cleared without the taxi light).

For formation takeoffs: flight/element leaders will turn the anti-collision light OFF and position lights STEADY when reaching the run-up position on the runway.
Wingmen will maintain the anti-collision light ON and position lights FLASH for takeoffs, unless IMC will be encountered shortly after takeoff.

After join up, the anti-collision light will be OFF and position lights will be STEADY for all except the last aircraft, which will keep the anti-collision light ON and position lights FLASH unless otherwise directed by the flight lead.

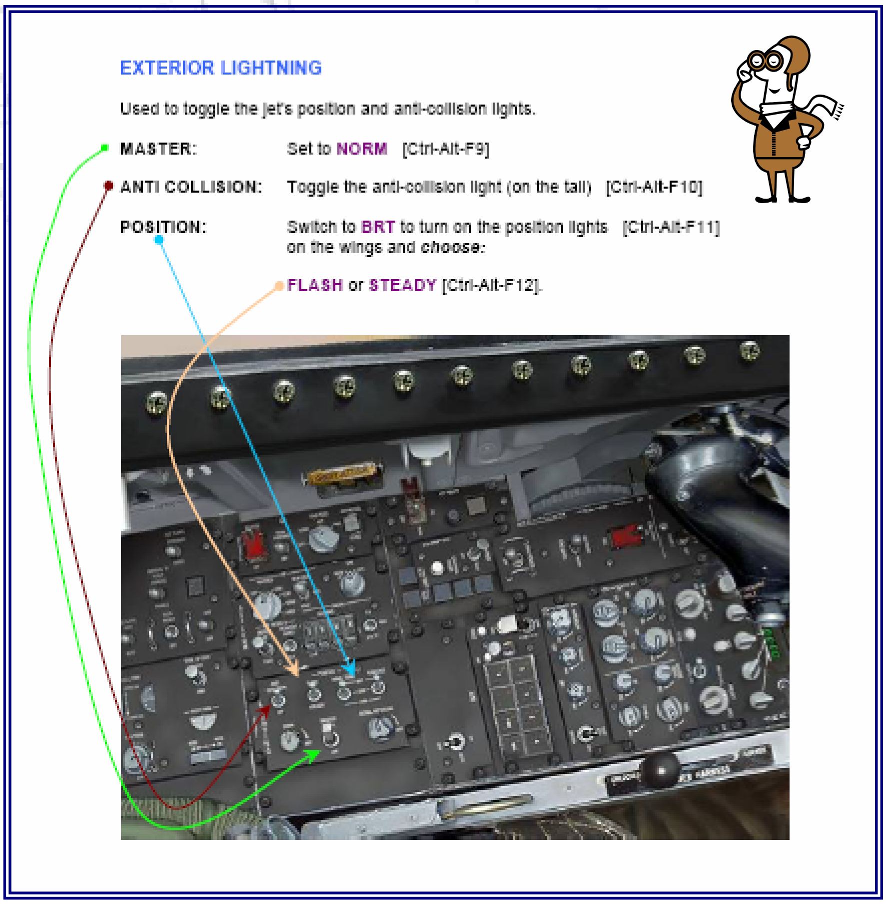
(From MCI 11-F16, "Pilot Operational Procedures - F-16.")

During **FENCE**, as you approach the FLOT, or any expected enemy air activity - be sure to douse the lights...!!

WHY? In F4 - just as in REAL LIFE - **your lights WILL give away your position**.

ESPECIALLY at NIGHT.

As explained in the RP5 Manual:
With lights on, the enemy AI *will* pick you up at greater distances.



Exterior Lighting

HIJACKING BARCAPS

Instructor: **"GRMCLE"**

Part of the strategy or complete waste of time ?

As a veteran Falcon4™ pilot and participant on many F4 forums in the past two years, I have read a great number of posts by newbies asking for the best way to fly a BARCAP mission. This is a complicated subject, and I think a discussion of BARCAP's is in order. Of all the missions in Falcon4™ the BARCAP mission is probably the most misunderstood.

First off, we must talk about why they are programmed as they are. We can all see that most of them go nowhere near a meaningful or dangerous area. You can fly most BARCAP assignments and most likely, you will not see action of any kind. There are exceptions to this but they are rare in my experience.

Now the assumption that has to be made is one of two things:

1) *The original Falcon4 programmers were all-knowing, and designed these missions to be an integrated and valuable part of the campaign.*
2) *The programmers did not do as good a job of designing them, as we would like to think they did, and just provided them so that we could edit their steerpoints, load outs, and areas to defend as the need presented itself.*

A quick look at almost all BARCAP missions will reveal two things they all have in common:

1) *Steerpoints 3 and 4 are usually very close together making your assigned area very small.*
2) *They are usually positioned in areas far from enemy ground forces or enemy aircraft. The limit of travel from the assigned area, and the disadvantage of having to initially report to the CAP steerpoints does not give you much of an opportunity to do anything meaningful on your mission, and usually results in limited opportunities to get into the fight. Subsequently, most BARCAP missions are a boring waste of time, with no action and no contribution toward winning the campaign.*

Now we have the choice of flying these missions as they are presented to us, or we can micromanage and try to salvage something useful out of them. If your goal is to do the best you can possibly do when attempting to win a campaign then you will want to:

1) *Win it as quickly as possible.*
2) *Ensure that you do not lose or tie the campaign.*
3) *Earn as many total points toward promotion as possible on every mission. If you fly useless BARCAP missions, you will not accomplish these goals, and could easily extend the number of missions that it will take to win a campaign by as much as 30%. However - if you do not fly them correctly your total point accumulation will be very slow or nonexistent. BARCAP requirements are very strict and if you do not fly the mission by these rules, your mission ratings will be poor.*

Most newbies get a little upset with themselves when they fly BARCAP missions, because they do not understand them, and get a *mission failure* rating. Mission failure can be correlated with low or no addition to your point totals. Rating – however - is not all that important when you have flown a mission lasting 30 minutes to an hour, without contributing anything toward winning the campaign.

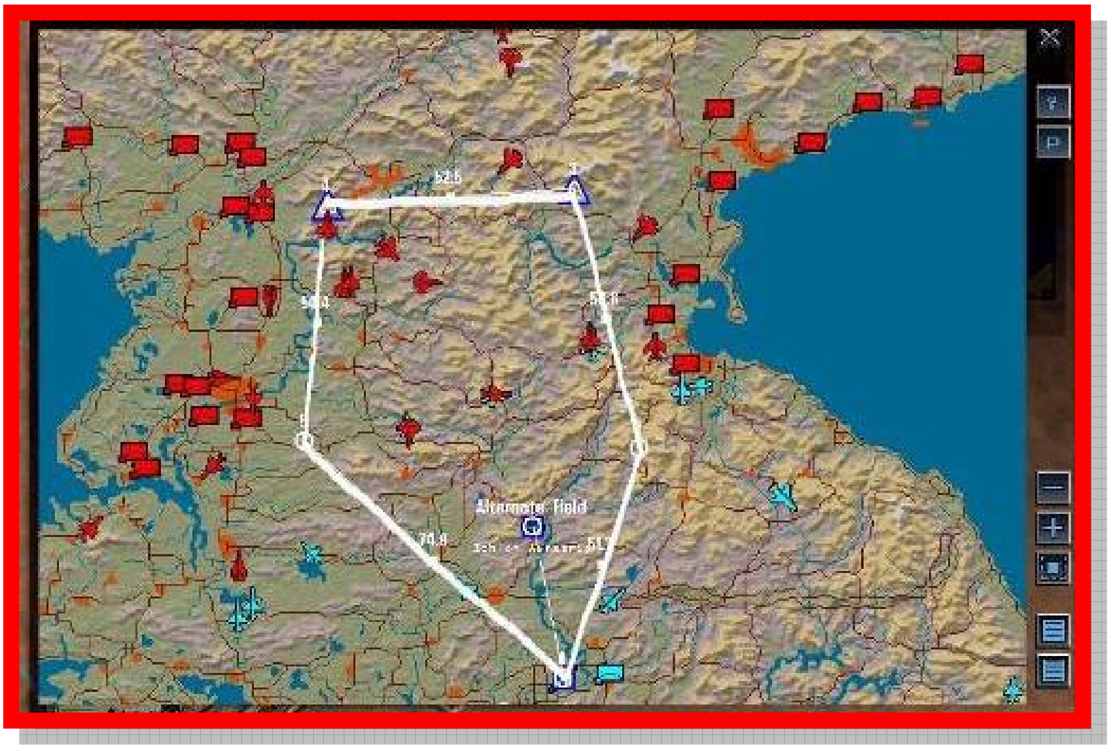
A perfectly flown BARCAP that does not result in the killing of the enemy is a wasted mission; it adds one more that it will take to win the campaign. You must kill the enemy every chance you get regardless of your mission rating; the enemy force must be degraded in order for you to win.

So how can we accomplish all these goals? **Micromanaging is the answer.**

You should micromanage your BARCAP's, and if you want to hasten the victory, you should also micromanage the AI BARCAP's. For your own missions start by going into the "flight plan" menu and at either steerpoints 3 or 4 **reset the patrol duration to zero**.

This will allow you complete freedom to go anywhere you want and not have to worry about getting a mission failure rating and low points for the mission. You can then freelance and just go anywhere and engage the enemy as you find them or change the mission completely. Load up with bombs or Mavericks and hit a ground target somewhere, before locating and killing some bandits. If you have the necessary flying and combat skills, you can make every BARCAP a mission that degrades the enemy and allows your points to accumulate more rapidly. You can also add to your collection of medals. You will most likely do none of that if you fly the BARCAP's as they are presented to you.

Now you can also **reset the BARCAP steerpoints**. You still have complete freedom by just setting the patrol duration to zero, but by re-setting the steerpoints you can use them to guide you to a ground target or an area that is fiercely defended by enemy aircraft. I use the steerpoints to define an area in the central part of Korea that I can safely fly in without worry about coming into range of SAM's or AAA. This area is large and allows me the ability to roam and look for enemy aircraft to engage.



I usually make all my kills catching bandits crossing back and forth through this area.

Watching the defined area on my NAV radar I stay away from enemy ground defenses by not crossing the lines between the steerpoints.

I set up my new patrol area with patrol duration set to zero as you can see on the map above.

As you continue to fight through a campaign, you will notice that the friendly AI have very few kills among themselves. Click on "INTEL" and then "Sierra Hotel" (the ACE logo) and you will get a report of how many kills each pilot in your squadron has to his credit. You will be surprised at how poorly they perform. Each squadron on the map will have this same result. Your total kills will be many times higher than your squadron mates.

So why fight the war alone? Why not get the AI more involved?

You can do this by **rerouting all BARCAP missions that the AI flies**.

Reset their BARCAP steerpoints to areas on the map where there are heavy concentrations of enemy fighters. ***Send the AI into battle***.

Give them a centerline tank or wing tanks and all the AIM-120's they can hold. **Do not set their patrol durations to zero**, but **reassign their steerpoints,** and expand their CAP area. Reset the patrol time to reflect their distance flown to get to steerpoint 3.

If they had to fly a long way to get to the CAP area then set the patrol duration to 1 or 2 minutes. If the distance is short then leave it at 15 minutes. You want them in the area you assigned as long as possible, but try to give them a chance to get home.

This will increase the AI kills and help you win the war.

Use a little imagination and BARCAP's will help you instead of being a waste of time.

George

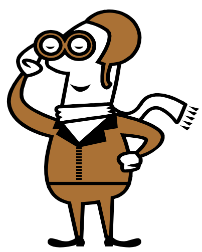
Editor's Note: Check the next page for additional tips

Gorny's Tips'n'Hints: Another way to Hijack a BARCAP would be to enter the cockpit and threaten the pilot. If you end up in Guantanamo Bay, just plead diminished responsibility due to playing too many Video games. Okay – not "games". "Simulations". You might also tell the judge that it was GRMCLE's idea, and you will happily roll over on him. Of course, being Guantanamo Bay, you probably won't be seeing a judge for a few years. Nor a lawyer, for that matter. This means PLENTY of time for simming…! One small point – just check the identity of your cellmates before firing up the ODS theatre. We certainly don't want to be taking out the village of the guy in the bunk above us, yes? As George points out, planning is essential. Therefore – before attempting to hijack a BARCAP, perhaps you could try installing the FF CUBA theatre. Always nice to recon your airbases BEFORE you land at them. Whether that's in the F-16 you've commandeered, or the troop transport taking you to your new "home". G'Luck.

ARA'S WAY POINT TASKING (WHICH to choose...?)

Hijacking a BARCAP...? A column of tanks at WP 3....?
Should I task the AI to "STRIKE" or "BOMB" or "ATTACK"..???
There are TWO "Attacks". Should I choose the 1st or 2nd....??

Ingame Name	***Symbol***	***Comment***
Takeoff	WP_TAKEOFF	
Push Pt	WP_ASSEMBLE	
Split	WP_POSTASSEMBLE	
Refuel	WP_REFUEL	
Rearm	WP_REARM	
Pickup	WP_PICKUP //	Pick up a unit
Land	WP_LAND	
Timing	WP_TIMING //	Just cruise around wasting time
Contact	WP_CASCP //	CAS contact point
Escort	WP_ESCORT //	Engage engaging fighters
Sweep	WP_CA //	Engage all enemy aircraft
Cap	WP_CAP //	Patrol area for enemy aircraft
Intercept	WP_INTERCEPT //	Engage specific enemy aircraft
Attack Armored	WP_GNDSTRIKE //	Engage enemy ground units at target
Attack Navy	WP_NAVSTRIKE //	Engage enemy ships at target
S&D	WP_SAD //	Engage any enemy at target
Strike	WP_STRIKE //	Destroy enemy installation at target
Bomb	WP_BOMB //	Strategic bomb enemy installation at target
SEAD	WP_SEAD //	Suppress enemy air defence at target
ELINT	WP_ELINT //	Elect intelligence (AWACS, JSTAR, ECM)
Recon	WP_RECON //	Photograph target location
Rescue	WP_RESCUE //	Rescue a pilot at location
ASW	WP_ASW	
Fuel	WP_TANKER //	Respond to tanker requests
Airdrop	WP_AIRDROP	
Jam	WP_JAM	
FAC	WP_FAC	
PreIP		
IP		
TurnPt		
NAV		
Move Opposed	WP_MOVEOPPOSED //	These are movement wps
Move Unopposed	WP_MOVEUNOPPOSED	
Move Airborne	WP_AIRBORNE	
Move Amphib	WP_AMPHIBIOUS	
Defend	WP_DEFEND //	These are action wps
Repair	WP_REPAIR	
Reserve	WP_RESERVE	
Air Defense	WP_AIRDEFENSE	
Fire Support	WP_FIRESUPPORT	
Secure	WP_SECURE	
Last	WP_LAST	



(Column of tanks...? The answer - by the way – is the 1st "ATTACK"......)

FENCE IN & TRAIL

When entry to a "HOT" area is imminent, combat pilots (virtual and otherwise) undertake a **FENCE** or **FENCE IN** check. "FENCE" is actually an acronym.

What does it stand for…?

Let Ara' help you jump that FENCE.

"Certain items should be checked to ensure that switches and avionics are set up properly prior to entering a hostile area. One way to assure you make a thorough check of your combat capabilities and are ready to fight, is by using the word **FENCE** as an **acronym**:

F Fuel.

Check balance, total, NORM feed and tank inerting selected.
NOTE: Tank inerting may cause slow external fuel transfer.

E Emitters.

Use the acronym: ***T R A I L***

T TACAN. Check operation. A/A set as briefed.
R Radar. Set CCR and altitude coverage as briefed.
A ALQ & ALR. Set proper ECM technique and RWR as required.
I IFF. Set modes, codes, and Auto/Man as required.
L Lights. All exterior off.

N Navigation.

INS check/verify steerpoints. Confirm GPS/Nav status High/High (Block 40/50). Accomplish update (FIX/ACAL) if necessary on preplanned point.

C Chaff and flares

Check programmer prior to strapping in. ARM and check operation airborne.

E Employment.

Recheck SMS programming to include DGFT, MSL OVRRD, AIM-120 BIT and ID set as briefed, AIM-9 cooling/tones, and rail priority. Check arming options to include weapon, fuse arming option, release pulses, spacing, and delivery modes. Ensure Master Arm is set as required, HUD has correct symbology, proper arm indication, and SOI/SOR in proper place. Confirm TGP laser code is set IAW mission requirements and Arm as required. Turn up volumes on missile, RWR, UHF, VHF, and secure voice to desired levels."

(From F-16 Combat Aircraft Fundamentals, MCH 11-F16 Vol. 5

MISSION BUILDER GUIDE

Instructors: **JOHN "TRITON" WALLER & "DEW DOG"**

This Guide will teach you how to create and edit TEs (Tactical Engagement Missions) in FF/RV.

Whilst some sections relate generally to Falcon4.0™, others are RedVIPER specific.

This Guide will aid you in:

- Building your own Training Missions (to hone & tweak specific skills)
- Creating exciting Missions and "Mini-Campaigns" for MP Flights and On-Line Squadrons.
- Creating missions of an interesting and/or complex nature; often not found in Campaign.
- Understanding some of the problematic issues with Falcon TEs
- Understanding some of the specific issues with the RedVIPER Install

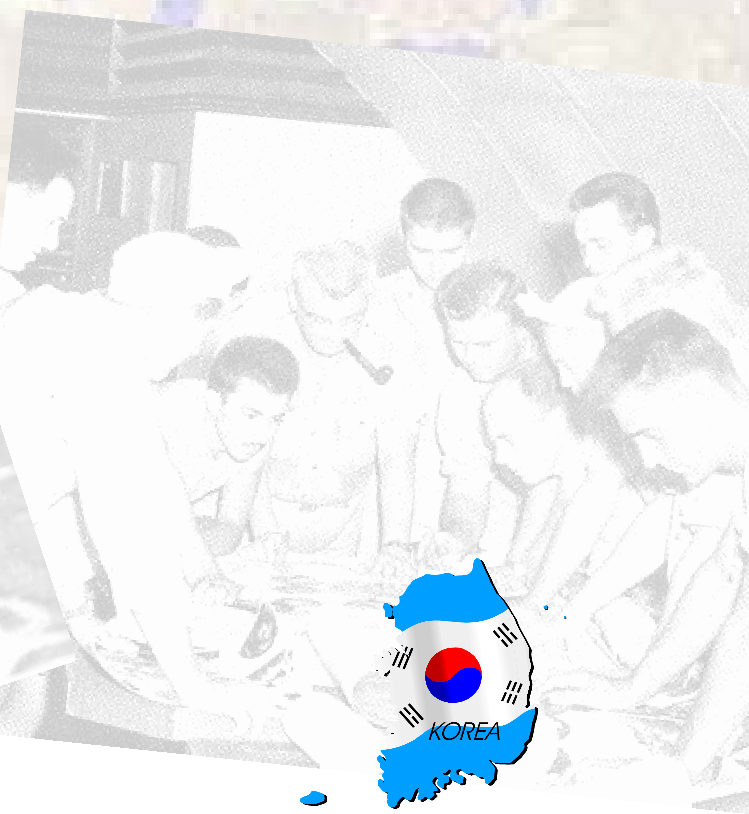
Furthermore, through the building of TEs, one may closely observe the actions of the AI within the TE.

This can aid the Virtual Pilot in:

- Understanding the strengths and weaknesses of the A.I.
- Formulating strategies in response to these strengths and weaknesses.
- Practising and experimenting with various Wingman Commands

SECTIONS OF THIS GUIDE

- Mission Builder Tutorial
- Step x Step TE
- Tweaks
- Object Ownership
- RedVIPER Specific Tweaks
- RedVIPER AirMobile



You have no clue how to create a TE?
The maze of buttons and menus puts you off when trying to create a TE?

Fear not…! This document will help you understand how the Mission Builder works.
It will also take you through building a TE, step by step.

(To reflect the fact that this Tutorial applies to all versions of Falcon4.0™, I have chosen to use a generic version of the U.I. for screenshots.)

Lets start at the UI screen you see when you have just started Falcon.
Choose Tactical Engagement, and then choose the Saved tab.
Now choose the ”New” button (if you wish to create a new TE) or ”Edit” (if you wish to edit an existing TE).

That brings you to this screen:

This is the main screen in the Mission Editor.

If you are in one of the submenus listed to the left (apart from Mission Builder) just click on **Mission Builder** at the top left to return to this screen.

Each submenu, function button and submenu pop-up will be described in detail below, but let’s start with a description of the main screen and the functions you can access here.

Right-click on map:

This will bring up menus where you can **choose what you wish to see on the map**.

This is very useful when - for example - choosing a target or patrol area, or for showing objects, airbases, troop locations, aircraft locations, etc.

It's simply too much to list here, but experiment with the options available there.

Clock *(top right)*:

You can use this to **set the starting time for the mission**. This enables you to select what time of day you want the mission to take place *(night, dawn, day, dusk)*.

Left-click on the hours, minutes or seconds and then use the arrows next to the clock for moving time backwards or forwards.

This function is also very useful when checking the timing of a mission *(i.e. where a flight is at any given moment in relation to other flights etc.)*

Planning how a mission will unfold goes a long way to ensuring that your TE will be an enjoyable one.

Function buttons *(right side)*:

Placing the mouse pointer over each button will tell you what the button is for.

These buttons provide you with **direct access to the most common functions** such as: *Help; Team Selector; Add Battalion; Add Squadron; Add Flight & Add Package.*

Also *Map Zoom* and *Altitude profiles* are accessed using these buttons.

These buttons will be further described in detail, below.

Submenus *(top left)*:

These are submenus that will "replace" the main screen window.

Here you can *set teams*, *save your TE*, *set Victory Conditions* and *Restore the TE* to what it was when you first loaded it (discarding all changes). This is very useful if you have screwed something up, and wish to start afresh.

Submenu pop-ups *(bottom)*:

These submenus open in a pop-up window while the main window remains as is.

In these submenus you can *change the loadout*, *view the Air Tasking Order*, *view the Briefing for each flight*, *view and adjust the flight plan for each flight* as well as *view the Help section*.

Again – fear not. *All* the above mentioned functions will be further described below, in detail.

Let us begin with the top left submenus

Mission Builder: That's what you are already looking at. This menu brings you directly to the main Map screen; the default view when starting the Mission Editor. Use this menu when you have visited any of the other left submenus for returning to the main screen.

Teams: This is where you set which Teams you want to have in the TE, their names, default pilot skill, default ADA skill and also what part of the map you want to belong to each team.

This is what it looks like:

The default Team flags in the Korean theatre are the USA and DPRK.

If you wish to ***add more teams***, use the "New" button in the lower part of the window.
To ***delete a team*** use the Delete button located right next to the "New" button.

To ***highlight a Team***, left-click on its flag.
You must do this in order to change any settings for the team.

You have two drop-down menus in the middle where you select both the default ***Pilot skill*** and the ***ADA skill***. This enables you to customize the level of difficulty in the mission. Skill levels can also be chosen individually when adding flights or battalions.

To the right of the Map image you have 4 function buttons. The top one is a ***Paint Brush*** which you use on the map image to ***allocate territory*** to the chosen team.

The next one from the top is ***Clear Territory***. I never use this button, as it does the same thing as the paintbrush; it allocates territory to the chosen team.

The third button from the top is ***Clear All***. Quite Self-explanatory.
It clears all changes and ***resets the map*** to default.

The fourth button is ***Undo***; it only ***discards the last change*** you made.

Victory Conditions:

On this screen you can set specific conditions that, when met, are awarded with Victory Points.

This feature is useful if you wish to make a TE where you have two opposing teams that will go head to head, or if you build a TE where you want the whole team to achieve several objectives. (Multiple flights and multiple targets, with one overall goal)

If you change the starting time of the TE in the Mission Builder or Teams screen you should adjust the starting time so that **the time span of your TE is within the boundaries of the Start time and Time limit of the Victory Conditions**.

This is what it looks like:

You can add a Victory condition from the right-click menu in the Mission Builder or by right-clicking on any object/flight/unit and choosing “add victory condition”.

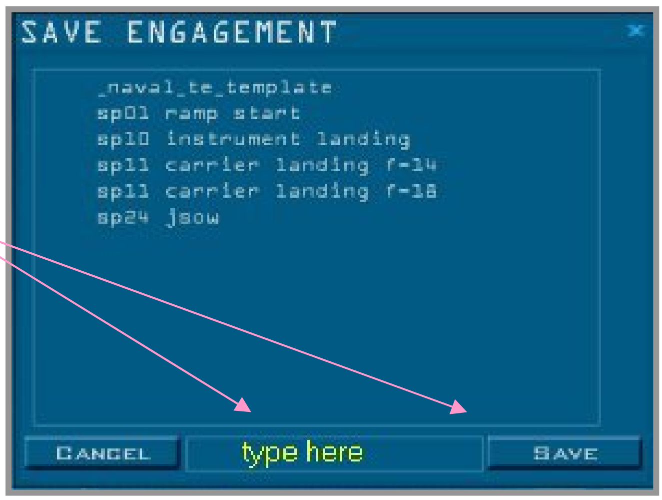
You can manually change the points and conditions in the large box below the map.

Save:

This is where you save your TE.

Just type in the name of your mission, then click Save.

It is recommended that you **save the mission at short intervals** so that you don’t lose what you have created in case of a crash of any kind.



Restore:

This is the big Nuke button; **it discards ALL changes** made to the TE.

F u n c t i o n   b u t t o n s

Located on the left side of the main map screen; listed here from top to bottom:

Help: Self explanatory.

Team Selector: When making changes/adding things you will be doing so for the team whose flag is showing here. To change team just left-click on the flag. Each click cycles you through the teams so just keep clicking until the team you want is displayed.

Add Flight: By using this button you will add a flight when left-clicking on the map. Click on the target / target area. You will then get a pop-up window where you choose what type of aircraft to use, mission type, number of aircraft, skill level, air base and squadron.

If there is no squadron added for the type of aircraft you have chosen the editor will add one at the airfield you chose.

Add Package: This button does pretty much the same as Add Flight, but with the following additions: You can choose the takeoff time and the time on target as well as choose which of the two that is “dominant” by locking it with the little padlock symbol.

You can put together a package with several flights in it, for example a Deep Strike with an Escort.

NOTE: *If you add several “Strike” type flights in the same package the debrief screen may show incorrect results, this is an old bug.* (SEAD Strike, Strike, Deep Strike)

So settle for one strike flight in each package.

Personally I always use this option as I like to control the takeoff times. Having flights scheduled for takeoff too close in time to each other can create problems in Multiplayer.

Add Battalion:

This button allows you to add ground units.

You will get a pop-up window where you choose nationality *(you can add any nations equipment to any team)* and unit type.

Add Squadron:

With this button you add Squadrons of aircraft to any airfield you left-click on.

You will get a pop-up window where you can choose aircraft type and airfield.

Zoom out: Zooms map view out.

Zoom in: Zooms map view in.

Fit map size to flight plan:

If you have been zooming back and forth you may wish to resize the zoom to fit the flight plan of the currently chosen flight. If so use this button.

Altitude Profile *(Detailed)*:

This button shows a graph of the flights altitude profile, viewed from left to right. This graph is more detailed than the following one.

Altitude Profile *(Overview)*:

Same function as the Detailed profile, this one is just less detailed.

S u b m e n u s

These menus will appear as pop-up windows.
Located at the bottom of the screen; listed here from left to right.

Help: Says it all.

ATO (Air Tasking Order):

This is a very useful window; here you can see each flight that is created for any team.

You can also mark checkboxes so that the flight paths of several flights (or all) are shown on the map at the same time.

The flight that is currently active will have a white flight path while the others who you have checked in the ATO screen will have black flight paths.

Very useful when placing BARCAPs or just generally checking where all flights are in relation to each other.

Flight plan:

This is one of the **most important** windows and one of the most **commonly used** ones for TE building.

Here you can adjust just about everything related to a flight such as Take Off time, *Time On Steerpoint*, *Time On Target*, *airspeed* for each steerpoint, *altitude* for each steerpoint, *action* for each steerpoint and *assigning target*.

This is where you make or break a TE.

The timing of a TE is critical, time things wrong and you might be going on a suicide mission or a totally boring milk run.

From here you can control the timing in detail by locking/unlocking the TO, TOS and/or TOT.

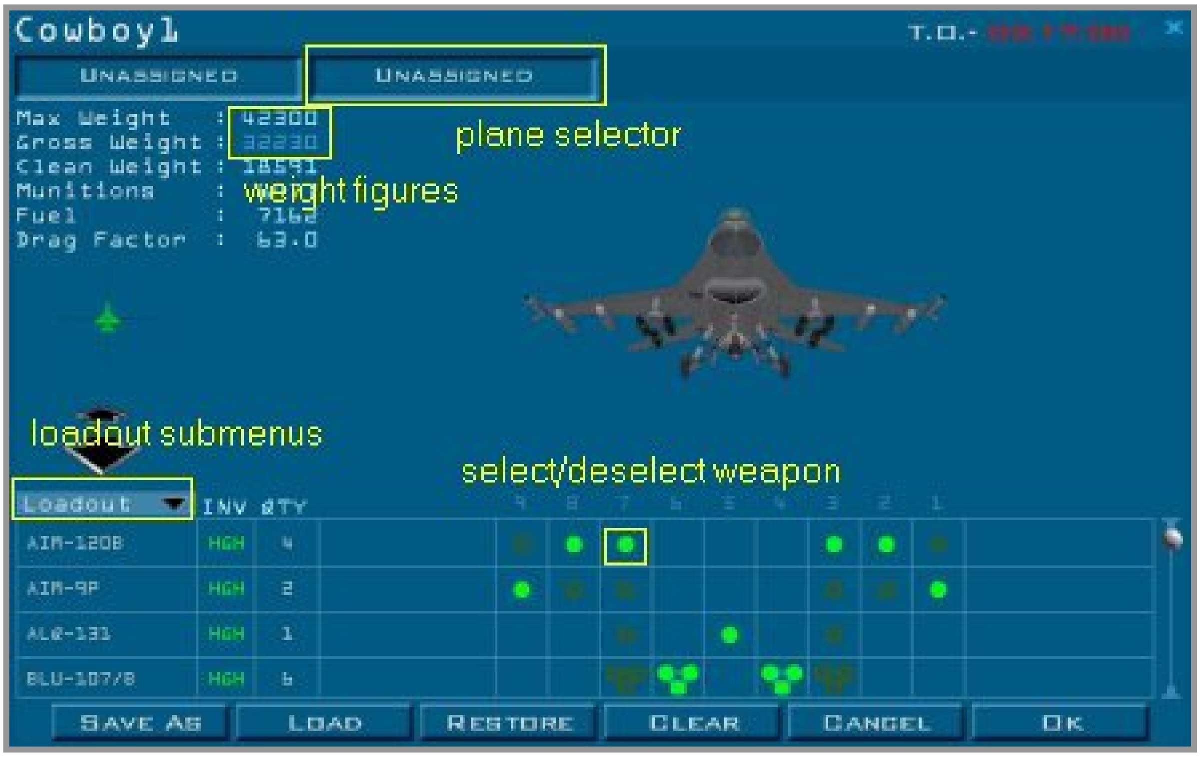
B r i e f i n g :

This window is for information only.

It tells you about *target*, *task*, *loadout* and *flight composition*.

Munitions:

Here you can view and change the weapons and accessories the aircraft will carry.



You also see the weight of your aircraft with the current loadout as well as the maximum allowed weight.

If you exceed the maximum allowed weight the Gross Weight digits will turn red.

You can alter the loadout for each aircraft individually if you so wish by clicking on the Plane Selector buttons at the top. You have one button for each aircraft, and if a button is depressed that aircraft is affected by any changes you make.

If a button is not depressed (i.e. raised) that aircraft is not affected by changes.

At least one button must always be depressed.

You can switch weapons by clicking on the hardpoints. If a weapon you wish to use isn't loaded by default you can load it manually by choosing one of the options from the loadout submenu.

There you can choose from A-A, A-G, Other and All depending on your preferences.

You can save a favorite loadout by clicking the Save As button so that you can load that same loadout some other time by using the Load button, even in a different TE.

Once you are happy with the loadout click OK and the window will close.

STEP BY STEP PROCEDURE FOR CREATING A SIMPLE TE:

First you need to sit down and come up with a “storyline” for the mission.
Pick a main objective, and then you can design the mission around that objective.

For example - let’s say the mission objective is to destroy an enemy airfield.
You will need a strike package to do the job, so that’s the main flight of the mission.

Then you want some enemy ground units (AAA, SAM and combat units).
The target is defended by ADA units? Ok, then - you might need a SEAD flight to suppress those units, in order to allow your strike a/c to do their job.

A pure A-G mission without any enemy air threats can be a bit boring, so to spice things up you want some enemy aircraft too. That gives you the option to add - for example - an Escort to your package for protection from enemy fighters. You can decide to leave this out if you want the Strike to have more of a challenge though.

An airborne AWACS is a good idea, so you have some help sorting threats during your flight.

Ok, that seems like a plan to start with. Now let’s get down to business:

1. Start Falcon4.0™
2. Choose Tactical Engagement on the left of the main UI.
3. Click on Saved.
4. Click on New. This opens the Mission Builder, showing the main screen.
5. Start preparing the map by right-clicking on the map and selecting the various Installations you want to view. This will enable you to pick your target when creating a package. In this example you choose Airfields. Under Ground units, choose Battalion, Combat, Air Defense and Support (HQ units have SAM and AAA but do not show up on the map unless Support is chosen).
6. Click on the Add Battalion function button in the top right toolbar and then click on the map where you want to place it. *NOTE:* ADA *(SAM/AAA)* units should be placed at major objects such as Factories, Airbases and such to function properly. A pop-up will appear where you choose the equipment (the nation the equipment comes from) and unit type. Don’t worry if the unit doesn’t show up immediately on the map, it’s an old bug. Repeat until you’ve added the units you want.
7. Click on the Add Squadron function button in the top right toolbar and click on the airstrip you want the squadron to use. A pop-up will appear where you select the aircraft type (for ex. F-16C). The Airbase will be the one you clicked on, but you can change that if you want by using the drop-down menu.
8. Click on the Add Package function button in the top right toolbar and then click on the airfield. A pop-up window will appear where you select the Take off time or Time on Target. Then click New to add a flight to the package. Now a new pop-up appears, Add Flight. Here you select the aircraft type (for ex. F-16C), the mission type (OCA Strike in this case), the number of planes in the flight (1-4), Squadron (should show the one you have added), Airbase (should show the airbase you previously selected for the Squadron), Target (should show the target airbase) and Skill (Recruit, Cadet, Rookie, Veteran and Ace).
9. Click New again if you want to add more flights to your package (such as SEAD or Escort), repeat steps **7** and **8** as required. Finish with clicking OK to close the Add Package window.
10. Switch to the enemy side now by clicking on the little flag at the top right.
11. Repeat steps **6** through **9** as required for the enemy units/flights.
12. Now click Save in the left menu of the main window, type in the name of your TE and click Save.
13. **You’re done! Now you have all the major pieces in place, you have created a TE.**

T W E A K S :

While the above procedure sets the stage for your TE, there are many tweaks that will improve on your creation. The basic ones are listed below; they enhance the stability and overall experience of flying the TE. I recommend you use these tweaks, because Falcon4.0™ doesn't always do a good job at setting up the parameters of a flight. They can, in short, save you a lot of grief.

T i m i n g :

Take Off timing: From a stability point of view Take off times are important. In Multiplayer it **can** cause severe problems *(lag, lockups, CTD's, violent warping, and other problems)* if aircraft are tasked with taking off too close in time to each other.

As a rule of thumb I always set 1 minute or 2 minutes separation between flights depending on if the flights are taking off from the same base, or from separate airbases.

1 minute separation for flights departing from **different airbases**.
2 minutes separation for flights departing from the **same airbase**.

This applies to ALL flights regardless of team.

This problem is due to a code limitation, so ignore this tweak at your own risk.

To change Take off times use the ATO menu in the bottom toolbar to select the flight and then the Flight Plan button (also in the bottom toolbar). There you can set the TO time. When you've set it, click on the little padlock next to it so it is locked. Do this for all your flights. I recommend you write down all TO times on a paper to keep track of them. Once all flights are sorted, you can move on to the next tweak on the list.

Steerpoint airspeeds: It is good to tweak the airspeeds between the steerpoints to ensure that the flight can be carried out in an efficient manner. This is also done through the Flight Plan window.

I recommend setting the airspeed for STP2 to max 250 knots in order to facilitate forming up after take off. For NAV steerpoints after STP2 I recommend 300-400 knots depending on loadout and altitude. That is fast enough to give maneuverability if a threat appears unexpectedly *(a SAM launch for example)*.

When you reach the IP, I recommend a higher airspeed - 450-550 knots depending on loadout and altitude. You don't want to hang around in the danger zone; you want to get in and get out again as fast as possible.

After the Target STP you should be rid of your A-G weapons, so a speed of approx. 400 kts is good.

You adjust the airspeed in the Flight Plan window. If the airspeed or TOS *(Time On Steerpoint)* is locked, unlock it *(with the little padlock)* before changing.

Once all airspeeds are set the way you want them, I recommend **locking the TOS** for all steerpoints from STP2 to the Target STP. Why? Because if you have an AI in your flight and something happens along the way so that he strays off, he will do all he can to reach the next STP on time even if it means flying at full AB to do so.

The advice above is meant for high performance aircraft such as the F-16. Low performance aircraft, such as bombers and transports, are covered in a separate section below.

Steerpoint settings for Low performance aircraft: When using the "heavies" *(bombers, transports and support aircraft)* in a TE, you will have to take into account the fact that these aircraft are much slower and have lower performance than fighters when you set the airspeeds, altitudes and steerpoint times.

The default values when you create the flight are usually way too high (more suited to fighters like the F-16), and when they can not possibly follow the flight plan they skip steerpoints in order to try and catch up. This can of course have adverse effects such as the flight taking a shortcut that leads it to fly directly over a threat instead of around it as you intended or that they do not climb to the intended altitude.

I usually lower the altitude of stp 2 and 3, lower airspeeds to just a notch or two above the minimum allowed (when flight path turns red you are below minimum allowed speed) and I also set great distances between spt 1, 2 and 3 (stp2 usually around 50nm out from home plate and 40-50nm between stp 2 and 3). Fly the TE on Combat AP and see if the AI can follow the flight plan, if not you'll have to tweak the settings a bit more.

In FF4/RedVIPER, only put them on dual-runway airbases. When used at single runway airbases it is common that the AI doesn't hold short in the right place and "gets lost", after which it doesn't take off when cleared. This of course disrupts the flights using that airbase, if an aircraft doesn't take off it holds up all the others following behind.

Steerpoint altitudes: You choose steerpoint altitudes in the Flight Plan window. This is how you control the flight profile of your mission. You should choose this based on what threats you might face during the mission. If you are attacking a target defended by SAM a low-altitude attack might be a good idea, but if you face AAA as a defense you could opt for a high-altitude attack. What ever you opt for, this is where you adjust the altitudes.

Keep in mind that flying low not only puts you at a disadvantage against enemy aircraft but it also increases fuel consumption, thus decreasing operational range.

Adjust the altitudes AFTER you have set the airspeeds and locked the TOS's.
That way, adjusting the altitudes will automatically adjust the airspeeds accordingly (higher altitude = lower airspeed, lower altitude = higher airspeed). I always start out with setting STP2 to approx. 15,000 ft, and the other NAV STP's to 20,000 ft. I then adjust the altitudes to fit the profile I have in mind.

The usual setup is to fly high as far as possible in order to avoid ground fire and stand a better chance against enemy fighters. When approaching the IP, you adjust the altitude to suit the type of attack you'll be executing. An airbase attack using BLU's is done at low altitude; a GBU attack is done at high altitude.

Steerpoint spacing: I recommend placing STP2 around 20nm from your airbase to allow the flight to form up before heading towards the target. In Multiplayer this is very useful as players are often delayed on their way into the cockpit, so providing some extra time is good.

The IP should be 10nm or more away from the target to give enough time to set the systems and weapons up for the attack. This is particularly important to the AI, if the IP is too close to the target they will get confused.

The Clock: Once all the other settings are tweaked and saved, right-click on the map and check that all relevant aircraft types are checked under Air Units. Then highlight the minutes on the clock at the top of the screen and click on the right arrow next to the counter. The clock will start moving.

Now you'll see all the units move according to their plans, allowing you to see if you have timed everything correctly. If you want the enemy to intercept the Strike, you will be able to see if they arrive at the right time to do so. If you have tasked a SEAD Escort to take out a SAM unit, they should arrive in time to attack and suppress the SAM before the Strike enters the engagement envelope of the SAM.

If some things are not working correctly, you can rewind the clock to its original starting time using the left arrow and then tweak things a little, before you try again.

Having things timed right can make all the difference between a boring milk run, and a nail biting adrenaline rush.

OK, by now you've got an idea of where to start. I hope this tutorial will spark the interest to learn more about TE building. With the Mission Editor you can create anything from very simple TE's, to full blown mini-campaigns with multiple packages and complex storylines.
It's all down to how much work you want to do; you've got the tools for it.

GOOD LUCK…! *Please continue on to the following sections*

John

An Important Note From Skratch:

You may find that when you click on AB to change ownership *(i.e. from DPRK to USA or USA to DPRK)* the change **does not stick** when you Save it. When you go to play or re-Edit, the AB has changed back to original owner.

This seems to apply mainly to Airbases. The solution is quite simple.

In addition to the airbase, **you need to change one other item.** This is because they are "linked together". If you do not, your AB wil show as recaptured. Try changing the base AND one item next to it. Then save.

A Brief Explanation:

Each item on the map is called an objective and all the buildings/other in an objective are called features. A tree cluster is a feature as well as a runway. All objectives have links to all other objectives. Links are like highways, & also like wires. You have TWO links between two objectives; NOT one.

It's like "send-receive". So if you change ownership if one objective, looks like only one of the links has been changed and not the other. So - if you watch in-sim, after a few seconds... the item you just changed shows as being recaptured and gets switched back…!

The only "fix" is to change two or more objectives to the other side in a TE. Then the links between them are BOTH on the same side and the recapture problem will not exist.

A "Two-Step":

1. Click on the item you want to change and bring up all the objectives on the map so you can see them.

2. When you change the side of your chosen objective, ***also*** do this for the objective closest to the one you want to change. Now you'll have TWO objectives that have been changed to the other side.

So - since you have TWO objectives that have been changed, the links between them have ALSO changed, and the change will "STICK".

No more "recapture problem"

Unless a ground unit shows up and recaptures the objectives… ☺

DEWDOG'S REDVIPER-SPECIFIC TWEAKS FOR TE'S:

1) When making a TE with a SEAD Escort and there are ADA and Combat Units nearby the Target Stp, open the Flight Plan and advance to the target Stp. You will see that the Action selected for the stp is SEAD. Change that to Nav. You will still be under SEAD authorization as the Enroute tab shows SEAD. This tweak is to avoid the AI attacking non-ADA capable units in the target area. If not used, the AI might waste its munitions on a Tank unit instead of on a SAM or AAA unit.

2) You may notice the flight plan demands a ridiculous climb to altitude at Stp 2 and descent for landing on return if you select an Airfield too close to the FLOT. The editor creates those Stps to be only 2.4 miles out from home plate, not enough distance. Using the default map, this would apply primarily to Mandumi Airstrip, so you should only use Mandumi for low flying aircraft such as A-10 and helos. If you do decide to base other aircraft this close to the FLOT it is recommended you manually move stp 2 and the Split stp (last stp prior to landing) well behind the FLOT, and then tweak airspeeds and altitudes so the AI can achieve them.

Any airfield that is closer than 30 miles from the FLOT will have the same issue. So if you are painting the Korea Map (under Teams in TE editor) to change ownership of parts of Korea you should keep in mind to not paint any closer than 30 miles from the airfield you want to create flights from. This will give Stp 2 a distance of 16 or more miles. **This is particularly important for heavies such as bombers**.

3) Every weapon has a minimum release altitude depending on its type. If you are below that altitude and give the AI the attack command with the Harm for example, he will fire one from current altitude and then climb to the desired weapon release altitude for remaining shots. If you do not want him to do that, or mistakenly give him the order, simply give a Weapons Hold or Rejoin command.

4) In the TE editor the assigned flight altitudes created for an A-G mission may be ignored by AI, depending on weapon type they carry. Thus if you assigned 20k' to the attack leg and AI climbs or descends sharply, he is moving to the weapon altitude. Often this will be some distance prior to the IP, again depending on type of weapon.

5) If you make complex TE's that involve several flights over a period of time you may start to see enemy Ground Units disappear from the UI map. This is due to the 'fog of war', in which units that have not been spotted by aircraft within 15 minutes might go missing. Thus, it is a good idea to add JSTARs *(E-8)* to your TE's within a reasonable distance of your flight path. Note however, do not have the JSTAR fight come within 5-10 miles of a Combat Unit. They get chicken and RTB when threatened.

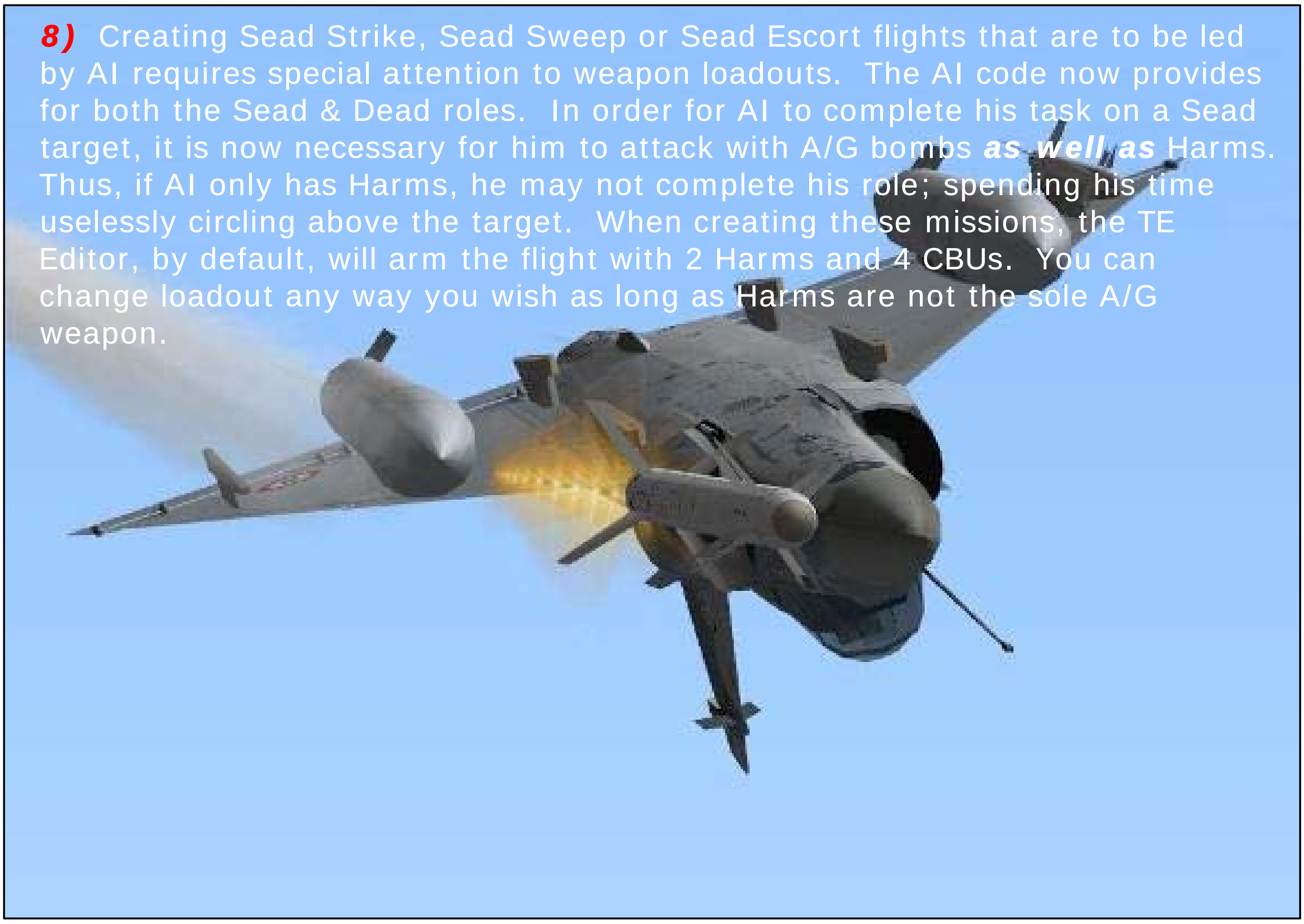
The Viper FoF Template TE included in the install for MP server mode and/or Force on Force team play includes E-8s already set to fly throughout the day. Unfortunately Red side does not have that type of aircraft so we let them have some E-8s too… ☺

6) If you are flying Lead and hear a call for "Mud Spike…" and you have pilot voice and/or Radio messages enabled you may think it is your wingman calling. It just may be ***YOU*** who is calling. Whomever is being spiked does the calling and - unless you gave the AI wingman the command to "Take Lead" - you are most likely the one being painted. Thus don't expect AI to fire without your instructions if it was – in fact - you who made the call.

7) An old bug in the 3D world that has not been fixed yet is the AI skipping past the Stp immediately in front of Target Stp in many A-G sorties. Thus if your flight plan has T/O, then climb stp 2, cruise to Stp3, IP at Stp 4 and Target Stp 5 - at Stp 3 the AI will ignore Stp 4 and go directly to Target. Perhaps even sooner if he starts to move to weapon altitude prior to Stp 3 or skips stp's due to incorrect altitude/airspeed settings for the waypoints.

If you made the flight a direct line to the target (default flight plan does this) this is not a problem. But you may want to create the flight to fly around threat areas (SAM, AAA, Navy). If so, you need to make a dog-leg route for the flight. You will then need to add a steerpoint just prior to target. Then you need to tweak airspeeds and altitudes enroute according to the aircraft types and test so that the AI can follow the flight plan. This will prevent the AI cutting corners of the flight path and going direct to target.

8) Creating Sead Strike, Sead Sweep or Sead Escort flights that are to be led by AI requires special attention to weapon loadouts. The AI code now provides for both the Sead & Dead roles. In order for AI to complete his task on a Sead target, it is now necessary for him to attack with A/G bombs ***as well as*** Harms. Thus, if AI only has Harms, he may not complete his role; spending his time uselessly circling above the target. When creating these missions, the TE Editor, by default, will arm the flight with 2 Harms and 4 CBUs. You can change loadout any way you wish as long as Harms are not the sole A/G weapon.



DewDog's Red Viper Update For AirMobile Tips

Subject: Tips for AirMobile missions in custom Tactical Engagements.

Mission: Enable C130 AirMobile in advanced mode.

Objectives:

- √ Air Drop Combat Battalion so that it will advance to its assigned objective.
- √ Air Mobile SAM that is unseen in UI Recon.

TE in RedVIPER: **AirMobileTraining**

The AirMobile Trainer manual I made years ago is very much out of date for current Falcon versions. If you are interested, you can still download the original Trainer manual at falconuk.com. The TE's included will not work in Red Viper however. The AirMobileTraining TE in your Red Viper install is current, and used for this discussion.

Figure 1

In the TE, there are two different roles of AirMobile: Moving *Combat Units* & Moving *Air Defense Units*. This discussion also applies to the C130, AN-72 and the CH-47.

However the ***CH-47 still has issues in the 3d world***, so I prefer not to use it.

Objective 1

Enable C130 AirMobile air drop a Combat Unit: When you click on the *4023 Armored Battalion*, you can see its assigned route to travel and capture Yechon Airbase *(Figure 1)***.** The *"Cowboy-9" C130 package* was created to pick up the unit and carry it forward to speed up the capture. When the C130 flight plan was made, the Drop Steerpoint [stpt] Four (4) was moved to a point along the road the Unit ***would have traveled*** but dropped on the road just ***beyond*** the objective.

The road goes through Yechon where the tank column ***would have*** arrived via ground movement.

This is very important. Because once the package is dropped, the Unit WILL RETURN TO ITS PREVIOUS POSITION. So, this way, when the tanks MOVE BACK, they will TRAVEL THROUGH YECHON, thereby CAPTURING IT…! *(Figure 2)*.

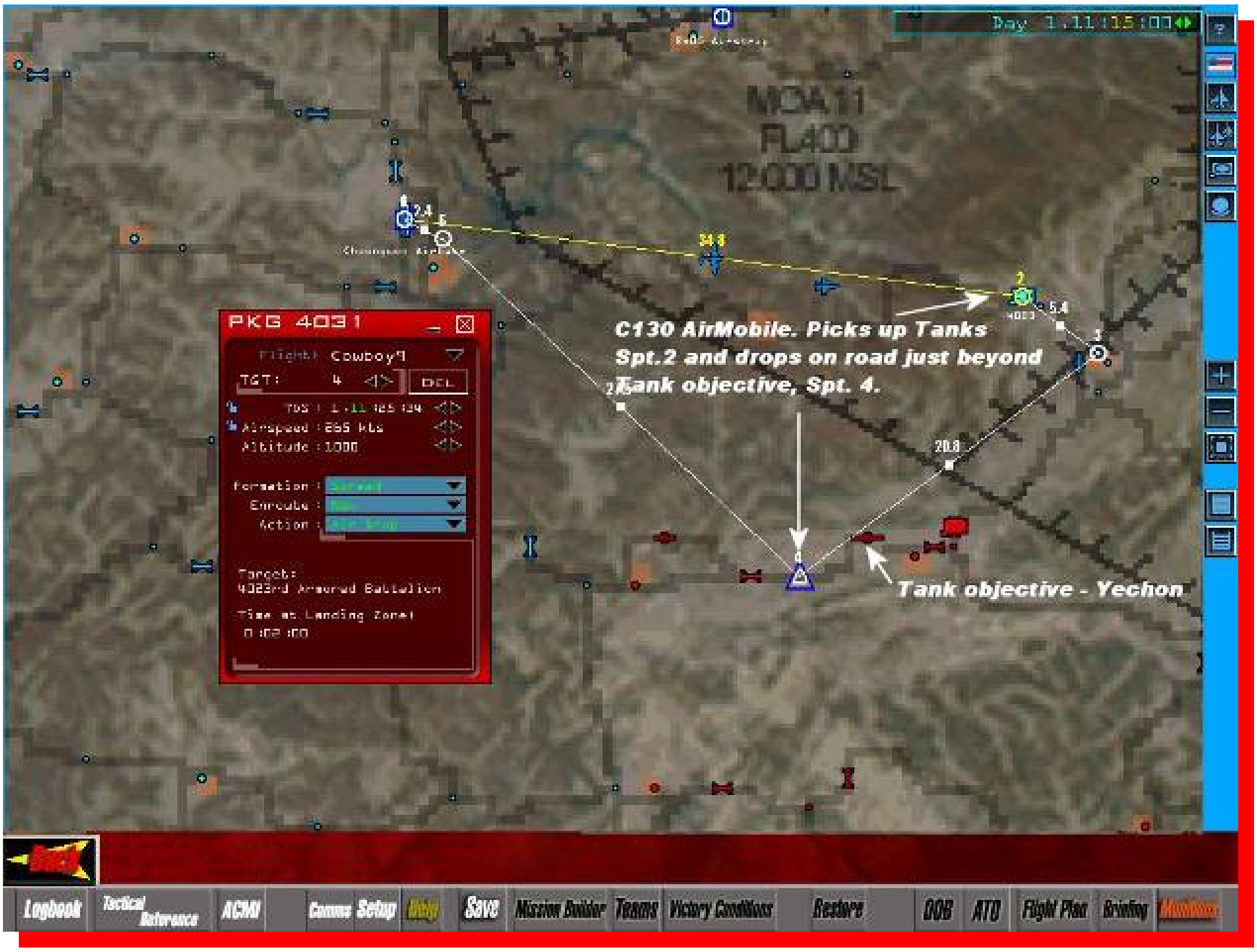


Figure 2

Load the TE and - if you want to see how it works - advance the clock while remaining in the UI. Or you can fly the F16 Escort of the C130s to watch the drop. Later, fly the F-16 Training to land at Yechon, hopefully now open for friendly business. *Can you raise Yechon ATC…?*

Ok….where would you want to do this? I leave that to your imagination, you can move anything anywhere. One use might be if you were doing FoF (Force on Force) against an opposing team, and the objective was to Capture the Flag of the opponent's home airbase. Sure - they are concentrating on stopping air attacks. But sneakily, you will capture it with tanks…! ☺

Figure 3

Objective 2

Enable AN72 to AirMobile drop a SAM Unit: As shown in *Figure 3*, *"Spirit 1"* (DPRK AN72) is moving an SA2 from Pohang Airbase area and dropping it in the path of an incoming ROK Strike Package. The drop is at Stpt 5. To enable this to work properly in RV, you'll want to create the flight with these points in mind:

1. The AN72 must have already picked up its SAM prior to the starting time of the TE. AI will see the SAM at its original location if this is not done. Additionally you get the benefit of players not knowing the flight exists when doing Recon in UI.

2. You need time for the SA2 to setup and get its radar working. Therefore, when you create friendly flights over the drop zone, have them be no closer than 50nm at the time of the drop.

3. You are not on an assigned SEAD mission. The only way the AI and yourself will get updates of new Air Defense units is by having a JSTAR flight in the area. The E-8 will update your Nav MFD information every 30 seconds *(SP3 manual)*.

Again, where would you use this? Kinda' obvious I think. What more fun than create a mission that has the element of surprise along the way? A challenge to keep you or your MP team alert…!

Fly the SEAD Escort F16 flight in the TE to see how it works.

Dave

FREEFALCON4.0
REDVIPER1.0

Aragorn's Munitions & Ordnance Guide.

Hi. I'm Ara'. Some know me as pr0n. Some as The Gorn. Some as Smurf. Some as Aragroin. Others as "that guy they hate". Whatever.

I'm here to give you - the Virtual Pilot - some advice on your choice of Ordnance.

So - despite your lack of skills - you've been foolishly tasked with a mission...?
What munitions to choose to ENSURE you get the job done...?

My advice: Consider the Target. By this, I don't mean to be "considerate" of the target.
If THAT were the case, you could probably just choose a BB gun or an air-rifle.

No. I mean CONSIDER how to inflict the most amount of damage on the target.

Let's start with that perennial favourite → The Tanker.

Most people are hopeless at A-A, and the only chance they actually HAVE to watch another aircraft burst into flames is to shoot the tanker.

My advice...? SLAMMER. Why...? It's a stand-off weapon. Judging by the type of person to actually read my advice, you certainly DON'T want to get into the booth with a hard turning DC-10. So - loose a slammer, and dive HARD for the deck. This way - if you miss – the tanker crew may have trouble identifying you when they see you in the Pilots' bar.

What about if it's a Mig-29 or Flanker you're tasked with taking out...? My advice: Don't take off. Just practice your RAMP-START, and go for a beer (preferably when the Tanker Crew is still airborne).

AIR TO GROUND --> "Mud-moving"; "A-G"; "Ground-pounding"; "What hopeless pilots who can't dogfight do". Sure - it's called many things. But, what about ordnance...?

Again - let's consider the target.

RUNWAYS - your normal bombs (e.g. Mk82s) will certainly leave a CRATER in the runway. This is good. However - that crater can soon be filled in, and smoothed over. All it takes is a Guy, a bulldozer, and a six-pack of beer. So - can you guess which munitions I recommend...? Yes. Correct. The B-61 Tactical Nuke.

It's a variable yield weapon, but - as we need to take out any and all bulldozers in the surrounding vicinity, I'd go with the 1.5 kiloton version.

SURGICAL STRIKE - Heavily populated neigbourhood...? Civilians...? Collateral Damage a real risk...? Tasked with taking out a single house...? My advice: The B-61 Tactical Nuke.

Of course - we are using the weapon more like a scalpel here, so - go with the 0.3 kiloton version.

Unless it is a really BIG house (with a car-port and outdoor shed) - then go with the 1.5 kiloton version.

FACTORY - Sometimes factories have BIG locks and chains on the doors and fences. My advice: The B-61 Tactical Nuke. The 5 kiloton version.

Why 5 kilotons? For no other reason than - you've *GOT* the 5 kiloton version, so why not just see what it looks like...?

CLOSE AIR SUPPORT - Enemy Troops dug in...? Running around the place shooting those pesky AK-47's...?   Those trenches can be pretty deep...!

UNLESS - you go with the 5 kiloton B-61 Tactical Nuke. This'll dig a trench which won't soon be forgotten.

Enemy troops have trucks...? In High Gear, those little mothers can move pretty quick...! My advice: Go the 10 kiloton. See how fast they move after that….

NUCLEAR POWER PLANT - These people have to be taught that Nuclear Energy can be DANGEROUS. Therefore, I recommend the B-61 Tactical Nuclear warhead.
I'd go with the 60 Kiloton yield, because "60" is just such a nice, rounded number.
There are also probably other reasons. I just can't think of them.

SAM SITES - Everybody has lost a jet to a SAM at one stage or another (except those Virtual Pilots who tell lies). So - when taking out a SAM site - my preferred weapon of choice is the B-61 Tactical Nuke. EVERYBODY HATES SAMs, so go the 60 kiloton yield. That should – quite literally - leave an impression.

MANPADS - IF it is a shoulder-launched SAM; single soldier - go with the 80 kiloton yield.

For two reasons:

1. It just really gives a message. "You shouldn't shoot at my plane".
2. You can experiment to see if his silhouette really DOES get imprinted the on the smouldering landscape.

ATC TOWER - Prone to attacking your own ATC Tower...? Hey - we've ALL done it.

But - what ordnance to choose...? I advise: The B-61 Tactical Nuke.

You have to go the 170 kiloton yield. Why…?

Because after Eight years of Falcon - *THAT ATC BITCH DESERVES IT*.

Q: What's the difference between an Air Force pilot and a jet engine?
A: A jet engine stops whining when the planes shuts down.

Q: How do you know when you are halfway through a date with a fighter pilot?
A: Because he says: "That’s enough about flying, let's talk about me"!

One day at a busy airport, the passengers on a commercial airliner are seated waiting for the pilot to board. The pilot and copilot finally appear in the rear of the plane and begin walking up to the cockpit through the ailse.
Both appear to be blind..!! The pilot is using a white cane, and bumping into passengers, as he stumbles down the aisle. The copilot is using a guide dog. Both have their eyes covered with sunglasses.
At first, the passengers do not react thinking that it must be some sort of practical joke.
But - a few minutes later though, the engines start revving, and the airplane begins moving down the runway.
The passengers look at each other with some uneasiness. Their nervousness is palpable. They start whispering among themselves and look desperately to the stewardesses for reassurance.
Yet, the plane starts accelerating rapidly, and people begin panicking. Some passengers are praying, and as the plane gets closer and closer to the end of the runway, the voices are becoming more and more hysterical.
When the plane has less than twenty feet of runway left, there is a sudden change in the volume of the shouts, as everyone screams at once…!
At the very last moment, the plane lifts off and is airborne.
Up in the cockpit, the copilot breathes a sigh of relief and tells the pilot: "You know, one of these days the passengers aren’t going to scream, and we aren't going to know when to rotate….”

Hooray for HOLLYWOOD

Gorny's Guide to the Movies

Haven't had much "Stick Time" lately…? Hard to "get back into" the sim…? Lacking Motivation…? Well – let HOLLYWOOD do the motivating for you. Here's some Aviation Films that will have you masticating into your Popcorn!

THE BLUE MAX

"Kill a man, then make a ritual out of saluting him - that's hypocrisy. They kill me, I don't want anyone to salute."

Chivalry meets gravity, in this 1966 film directed by John Guillermin. The art of Aerial combat during the "Great War" *(1914-1918)*; it's codes of conduct, and the lives and honour of the aerial knights who fought high above the trenches, are explored in this beautiful, at times brutal, period film. The Blue max demonstrates both the terror and grace of WWI aerial battle. George Peppard stars as a young German Pilot, striving for the 20 kills which will earn him the Blue Max - the German Air-Medal for which the film is named. Also starring Sir James Mason and Ursula Andress, this film explores the struggle between the ideals of chivalry (as expressed in the character of Willi von Klugermann, played by Jeremy Kemp), and the newly emerging ideas of brutal pragmatism. In this we are able to see the roots of the modern combat fighter pilot, and the mentality of modern aerial combat.

Although his thespian skills are quite hopeless, it's nonetheless a nice opportunity to see George Peppard before he got fat and mental with the "A" Team.

TORA TORA TORA

"I fear all we have done is to awaken a sleeping giant and fill him with a terrible resolve."

The word "epic" comes to mind. This is a BIG film. "Tora, Tora, Tora" *("Tora" translates as "Tiger")* was – of course – the code phrase which triggered the launch of the infamous attack on Pearl Harbor on December 7th, 1941. EIGHT Oscar nominations, and one Oscar later, this film tells the story of Pearl Harbor from BOTH the Japanese and American sides. In fact, it had TWO directors – one Japanese (Kinji Fukasaku) and one American (Richard Fleischer). [*Akira Kurosawa was the original director, but had to be removed due to his overly methodical pace.]* An incredibly detailed movie, deeply researched and relying much on facts and first-hand accounts, the aerial sequences alone are worth the price of admission. SFX are kept to a minimum, in lieu of REAL-LIFE stunts and action sequences. Starring Martin Balsam and Sou Yamamura, this 1970 film is a masterpiece of the genre.

(Also check out the 1976, Epic: **The Battle of Midway**. Owing MUCH to *Tora Tora Tora* , Charlton Heston and Henry Fonda team up with Japan's Toshio Mifune in this big budget feature – directed by Jack Smight. Heavy into factual account, this film documents the decisive Battle of Midway. Also starring Glenn Ford, James Coburn, Hal Holbrook, Robert Mitchum, Cliff Robertson, Robert Wagner, Edward Albert, and Robert Webber.)

PEARL HARBOR

In a word – Shit. Other words come to mind, but they mostly revolve around feces. Grab a thesaurus, and let your fingers do the walking. Crap, turd, poo, brown-mullet; this film is bad beyond anything I could hope to dredge from a latrine. An offensive insult to those servicemen who died at Pearl Harbor; a sodomy of fact; a hemorrhoid on the anus of history. The acting is retarded; the dialogue embarrassing. This travesty of a film is pornographic in its handling of the sensitive subject matter. CG sailors explode and rupture; sliced and diced in sacrifice to the CGI god. The 12 year olds will love it. Hey - see it for the SFX. Or - don't.

FLIGHT OF THE INTRUDER *"Our job, the task of the Intruder, is to kill SAMs."*

Set during the early days of the Vietnam conflict, Danny Glover, Willem Dafoe and Brad Johnson star in this 1991 release by director John Millius. After his bombardier/navigator (BN) is killed during a meaningless strike, Lt. Jake "Cool Hand" Grafton (Johnson), a carrier-based Intruder Aviator, begins to question the strategy and ROE of the US Navy, and their seemingly pointless strikes on unimportant NVA targets. Aided by legendary Virgil "Tiger" Cole, a psychopathic BN *(played by* Willem Defoe – *an actor who's made a career playing psychopaths)*, "Cool Hand" plots a mission to go "DOWNTOWN", and take out the heavily defended NVA Missile Dumps located deep in "SAM City". Special cameo appearance by *The Phantom Shitter*.

THE RIGHT STUFF

"There was a demon that lived in the air. They said whoever challenged him would die. Their controls would freeze up, their planes would buffet wildly, and they would disintegrate. The demon lived at Mach 1 on the meter, seven hundred and fifty miles an hour, where the air could no longer move out of the way. He lived behind a barrier through which they said no man could ever pass. They called it the sound barrier."

I haven't seen a cooler man than Sam Shepard since I looked in the mirror this morning, and his portrayal of Chuck Yeager is just too cool for school in this 1983 Philip Kauffman film (based on the book by Tom Wolfe). See the evolution of the modern fighter pilot; the evolution of the US Space program, and some beautiful aerial scenes with Yeager. As a bonus, you can see Gus Grissom piss his pants. An amusing cameo, also, by a young Jeff Goldblum. HIGHLY recommended.

TOP GUN *"Your ego is writing cheques your body can't cash!"*

If you haven't seen this film, then you're dangerous. Tom Cruise stars as "Maverick" - an F14 Naval Aviator chosen to attend the Top Gun Flight School in Nevada (of Falcon 3.0™ fame). His nemesis "ICEMAN" is played by Val Kilmer. The film co-stars Kilmer's aviator ray-bans. Watch for the part where "Goose" dies. I can never get enough of that scene. After he died, "Goose" went on to become a doctor *(see: ER).* Featuring Kelly McGillis before she got fat; check, also, for the cameo by anti-war icon Tim Robbins as the RIO, "Merlin".

Released in 1986, and directed by Ridley Scott, this film is – mercifully – bereft of both bad 80's haircuts, and Kevin Bacon. It does, however, "feature" music by Kenny Loggins.

Some GREAT tactics to be learned, too, for anybody who enjoys PlayStation™ games…!

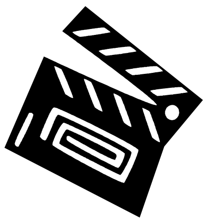
BATTLESTAR GALACTICA *(1978).*

***Cylon Centurion:* These humans are not very resilient. They bruise easily!**
***Lieutenant Starbuck:* At least we don't rust!**
***Cylon Centurion:* Silence!**

Well… you DO want to see where the Viper got it's name, don't you? Frack! This full-length feature film (released in cinemas) was the pilot of the original cheesy series. Like "camp"…? You'll love this. A rag-tag bunch of humans are pursued through space by a race of art-deco kitchen appliances who keep saying things like: "By your command". Starring Lorne Greene, Richard Hatch *(later to appear as a terrorist in the 2004 series)* and Dirk Benedict *(later to become a girl in the 2004 series)*, this Sci-Fi classic features the original **"Viper"**.

For more information on this aspect, please check the **"Viper" entry** in the *Mother Of All Lists* at the back of this manual.

All original reviews by Aragorn
(Except for the plagiarised bits)



Aragorn was lucky enough to arrange an interview with Mr. Simon Earl, Founder of "**DeF**" ***(De**af **F**alconeers)*, a spirited group of Falcon Pilots, all of whom suffer from varying degrees of hearing loss.

Due to time constraints, I decided to conduct the interview via telephone.

Aragorn's "D.e.F" Interview

Aragorn: ***[*phone rings*] [*Aragorn picks up phone*]*** Hello. Ara.G.Orn speaking.

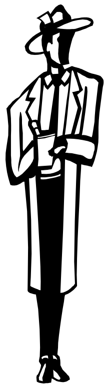
S. Earl: ….

Aragorn: Hello…? This is Ara.G.Orn. May I help you…?

S.Earl: ….

Aragorn: Hello?

S.Earl: Hello…?



Aragorn: Hello….? Hello….? Mr. Earl…..?

S.Earl: Hello…?

Aragorn: Mr. Earl…? This is Ar…

S.Earl: Hello…? Hello, are you there?

Aragorn: I'm here, Mr. Earl. I was wond…

S.Earl: Hello…? Is anyone there….? Hello…..?

Aragorn: …..

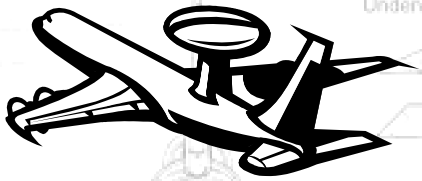
S.Earl: ….

Aragorn: ….

S.Earl: Hello…?

Aragorn: ***[*hangs up the phone*]***

TACTICS SECTION



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CAS/Interdiction

Instructor: COL. TER BEEK

INTRODUCTION

Your initial action should be to check your nation's posture and know what the Offensive and Defensive priorities are. You can find those in the Intel screen. That is where the action will be taking place. Make note of the Forward Line Own Troops (FLOT). I usually mark it with a steerpoint. It is also marked on the HSD, but a steerpoint will give you instant heading and distance information to the FLOT. Be aware that depending on the situation the FLOT may be moving. These updates are not fed into the HSD display, instead the HSD display shows the information at or around the fragged takeoff time.

Basically, a mission consists of three elements:

- **Planning**
- **Execution**
- **Debriefing**

This article will be devoted mostly to the planning phase for CAS and Interdiction missions. However, the planning phase is of course connected with the execution of the mission. Therefore I will add a few remarks that are related to execution.

TASK & EXECUTION

Your main task in an air-to-ground mission is getting to the target and accomplishing the mission objectives. Should you accomplish that, you are not home free. Your primary objective should be to RTB. Any mission that runs as smooth as silk but has you end up hanging beneath it, is a failed mission. Since you are primarily responsible for your own survival, you should try to maximize your chances. Do this by adopting a defensive mindset. Know that every target worth attacking is worth defending, the standard response to threats should be as follows:

- **Avoidance**
- **Evading & Countering**
- **Defeating**

1. *Avoidance*

Mission planning will only let you avoid certain threats. Simply fly around them. Place the steerpoints on the map in such a way that you are not crossing into engagement zones if it is not absolutely vital for mission success.

2. *Evading & Countering*

Evasive measures should be employed for as long as you are within the engagement zone of the threat. For a guns battalion it could mean that you are not going to follow a predictable flight path. Vary altitude and speed, this also rings true for crossing the FLOT. For a SAM site it could mean using the ALQ-131 jammer to make it harder to track your aircraft, as well as deploying flares and chaff as needed. Remember: using your jammer may have undesired side-effects.

(Gorny says: Cycle the jammer on and off. "Pulse" it. Don't leave it on for extended periods.)

3. Defeating

Defeating is to actively employ ordnance against an ADA emplacement / SAM site. While not the primary task of the CAS/Interdiction flight, it can be paramount to mission success. Should the ATO not provide for SEAD coverage in your area of operation, it is wise to have the means available to defeat SAM threats yourself.

IDENTIFYING FRIEND FROM FOE

Identifying ground targets is perhaps the most difficult aspect of Situational Awareness you should master before taking on CAS/ Interdiction missions. I should not have to tell you that shooting is not an option if you are not 100% sure of the nationality on the receiving end. Combined with the fact that you do not want to be loitering above the FLOT in CATIII while the enemy throws everything they have at you, effective identification is a high priority.

Here are a few pointers which should help you distinguishing friends from foes:

- Note the heading of the battalion you are going to attack in the recon window, mostly they differ from other targets in the area - and more important heading appears to be pretty constant;

- Know their tasking
  - *when are they moving*
  - *where are they moving to*
  - *what are they going to do (reserve, defend, capture)*

- Note key features, such as hills, bridges, buildings, even the tile(s) on which they are located
- Note the bullseye position
- Query AWACS for 'Vector to Target'
- Use Padlock (Switch to A-G Master mode first, for A-G targets only)

MISSION PLANNING

At the very least, you should have easy access to notes made in the planning phase.
You should gather information about the following subjects, as a minimum:

- **Target of the mission**
- **How to find the target**
- **Objectives & Munitions planning**
- **Attack profile**

1. Target of the mission:

Before I start on this, I would like to discuss a peculiarity about CAS/Interdiction mission planning in Falcon4. One of the most noticeable is that your target's location is not always known.

There are two common causes:

- ***The intel is not available (a.k.a. 'fog of war')***
- ***A glitch in Falcon's dynamic campaign.***

How to differentiate those from each other? It is quite simple, as long as you know what to look for.

There are some shortcomings in the campaign. One is that the intel in the Order of Battle (OOB) is omniscient. Every battalion is listed in the OOB, both for the Combined forces and for the DPRK forces. You can use this to your advantage to differentiate the aforementioned causes from each other. At times you will be confronted with a glitch in the campaign planner. There are two clues that this is the case. First, the battalion is not listed in the OOB. Second, if you open the briefing it reads: 'Battalion *XX* is...' (where *XX* is actually in the briefing instead of a unit name).

Don't bother taking that mission, you won't find the battalion but you will fail the mission.

Onto the subject at hand: If a battalion appears in the OOB, but you do not get a location on them *(by right clicking and selecting 'recon')*, then there is simply no intel on its present location.

Generally speaking, intel will only be available if the battalion is in contact with a friendly ground unit, or within the 'Line of Sight' of a friendly air unit. You can try to get intel on its location by forwarding the time until just before takeoff, stopping the clock and try to locate it on the map. If it gives you a general area again, call up the briefing and read your tasking. The tasking is the part where it says 'The 14th Armoured brigade is moving to *for example* Seoul (objective). Look for that location on the map by right clicking on the map and selecting 'Political' targets in the infrastructure menu.

If you do not know the location of the objective of your target, locate it through the OOB in the same fashion.

2. How to find the target:

First, establish whether you are confronting moving or stationary targets.
If you are dealing with moving targets (retreating or advancing units) GMT should give you a picture. If they are stationary, GM is the mode of choice. You can check this by right clicking on the unit in the mission map and selecting 'status'. A window will appear containing name, orders and strength of the battalion.

'Reserve' or 'Defend' indicates a battalion is standing ground while 'capture' obviously indicates the battalion is moving to a given objective. Again, you can check the location by using the OOB in the same way you would find the political targets thru the 'mouse right' menu in the map screen. A word of caution though: sometimes the orders will appear in the following format:

"ORDERS: DEFEND/RESERVE *for example* Seoul."

If the unit is not actually at Seoul, it means that they are moving to Seoul to defend it or to be added to the reserves of the city's defence. Before you start to edit the flight plan, a few things should be checked:

- *Click the padlock Time over Steerpoint 'TOS' at steerpoint 1, takeoff*
- *set the speed at steerpoint 2 to '240' and padlock it*
- *click the padlock Time over Target, which is basically TOS of the target steerpoint*
- *unlock the other padlocks, if applicable.*

Failure to do this will increase the chance of creating 'red legs' in the flight plan. On those legs, it is not possible - given the performance of the aircraft - to make the timing. Bear in mind that the time is running from the moment you get into the aircraft. That is why the speed at steerpoint is set relatively low. Try to maintain a speed between 350-400 kts. when you are on the wrong side of the fence.

You can now set steerpoints accordingly. One steerpoint should be at their last known position, the next should be co-located with the target of the unit you are about to attack. This gives you a general search area for you to scrutinize using your on board sensors. You have to know what you are attacking by now. For example an infantry unit moves slower than an armoured unit. Their anti-aircraft defences are also different.

3. Objectives & Munitions planning:

Typically, in the CAS/ Interdiction role, you are assigned a flexible role. Unlike OCA strike missions for example, there are no set objectives, such as destroying a runway.

In the previous step you have looked up the target battalion. Compare your findings to the tactical reference to establish what is needed to render the target(s) useless. To effectively pick the type of munitions you need to know what formation the target is in. A good release profile for CBUs would be single RP, 1500 above ground level. Pickle using CCIP, account for movement if you have to. Consider yourself in luck if they are in a column formation, this allows you to attack the whole battalion in one pass. Such a formation would make JSOW or cluster munitions the primary choice.

Should you strive for an area effect without using CBUs for whatever reason, choose for the Mk84, or its guided equivalent, the GBU-10. The BSU49 and BSU50 are retarded versions of the Mk82 and Mk84. Those can be dropped from lower altitudes. If the targets are not grouped, one might consider using (a combination of) mavericks and GBUs. B-model Mavericks should only be employed during daytime with fair conditions. The D- and G-model can be employed during night-time and in adverse weather conditions. In general the following holds true:

SOFT TARGETS:

- All CBUs *(with the exception of CBU97 and MK20)*
- Mk-82 / BSU49
- Rockets
- JSOW*(A&C-model)*

MEDIUM TARGETS, SAMS/AAA:

- All CBUs *(with the exception of CBU52)*
- Maverick B, D
- GBU-12, 22
- Mk-82,84 / BSU49,50
- Rockets
- JSOW *(A&C-model)*
- HARMs *(SAM/AAA only)*

HARD TARGETS:

- CBU97, Mk20
- All Mavericks
- GBU-12, 22
- Mk-82,84 / BSU49,50
- JSOW *(C-model)*.

3. ***Attack profile:***

Attack profiles are determined using the answers on question 4. Attack profiles can be denoted in a standard format (ingress/attack/egress). For example Hi-Lo-Hi means that you ingress and egress high while the attack is taking place at a lower altitude. For interdiction missions above the FLOT this profile is commonly used.

When employing 'dumb' munitions with 'winds aloft' enabled you should always set your attack heading with or against the wind. Setting another heading will result in unpredictable results. Guided munitions such as GBUs, JSOW and Mavericks can only be used when you have an unobstructed view through the TGP or WPN MFD.

Personally, I fly most (low risk) attacks with 'dumb munitions' between angels 8 and 10. For guided munitions the altitude is depending on the cloud cover.

On high risk sorties, I use stand off weapons such as the HARMs, Mavericks, or the JSOW.

LOW ALTITUDE CONSIDERATIONS

Advantages:

- Detection by threats may be delayed.
- Exposure time to surface-to-air threats is reduced. Threat systems are restricted to line-of-sight. Terrain degrades the detection and tracking capabilities of many systems.
- Many A2A threats have little or no radar and missile capability at low and very low altitudes.
- Look down/shoot down fighters provide a low altitude capability, but all weapons systems have reduced effectiveness at low altitude.
- Below the weather operations are possible if the threat allows.

Disadvantages:

- Proximity to the ground is the most significant disadvantage. Demand on your flying skill is greater than at higher altitudes.
- Navigation can be more difficult. You see much less of the "big picture" and can quickly become disoriented regarding your position, or confused by intentional alterations of the target area. Task saturation, due to low altitude operations, degrades time available to concentrate on position analysis.
- Fuel flow increases significantly at low altitude. As such, combat radius is reduced. Missions requiring extended periods of low altitude operations require thorough mission planning to ensure sufficient fuel is available. Tankers may or may not be available.
- Low altitude operations put you in the heart of AAA engagement zones.

MEDIUM ALTITUDE CONSIDERATIONS

Advantages:

- Better range/endurance potential.
- Threat avoidance from certain systems; especially light AAA.
- Easier navigation when weather is not a factor.
- Higher potential energy.
- More time available to work aircraft systems and to interpret and recognize details from target study.
- Simpler attack geometry is possible.

Disadvantages:

- Vulnerable to certain threat systems.
- Easier detection by threat due to radar LOS.
- Threat is not isolated above you; 3D threat attack axis exists.
- Less aircraft performance dependent on configuration.
- A-A missiles have longer ranges.

***Ref*:** MCH 11-F16 Vol. 5; pp.126-127 (http://f4hq.com/default.php?page=Documents)

THREAT ANALYSIS

In threat analysis, you should strive to minimise the element of surprise. Do this by analysing the following subjects, as a bare minimum:

- **Which air to air threats are likely to be present?**
- **Which ADA threats are likely to be present?**
- **Do I have any support on this mission?**

1. Which air to air threats are likely to be present…?

Know what you can expect, check the OOB for DPRK bases with operational runways and determine which squadron is located there. Look at the map for air to air threats already present. Determine their likely mission. Are they CAP-ing the area or are they flying escort tasks for bombers? In most campaigns Mig19s, 21s, 23s and Su25s are tasked with strike missions and Mig23s, 25s, 29s and Su27s are tasked with air to air missions. Generally, the Mig25s, 29s and Su27s fly at higher altitudes and speeds than the aircraft of older generations. Remember this when confronting bogeys. Watch the speed of your locked target in the radar MFD, it tells you if you are dealing with high performance aircraft. Establish if they are jamming your radar or not. Fast movers with radar jammers are most likely to be high performance aircraft.

Next, establish their ordnance capabilities. Your course of action should differ when you hear 'Mig 21s inbound 3-0-5 for 20 miles' as opposed to 'Su27s inbound 3-0-5 for 20 miles'. In the first case the second element is very well able to handle it. If Su27s are crashing your party, you have to take immediate action while thinking 'why didn't I see them earlier?!' When you are threatened by high performance fighters, don't be reluctant to jettison your ordnance. You WILL have a hard time dodging AA-12 Adders in CATIII. There should be no doubt in your mind about what you should do when a missile is launched against you. Jettison your stores! Yesterday! Others may say that it is SOP to jettison your A-G ordnance when engaged by air threats (not necessarily involving being fired upon), I only tend to do so when the bandits are Mig25s, Mig29s or Su27s (and up).

The reason for this is quite simple. Other a/c types are far inferior to your F16. You should be able to coordinate your flight in such a way that those inferior aircraft's pilots never knew what him them. This however, is not going to happen if you are up against a/c which are in the same performance class as your F16. Su27s and the MIG29S could be equipped with AA-12 Adder missiles. This missile has got even longer legs than your AMRAAM. Your RWR might not give you a hint when an adder is launched at you because the bandit does not enter Single Target Track mode. The only hint you will get from your RWR is a circle with an 'M' in it, which appears when the Adder has gone active. Therefore you need the maximum performance the F16 can give you. You can only achieve that in CAT I mode.

One exception: don't be caught in a dogfight with any type of aircraft with A-G ordnance on your wings. Even a Mig19 will have no trouble getting at your six if you are CAT III. It will then proceed quite happily to shred your fancy engine to pieces with 30mm rounds.

2. Which ADA threats are likely to be present…?

Know what to expect in this area as well. Check the map for active SAM sites; know where the AAA positions are. Know what the capabilities are of the ADA systems in the area. For example: Older SAMs can easily be evaded when launched at you from long distance. You can even evade it in CAT III if need be. Although these SAM systems are relatively old, they still can wreak havoc on your box formation if you over fly them... So don't!

Systems such as the SA4, 10, 13, 15 should never ever be allowed to take a shot at you. Don't enter their engagement envelope unless you absolutely need to. Take them out as soon as possible. The tactic associated with taking out SAM-sites differs with the type.

For example a target defended by SA10s requires a very low level approach using maximum terrain coverage available. You'd better not allow the SA10 a prolonged tracking solution or you WILL be walking home. Provided you even noticed it launched at you in the first place! It is an IR SAM, meaning that it won't trigger your RWR. SA13s and 15s can easily be taken out from any altitude, provided you fire your HARM early.

Check ground units and their objectives in the vicinity of your target. Know where they will be moving during your mission. It would be a pity if you managed to avoid all SAMs during ingress only to be capped by that SA-13 which is part of the HQ battalion that just moved in position next to your target.

Again, the importance of assessing the capabilities of the systems you are encountering cannot be overstressed. Personally, I like to listen to the warning tones in the Tactical Reference as well. I memorise them so that I know what is locking me up without having to check the RWR.

3. *Do I have any support on this mission…?*

If you are in a BAI mission, you will mostly operate as a flight (as opposed to as a package). You can counter this by assigning your second element as air cover for example. Give them drop tanks and 6 slammers and they will do a terrific job protecting your six. If there are SAMs in the area which need to be taken out, give them HARMs. Don't forget to supply yourself with one to, or otherwise you'll be having a hard time getting them to engage a target without the HTS available to yourself.

Be aware of what they are doing though... I once had my second element request permission to land right after take off, because they decided that they would rather not come with me if they did not get to shoot at ground targets. So have them 'rejoin' you as soon as they are airborne, or they will be in the mess while you are hauling your a** over the FLOT.

Check whether or not there are friendly battalions in the neighbourhood and account for them in your planning.

FINAL THOUGHTS

Of course it is possible that the mission planning leads you to believe that the threat level is too high. There is no problem in that. It takes sound judgement to know what fights you can take on, and from which you should walk away. For example, if you noticed that the air threats are consistently ruining your day, you might be better off by first attacking the airbase they are operating from. This article, however, is not intended to explain how to fight a campaign…

I've only skimmed the surface of mission planning, but I hope that you've been given some general, and useful pointers.

Don

The Way Of SEAD

Instructor: **YONI "I-HAWK" SARUSI**

Before we begin I would like to remind you of a couple of points:

1. **SAMs are bad**…!!

2. In falcon, as in RL, I'll assume that the fighting area is full of them.

3. You must understand that **jammers are very limited** in their ability to jam. It depends on what missile is fired at you and how many of them are fired at once.

4. Flying **low and fast** "under the radar" is a **very limited option**, since sometimes it becomes even worse down there against nasty AAA and low altitude SAMs. SAMs doesn't have to physically hit you to cause grief. If you had to get low because of a SAM radar and you were hit by AAA because of that, I would still call that a SAM problem.

5. The radar is the most important target in a SAM site, so make sure you **destroy it first**! Without it, the missiles are no more than flying metal.

6. Finally, the main point:

I see no way to get through a campaign without dealing with the SAM sites yourself.

OK - let's start the tutorial:

We are talking about SEAD tactics so you will need to choose a squadron with A\C that can carry HARMs. I'll concentrate on the F-16CJ, but you can use the same tactics for any A\C with anti-radiation missiles. You will just have to make some little changes according to the range of the specific missile, and the fighter flight profile.

I'll use the FF Korea default campaign *"Rolling fire"* for the demonstration. I'm just opening a new campaign and choosing to fly the F-16CJ squadron at *Kangyoung*.

Before starting a new campaign I suggest you modify the missions Priority sliders.
You will find it under the "P" button right of the UI map.

The campaign area is probably full of SAMs; enemy squadrons full of A\C. So, the best thing to do, is to ***set SEAD and A-A missions to a very high priority*** settings. You also want SAMs and A\C to be high priority targets. So click on "targets" and set the sliders properly. This way, you make sure that allied squadrons will concentrate mainly on enemy A\C's and SAMs. You can change the sliders as the campaign progresses.

(For more info on the priority sliders, see **SKRATCH's Campaign Tips** *in this Guide.)*

Set it something like this:

With settings such as these, you can make sure SAMs and defensive A-A missions will get high priority as the campaign engine generates missions.

With the settings above, at least one of the first missions in the campaign should be a SEAD strike.

Just pick one and let's go over it:

Before heading to the cockpit you <u>must</u> get familiar with the area you are going to fly. The first step is to look for SAMs in your path. Right click the mouse on the UI map, go to "Threat circles" and click on "ADA-high altitude". This will draw some nice red circles on the map. This is the area covered by enemy SAMs. *(See the picture below)*

Pretty big area, huh? That's what we are going to change. We are simply going to decrease the coverage to a minimum.

Each red circle on the map represents a SAM radar. Notice the circles represent the missile ranges. *Usually the true range is a bit shorter.*

It's a good habit to modify the default waypoints and flight profile of a given mission. But – consider that in missions in which you escort A\C from other squadrons, you don't want to get to target area early or late.

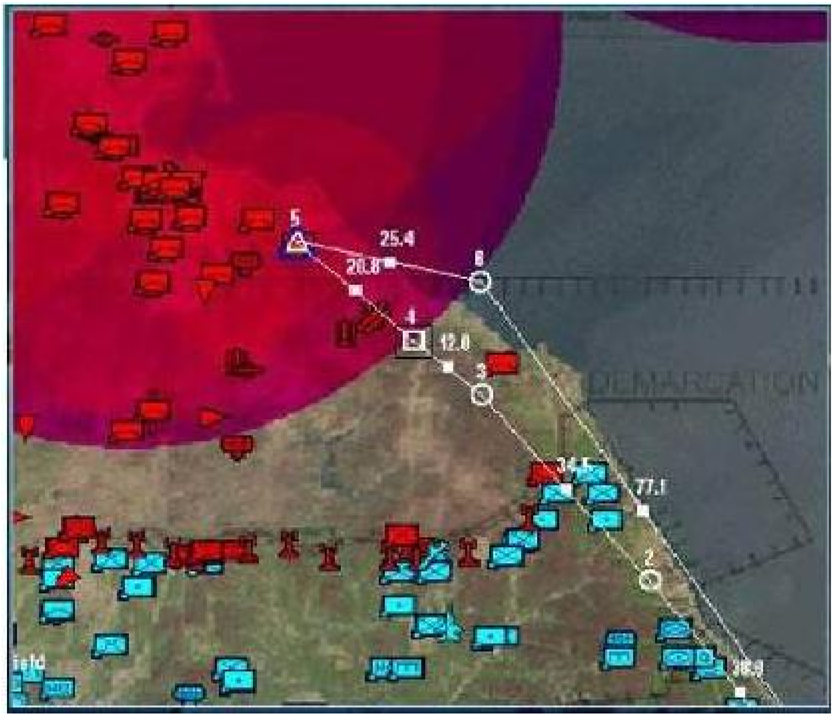
In a SEAD mission, I suggest you first determine which SAMs to destroy. Notice that you <u>don't</u> have to destroy the default target if it's too deep in enemy territory. In such important matters, **don't let the mission generator decide for you**. Rely on your judgment. It's better to fail a specific mission and destroy other SAMs than to get yourself destroyed just because your mission generator isn't "smart" enough.

Make yourself a kind of "*imaginary line of SAMs"* on the UI map, and make sure you take those out first, before pushing this "line" further into enemy territory. Note that it is the RANGE of the SAM that counts; NOT the "proximity". Sometimes long range SAMs will give you more trouble than closer SAMs. In this case you will have to take care of those first, simply because they extend their threat range more than the closer SAMs.

As we've now completed the planning section, let's go over some specific details of a demonstration mission I flew:

Flight path

I put a waypoint just on the top of the first red circle on my flight path.
This way I know, in flight, when I'm entering SAM territory.



You should position the other waypoints according to how many targets you are planning to hit. I advise you to not get "greedy" with the number of targets for a sortie.

Even though 1 HARM is enough to take out 1 SAM radar, I don't think you want to find yourself in the heat of battle surrounded with SAMs painting you but no remaining missiles to fire…!

If you can carry 4 missiles, you shouldn't pick 4 targets to destroy. It's better to pick only 2 or 3 targets for this sortie.

Always leave yourself at least 1 HARM for each plane for self-protection in case you get into trouble. In the worst case, if you have 1 missile left on the way home, you can always find something valuable to spend it on……

Flight profile

I fly at angels 25, at 350 kts in SEAD missions. I think it's a good balance between not getting too low for AAA, and not too slow to evade missiles. Of course – in case of defensive maneuvers, you will have to accelerate.

If you know it's an SA-10 or SA-12 out there, you would do better to fly lower than 25K. The detection range of SAMs very much depends on your altitude. Just make sure this nasty system won't be able to fire before you fire at them first. Even if it means getting down to 5,000 or 10,000 feet. Survival is the most important issue!

Range and munitions

You must maintain a good balance between how much fuel you need, and how many HARMs you want. I suggest you not get "greedy" with the missiles. If you have any doubt, give up missiles for fuel tanks. **You don't want to get caught deep in enemy territory without fuel to run away**. Remember that sometimes you will need a very high speed to evade missiles or enemy aircraft. This means you will have to use your burner to accelerate faster.

One more thing about fuel tanks: Unless it's a very ***very*** long range mission, in which you have NO choice - ***never*** give up the ECM pod for extra fuel. Don't do it because you don't want to waste stations 6 and 4 for fuel tanks. **ECM is very important when SAM hunting**.

The HARM missiles should go to stations 3 &7, and also to 4 &6 if you can get along with only internal fuel. Don't forget - of course - AA missiles on the outer pylons…!

In the air:

Don't forget to switch the master arm on as you get close to enemy territory. Make sure you have no bandits threatening you, one enemy A\C you haven't noticed and all your HARMs won't save you. As in every AG mission, if you need to maneuver sharply in a dogfight, you better jettison your HARMs and fuel tanks and save yourself. Sometimes you just can't do it all in one mission!

Just before you enter SAMs territory you should choose the AGM-88 on the right MFD. Now it's very important to set the range on the MFD according to the SAM system you are facing. The default 15 NM is good enough for low and medium range SAMs (notice that the range you can actually "see" on the MFD is a bit higher than the number indicating it). In case of long range SAMs, you better increase the range to 30 NM.
Now open your eyes and ears and wait for the sharks to smell the blood!

Take the following SA-2 kill as an example:

The detection: That's an SA-2 there, just covered with a search radar sign.

Locking up target: 17 NM out.

Missiles launched; both SAM and HARM:

Jamming and Beaming, to shake the missile:

That's all there is to it…! The SAM radar was gone after my HARM impacted it.

It may be true that the SA-2 is a very old and weak system, but you should remember that each system has its own weakness, and you should know how to find it.

In the following table is some valuable information on Falcon4.0™ SAM systems.

As I prepared this tutorial, I gathered some specific details on the SAM systems in falcon. I decided the best way to "test" SAM reactions was to build specific “testing” TEs, and gather data on each system, whilst “in-sim”.

Based upon my research, I have created the following table for your convenience:

SAM SYSTEM	**SA-2**	**SA-3**	**SA-5**	**SA-6**	**SA-10**	**SA-11**	**SA-12**
Description	Medium range; Very old system	Short range; Old system	Long range; Old system	Short - medium range; Old system	Long range; Modern system	Short – medium range; Modern system	Long range; Modern system
Max. range in falcon	~ 20 NM	~ 10NM	~ 45 NM	~ 15 NM	~ 40 NM	~ 15 NM	~ 50 NM
Jammers chaff and "beam" effect 0-10 *(lower is less effect)*	8	7	7	5	2	1	1
Maneuver ability 0-10 (*higher is better)*	2	4	3	5	8	9	9
Blast radius	Large	Medium	Very large	Medium	Large	Medium	Large
Low altitude behavior 0-10 *(higher is better)*	1	4	2	5	7	8	7

Some comments concerning the table above:

The information presented in the above table was generated from my ***personal*** experience. I built a series of simple TEs; each representing a different SAM system. I flew at 25K ft, on a DIRECT course to the radar system. Waiting for the missile to be fired, I was able to record the "range" values.

Of course the countermeasures and low altitude "grades" I assigned may be debated and discussed. I believe others may see things a bit differently. But - then again - this table is both a good starting point, and an easy way to appreciate – at a glance - an overall comparative assessment of the most important SAM systems you'll see in falcon.

Here are a couple of important points I wish to emphasize:

1. ***SA-2***, ***SA-3***, ***SA-5*** are pretty old systems. Jammers can block one or two radars. More than that, and - as range decreases - you will have to really maneuver to shake them loose. Notice The **SA-5** has some surprises when it "comes back from the dead" to hit you. A missile you thought was no longer tracking you will suddenly become active on your scope and look for you again. Strange. And dangerous.

2. The ***SA-6*** is somewhere between an "old" and "modern" SAM system. You can fool it with chaff and jammer, but it's harder to do. Maneuverability is better than the old missiles, but still quite weak. The **SA-11** is the replacement of the **SA-6**. the **SA-11** is a far more dangerous and modern SAM. Don't get close to it without HARMs..!

3. ***SA-10*** and ***SA-12*** are the most dangerous SAM systems in Falcon4.0™. Whilst not even generating a "missile launch" warning, they'll hit you very fast for the 40-50 NM range. Jammers have almost no effect on them and maneuvers will maybe save you from one missile. If you have no HARMs I suggest you to head back home before getting into range. <u>Even</u> if you do have HARMs, I suggest you to get as low as possible for a firing solution. These SAMs are no game. They will hit you before you can even say: "Eject; Eject; Eject"…!

Yoni

"Can I engage multiple targets with slammers...?"

"They do it in *REAL LIFE*….!"

Falcon4.0™: Well – "yes" and "no'.

In Falcon4.0™, the exact operations of multiple Lock and launch are not strictly modelled. HOWEVER – you are able to SIMULATE that function of the AMRAAM (AIM-120 "Slammer").

- **Firstly, you have your A-A Radar in TWS mode.**
- **You're slinging multiple "slammers".**
- **You paint some bogeys at the edge of your BVR envelope.**
- **You identify (and confirm through AWACS or IFF) multiple bandits..!**
- **They're far enough away, that you want to engage ALL BVR – MULTIPLE lock'n'launch.**

OKAY. The timing is a little delicate – but doable:

1) LOCK up your best target and LOOSE an aim-120.
2) Wait a few seconds (perhaps five seconds – you'll need this time during a later stage…)
3) Launch your second slammer.
4) Wait again, and launch your third *(and – repeat for your fourth AMRAAM shot)*

Note: *at this stage – ALL missiles in flight are locked upon the FIRST bandit…!*

When your Time Countdown shows **"T"**, your FIRST AIM-120 will go PITBULL…!!

This means, it is now **ACTIVE**; homing on the target ***with it's OWN* onboard radar**.

When the **"A"**- timer (time until "active") in your HUD changes to **"T"** (time until impact) –

BREAK LOCK on the FIRST MISSILE…!!

The 1st missile is now acting INDEPENDENTLY → It is homing on the target WITHOUT your input

NOW – slew the cursors in your MFD and ***LOCK THE NEXT TARGET***…!

<u>At THIS stage</u>:

Missile1 is on-route to first target.
Missiles 2, 3 & 4 are locked on the **NEXT target**

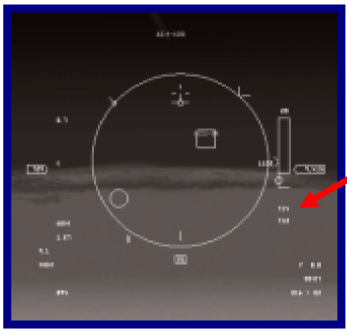
NOW, when the **SECOND** slammer goes ACTIVE – **BREAK LOCK**…!!

AGAIN – slew the cursors to your NEXT target, and LOCK him up…

<u>At THIS stage</u>:

Missile1 is on-route to **target 1**
Missile 2 is on route to **target 2**
Missiles3 & ***4*** are ***locked on the NEXT bandit****…)*

(repeat ad infinitum)



This is the **Time Countdown**.
"T" means that the missile is active and pursuing the target. The time that is now being displayed next to the "T" is the time in seconds to missile impact or time to the "Target." Any time you see a "T" in the HUD, you can break lock on the target.

Keep a watchful eye on your Active Countdown Timer, and use some delicate timing, and →

It is possible to BVR Launch at Multiple Bandits…!

Theory:

Whilst your Slammer is YET TO GO active, you can change it's target in flight.

DoctorX writes →

There's a similar theory can be applied to LASER GUIDED BOMBS.
2 targets; 2 LGBs; 1 pass. It's, both very challenging and very cool...

Here's what ya' gotta do:

Locate your primary and secondary targets. They should be as close together as possible to have any chance of successfully destroying both.
You should also have plenty of altitude.

Slew your targeting pod cursor over the primary target. **Do not lock up the target**, otherwise it will be harder for you to designate the second target. Just slew the TGP designator over the first target and keep it there.

When in range, press the pickle and start counting. ("One Mississippi... Two Mississippi...") After about five Mississippi's, drop your second LGB.

Keep your TGP slewed over the first target until your first LGB impacts it.
As soon as it does, slew the cursor over the second target.
[You have to do this quickly, you only have about five seconds until impact, and realistically you have less time than that because your second LGB has been heading toward the first target and needs time to redirect toward the second target.]

Keep the designator over the second target until the second LGB impacts it.

With luck, you will have destroyed two targets, and have one big shit-eating grin on your face.

For best results, **use manual lasing** and keep lasing from the time you drop the first LGB until the second one impacts.

Also keep in mind that **some targets require a pair of LGB's to destroy**, so even if you hit both targets you might not destroy either of them.

Gorny's Life Advice:

Whilst the advice above seems to be sound, I would caution against trusting anybody whose name is "X". Does he mark some kind of spot…?
Is he a divorcee…? Does he have Mutant tendencies…? Is hidden treasure involved…? Was there some kind of dramatic childhood experience at an intersection…? Sure – call me paranoid. But – when you're catching some "Z"s, and dude shows up in your bedroom to beat you to death with an Algebra textbook – don't come running to 'Gorn. And – don't ask me "Y"….

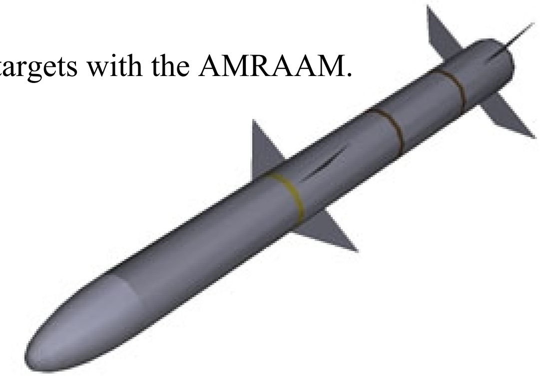
multiple lock'n'Launch

RedVIPER Style

Instructor: WAZOO

“NO WAY, Ara’… You are *SOooooooooo* last .exe....!! Things have changed, and I'd recommend the following for multiple launches....**!”**

Wazoo’s ALTERNATE way for engaging multiple targets with the AMRAAM.



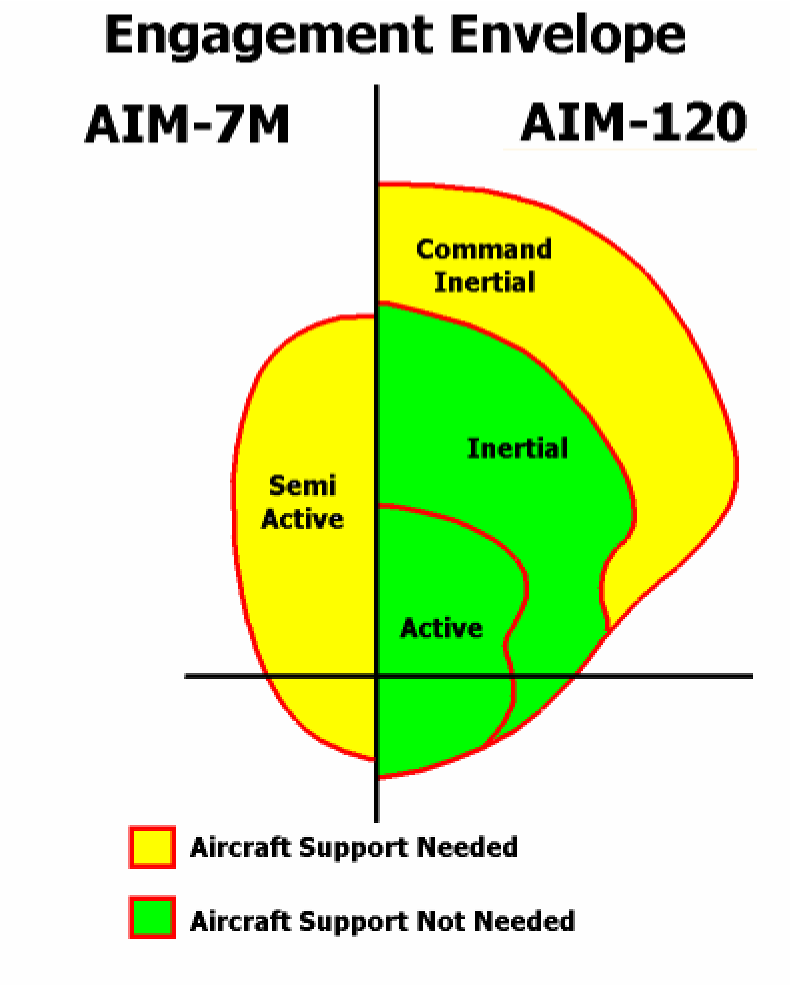
Q: “So… how DOES the *Real* AIM-120 work in conjunction with the F-16’s radar?”

Well…. assuming you are not launching from Boresight Mode, it all depends upon what distance the bandit is from you when you launch.

Basically, the farther away from the bandit at launch, the more the missile will need to rely on the F-16’s Fire Control Radar (FCR).

Just prior to missile launch, the FCR programs the AIM-120’s inertial autopilot with information about the targets range, speed and direction. The idea is to get the missile moving on an intercept course to the projected future vicinity of the target as soon as it is launched from the aircraft. Therefore, when it arrives in that vicinity, it will activate its internal radar system for the final ride up the tailpipe.

The illustration below shows a Missile Engagement Zone (MEZ) for the AIM-120.



Q: "Nice picture… but do I need my FCR helping my missile find the target or not??"

Well… it depends.

If you are pretty close to the target when you launch, the missile will go ACTIVE as soon as it leaves the rail thus using its own internal radar system. You could shut your FCR off the moment it leaves the rail and your little buddy will do just fine without your input. This is in the green Active Zone™[1] above.

If you are beyond the missile's Active Zone™ when you launch, but not TOO far outside and thus in the yellow Command Inertial Zone™, the missile will leave the rail in the green Inertial Zone™. Here, the missile will not yet be using its wee little internal radar as soon as it leaves the rail, but will instead have been launched close enough to the target that even if the bandit does some nice maneuvering, the missile will arrive in the bandit's vicinity close enough that when the missile goes active, it will most likely find the bandit and close for the kill. Of course, target positional updates via a datalink from the FCR are helpful to a missile in the Inertial Zone™, but probably not necessary to obtain an acceptable kill probability (PK).

The yellow Command Inertial Zone™ is the one where your tax dollars really come into play. Here the missile is fired at its longest range. Although its autopilot has been programmed prior to launch, the extreme distance to target combined with the uncertainty of target maneuvering during the missile's flight time makes it less likely that it will arrive in the vicinity of the target to make good use of its internal radar.

Here, target positional updates from the FCR are vital to obtain an acceptable PK and are sent to the missile from the FCR via a datalink. Might you still get a hit if you shut your radar off right after launching? Sure. If you're lucky and the target continued on its same speed and heading as when the missile was launched, your AIM-120 will arrive near the target when it is within the missile's internal radar range.

[1] *(cue Camper Music) "A Registered Trademark of Krusty Corporation, all rights reserved."*

*Q: “So… how **are** multiple AIM-120 launches modeled in RedViper”*

Although a **vast** improvement over the original F4 code[2], RV does not model the sending of positional updates to an in-flight AIM-120 if additional AIM-120s are subsequently launched.

Q: “Huh?”

Let’s try an example. Let’s say you have three Mig-25’s in front of you and you just so happen to have some AIM-120s on the rail. In RV, you have the option of ripple firing your three Slammers as quickly as you can bug ‘em and launch ‘em. For this example, we will assume that none of the missiles are fired within the Active Zone™ →

Step #1 – Enter either Air-to-Air mode and then select your AIM-120s or go directly to Missile Override Mode which will, of course, set A-A mode and call up your AIM-120s automatically.

Step #2 - Call up TWS mode on your FCR. You can do this via the OSB on the MFD or by initiating a TMS-Right command on your HOTAS (or CTRL – Right Arrow from the keyboard).

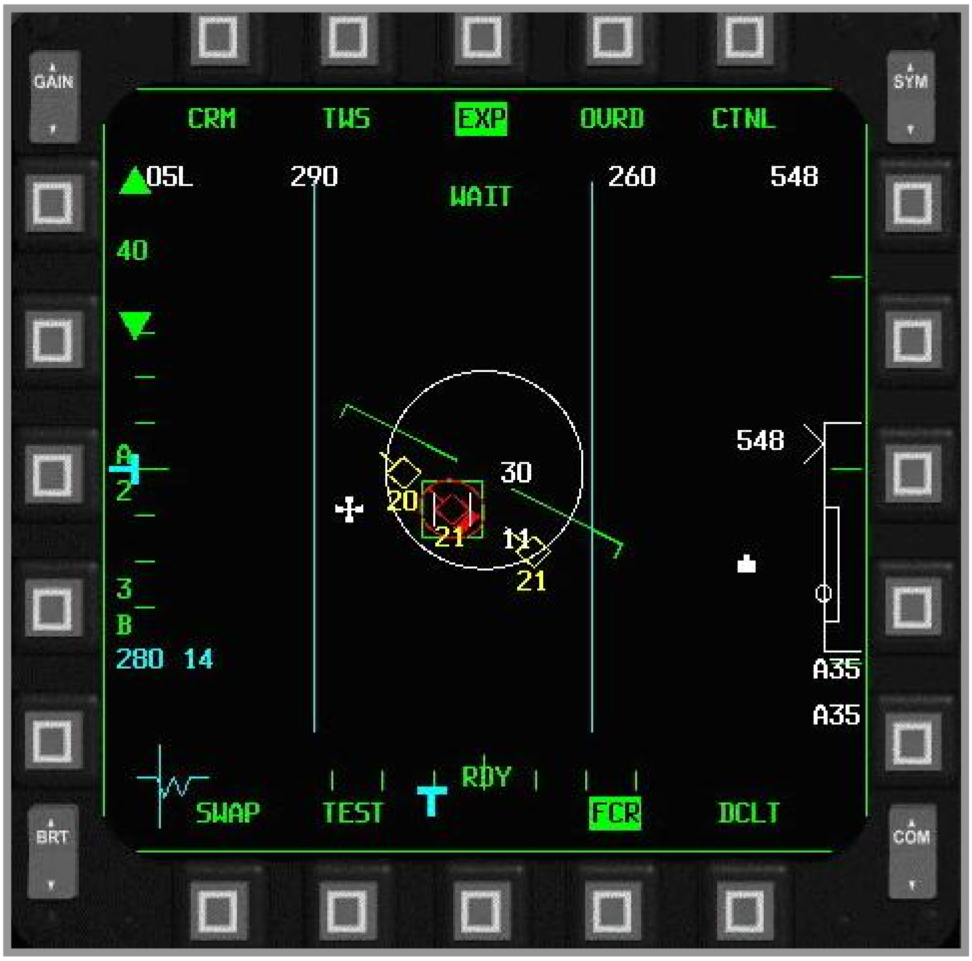
Step #3 – Assuming your radar has three good tracks going (i.e. three hollow, yellow triangles), bug the first target by initiating a TMS-Right command. This will place a circle around the highest threat target and will display the Dynamic Launch Zone (DLZ) on your HUD and your FCR MFD.

Here, the highest-priority bandit (#1) is bugged by initiating a TMS-Right command on the HOTAS. Note that I initiate EXP mode to make it easier to view tightly grouped targets.

Step #4 – Launch the AIM-120. Slammer #1 is now heading towards Bandit #1.

Step #5 - Initiate a TMS-Right command to bug the next target. At this point Slammer #1 will no longer receive target positional updates from the FCR and will continue towards the projected future position of Bandit #1 based upon its inertial programming.

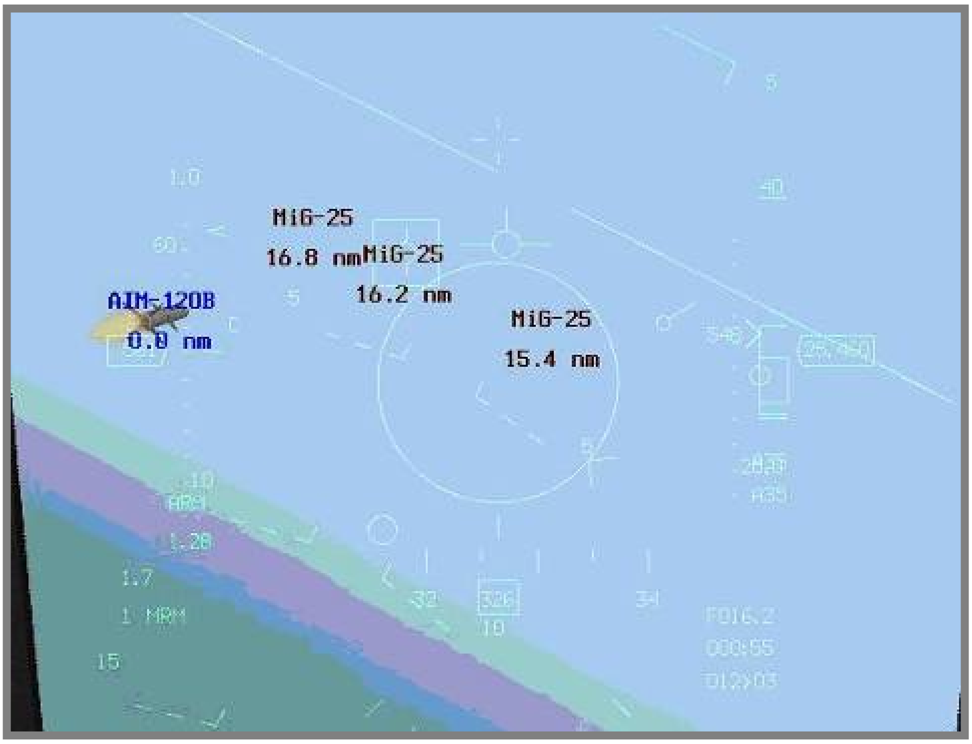
[2] *Those of you accustomed to OF will find much that is familiar with RV's implementation of multiple-launch support of the AMRAAM. AF players will enjoy the enhanced realism and flexibility of TWS implementation.*

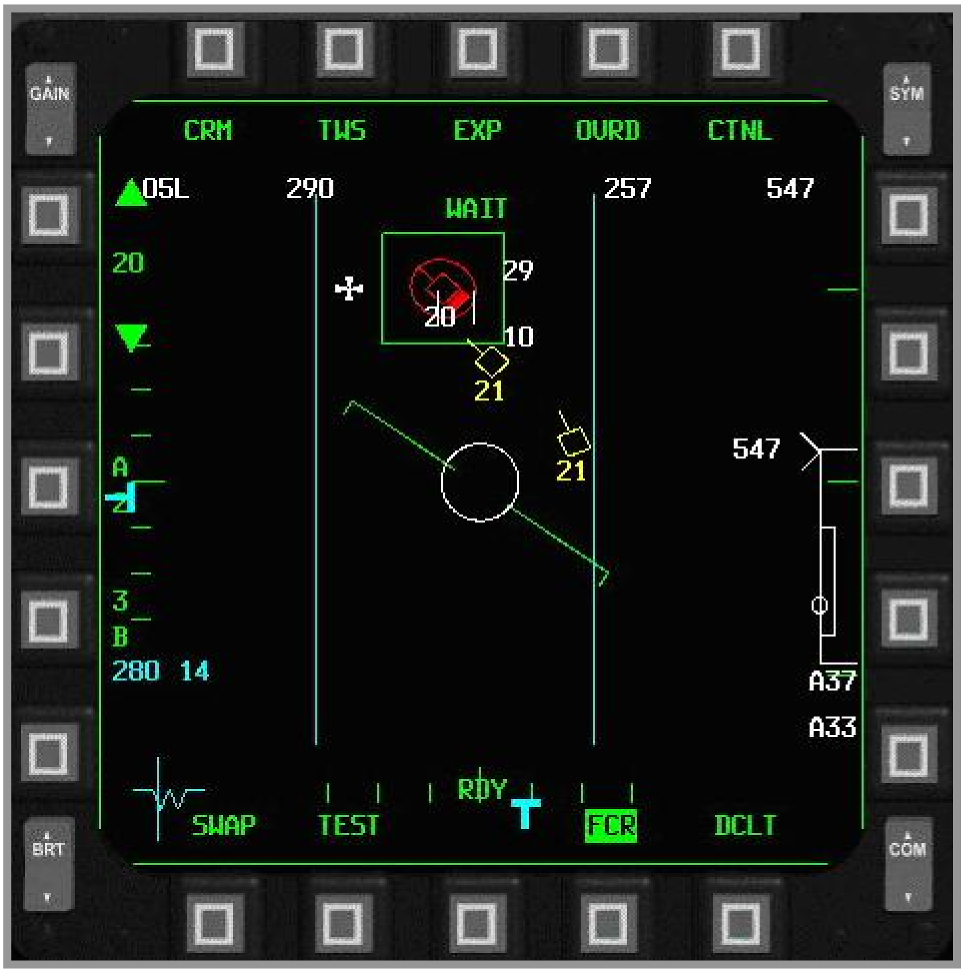


Step #6 – Launch the next AIM-120. Slammer #2 will now proceed towards Bandit #2 and will receive positional updates via the datalink.

Step#7 - Initiate a TMS-Right command to bug Bandit #3 and immediately launch Slammer #3.

Slammer #1 is heading for Bandit #1 and a TMS-Right command has been initiated thus bugging Bandit #2. Slammer #1 is no longer receiving updates from the FCR and is flying in inertial guidance mode.



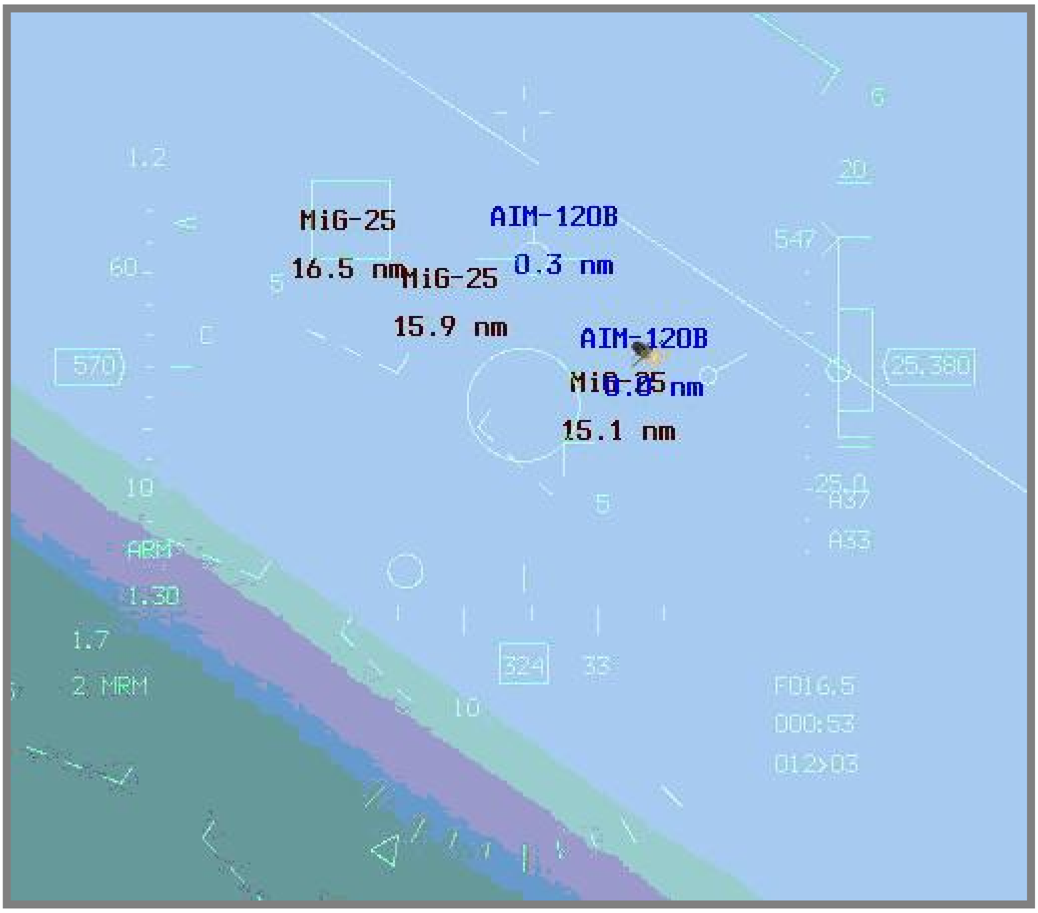


Slammer #1 & #2 are one their way to target using inertial guidance.

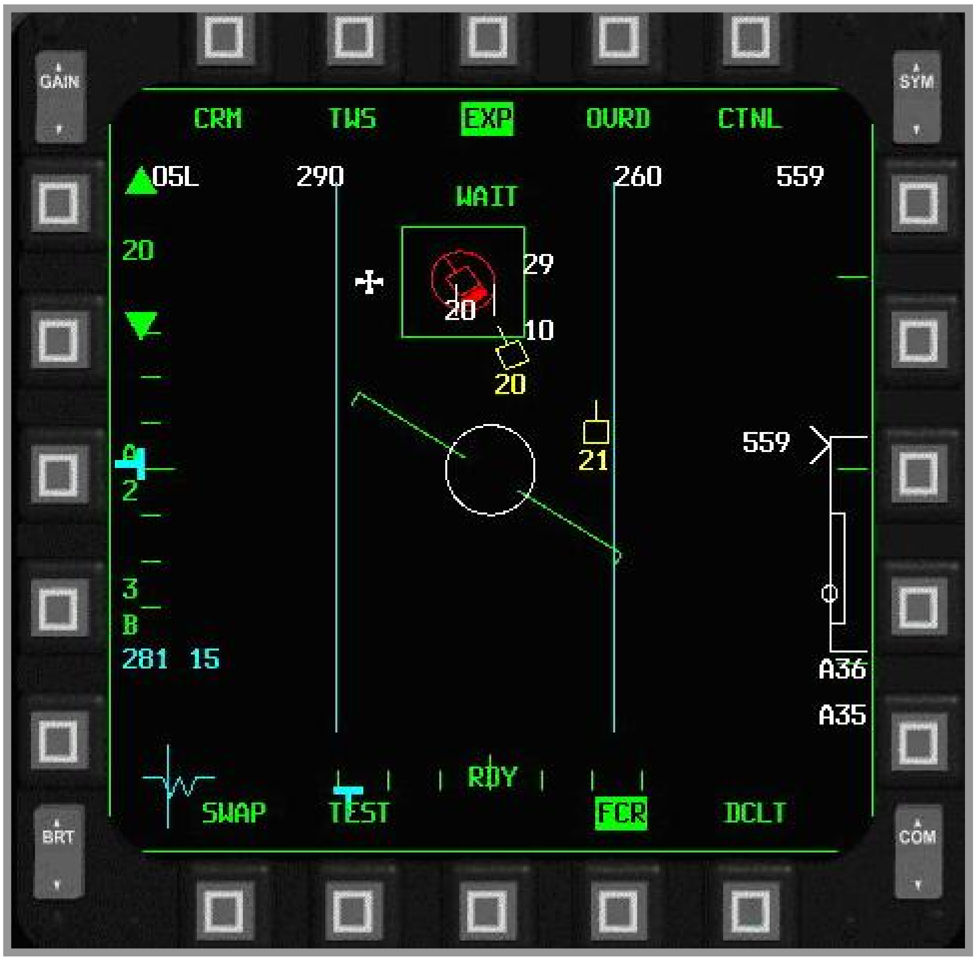
A TMS-Right command has bugged Bandit #3.

Now… Slammer #2 joins Slammer #1 as no longer receiving positional updates from the FCR as they continue on towards the vicinity of Bandit #1 & Bandit #2's projected positions in inertial guidance mode.

Slammer #3 continues to be supported by the FCR and receives positional updates accordingly.



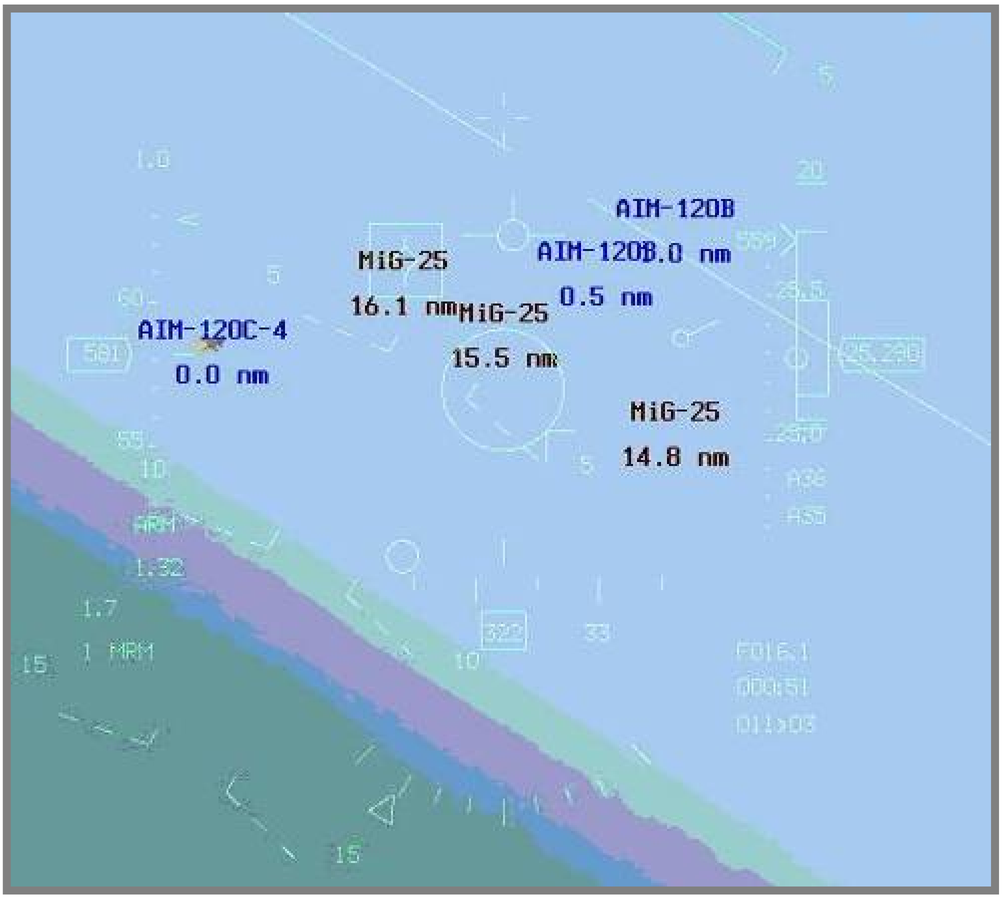
All three Slammers are now on their way to their respective targets.
From first bug to last launch approximately 8-10 seconds have elapsed.

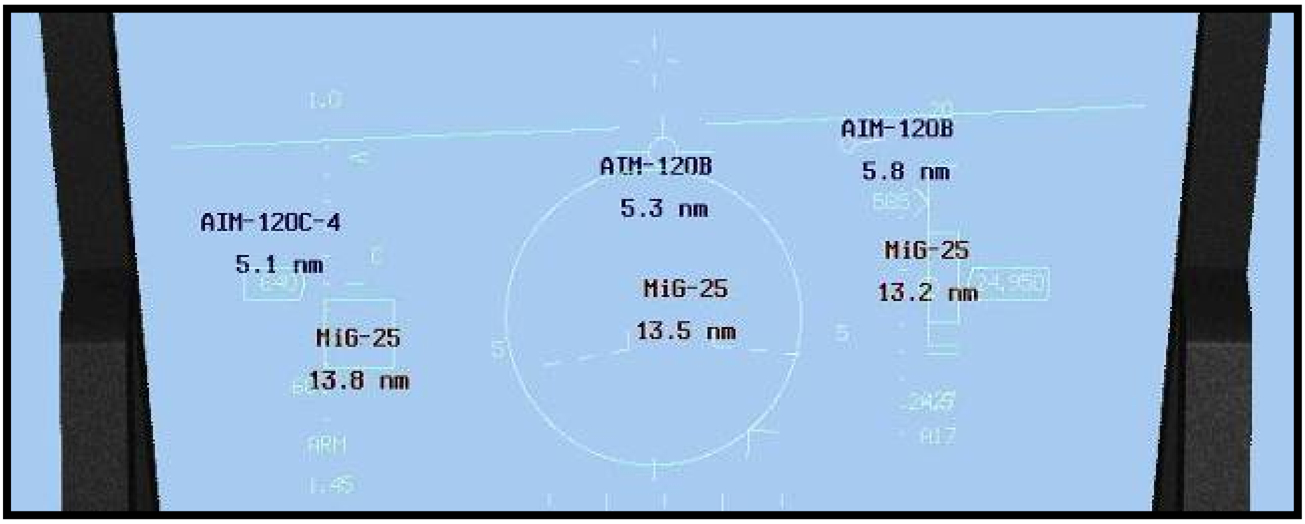


As discussed above, the probability that Slammer #1 & Slammer #2 will find their targets varies greatly with when they were launched and the actions of the bandit. Since they will be flying most of their flight in inertial guidance mode, a bandit that does violent, evasive maneuvers will have a greater chance of escape than a bandit that continues on its merry way.

Why? Since the missile is not receiving updates from the FCR, it does not KNOW the maneuvering history of the bandit.

It will continue flying to the area where it THOUGHT the bandit was going to be and then activate its internal radar. Hopefully, it will be close enough to find it.





The bandits turn to drag the Slammers while each missile is now guiding towards their original targets.

Notice that the bug remained on Bandit #3 to give the missile datalink support as it is the longest shot.

Q: “So what’s the walk-away here?”

If you are faced with multiple bandits, you CAN ripple-fire your AIM-120’s…. but you have a higher probability of hitting them the closer they are when you launch them.

Q: “Are you sure about this “under the hood” stuff?”

NO! I am by no means an AMRAAM expert. These are my best guesses based upon extensive research and testing. I could be 100% wrong on the way things are actually working “***under the hood***.” However, the method discussed DOES work.… and seems to - at least approximate - Real Life™®©.

Aragorn: So, Waz' - I guess you could say that my Tut. offers a LONG-winded, and complex procedure which almost guarantees your Pk., whilst your Tut. is offering a much simpler procedure, which more fully reflects Real Life, but offers a slightly lower Pk....?

Wazoo: Uh-huh. Can I leave yet....?

Aragorn: So, offering the Virtual Pilot BOTH of these methods offers a redundant procedure…?

Wazoo: Uh-huh. Can I leave yet…?

Aragorn: And your method is taking advantage of the latest code…?

Wazoo: Uh-huh. Can I leave yet…?

Aragorn: S’alright.

SEAD

Instructor: "DOC"

SEAD missions (SEAD Escort and SEAD/DEAD Strikes) are the most vital missions in the entire battlefield. Even if the enemy can't mount a sufficient air power to control the skies, it can pose a serious threat with the combination of SAMs/AAA in an IADS (Integrated Air Defence System). We expect to see almost all Russian-made air defence in Falcon4, but sometimes a pilot will be called to fly against American or European air defence systems as well.

The most commonly Russian made systems used by the DPRK in the Korean Theatre of Operations are the ***SA-2***, ***SA-3***, ***SA-4***, ***SA-5*** and ***SA-6*** systems. These systems, though obsolete, form a dense air defence network, which spreads across the enemy territory. These systems - though they cannot pose a serious threat when facing modern aerial platform/weapons systems combinations in a straight forward confrontation - are very dangerous in an IADS. Expect to have to deal with multiple launches from different sides. This tactic ensures a high ratio of SAMs Vs aircraft resulting in increased pilot workload, decreased situational awareness and high probability of mission aborting either through the destruction of the attacking aircraft or the compulsion of an AG stores jettison whilst dealing with threat-missiles.

Missiles such as the ***SA-8***, ***SA-13***, and ***SA-15*** are ideal for ambush tactics. Their short range, even though depriving them of area defence options, gives them a great point defence capability. These missiles will be launched only if the enemy aircraft is very near and at an ideal altitude for SAM engagement. I would consider these missiles the biggest threat in the Korean Theatre of Operations ***(KTO).***

Last, but not least, is the **AAA** threat. Though the less sophisticated air defence system in the theatre, it can still mount quite a resistance to the unwary attacker. Barrage, and computer-controlled fire can make the pilot's flight a nightmare. **It only takes one bullet to abort a mission**.

The AAA guns can form the air defences of various targets, or act to support SAM systems. Usually they are scattered in a wide area around the target, making their individual destruction a prolonged and dangerous procedure. That's why AAA guns always remain after other air defences have been dealt with.

Following this general introduction, we will analyse and evaluate general mission planning guidelines concerning SEAD/DEAD missions. Finally we will look into correct selection and usage of weapons systems in order to fulfil the SEAD/DEAD mission.

MISSION PLANNING

When planning a mission against enemy air defences there are several considerations. Here we have to distinguish SEAD Escorts from SEAD Strikes. In SEAD Escort missions, the SEAD element must bring the Strike element untouched to the target site in order to deliver its bombs. In SEAD Strike missions, the specific target must be attacked. This means that in SEAD Escorts, the SEAD element can use its weapons against ***any*** potential threat. In SEAD Strikes, the weapons must be delivered against the **targeted** air defence system. When fragging missions against enemy targets of vital importance, the ATO will usually assign a dedicated SEAD element. The **SEAD element** will push in before any other package element to ensure that all enemy air defences are suppressed or destroyed. This will give the **Escort element** freedom to deal with enemy aircraft, and the **Strike element** freedom to target and destroy its objective. The SEAD element must fulfil the motto "First in, last out". Planning a successful strike mission considerations are:

- **Trying to avoid all unnecessary enemy air defences during the ingress and egress routes.**
- **Prioritizing the enemy air defences that have to be dealt with.**
- **Deciding on the weapon which suits best the mission profile.**
- **Minimizing the exposure over enemy territory.**

Usually, the Falcon4 ATO plans missions that call for the strike element to fly over numerous enemy units and facilities. Here the planner (SEAD Escort element leader) must be ready to re-route the entire package. The best course he/she can choose is the one that combines:

1.) *the least exposure time to enemy air defences,*
2.) *the smallest consumption of weapons to suppress/destroy these defences*
3.) *maintenance of the furthest possible distance from enemy airfields.*

So, go into the mission planner, change waypoints, times and altitudes to best fit your plan. When you are happy with your new course, save the mission and then visit the other elements squadrons for re-routing their flights in relation to the SEAD Element's flight plan.
This will guarantee that the entire package will face as little danger as possible.

The threats that have to be considered can be divided in three major categories:

1. **Long Range SAM defences** (***SA-5***, ***SA-10***, ***SA-4***, ***SA-17***).

2. **Medium Range SAM defences** (***SA-2***, ***SA-3***, ***SA-6***, ***SA-11***)

3. **Short Range SAM & AAA defences** (***SA-13***, ***SA-15***, ***SA-8***, & ***AAA***)

Of the long range SAM defences, the **SA-5** system is obsolete, **so it doesn't pose a real threat** to the veteran aviator who can employ the right tactics to avoid a successful SA-5 shot. The use of jammers/chaffs and beam manoeuvres can easily defeat the SA-5 missile and guidance system.

That's not the case with the **SA-4** (and **SA-17**) and the sophisticated **SA-10** SAM systems. The SA-4 can be regarded as an SA-2 system with greater range and more lethality. Expect it to guard passages towards key military assets and behind a wall of shorter range SAM systems. This support vastly improves its efficiency.

The **SA-4**, unless it constitutes a direct target or an inevitable threat, must be avoided at the first stages of the air war by other aircraft than the dedicated SEAD planes. **It's therefore one of the primary targets to be taken out by the SEAD strikers**. These systems must be suppressed or destroyed as soon as possible to clear large areas of enemy airspace and to provide free corridors through enemy air defences.

Finally **the SA-10 can be regarded as the nemesis of modern western aviators**. Its huge range, combined with a very sophisticated radar system, makes it the biggest threat that allied aviators will face in the entire KTO. This system can engage targets that fly either very low or very high; with or without the use of jamming devices. The fact that this system is only in use with the Chinese military provides a "safe heaven" over the DPRK airspace.

The medium range SAM systems are the most numerous in the Korean Theatre of Operations. The DPRK IADS is mostly based on the outdated **SA-2** system. The particular system doesn't pose a real threat individually. The F16CJ with the combination of HTS/HARM can fire at the SA-2 acquire/track/launch radar component well outside its shooting range. **The real danger comes when several SA-2 sites are working together** in ambush tactics, or when multiple missiles are launched on one aircraft. When saturating the skies with missiles, increased pilot workload & reduced situational awareness usually result. The pilot has to find the weak points in the enemy air defence network and engage targets from safe distances. SA-2s are usually positioned to protect high value assets, such as depots, airfields, radar sites, etc, or corridors that lead to key military installations and cities. They are also positioned in such a way to form SAM-arcs that ensure that the target is protected from all possible routes of attack.
The SA-2 has one serious disadvantage that the pilot must always try to exploit: it can't detect and engage aircraft that fly low – below 500ft. If you ever try to avoid an SA-2 defence by flying low, you're advised to stay low. If you have to pop up for any reason, you'll find yourself with multiple threats all over.

The SA-3 system isn't a real threat. It has a short range of firing, making an ideal target for a SEAD aircraft armed with AGM88 or JSOWs. Only the unaware pilot will find himself in trouble with an SA-3 site.

The SA-6 is a dangerous system. Usually it is used in ambush tactics. You will find yourself flying peacefully in an area that in briefing shows no enemy air defences, and suddenly a "6" symbol will appear on the RWR scope. If you're lucky, it will be placed far enough to avoid or engage it, but normally when it lights you up, it will fire at you within seconds. To provide secure passages and clear skies for the allied aircraft, these targets must be taken out as soon as they are discovered. **An SA-6 site must be considered a first priority to engage**.

The **SA-11** system has a range between the SA-2 and SA-3. It's a more modern system than all previous. Usually it works in coordination with the SA-6 system, so **expect them to be found in every location**, whether it's present in the briefing or not…

Finally, we have the short range **SA-8**, **SA-13**, **SA-15** systems and the numerous **AAA** units. These systems are usually located around airfield complexes, factories or protect enemy mechanized, armour and artillery formations. **They provide point defence and are extremely lethal**. Normally they are scattered around the target they protect, covering all ingress/egress routes. They don't have a central tracking radar component, making their suppression or destruction a lengthy and dangerous job. This results in many weapons targeted against multiple targets. The planner has to assess the tactical picture and direct the attacks as well as possible to eliminate as many targets as the flight weapon load out permits. In the case of the SA-13/15 systems, it will be the pilots flying CAS missions that will mostly encounter them. These missions will not have dedicated SEAD assets assigned for protection, so caution must be taken either to eliminate these vehicles first or avoid them at any cost.

INDIVIDUAL THREAT ANALYSIS

As stated above, the **SA-2** is the system that is most commonly present in almost every mission we plan. Its real potential lies in numbers. In such conditions, this missile system can be dangerous and lethal. But **it only takes a hole punched through the air defence network to reduce SA-2 to non-threat status**! In most cases you will find the SA-2 rings lie within the rings of other systems like the SA-4 and SA-5. This tactic is used as follows: As soon as you enter the ring of a bigger system, you will have to take defensive actions to avoid a potential shot. If this takes away a considerable amount of your SA, you may find yourself in the engagement zones of an SA-2 system. Then your problems will multiply. In this case, **your first priority is to avoid the big system**. This requires a thorough mission planning to discover the weak points in the air defence network and use it to your advantage. Once the SA-2 has no additional cover by other longer range systems, it won't stand a chance against the combination F16CJ/HTS/AGM-88 HARM.

When dealing with the SA-2, your first priority is to negate any additional SAM cover an SA-2 system may have. If this not be the case, simply proceed directly to the SA-2 and take it out.
The SA-2 can also be fired at using the JSOW standoff weapon series. When using the JSOW, you need to perform certain tasks before launching for the mission. Firstly, recon the site if possible. See where the radar is and note down the coordinates. These coordinates will be entered as a desired waypoint so the aircraft radar and the weapon will be directly targeted at the desired DMPI. Then as you will approach the target, from a location of >20miles out and at above 20,000ft you can fire the weapon after confirming solid targeting. Always remember that the SA-2 has a fire range of approximately 18miles. One final way to deal with the SA-2 is to put some bombs on it. This will require a low-low-low approach to the target and the use of cluster munitions. Recommended only for those with NOE experience. Be aware of AAA at this level.

S o ,   w h e n   d e a l i n g   w i t h   t h e   S A - 2   s y s t e m ,   y o u   h a v e   3   o p t i o n s :

a. **Use the AGM-88 HARM with the HTS. This will allow you to suppress the particular site by destroying the radar component. Fly at 25,000ft to have a ~25 miles launch distance.**

b. **Use the JSOW standoff weapon. This will require knowing where to target the weapon and getting closer to the threat. Your actions must be quick and you'll have to be cautious not to enter the SAM's threat-ring.**

c. **Finally, there is always the option to over-fly the target and use CBUs or other conventional bombs. This is only for the veterans that know how to plan a low ingress/low egress to the target and how to expose themselves to the enemy for as little time as possible.**

SA-3 GOA (LOWBLOW RADAR)

The **SA-3** is short/medium range system. It has a firing range of ~11 miles. This means that it can't pose a real threat to a SEAD platform when it's not supported by other SAM systems. Just as the SA-2, it can work effectively in an air defence network. The SA-3 shouldn't be the first concern when dealing with such a network, but it mustn't be neglected. **Consider it as a second-rate target when planning your mission.**

The same tactics with the SA-2 can be performed with the SA-3 and with additional safety, due to the smaller firing range of the LowBlow radar component. Usually the SA-3 can't hinder allied air operation once the long-range SAM systems have been suppressed or destroyed. But always have in mind that a SAM can get you down if you don't pay attention when dealing with them.

SA-4 GANEF (LONG TRACK RADAR)

The SA-4 SAM system is a medium/long range system. It has a greater scan/track/acquire range than the SA-2 system. This means that it poses a greater threat to the aviator. It is more lethal than the SA-2 and it's more difficult to evade. **The SA-4 is one of the greatest threats in the KTO**. Usually, this system will be situated around key enemy military assets and behind a first screen of enemy air defences most commonly in the shape of SA-2 SAM rings.

This tactic gives the enemy IADS the following advantages:

i. it can engage targets either before the SA-2, or simultaneously,

*ii. it offers coverage to shorter range systems increasing their Pk (probability of kill). As stated above in the SA-2 section, this system must be negated as first priority, in order to deprive the enemy IADS of its inter-connectivity. Remember, **the SA-4 can live alone in the battlefield**, the SA-2 can't. By taking out the SA-4 as soon as it's possible, the planner succeeds in breaking the IADS in small air defence bundles, which can therefore be more easily attacked.*

In dealing with the SA-4, **my recommendation is the HTS/AGM-88 combination**. The HARM has the firing range needed to strike this SAM system from safe distances. When dealing with the SA-4, my first priority is to suppress the radar component as soon as possible and then deal with the launchers at a latter stage in the war. The JSOW can also be used, but here the attacker must be proficient in finding (using precision waypoints), targeting and launching the weapon in seconds. It's because the SA-4 has the firing range to pose a real threat that **time is of the essence**.

SA-5 GAMMON (BARLOCK B RADAR)

One of the most obsolete and least dangerous SAM systems in the KTO. **This system is no real threat to the modern aviator.** It has a huge detection, acquisition and firing range, but the control and command system is highly untrustworthy. The standard combination of beam manoeuvres & the use of jamming and chaff can defeat almost all missiles fired at you. And I say 'almost', as there is always the possibility that an **SA-5** missile may actually score a hit against a non-manoeuvring aircraft which doesn't take any defensive measures. As for weapons suitable for dealing with the SA-5, the **HTS/AGM-88 as well as the JSOW platform** can deal with the SA-5 battery more than effectively.

SA-6 GAINFUL (STRAIGHT FLUSH RADAR)

The **SA-6** is potentially one of the most dangerous SAM systems in the KTO. It has a small/medium range which doesn't pose any threat to modern SEAD platforms. Its lethality lies in the fact that **these batteries aren't always present during the briefing period.** So, the mission planner can't take them into account during mission planning. Another danger is that **the SA-6 is used mostly in ambush tactics**. As you fly towards a target, you will all of a sudden find yourself spiked by an SA-6. Most of the time, as soon as the Straight Flush spikes you, a missile launch will follow in mere seconds. This will results in defensive manoeuvres with narrow space in which to operate.

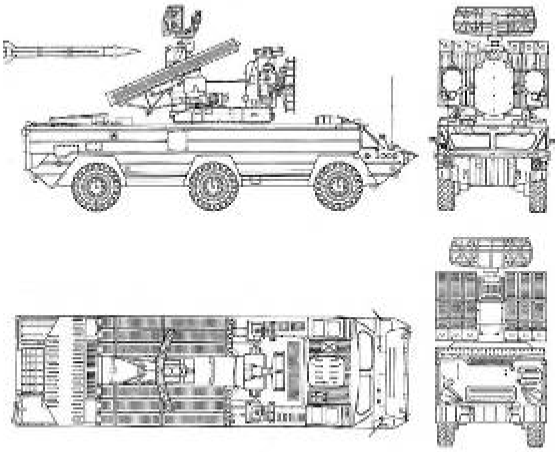
When dealing with the SA-6, employ defensive tactics immediately.
The SA-6 will be fired when you are close enough for it to kill you.

The weapon of choice against the SA-6 SAM system is the **AGM-88 HARM**. Since you will either find yourself incapable of knowing where the Straight Flush is or extremely difficult to pinpoint visually the launching site, you won't be able to use JSOW or CBUs/Dumb Bombs respectively. Using AGM-88s and the HTS pod, I usually perform **SEAD Sweeps.** I normally hijack a DCA or BARCAP mission and re-route it to a certain geographical area where I suspect enemy SAM systems are located. Flying in wide circular or horse track patterns, I use the HTS to scan for and detect enemy radar emissions. If a threat arises, and in this case an SA-6, I put an AGM-88 on it as soon as possible. This tactic uses my own platform as a bait for enemy SAM systems and at the same time permits me to engage them from "safe" distances.

So, concerning the SA-6, would remark:

- **It is used for ambush tactics most of the times. This means limited reaction time and probable mission aborting.**
- **I don't recommend using the JSOW, unless you know exactly where the radar component is.**
- **I don't recommend bombing with CBUs/Dumb bombs, as multiple missiles will engage you.**
- **As the leader of a SEAD Escort flight, always make provision of possible SA-6 present at ingress/egress routes.**
- **The weapon of choice is the AGM-88 HARM.**
- **Perform SEAD Sweep missions to take out as many SAM systems as possible, including the SA-6, using the HTS/AGM-88 combination.**

SA-8 GECKO (LAND ROLL RADAR)



The SA-8 is a short range missile with a high Pk for any aircraft that flies in its engagement zone. It has a short range of 5 miles approximately and can engage targets flying up to 10,000ft. It doesn't have an autonomous radar unit, but each platform is capable of acquiring, targeting and firing independent missiles. This makes the SA-8 **a very agile SAM platform** and a difficult one to suppress. The attacker must actually find out and destroy each SA-8 vehicle. This SAM system has a high Pk. It will fire its missiles only when the target is very close, & with very limited room to outmanoeuvre the missile. I wouldn't consider it as an ambush system, since its radar gives away its presence from a safe distance for the attacker. But this doesn't mean that you can get close to it unharmed, unless you fly over 12,000ft.

When dealing with the SA-8, the weapons of choice are the **HTS/AGM-88 combination** and the **JSOW**. As for all tactics mentioned using these systems, the HTS/AGM-88 combo gives the attacker the opportunity to discover and engage the radar system from safe distances, minimizing any exposure to the SAM threat. On the other hand, the JSOW permits a single launch combined with multiple kills given the known position of the SAM battery. Thus, pre-flight recon is vital to pinpoint the enemy site's location or at least mark geographical points of reference in case the battery can't be pinpointed.

Is summary, if you find where the SA-8 launchers are, try and take them out from safe distances. Don't try to engage them from close proximity and low altitudes. I wouldn't also recommend a high altitude CCIP release, because this will force a recovery from the release WITHIN the SAM's EZ. Use the AGM-88 or JSOWs to take them out safely.

SA-10 GRUMBLE (TOMBSTONE RADAR)

This is the NEMESIS of all aviators in the KTO! This system combines an extremely long range of engagement with a fabulous capacity to engage low flying targets. **It can get you no matter where you are!** Its powerful radar system is one of the best (if not *THE BEST*) in the entire KTO. Happy days end when China enters the war alongside the DPRK against the ROK/US coalition. **As soon as China enters the war, expect to be seeing multiple SA-10 batteries** storming south to protect the open air corridors towards key North Korean targets.
Each SA-10 battalion is expected to have more than three scan/target radar Components and approximately ten launch vehicles (each with a quadruple launcher). This means that more or less, 40 missiles can be launched each targeting a single aircraft.

When dealing with an SA-10 battery, the aviator has two options:

i. avoid the site at any cost,

ii. try to suppress it knowing that the price most of the times is very high both in aircraft and pilots.

Avoiding the EZ rings of the SA-10 is the first solution one must consider. But this has its drawbacks: the SA-10 has an effective range of almost 50 miles for high flying planes and about the half range for aircraft flying below 100ft (literally) and using terrain masking techniques. But flying around it will cost both time and fuel. This means no room for manoeuvring, and no room for engaging intercepting aircraft. Everything is limited.

And what happens if flying towards an SA-10 site is a must, like providing SEAD Escort to an allied strike element? Then you say your prayers and go for it!

So, dealing with the SA-10 is sometimes an unavoidable task. In this case, you have to prepare your strategy taking into account the flight profile and potential weapons for use. **Forget about the rule HTS/AGM-88 combo or JSOW, as with the previous SAM systems**. Of course these weapons are again your only available choice to beat the long engagement range of the SA-10 system. To achieve the maximum distance for firing either weapon, you have to fly as high as possible. This is mere theory when dealing with the SA-10. Before even you fire your own weapons, an SA-10 missile will be in the air with no RWR launch warnings at all. The only thing you'll see is the fire and smoke from your dying F-16CJ. And that will be the end of everything.

So, if flying high is too dangerous and lethal, **maybe we should go down low**. This may be the only way to put a couple of missiles on these radar systems and have some chance to return alive at our base and not during a POW exchange program! The only way I have managed to defeat this air defence beast is to fly below 100ft and using terrain masking to get as close to the site as possible. OF COURSE: bear in mind the dangers of flying low over hostile territory.
But again, don't get carried away. As soon as you see that a Tombstone is tracking you, you have to understand that the clock is ticking very rapidly against you.

Launch the weapon and then immediately put the SA-10 site on your 6 o'clock. Fly at Mil Power or even AB to maximize the time the missile needs to intercept you. Then be patient and let your HARM fly its long flight. If the "10" symbol still persists on your RWR or HTS page, this means that either your missile has missed its target or that there is another Tombstone active. Employ the same tactic again if you have any AGM88s left on under your wings.

To Summarise:

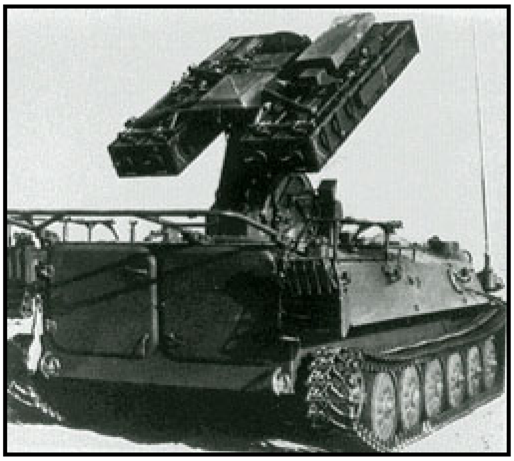
1. **The SA-10 is the most difficult system to beat by far!!**

2. **Another tactic to be considered is to actually over fly and bomb the site from low altitude, if there is no low alt coverage by the radar system. This of course needs careful planning and experience.**

SA-11 GADFLY (SNOWDRIFT)

The SA-11 is a short/medium range SAM system. The way of dealing with it is similar to that of the SA-3. But, this system has an advantage. **Sometimes it will activate its radar only when the attacking aircraft is near enough to engage with a high probability of kill.** Good pre-mission planning and knowing what SAM systems lay ahead is vital. As for the weapons, the HTS/AGM-88 combination and the JSOW (if the site location is known before hand) are the weapons of choice.

SA-13 GOPHER



Most of the introductory tactics apply here.

Expect to find them in almost every enemy column protecting tanks, APCs, trucks or infantry.

They can offer marvellous point defence.

SA-15 GAUNTLET

So stay above 12-15K feet and always have your eyes and ears open for possible launches. The **weapon of choice is the AGM-154 JSOW,** if the location of the launchers is known. This weapon can combine multiple kills with as few weapons launched as possible.

SA-17 GRIZZLY

The SA-17 can be regarded in the same way like the SA-4, although it's a more modern system and thus more sophisticated and lethal. But it can't stand up to a match with the HTS/AGM88 combo. The tactics that can be applied are similar with the SA-4.

MANPADS

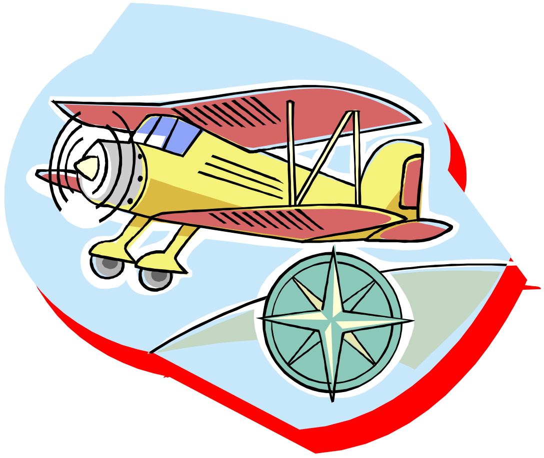
The most common manpads are the **SA-7** and **SA-14**. These are IR missiles, so **you will not have a launch warning** at any time. The only warning you may have is that of your wingman's 'Break' Call. Reactions must be as fast as possible. You will deal with these systems only below 6,000ft most of the time.

So, special care must be taken by mud movers who are usually flying and delivering ordnance that low.

Always have your finger on the flares release button.

I haven't developed a foolproof tactic for these systems, but when I fly low, **I fly fast and as low** as possible.

RED DOG'S CHARTS & NAVIGATION HANDBOOK



"RED DOG" provides the community with many wonderful resources.

His Checklists are listed in the Study Programme, and form an essential part of EVERY Falconeer's collection.

Perhaps his crowning achievement, however, is the complete set of Approach Charts for our Falcon World.

The perfect combination of Science and Art, they are a MUST HAVE for ANY serious Falconeer. So beautifully rendered they are, that I often just kick back, and LOOK at them.

This – however – led me to discover something rather problematic.
We all HAVE them; we all love to admire the beauty and workmanship.

However – the MAJORITY of us DON'T know how to USE them…!

Enter Red Dog. With cooperation from Snake122 – a REAL LIFE Pilot Navigation Instructor – Red Dog has agreed to produce an IN-DEPTH tutorial, covering both NAVIGATION, and the Navigation CHARTS.

In appreciation of the effort, the FF/RedVIPER team has worked in concert to address some bugs and tweaks with regards Navigation. The long-standing "To/From" Bug has been fixed, so you may get more enjoyment from your new Navigation skills. As you will discover, the Charts are largely concerned with Multi-Player, and RedVIPER includes massive improvement to the Multi-Player code.

This cooperation has opened up a NEW vista for the Falconeer.

Now there is more to life than dropping Ordnance.

Let us take advantage of The World of Navigation.

Navigation & Charts Tutorial

Instructor: Olivier "RED DOG" Beaumont

(***With Real Life Instructor:*** Matthew "SNAKE122" Edwards, **CFI-I**)

Contents

Introduction

The purpose of this tutorial is to document the Falcon 4 navigation charts I have been creating for the past two years. Those charts refer to specific symbols, abbreviations and IFR (Instrument Flight Rules) procedures that the average F4 flyer might not be current with.

Let's try to clear it up a little.

First, let me stress the point that I'm not a specialist in the matter. I'm just an IFR freak, flying flight sims for more than a decade (geez' - I could almost say two decades!), especially IFR flight sims like Elite or alike. So my experience and knowledge is pretty limited, and I am responsible for any mistakes in this document. *(*Editor – okay: I'll take responsibility for spelling… ☺)*

So - it's not a tutorial about real life IFR flying, just the way we can do it in Falcon. Having said these things, I am very happy to welcome ***"Snake122"*** aboard, to offer his professional guidance on all things Navigational.

Now, F4 is very far from being an IFR flight sim, but since BMS1.3, we had some nice weather effects *(unfortunately taken back since, but tweakable in FreeFalcon).* The idea of IFR was appealing to me, and I decided to press further by doing a chart set for each South Korean airbase. I took the liberty of taking some distances from real life IFR procedures, and adapting them to Falcon. And you will certainly notice that most of the procedures come from the civil side of aviation. I am perfectly aware that fighter pilots may not waste their time flying such procedures, but it's the best I have to base the Falcon charts on.

Besides the weather aspect, the idea was to give reference points to members of the same multiplayer flights by naming (and giving relevant F4 GPS coordinates) specific waypoints around the airports. The purpose here is obvious. Each member would follow the published route alone and rendezvous with the other member of the flight by holding at a certain point.

And finally, the lack of decent ATC in Falcon can also be avoided by following the charts. It's even possible to assign a human controller in multiplayer to act as ATC and vector the flight around the airports, completely bypassing the original ATC.

You have it figured out by now: most of what will be explained might be relevant to human flights only. There is no way at this time that the AI controlled flights or the AI ATC might play the charts game. Meanwhile, having one AI wingman doesn't really complicate the problem if you make him stick to your wing closely (otherwise, he will circle around you, keeping his speed up). The other annoying aspect will be the Falcon ATC, but - as you will see - there are workarounds and, at worst, it can be completely ignored. The best solution is for a multiplayer squadron to assign a human flight controller who endorses the charts. That what we are putting in place in our squadron, and it works pretty well.

The charts were created with a BMS based version of old Falcon with BaZT elevation patch.
But they should be compliant with any F4 flavours – even with F4AF. Although Lead pursuit seem to change their Tacan channels with each new patch. (Some might guess why?) I don't want to keep track of those futile changes, so you might need to change the tacan channel, but the procedures remain valid.

Disclaimer: *It took me about two years to create a chart set for each South Korean airbase. It is obvious that during that time, my experience and way of viewing things changed a little. And the Falcon code changed as well. As a consequence some early charts are quite different from latter charts. Whilst writing this document, I realized some charts had errors needing correction. This will be done but probably one at a time, depending on my availability for such a task.*

Basic Radio Navigation in Falcon.

We can't really hope to explain how to use the charts in Falcon without talking a little bit about radio navigation, can we? Radio navigation is a very vast subject and there are publications and tutorials available on the web to learn how to master IFR flights. One of the best resources for us is the lessons in Microsoft Flight Simulator. The following publications are also very useful:

Sources:

- Falcon 4 handbook
- RPx/SPx handbook
- F4-BMS_2.0-Manual
- CombatSim Checklists Navigation charts for Falcon: http://www.combatsimchecklist.net/
- Jeppesen Airway Manual Initiation.
- Jeppesen Instrument and Commercial Manual.
- Multi-Command-Handbook 11-F16.pdf
- ONC charts for Korea and Balkan
- Jeppesen charts for Korea and Balkan
- Flight Information Publication (terminal) for Korea and Balkan.

As opposed to VFR (Visual Flight Rules), IFR (Instrument Flight Rules) use radio beacons aids and allow the pilots to fly without any visual reference. In real life, there are quite a few different beacons:

- NDB: Non Directional Beacon
- VOR: VHF Omni Directional Range
- DME: Distance measuring equipment
- VORDME: Beacon combining the VOR and the DME.
- TACAN: **TAC**tical **A**ir **N**avigation system.
- ILS: Instrument Landing System

Falcon supports only the TACAN and a pseudo ILS system, with the downside that ILS is collocated with a tacan and tacan stations can only be collocated to an airbase. It's often the case in reality as well. But some radio-navigation aids can be placed outside of the airbase perimeters and act as stand alone beacons.

In Falcon, implementing those is possible by using an INS steerpoint but we will come back to this later on.

For Falcon, we will consider the TACAN as a VORDME: A beacon emitting in all directions (360°) with a fixed range and a distance measuring capability.

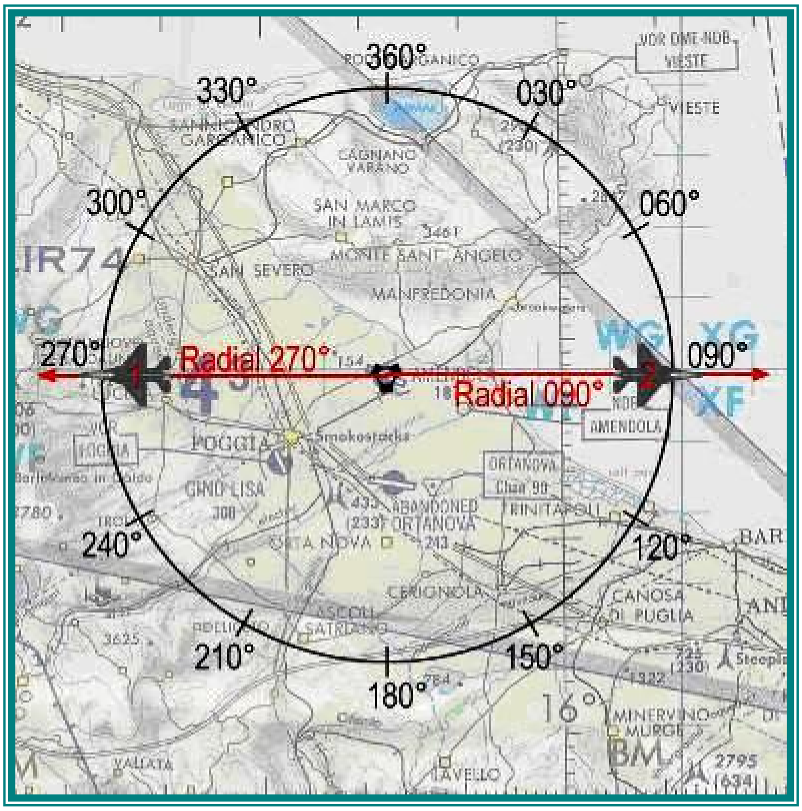
In the cockpit, we read the Tacan information through the HSI Instrument.

2.1. Tacan mechanisation

Let’s first come back to the TACAN.
The station is emitting 360 radials, one for each degree of the circle. We could be more precise than this but since the falcon HSI is able to increment radials by only 5°, we actually have 72 relevant radials. Please note that the further you are from the station, the further apart the radials are and as a consequence, navigating far from a station is less precise than navigating near the station.

Radials are half-line (demi-droite) with a fixed origin (the station) but are reaching infinity on the other side. Please note, here the infinity stops at the station maximum emitting range ☺ which is set in the stations.dat file. In real life, they are line of sight limited, as any radio wave is. In Falcon, the curvature of the earth is not implemented and the tacan emissions go through the mountains as well.

We accept that, for the headings, 360° is North, 090° is East, 180° is South and 270° is West.



As a consequence, we need two radials to cover one direction:
For instance, Radial 090° for the right quadrant and radial 270° for the left quadrant. Those two radials draw a full line in the middle of the circle.

An aircraft cannot be on the 270 radial if it is east of the station. It is on the 090 radial. But established on the same radial (090° for instance), you can fly a heading of 090° (outbound the station – your distance to the tacan is increasing) or 270° (inbound the station – your distance to the tacan is decreasing)

This is mainly semantic, because you will realize that using R-270° or R-090° whatever your quadrant, has no real importance in F4.

The important thing to note here is that when you talk to somebody (a wingman or ATC), you need to stay coherent and use the correct terminology. So even if you are flying a heading of 270° to the station but you’re still east of the station, you need to state that you are on the 090 radial inbound the station. *I know this is probably confusing at this time, but read on.*

Tacans also have distance measuring equipment (DME) that gives the distance in Nautical Miles (Nm) between your aircraft and the selected station. That indication is given in the top left window labelled “miles” in the HSI.

There is a maximum distance at which the tacan is emitting according to different parameters in real life. In Falcon, the range varies between 25Nm and 150Nm. Past that distance, the HSI will be flagged with large red indicators to notify the pilot that the data received is not useable. See the HSI description further down for more information.

2.2. Setting up the cockpit

Obviously, the first thing you'd need to do is to set the correct information in the system. Tacan channel, tacan band etc.

With the original Falcon, we only had access to the BACKUP navigation system of the F-16. With current versions however we now have access to both the backup system and the "Main" system. I mention it because I know a lot of you still use the old backup system while you should really start learning how to use the UFC *(Up Front Controls)* to set all the navigation data in the cockpit.

The backup system is implemented on the AUX-COMM cockpit panel. When the CNI switch is in the backup position – tacan channels and band are to be inputted from this panel by clicking the channel numbers and X or Y band. You also need to specify if you will track a ground station or an airborne station. That is done with the T/R or A/A TR switch. The A/A TR being for airborne emitter like the tankers.   Now again, it's not the correct way to do it, it's a backup way only used when the main system is inoperative.

The correct system to input the tacan channel and band into the cockpit is through the Up Front Controller (UFC) by using the ICP and the DED. For that to work, obviously the CNI switch of the AUX COMM panel needs to be placed in the UFC position, but that's an item required to be done at the ramp start (see checklists).

Depress the T-ILS button #1 of the ICP to enter the Tacan/ILS page of the DED:

The tacan channel can then be typed in the scratchpad by using the ICP buttons. First check that the asterisks are correctly placed around the scratchpad (DCS up or down if necessary) and depress the ICP numeric keys 5 and 4 then the ENTER key supposing you want to input Amendola AB tacan channel.

In the example below, the picture on the left shows the T-ILS page with a 118Y AA tacan selected.

Next, one is to set the correct band. In F4, we have the X band (for ground) and Y band (for air). Strictly speaking it's not 100% accurate, but it's the way it's supposed to work in F4. To change the band, simply input "0" (zero) in the scratchpad and press ENTER *(see figure above right)*. That will toggle the band from Y to X to Y …

The last thing you need to set as the tacan is concerned is the T/R or A/A TR. That is done by depressing the DCS switch to the right (SEQ position). The value will toggle from T/R to A/A TR and back.

Okay; the basic steps are done. Now is a great time to introduce the main navigation instrument of the F-16 cockpit: the Horizontal Situation Indicator. A note of warning first → When you're simply following your pre planned route, your main instrument will of course be the MFD on the HSD page. But when you will be doing radio-navigation relative to a steerpoint or a tacan station, you will need to use the HSI.

Before giving a rundown of the instrument's purpose, you need to know that the HSI has 4 different working modes. Those modes are set on the small panel just left of the HSI:

TCN MODE: The instrument uses the set tacan station as a reference and gives bearing and distance relative to that station.

TCN/ILS MODE: Same as above but gives steering cues for the Tacan collocated ILS.

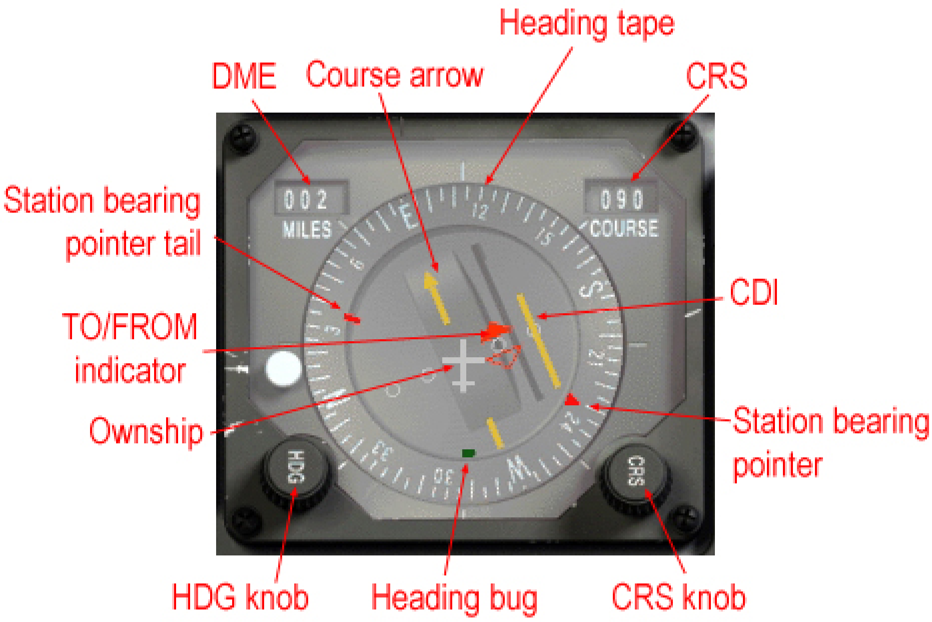
NAV MODE: The HSI in this case will not use a radio-navigation station as a reference but the currently selected INS steerpoint. That is very handy when you want to navigate to a waypoint and arrive with a set heading. In this mode, the steerpoint is considered a virtual tacan.

NAV/ILS MODE: same as above but providing ILS steering cues at the same time. That position will be used for instance when returning to the pre-planned airbase and shooting an ILS approach.

Note that both ILS positions are not really implemented correctly since the ILS in Falcon is tied to the Tacan which is obviously not the case in the real life.

2.3. The main navigation instrument: the HSI.

Still there? Perfect. Let's move on to the main course, the Horizontal Situation Indicator.



The instrument gives you a god's eye view of your aircraft (in the centre of the instrument) and its position relative to the selected reference (radio-navigation station in TCN mode or Steerpoint in NAV mode)

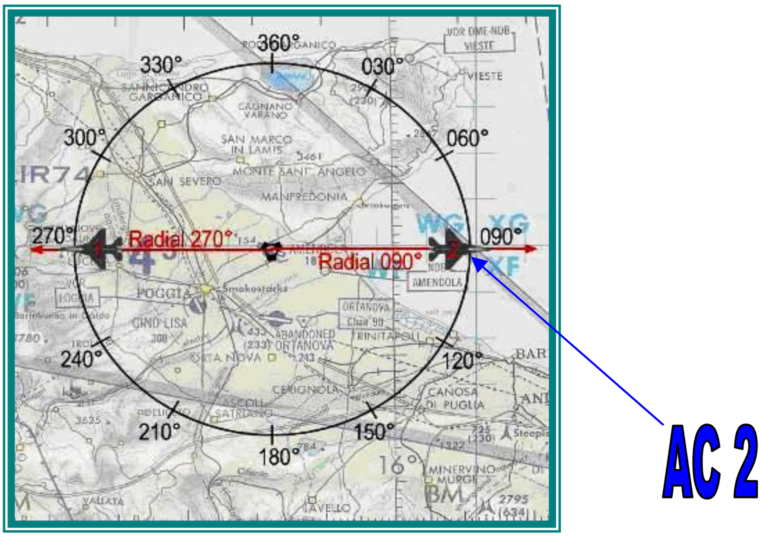
- **The Heading tape**: Gives your heading on the 12 o'clock position.
- **The DME window**: Gives the slant range between you and the selected station.
- **The Course window**: Gives the currently selected radial.
- **The Course knob**: Set the desired radial
- **The Heading knob**: Allows the heading bug to be set on a selected heading.
- **The Course arrow**: points to the selected course on the heading tape.
- **The CDI** (Course Deviation Indicator): Gives the position of the selected radial relative to the position of your aircraft.
- **Station bearing pointer**: Points directly to the selected station. This arrow is really interesting both for the beginner and the advanced user. Firstly it clearly gives the bearing to the station and for the most advanced user it can be used as an ADF (Automatic Direction Finder) able to track a virtual NDB. More on this later.
- **Station bearing pointer tail**: That's the tail of the red pointer, giving the reciprocal heading of the station bearing.
- **To/From indicator**: Indicates whether the aircraft is moving toward or away from the VOR Ground station (Radio Navigation Beacon)

  ***Editors note**: *The long-standing "to/from" BUG has been FIXED in FF4.0/RV1.*

- **Heading Bug**: Moves accordingly to the HDG knob. It's a reference heading that is used by the autopilot system in HDG mode. It can also be used as a reminder of headings (wind corrections, etc.) when you don't use the autopilot.

Let’s start with a simple ☺ example.

We’ll use the picture to the right →



The airplane #2 is on the 090 radial.
But the HSI can display two readings, depending which radial is selected:

First, notice that the actual heading is 090°, since you see the position of AC#2 on fig1; you know the aircraft is EAST of the station and is going away. We say it’s OUTBOUND.
The station bearing pointer points at 6 o’clock, meaning the station is right behind AC#2.

AC#2 – Option 1 : Set R-090°

The set course is 090 and the course arrow is aligned with the 090° on the heading tape.
The CDI is centred; meaning AC#2 is spot on the radial. If the pilot were to continue flying on the 090° heading (considering a no wind condition) the aircraft would continue flying away from the station established on the 090° radial.

AC#2 – Option 2 : Set R-270°

The second picture on the left is taken at exactly the same moment (please forget the DME reading that has increased – the sim was not “frozen” ☺) but this time the course 270° has been selected. The aircraft is still on a 090° heading OUTBOUND the station. The Course arrow points at the 270° mark on the heading tape and the CDI is centred, meaning we are still on the 090° radial. This is where which radial you are on gets tricky!

Obviously, it is easier to radio-navigate with option 1 when the course arrow is pointing to the actual heading. So you will want to align as much as possible the Course arrow with the actual heading to avoid thinking about reciprocal radials.

In case of option 1 above, it is clear we want to fly outbound using the 090° radial. Because firstly, we are flying outbound and secondly we are indeed on the radial 090°.

Notice the TO/FROM indicator. On the first picture it is on the right side of the course arrow and it points down, meaning we are in “FROM”. Indeed, the station is behind us and we are moving away *from* it.

On the second picture, it is on the left side of the course arrow and it points down, meaning we are in FROM this time, also.

Please note that the long-standing “TO/FROM” bug in Falcon has been FIXED in FF4.0/RedVIPER. The FF/RV Team hope this makes your navigation and flight simulation more immersive and enjoyable.

Now - let’s also take the indicator from FS2004, and check the same situation:

We are flying a Beech Baron established on Radial 090° from a VORDME. The RMI is set to 090° as indicated by the course arrow and we are on the radial, as indicated by the centred CDI. Now look at the TO/FROM indicator which in this case is white… it points backwards, meaning we are “FROM” the station. This is what the F4 HSI displays in the above example. Now let’s turn the Course knob to select R-270 on the RMI and see what happens with the TO/FROM indicator.

Now, the TO/FROM indicator rotates with the course arrow but it changes its state at the 360° mark (actually 90° off the selected radial) and continue its rotation until R270° is set where it points downward.

See the two pictures on the left.

As you see in both images, taken at the same moment but with a different radial selected, the TO_FROM indicator remains coherent and correctly indicates the FROM state we are in.

In this Guide, I will refer to INBOUND and OUTBOUND course.

Let’s go back to Falcon by considering the following example:

AC#3 is on the WEST of the station and is flying toward the station with an actual heading of 090°. It’s actually on the 270° radial. But it will be easier to use the 090° course in the HSI because the reading will be clearer. Indeed, if we select course 090° in the HSI, the course arrow points at the 12 o’clock position and is the same as the heading – as pictured below. On the contrary, if course 270° is set, the course arrow points at the 6 o’clock position and although it is more correct, it’s not easier to work with.

As a conclusion, even though the radials are half-line with a fixed origin, it’s always better to use the radial pointing at the heading as long as you always keep in mind the true radial you are on.

So far, we have been considering very easy cases where the aircraft is already tracking a radial – with the CDI centred. This is called ‘tracking’ a radial, and it’s the easy part. The hard part happens before that stage when the pilot tries to intercept the desired radial.

Initially, when the pilot sets the required radial in the HSI, he gets something like this:

So what does the instrument tell us?

1. The tacan is somewhere behind on the right hand side. On the 230° bearing. So we are going away from the station
2. The selected course is 090°
3. The 090° radial is on my right (CDI is offset to the right) So we are LEFT of course.
4. I’m flying on a 112° heading
5. The station is at 2 Nm from me.

With a little experience, you will have a rather good idea of your position in space relative to the station. If it’s clear for you, go direct to the next section. If not, read on…

A good trick to visualize your position in space before starting a radial interception, is to centre the CDI by turning the CRS knob. Once the CDI is centred, you know for sure on which radial you currently are… Bear in mind that the CDI will be centred on two reciprocal radials (310° and 130° for instance) and that you are usually moving at high speed in your F-16 and the CDI may not remain centred for long.

The picture above was taken on the threshold of Amendola runway 11.

Let's centre the CDI to check the radial we are on:

We are on R-135 (reciprocal is R-315°)

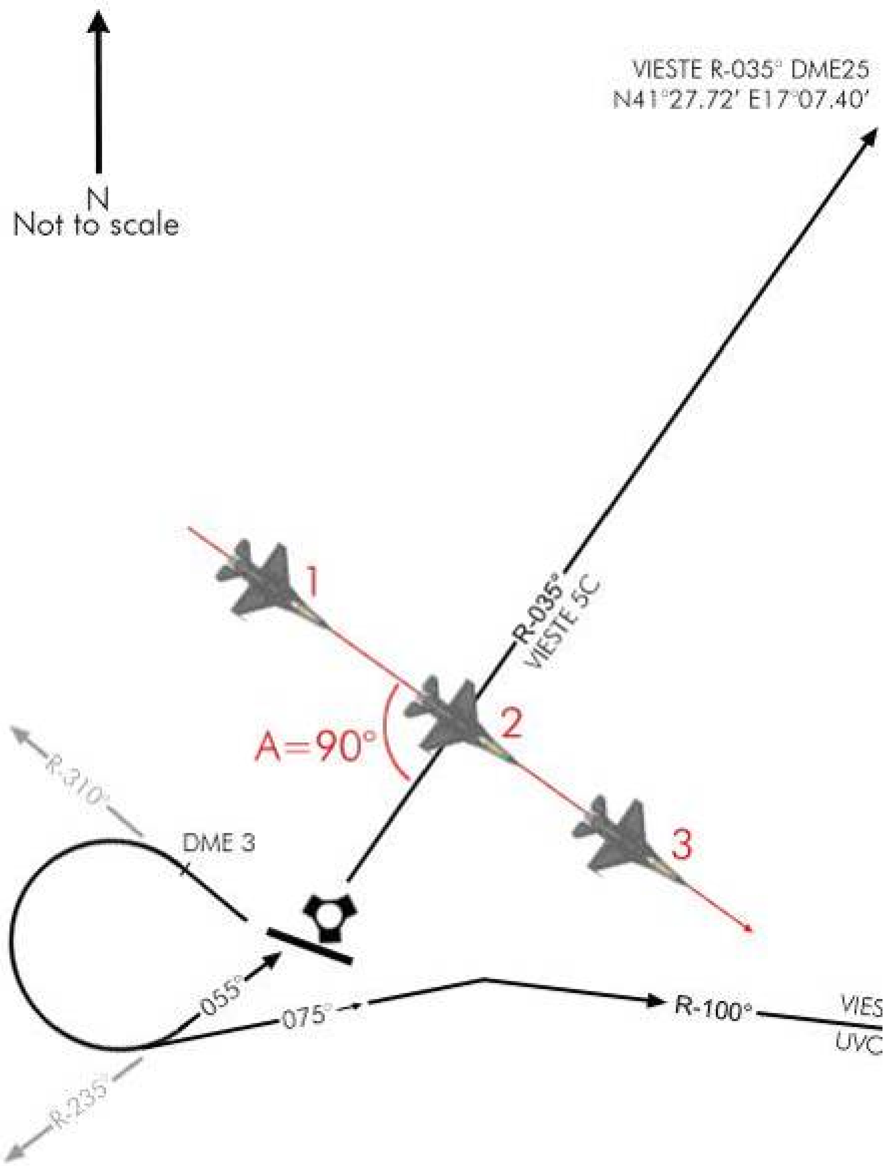
Knowing that information, you know you are somewhere on a line originating at the station and extending on the 135° direction. The DME indication gives you the distance to the station, fixing the point on that imaginary line where you exactly are.

You will understand then, to succeed in correctly intercepting a radial, you first need to know exactly where you are relative to the emitting station, hence the relevant radial.

2.4. How to intercept a radial.

Once you know where you are and you know which radial you need to intercept, you need to fly towards the imaginary line drawn in space by the radial. The shortest route to that interception point is to fly a heading at 90° from that line. With such a perpendicular heading, you will reach the radial very fast but you will have lots of difficulties to make a smooth interception because the CDI will pass from one side to the other very fast.

Let's consider the following example:



We have to intercept R-035° outbound Amendola tacan. We are on the ground, ready to take-off on RWY 29 and once airborne, we will make a right turn to heading 310° as the procedure implies. Once we flew away a little from the airbase, we will make a large 180° to the right and attack the radial with a 90° angle and see what happens on point 1, 2 and 3. The HSI is in tacan mode, radial set to 035° and we are rolling on the runway.

At point 1, we show a 90° attack angle (A) on the 035° radial. The “A” angle is clearly pictured on the HSI by the angle created by the actual heading (125°) and the set course (035°). Note the position of the station bearing pointer. As you are nearing the radial, it will descend to the 215° mark that will be reached when the radial is intercepted.

Nearing the radial, the CDI will start to move towards the centre of the dial. The greatest the interception angle, the fastest the CDI will move. When the CDI is centred with the yellow arrow, it means you are spot on the radial. That is point 2.

Note that the course arrow points to the left, meaning that the 035° radial extend to the left side. So if you were to intercept it OUTBOUND, you should turn LEFT. If you were to intercept it INBOUND, you should turn RIGHT, towards the tail of the arrow, or toward the station bearing pointer.

Now of course you are flying a 125° heading, so you’re just a fraction of a second on the radial. After that time, the CDI will start to move on the other side of the course arrow. You have just passed the radial and are now on the other side. That is position #3.

Notice the station bearing pointer that continue its progression past 215° now that you overshot the radial.

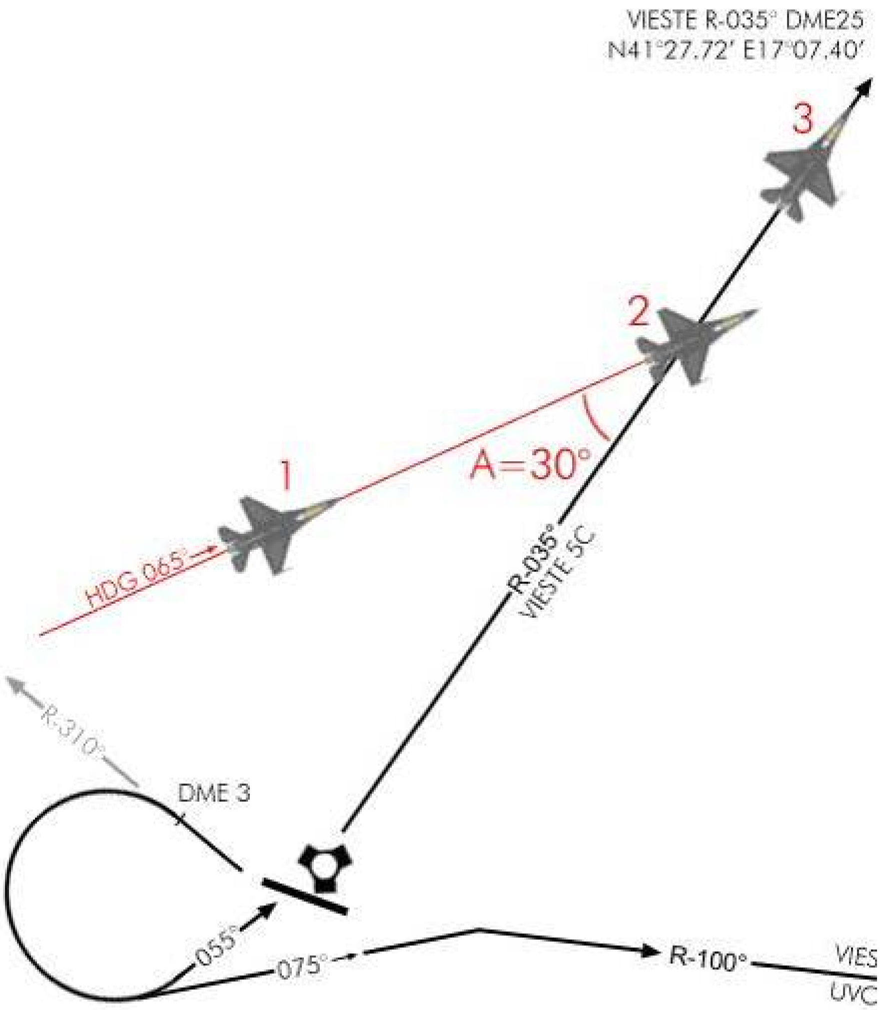
Notice that according to your distance to the station, the amount of time it takes the needle to swing from one side to the other will be different. Really fast at close range; slower - but still faster than desired due to the 90 intercept - at longer ranges

Fine. You probably have it figured out by now - intercepting a radial with a 90° attack angle won’t provide a smooth ride. But who cares? You don’t have passengers – do you? The guy in the back you say…? Don’t worry about him - he likes being bounced on the canopy.

In general aviation, they teach you to intercept a radial with a 30° attack angle.

That indeed will provide plenty of time for the pilot to see the CDI start moving towards the centre and the final turn will be smooth.

Here's how it's done still using the same example:



After taking off from runway 29, we turn right to a heading of 065° to have a 30° interception angle on the 035° radial. As before, that interception angle is perfectly visible on the HSI *(as pictured on the left).*

At position 1, the CDI is offset to the right (meaning the set radial is on your right side) and will start to move slowly towards the centre of the dial as we near the imaginary line.

At point 2, the CDI is centred and we turn to follow the radial on a heading of 035°. Notice, I already started a gentle turn to the left to intercept. If you delay your turn too long, you run the risk of overshooting the interception and flying parallel to the radial on the other side. You would have then to restart a smooth interception to get back on the correct route.

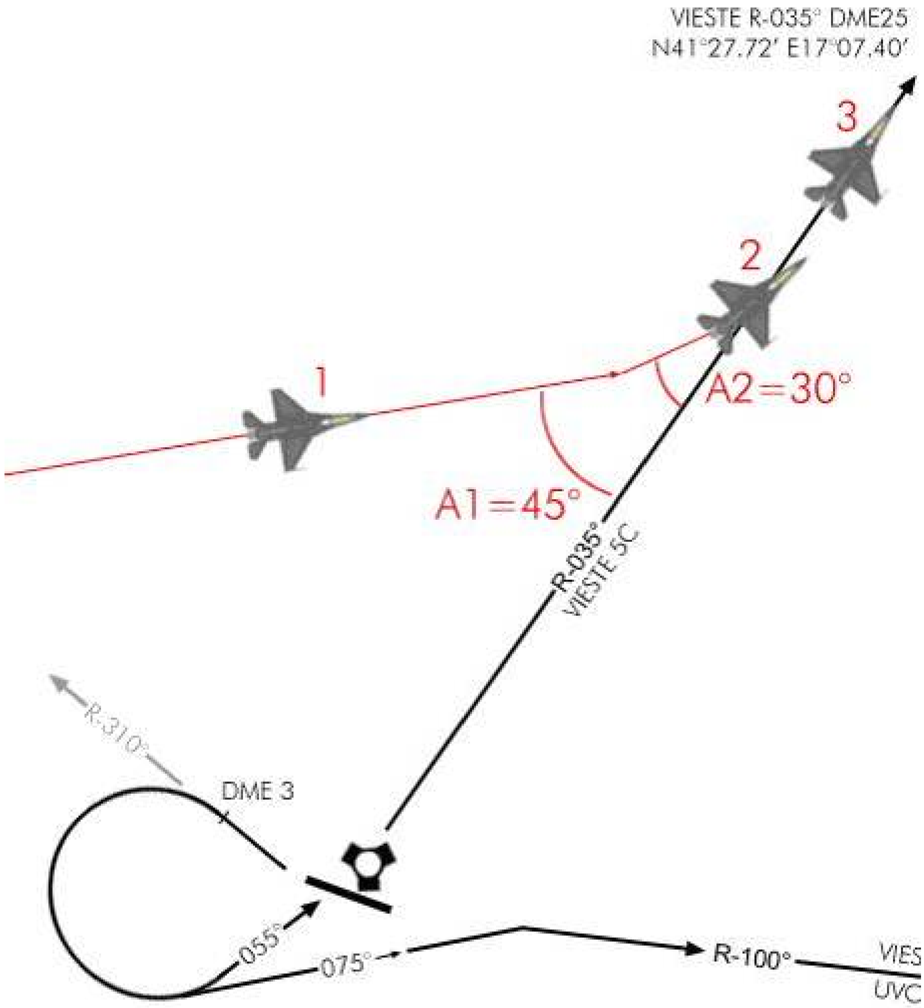
At 13 DME and with such a small interception angle, the CDI moves very slowly giving you plenty of time to intercept smoothly.

Here's the instrument view at point 3. We are going away from the tacan, aligned on the 035° radial.
The station bearing pointer shows the tacan right behind us, confirming the fact that we are outbound.
In a no wind situation, we would remain on the radial and the CDI would remain aligned with the course arrow. In a windy situation, you might drift off the radial and might need to start compensating for wind drift with a small correction angle.

Of course, the situation is a little bit more dynamic than explained on paper. Once the CDI starts to move toward the course arrow, you will need to be ready to turn. You might also turn a little; say by 10° increment, to slow the CDI progression toward the centre. That will give you more time and will flatten the final interception turn and decrease the risks of overshooting the radial.

With a little experience, you will increase your interception angle according to the distance you are from the station (the closer you are, the faster the interception will occur), and smooth it on the run to fly a curved interception on the radial, finishing your turn correctly aligned.

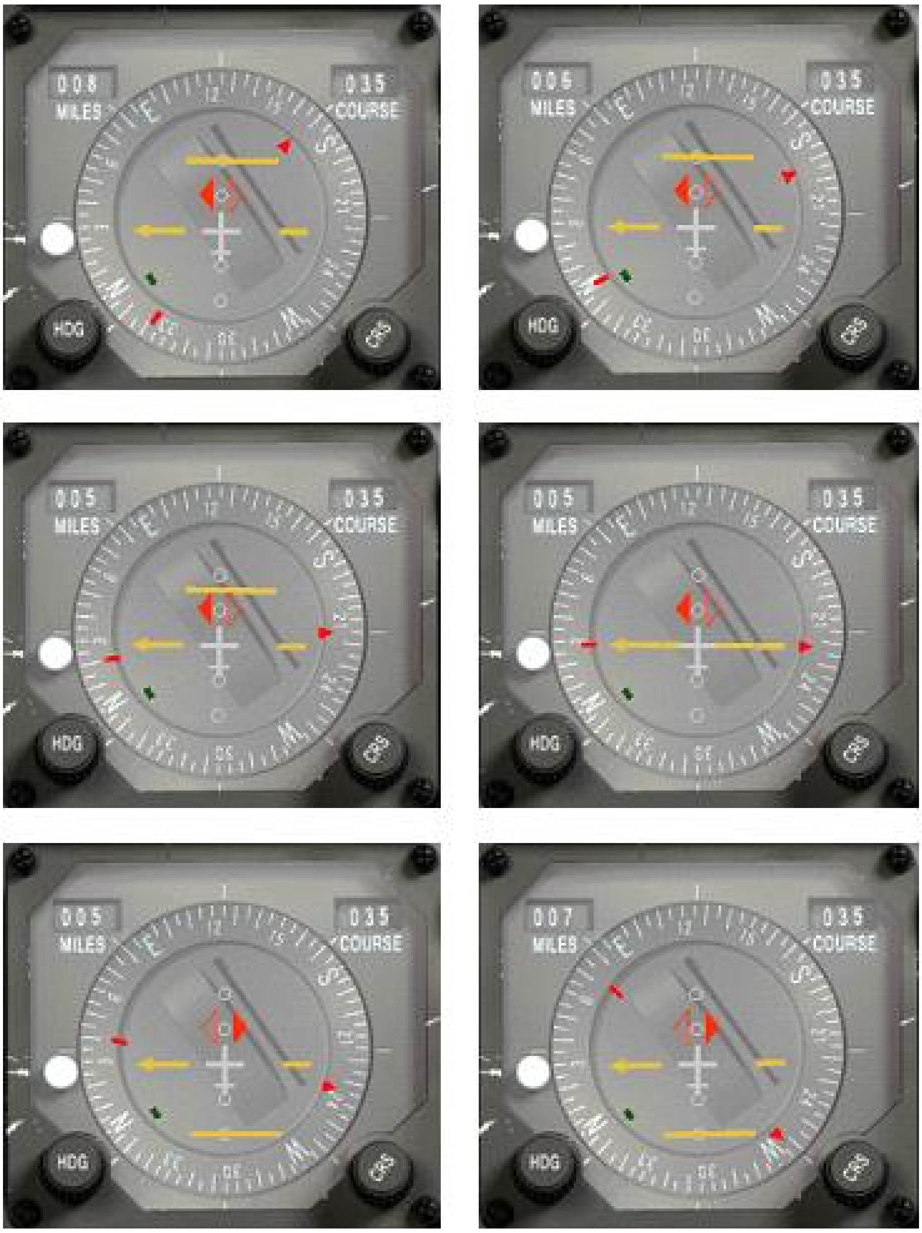
Personally, in Falcon, I tend to use a 45° interception angle and decrease the angle a little once the CDI is one dot from the centre.



As I mentioned above, when you are very far from the radio navigation station, you might want to start your interception with a rather large angle to ensure that you do not go too far away especially when intercepting outbound. (Tacans in F4 have a limited range, remember?) So start with a 90° intercept angle and decrease your angle once you near the radial. Also bear in mind the distance to the station when deciding an intercept angle!

A very good tip here is to use the station bearing pointer. Indeed, you know it points directly to the station, so when the bearing pointer starts to move toward the course arrow (or the end of the course arrow when intercepting outbound – you know the radial is nearing, even before the CDI starts to move. That indication is a good information to help you decide what interception angle to use.

Consider again the following images and concentrate on the red bearing pointer:



The example is the same as the 90° interception above.

The important thing here to visualize is the progression of the red bearing pointer starting at the 1 o'clock position and descending to the 5 o'clock position.

As you know the red arrow points to the selected station and as you are nearing radial 090°, the pointer will move toward the course arrow (point or tail depending if the radial you set is outbound or inbound). When you are on the radial, the pointer will be aligned with the yellow line (right picture of the middle row). As we are just passing the radial in this example, the pointer continues drifting downwards as the tacan goes to our right rear quadrant.

The bearing pointer is a very helpful instrument to help you visualize your position in space relative to an emitter, which is after all the goal of radio navigation. Don't hesitate to use it.

Then there is a trick to intercept the radial very precisely. You know the small aircraft icon in the centre of the HSI represents your aircraft. If you extend a line in front of your aircraft longitudinal axis, you picture your flight path (the white arrow). If that line were to always remain between the CDI and the course arrow (the green lines), you will constantly turn your aircraft until the three lines are perfectly aligned and you have then flown a perfect intercept.

We are intercepting R-280° outbound, meaning we are following the radial to get away from the station. We know we are not too far away from the radial because of the position of the bearing pointer, close to the course arrow tail, and we are at 16 DME from the station. The interception starts with an angle of 45° on the left image. Once the CDI starts to move inboard, the angle between the green lines will get narrower. The trick is to keep the white arrow close to the middle.

The green angle narrows, the projection of the flight path remain in the middle area. Do take care, because if you fix your attention on the HSI, there’s a great chance your attitude will become dangerous. Better check your artificial horizon, speed and altitude as explained below.

The green angle gets even narrower and on the right picture we are almost there. Since we are getting away from the station, the CDI will move slower at greater distance, so in this case, the interception is easy to perform because we have more time to make it nice.

Once established on the radial, all the reference lines are aligned. The CDI is centred on the course arrow, the 2 green lines are common and the white line is also aligned with the green one. As pictured below, we've made a textbook perfect intercept.

Of course, in the cockpit, you don't have the green lines or white arrow. Still there is the 12 o'clock mark on the HSI that could be used as the white arrow to help you, as pictured on the right image. For the green lines, you will have to find your way, but it becomes second nature very quickly with a little experience.

2.5. Tracking a radial once established.

Now that you know how to intercept a radial, let's see if we can track it.

Maintaining the aircraft on the selected radial is very easy in a no wind and no turbulence situation. And we all know we have a very stable platform with Falcon, so that makes things easy for you to learn basic radio-navigation. Still the HSI in the cockpit is small and it's very difficult to fly a heading to the degree. Add to that the Course arrow only selects radials by 5° increments, and you figure easily that 'real' precision flying is a "view of the mind" with our sim. Anyway, read on.

Established on R-180° inbound the station, you need to fly a heading of 360°. Let's say you concentrate on your mission and drift slowly to the 002° heading. It's visible with your HUD heading tape, but you are head down in the cockpit checking the SMS system. (Next time turn the autopilot on, you rookie) Slowly, the CDI will start to drift to the left side of the course arrow. After a while, you notice the drifting of the CDI and decide to centre back on the selected radial. Now don't go take a 45° interception angle to get back on course, there is a great chance that you will overshoot the line and zigzag around it. The best course of action here is to first fly a heading of 360° to stop the drifting from the radial then turn left 2 to 5 degrees (depending how far you have drifted) to gently intercept back the radial.

Try to visualize the position in space by looking at the "god's eye view" the HSI pictures for you.
The yellow line is the set radial; you are in the small aircraft in the centre, and the CDI shows the radial position. The intercept angle will become obvious at a glance: always place the longitudinal axis of the small plane between the CDI and the course arrow. Turn your airplane accordingly and you will make a perfect interception. Once the CDI centres; turn right to fly a heading of 360° to remain on the radial.

The closer you get to the station, the more precise the CDI will become, so it's normal to have to adjust your course when you fly inbound an emitter. The contrary is true as well. The further you fly from a station, the less accurate the CDI becomes.

2.6. What about the wind ?

You know the wind will naturally push you upon one side or the other of the radial, so depending on its force you will need to fly a wind corrected angle to remain perfectly aligned.
Of course that means you need to be aware of the wind direction and speed – but that's easy. Just dobber right on the DCS switch (SEQ position) while the DED in on the main page (STPT) and a new line will appear with wind settings.

On the example to the left, wind is 340° at 9 Kts. With that information in mind, it's easier to decide which wind correction angle to apply and especially on which side!

Unfortunately, winds are not really a concern in Falcon and are usually very slow. So I just fly whatever heading necessary for the CDI to remain centred and I usually end up with a very small WCA – if not none at all.

2.7. Station passage.

Imagine that you're tracking R-130° inbound of a known tacan. Your flight plan will take you right over the emitter and then you will continue on your heading and fly on R-310° outbound the same tacan. You will over fly the station and your heading will remain unchanged on 130° (in a no wind situation).

Nearing the station, the CDI - which is centred - will start to drift toward one side or the other. And the bearing pointer will make a 180°. Once the CDI starts to move (in F4, it usually starts at DME1) don't try to follow it. You're too close to the station and the instrument readings are inaccurate. Just fly along your heading until you are on the other side of the emitter where the CDI will centre again. It might not centre perfectly, and you may want to fly a new interception angle until it centres again.

In real life, we talk about a *cone of uncertainty* when we are that close to the station. It starts sooner the higher you fly. But in Falcon, it's mostly happening very close to the station, whatever your altitude is.

2.8. IFR instrument scanning.

Radio-navigation will bring you from point A to point B on a pre-planned route, but try to remember that your first goal is to fly the plane safely. So don't get fixated on the HSI because obviously it does not give you information about the altitude and speed of your aircraft.
To be able to correctly fly a letdown chart, you will need to master heads down flying by completely forgetting the HUD (and that is the real challenge!)
Down below on the instrument panel, you only have some analogue instruments you will need to use all at the same time. I know, the HUD is much easier, but you can't see the HSI in HUD view!

You have 3 main instruments you need to scan one after the other at all times. The artificial horizon, altimeter and mach meter. I won't cover their purpose here. If you don't know – don't even try to master radio-navigation; it's too soon. What you need to do is this:

1. Look at the artificial horizon, check it's correct according to what you want to do,
2. Look at the altimeter check your altitude is correct.
3. Look back at the artificial horizon, check it's still correct
4. Look at the Mach meter to check your speed
5. Look back at the artificial horizon, still correct?
6. Look at the HSI for radial alignment or intercept
7. Look back at the artificial horizon

And start all over again.

That technique is called scanning and it helps the pilot checking that his airplane is doing what he wants it to do. By acting like this, there's a very small chance that you'd miss a parameter going out of limit *(speed, altitude, etc.).* You also noticed you always have to go back to the artificial horizon? Because it really is the instrument giving your attitude. For instance, if the artificial horizon is flat and shows no turn or a climb, then you're almost sure your speed will remain the same (if the throttle hasn't been touched) and the altitude will be fine as well. So centre your scanning technique on that primary instrument.
You can also include other instruments on your scanning like the AOA and VVI indicator. And according to the situation, you might want to concentrate on the HSI for a little while, but always do get back often to the artificial horizon and maybe less often on the other instruments. Priority.

Needless to say, that scanning technique is mandatory once you switch to heads down view and transition to IFR flying. It is also the only method that will let you fly an IFR approach, STAR or SID procedure because you will need to be at specific altitude, specific headings and specific speed all along the route.

I also discovered that talking to myself greatly enhances my scanning and gives an aural cue of what's to be done next. Especially useful when climbing or descending. I state aloud that I have a thousand feet to go before level off. Or I remind myself by speaking aloud the next step to be completed. It's really useful. Just be sure you are cold mike (teamspeak hot mike can spoil your reputation). My wife already has a good idea of my reputation, so I don't care if she hears me ☺ !

2.9. Things to remember.

Although what has been covered is only the very basic stuff, it's enough for basic radio-navigation in Falcon. You should now stop reading and launch the sim to make some very basic exercises. Start by making sure you know how to fix your position with a tacan (by centring the CDI) and try some radial busting (90°) and finally some intercepts, both outbound and inbound. Experience will do the trick here – we aim for precision flight, so you will need to learn to intercept a radial with a nice curve and finish the turn perfectly aligned and direct, correcting for wind drift. So get some practice, re-read some pages from above and/or call for help if anything is still unclear.

Some points to remember:

- The interception angle will vary according to the distance of the emitter due to radial spread.
- The interception angle has to be determined according to outbound or inbound intercepts.
- To intercept a radial by flying a nice curve, keep the longitudinal axis of the small HSI airplane between the CDI and the course arrow.
- Within 2 DME of a tacan, the reading of the HSI becomes erratic – just fly the constant heading
- Don't forget to check the wind.
- Reduce speed; it gives you more time to think things over.
- When you're heads down in the cockpit, SCAN the instruments or you'll buy the farm.

Gorny's Tips'n'Hints:

Can barely stay airborne, when suddenly you notice your girlfriend looking over your shoulder…! What to do? How to impress? **Simple:** Steer over a highly populated area, and JETTISON your External Fuel Tanks. Now, quickly switch to an external camera, and – pointing at the tanks – say: *"Whoa - Look at the size of THOSE bombs…! They're sure gonna' reek havoc on the enemy below."* Now cleverly hit the Reboot Button with your knee. When the PC shuts down, slap your forehead and say: *"Phew…! The explosion musta' knocked out the Computer's Dilithium Circuits…!"* There'll be one mightily impressed chick at your shoulder. She'll bed you for sure.

Before reading further, you should be able to intercept and track precisely any inbound or outbound radial while maintaining a set speed and set altitude.

Advanced Radio Navigation in Falcon.

To follow the charts, you will need to understand the principles of some more advanced manoeuvres such as performing DME ARC, following an ILS, studying the different holding pattern entries and performing circle to land procedures. Offset tacan approaches will also be documented.

3.1 Following the ILS to the minima.

The ILS works the same way as a fixed tacan radial along a runway centreline, though with some important differences. It's a double radio emitter. One emits in VHF for the localizer - also referred as LOC - and is usually located at the end of the runway (opposite to the approach). The other emitter is paired to the localizer but emits in UHF for the glide slope, also called glide for short. It's usually placed offset to the runway centreline at a distance from the approach end of the runway.

The localizer provides guidance to the centreline of the runway and is pictured in the cockpit by the vertical line in the HIS, the ADI and the HUD. The width of the localizer emission cone varies between 3 and 6°. Such a small cone provides higher sensitivity of the CDI than when tracking a tacan radial. As a consequence, pilots tracking the ILS should make smaller corrections and should make them more promptly than when tracking a simple radial.

As mentioned above, the localizer emits only in the runway centreline direction. That's why you don't need to set the course for the HUD & ADI vertical bars to work as advertised. The HSI course arrow doesn't really need to be set to the runway approach course; the reading of the CDI will remain correct to the ILS, but it may lead to some confusion if the course arrow points backward. The deviation of the CDI would then be opposite to the side of the ILS. This is normal behaviour when the course arrow points to a reciprocal heading of the approach runway heading.
So - to avoid any confusion - it's better to set the HSI course arrow on the runway approach heading. That way. the CDI deviation will point to the Localizer as it would to tracking a radial inbound.

The glide slope provides the vertical guidance to the optimum descent profile which is usually 3°. In the cockpit, it is pictured by the horizontal needle in the HSI, ADI and HUD. Since the emitter is offset from the runway centreline, the glide slope can't be followed until touchdown. Usually, pilots needs to transition from an instrument approach to a visual approach at the minima. There are visual aids helping the pilot's transition at this critical point, and we will cover these later on.

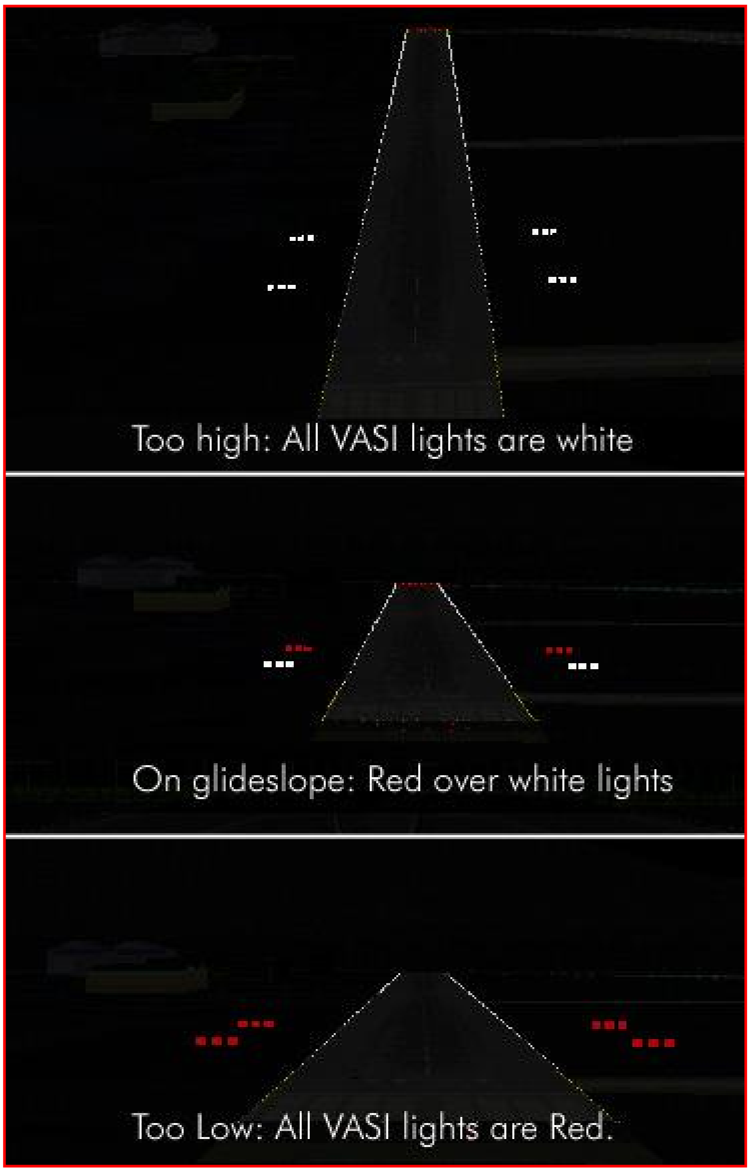
ILS procedures also use two (or more) beacons along the approach track: the outer marker and the inner marker. Markers are displayed in the cockpit both visually by flashing lights and aurally by different frequency Morse code. Unfortunately, those markers beacons are not implemented in available Falcon versions. The F-16 cockpit does have the corresponding instrument though: A green lighted indicator labelled MRK BCN on the right of the HSI, above the FUEL QTY panel. But it never comes ON.

The markers provide range information to the runway.

The outer marker is usually placed between 4 and 7 Nm from the runway threshold and is actually the point where the glide slope is intercepted. Inner markers are placed closer to the runway, usually 3500 feet and should be heard and seen in the cockpit around 200ft above the ground, usually near the minima.

If it were implemented in F4, both markers would light up the MRK BCN indicator making it flashes at different frequency: (low freq for OM and higher freq for MM). Although in general aviation, the colours for each marker are different, in the F-16 cockpit, the indicator is monochrome and remains green.

Backing up the visual cues, a different Morse code would be played in the pilot headset according to which marker is over flown: Outer: dashes / Middle: dot dash / Inner: dots



Finally visual aids are placed on the runway to help the pilot's transition from IFR flight to visual short final approach. In Falcon, those aids are the runway approach lights– which are always the same, whatever the airport and they don't blink as much as a real system would do. The second help you will get is the VASI: Visual Approach Slope Indicator. This system consist of a double bar row each side of the runway. The system reflects coloured lights according to your position on the 3° glide path. The pilot should attempt to fly the aircraft so the far bars are red and the near bars are white. When all bars are red, the aircraft is below the glide path and when all bars are white, the aircraft is above glide path.

There is a mnemonic to remember easily the VASI lights:
"Red over white is alright – Red is dead"

These systems are extremely useful especially in low light conditions when the lack of contrast makes the descent angle difficult to gauge for the pilot.

Intercepting the ILS is done in two steps. The first step is to intercept the localizer. This usually happens at the longest distance from the runway. With the F4 charts it's usually done between 14 and 9 DME. At this point, you concentrate on getting the localizer centred while having stabilized the aircraft at a certain altitude with a certain speed. Between 9 and 7 DME, you usually should be at 2000ft with the loc centred and the glide slope above you and coming down to meet your flight path. At DME 6 or 7 according to the approach, you should meet the glide slope (and the outer marker if it were implemented). Pop the airbrakes if they are not out already and lower the landing gear. In Falcon, extending the gear also lowers the flaps so your aircraft may pitch up for a moment but speed will greatly decrease because of the increased drag. Usually, the drag created by the gear is enough to create a pitch down motion so your aircraft starts descending along the glide path. If not, pitch down a little and place the flight path marker on the minus three degrees on the HUD scale. Concentrate on the instruments; keeping the Loc and glide centred & the on speed AOA (13° green doughnut) and you should make a perfect approach.

The HUD is a real great help here because you can keep the ILS indicators, speed tape, altitude and heading tape as well as the AOA indicators all in view at the same time. And on top of that, the runway will be seen as well, greatly assisting the transition to visual approach at the minima.

Quite often, in F4 and in real life, you may get a visual on the runway well before reaching the minima just to loose the visual a few moments later because a low cloud drifted in the way or because of low fog. So care should be taken to keep scanning the instruments as long as you are unsure that the approach can be finished visually.

Since you committed the minimum decision height to memory, you wait for this moment at the final stage of the approach *(see the chart section for a discussion about the decision height).* If the inner marker were implemented, that's where it would sound. Pilots should then announce runway in sight and finish the approach using the VASI lights and maintaining the green AOA doughnut configuration.

Should the runway not be in sight, the pilot should initiate a missed approach and call it on the radio.

3.2. DME ARC

Many instrument approaches start with a DME ARC because they are an easy means to transition from the enroute phase of the flight to the final approach course. It seems quite complicated but actually it is very simple to fly.

A DME ARC is simply part of a circle around an emitting station (here a tacan) at a given distance. The arc is 1 Nm wide, and the pilot tries to remain within that arc by constantly turning toward the station. The trick is to keep a constant mental image of your position throughout the ARC and to the tacan. Larger arcs are easier to maintain than smaller ones. The speed at which you fly the arc will also define its difficulty level. Obviously higher speeds make it more difficult. And if you try to fly a small arc at high speed, you are in for a lot of fun!

Flying a DME ARC is done in three steps: Intercepting the ARC, flying the ARC, and intercepting the final approach course. The first and last parts are usually the most difficult ones because they usually induce a 90° turn which takes time to perform. Luckily, our F-16 turns fast, even at 300 kts; much faster than a standard rate of turn of 3° per second. With such a rate of turn, a 90° turn takes about 30 seconds, which at 300 kts makes a 2.5 Nm long turn…

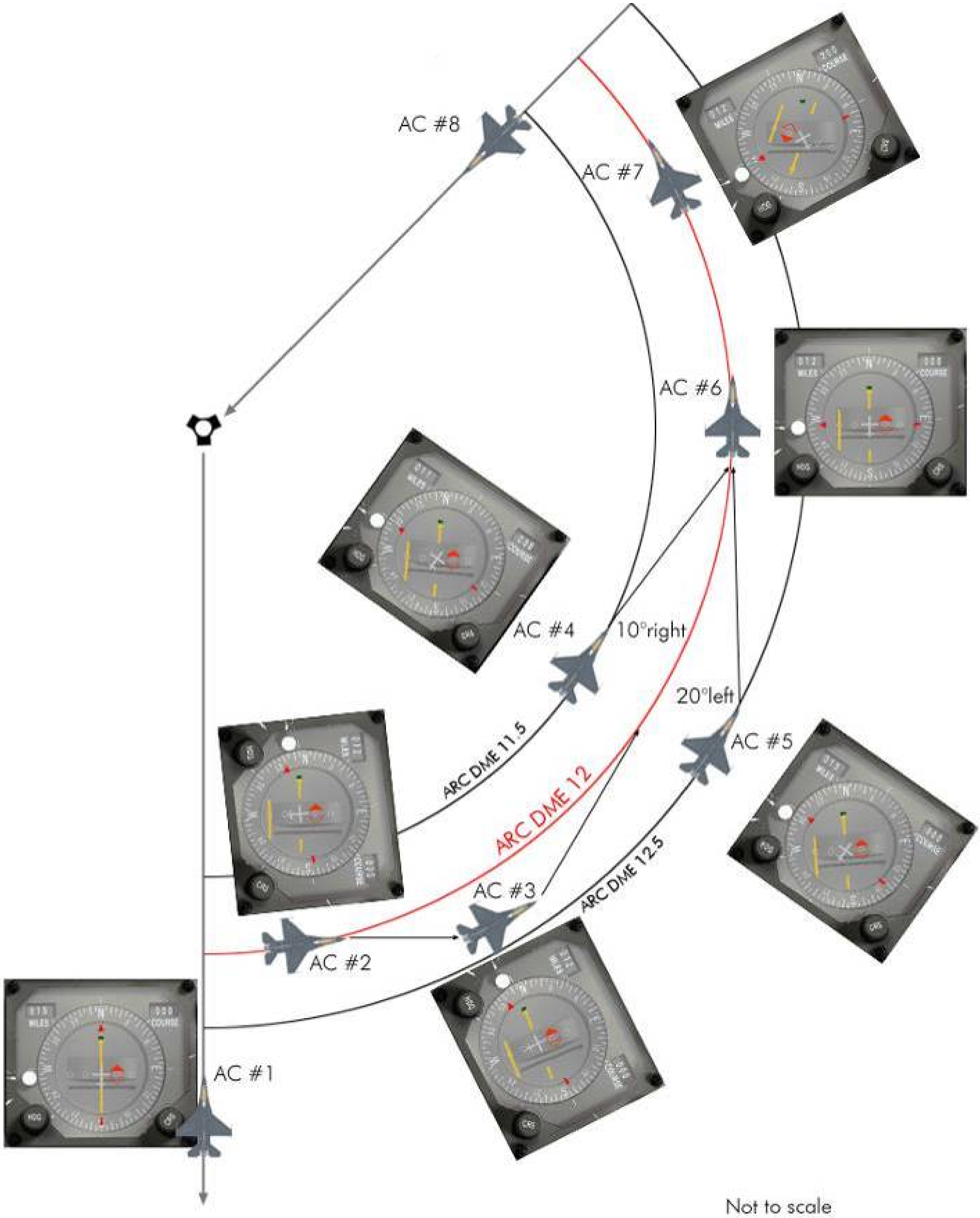
If you fly 300kts and turn at a rate of 10° per second you will need 9 seconds to make the 90° turn. That makes a 0.75 Nm long turn at 300 kts. So you know you need to lead your turn by less than 1 DME to be precisely on the ARC. The final approach turn might be somewhat more complicated, as you will be considerably slower, but we will cover this turn in the chart section.

Maintaining the arc is done by once again using the red station bearing pointer. Since you want to turn around the station, all you actually need to do is to maintain the bearing pointer on your wingtip and turn accordingly so it remains there for the duration of the arc. It is as simple as that!

As you see on the image on the next page, once the DME ARC has been intercepted (by leading the initial 90° turn), the bearing pointer is on the nine o'clock position on the HSI (left wingtip). That's position #2. The aircraft flies a heading of 90° or already a little less. In a no wind situation, it would be possible to make a constant turn toward the station to maintain the bearing pointer exactly on the nine o'clock position and the required DME distance. In real conditions, it's best to let the bearing pointer drift some 5 to 10° past the wingtip and then turn to replace it some 5 to 10° forward of the wingtip. And start the process as often as necessary to maintain the ARC.

At position #2, If the pilot were to continue on this heading, it would reach position #3 and the bearing pointer would start drifting aft of the left wingtip position. The pilot should then turn left some, so the bearing pointer points ahead of the left wingtip position. Then he can fly in a straight line, letting the bearing pointer point to the nine o'clock position and slightly past it, where the process start all over again.

At position #3, If the pilot over corrects (by placing the bearing pointer too far forward of the left wingtip position), he would find himself in position #4 with the DME indicator reading 11Nm. On the other hand, if he did not correct enough (by placing the bearing pointer not forward enough of the nine o'clock position) he would find himself in position #5.



AC #8
AC #7
AC #6
AC #4
10°right
20°left
AC #5
ARC DME 11.5
ARC DME 12
ARC DME 12.5
AC #3
AC #2
AC #1
Not to scale

Its simpler to fly the DME ARC on the inside of the curve, letting the ARC come to you and then turning a little to replace the bearing pointer forward of the wingtip.

To come back on track when inside the curve – as in position #4 - a 10° turn (for each half mile deviation) outside the ARC is enough. If the pilot is outside the arc at position #5, a 20° turn (for each half mile deviation) inside the arc will be required to get back on the required DME ARC. That is of course when the bearing pointer is correctly placed on the wingtip position.

AC #6 is spot on the DME ARC, flying a heading of 360° and having completed a 90° of the turn.

AC #7 is also perfectly on the DME ARC and the pilot gets ready to intercept the final approach course as pictured by AC #8. A lead turn will be required to intercept the radial correctly – notice the 200° radial has been set on the Course arrow to give the reference point of the lead turn.
Bear in mind that you might also want to intercept an ILS instead of a tacan radial.

Refer to the approach chart section for an explanation of the final turn.

Correcting for the wind may seem complicated since your heading is not constant and the wind correction angle will constantly change. If the wind is pushing you away from the station, place the bearing pointer ahead of the wingtip position and use this as the new reference for your turns. If the wind is pushing you towards the station, use a new reference point past the wingtip position. The wind correction angle is then easily viewed: it's the angle between the wingtip position and the new reference point on the HSI.

Besides speed, keeping the altitude at the correct level is critical. Quite often you are flying below the MSA (Minimum Safe Altitude) and there are mountains around you. So scan your instruments properly to not only remain on the DME ARC but also to keep the correct speed (300- 250 kts) and the correct altitude mentioned on the charts.

Usually you start the DME ARC at a relatively high altitude and higher speed (350-300kts) and you want to leave the DME ARC at a lower altitude and with a lower speed near the gear down speed.

As a consequence flying the DME ARC, you will need to change your speed and altitude according to the charts and that will certainly spoil your trim settings… ☺

Did you know you can trim the F-16…? Check out Aragorn's Tutorial…!

Pretty handy whilst flying an IFR procedure.

3.3. Tacan approach

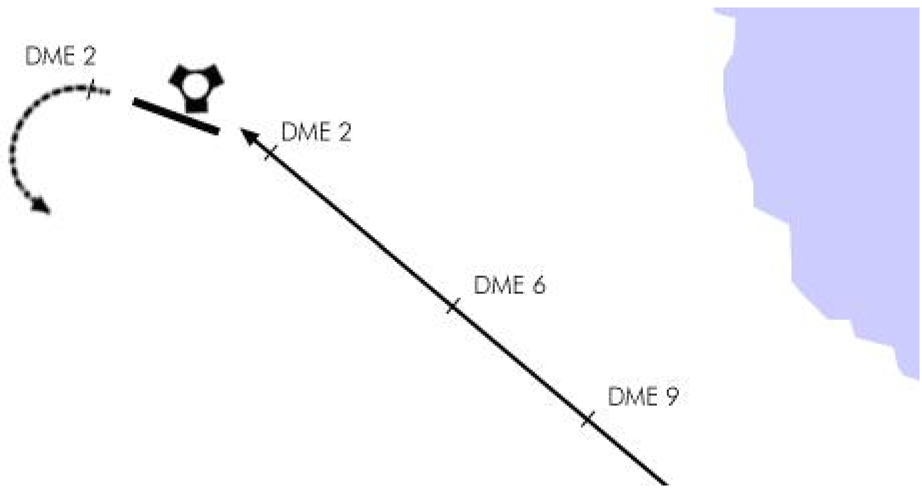
Following a tacan radial to the minima is the same kind of approach as the ILS, but with less guidance. You don't have glide slope information while shooting a TACAN approach, so the altitudes are given in levels to be at a certain distance from the runway threshold in the side view of the tacan approach chart (refer to the approach chart overview). Once again, pilots don't need to fly in level. As long as they can reach a specific DME at the required altitude, they can fly a gentle descent to the minima.

The other aspect specific to Falcon is that since all tacan stations are placed alongside the runway, most of the tacan approaches are offset from the runway axis. The reason is simple, by angling the final approach course from the runway centreline; it's often possible to intersect the runway threshold at the minima. Then only a gentle visual turn is required to align the craft on the centreline.

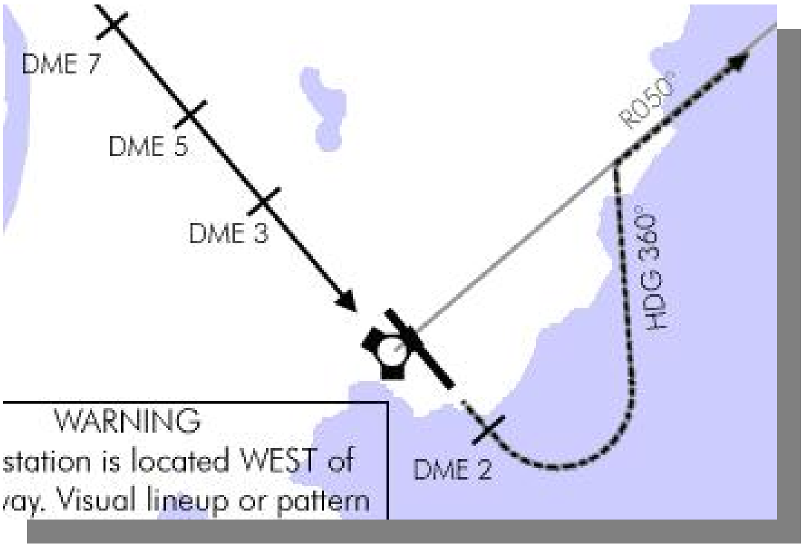
If the chosen tacan radial for the approach was the same as the runway axis (Radial 230° for a 23 runway for instance) the pilot would find himself parallel but aside the runway when looking out of his instrument at the minima. A visual S would then be needed to get on the runway centreline. This double turn is more difficult to fly than the angled approach.
In the charts I created, both type of tacan approach are available… I found the angled radial trick a while after doing the first tacan approaches.

In real life, we can find both approaches as well – but quite often, the emitter is placed somewhere on the runway centreline axis to allow easy alignment on a fixed radial. It's not necessarily a Tacan; it can be a VORDME, a VORTAC or even a NDB.

Since a final turn is almost always necessary for the pilot to align his aircraft visually with the runway, the minima for tacan approaches are always higher than an ILS approach. They are around 500 - 700 feet above ground level. That will leave plenty of time for the final line up.



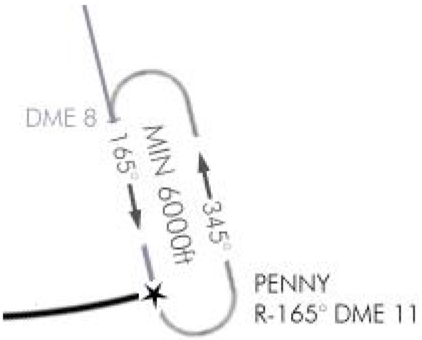
Amendola runway 29 tacan approach is 20° offset and runs down the radial 130° on a 310° heading. As you can see DME 2 is perfectly aligned with the centreline and that's where the minima is. So right there, a left line up turn is all it takes to get on the runway centreline.



Pusan RWY 14 tacan approach is not offset with the runway. As such the pilot will need to make an aligning S turn at DME3 to get on the centreline.

3.4. Holding procedures

Holding in Falcon is not something you will do often unless you are masochist ☺.
Still - performing a CAP is a kind of holding, albeit with longer legs.
The charts have holding patterns published on most approach charts and even on some SID charts. So you need to know how to fly them and - more difficult - how to enter the holding area.



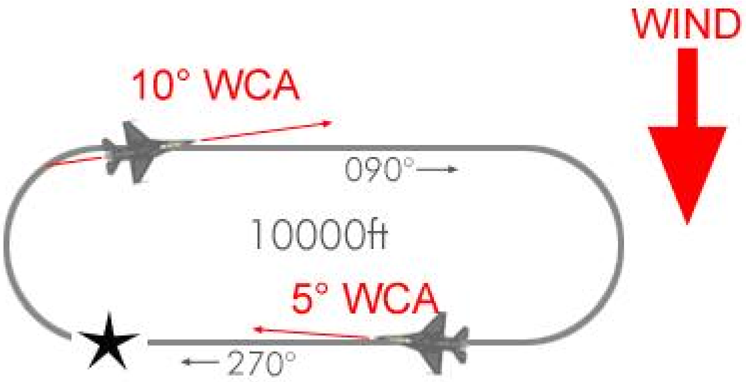
Holding is a racetrack pattern where the aircraft fly at a specific altitude while waiting for trailing elements to rejoin, or waiting during a refuelling, or awaiting clearance from ATC… you get the picture: it is all about waiting.
Indeed, it is not unusual to receive the hold command from the Falcon ATC while other flights are landing.
Patrolling can also be a reason to hold. Flying a longer holding pattern allows 2 aircraft on opposed legs to scan the airspace with their radar in front of them.

Both directions are then searched for intruders.

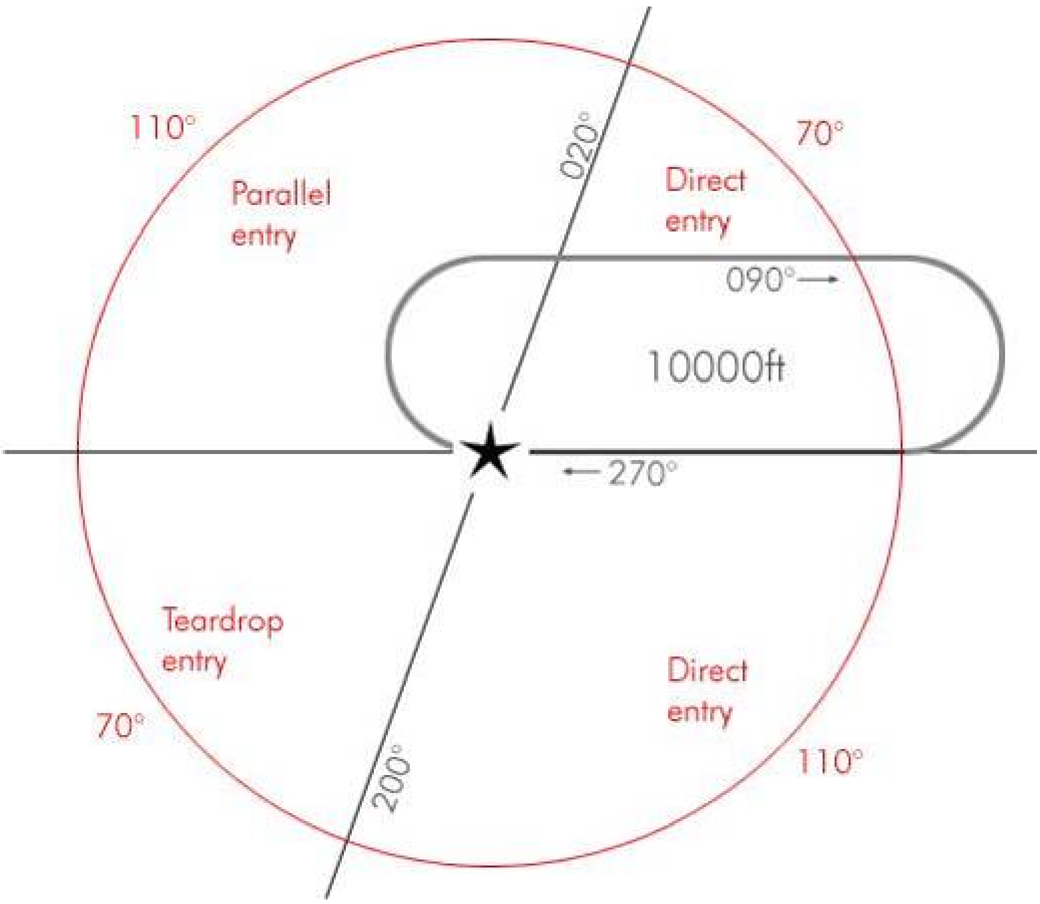
The holding entry point *(usually the IAF or the exit point)* is marked along a known radial, and at a given DME. I fly the racetrack pattern at 300 kts or less and the turns are made at 45° bank angle – 1.5G. Each turn takes about a minute to complete, which is also the requirement in real aviation. The straight legs are also flown for one minute, unless a DME is mentioned on the chart. In this case, the turn should be started passing the mentioned DME. At 300 kts, a minute leg covers a distance of 5 Nm. Note that usually one leg is timed and the other leg is adjusted according to the wind. To time your legs, you need a stopwatch which is available on the right aux console for we cockpit flyers, or there is a hack time clock available in the UFC by pressing ICP button #6: Time. The ICP next button (up arrow) starts and stops the stopwatch, and the previous button (down arrow) resets it. Start timing the leg once the turn is finished, then fly the required heading until the stopwatch reads 60 seconds and start the next 45° bank angle turn. At 300 kts, such a bank angle will make the nose of the aircraft pitch down so constant back pressure at 1.5G will keep the flight path marker on the horizon line. Keeping your altitude is critical since other aircraft may be in the pattern above or below you, and you want to maintain separation.

Both heading legs are mentioned on the chart, so you don't even have to calculate the reciprocal headings. You will need to account for the wind though. Heavy winds can push you out of the holding area. You calculate the wind drift when tracking the inbound leg of the holding – the one on which you are tracking a radial (165° in the image above). If you encounter tailwind during that leg that shortens the leg to 45 seconds, you might want to lengthen the outbound leg by 15 seconds to compensate. So fly the 345° leg for one minute and fifteen seconds. The same method applies when you encounter head wind on the inbound leg that will this time lengthen the time. Just shorten the outbound leg by the same time difference.

Crosswind can be trickier and you will probably notice it when doing the final turn to intercept the holding radial. If that turn is very steep, there is a great chance that the wind is pushing you. Once again, calculate the wind correction angle whilst flying the inbound leg. If you have to apply a 5° correction to compensate wind drift, double that correction on the outbound leg to keep the Hold in the safe area.



The biggest problem with holding patterns is knowing how to enter them. When you are coming from the holding radial, it's very easy since you naturally enter the racetrack. Unfortunately, it's hardly ever the case. Depending on your arrival heading, there are three different entries: Direct entry, Parallel entry and Teardrop entry.

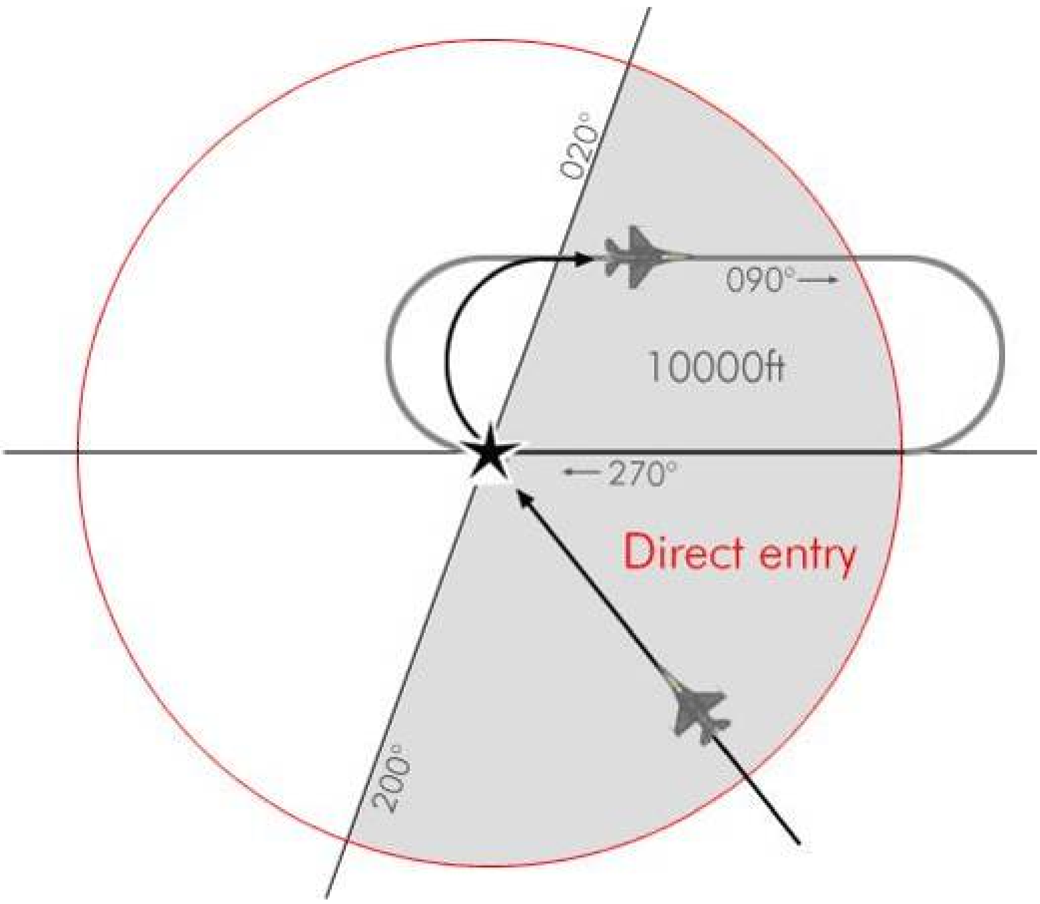


The first thing to do is to visualize the 20° angled line from the entry point. Here, it is particularly easy since the holding axis is 090°/270°. So the angled line is 020°/200°. But it's not always the case and determining the entry you have to fly is often the hardest part of the holding procedure.

3.4.1 *Direct Entry*

The direct entry is the easiest one and luckily covers 180° of arrival route, so with a little planning, you can easily manage to always enter the racetrack with this procedure.

Flying this entry, you just have to overfly the entry point, and then turn towards the outbound leg. It may take several turns for you to fly the correct racetrack but use the inbound leg to position your aircraft easily on the holding radial.



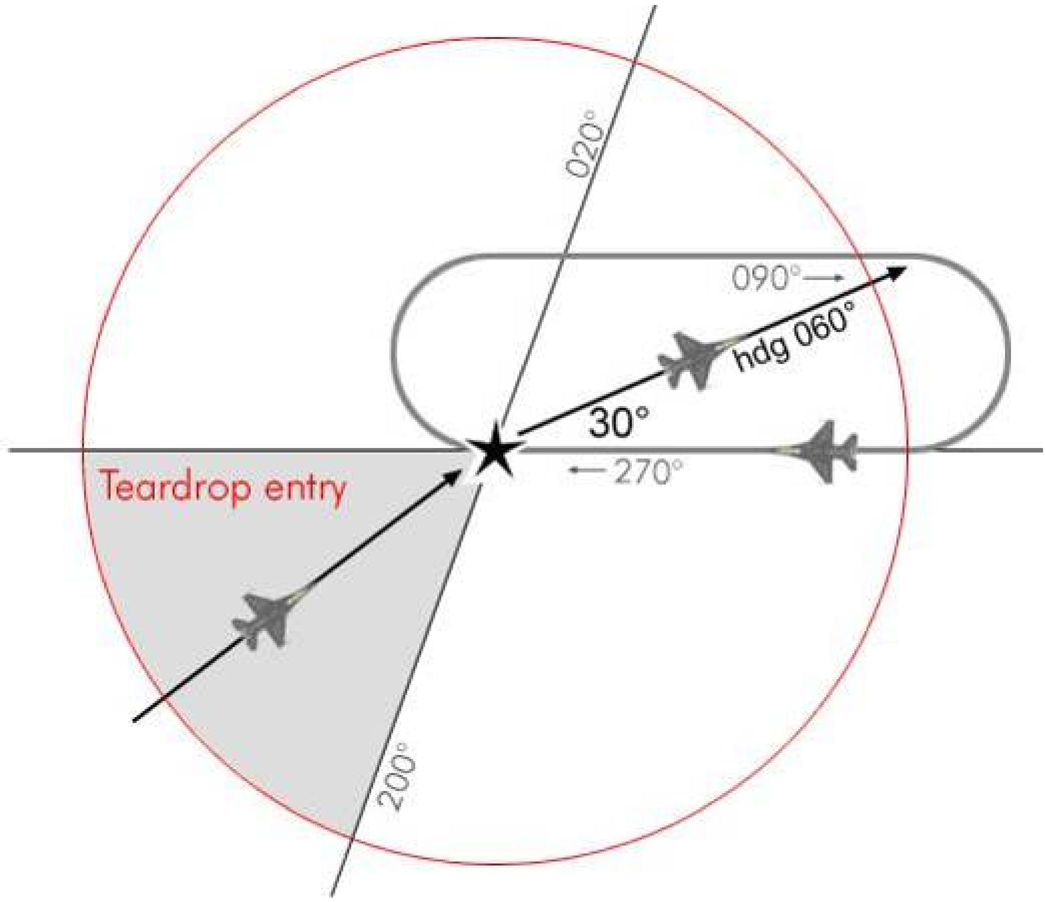
In the above example, the aircraft reaches the holding area with a 315° heading which is within the direct entry quadrant. The pilot simply overflies the entry point, turns right to the outbound leg of 090° and starts the clock when abeam the entry point. The racetrack should be easy to fly since the aircraft is almost directly established.

If the aircraft was coming from the North-East on a 220° arrival route, the pilot would do the same but since the initial turn will remain south of the holding area for a certain time, he might fly the outbound leg a little south of the published route. By intercepting the holding radial on the inbound leg, the pilot will be able to correct his racetrack.

3.4.2 Teardrop Entry

Obviously, turning directly as pictured would push you too far away from the racetrack. So when doing a teardrop entry, the pilot should aim his craft some 30° off the inbound track so he cuts the racetrack in two parts.

Once established on this heading, time for a one minute leg and then start your right turn to intercept the holding radial.

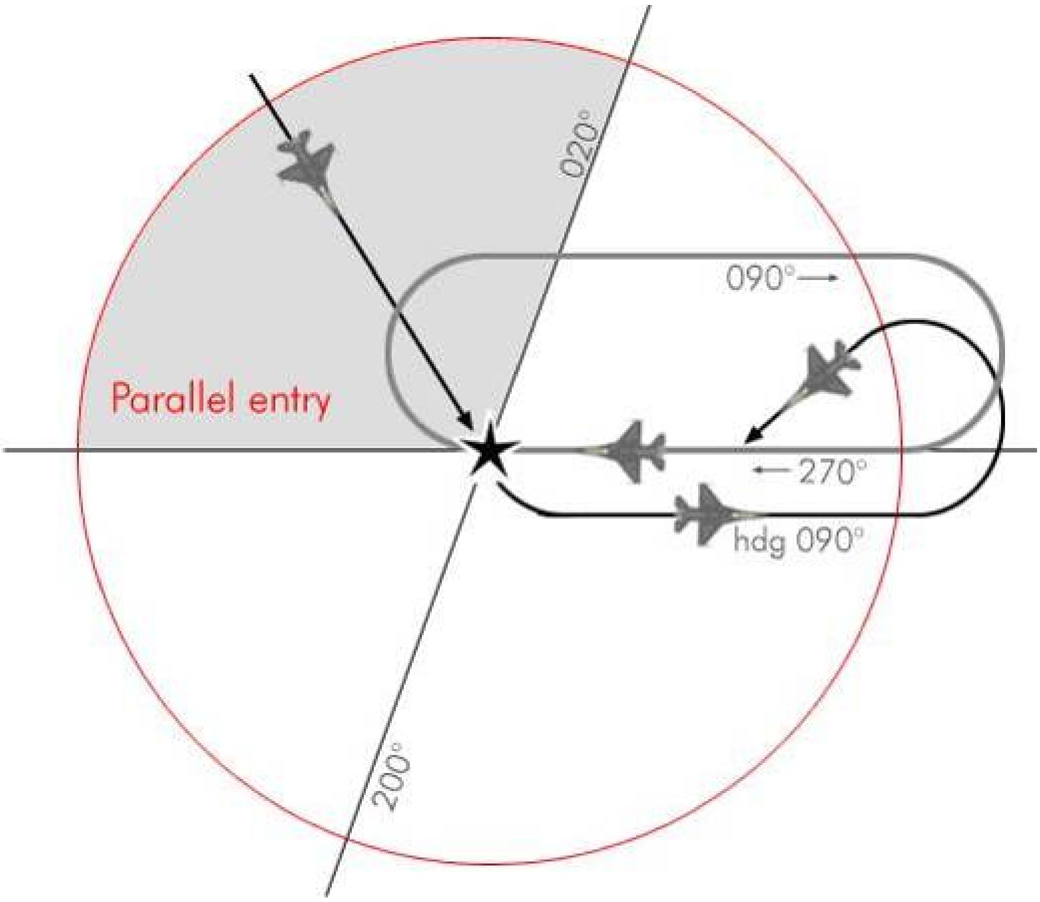


Arriving from a 040° heading, the pilot overflies the entry point and then turns on a 060° heading which is 30° away from the holding radial. That will give him enough room to execute the intercept turn on the holding radial.

He flies that teardrop leg for about 60 seconds before starting the turn.

3.4.2 *Parallel Entry*

As its name implies, the pilot will need to fly a parallel course outside the holding area before making a turn to intercept the holding radial. After overflying the entry fix, the pilot will turn his craft to the reciprocal heading of the inbound leg while taking care to remain outside the holding area where other aircraft might fly the racetrack. That parallel course needs to be timed to one minute as well. Then turn left and cross the inbound holding radial and intercept it from the holding area. Once the radial is intercepted, proceed to the entry fix and fly the racetrack.

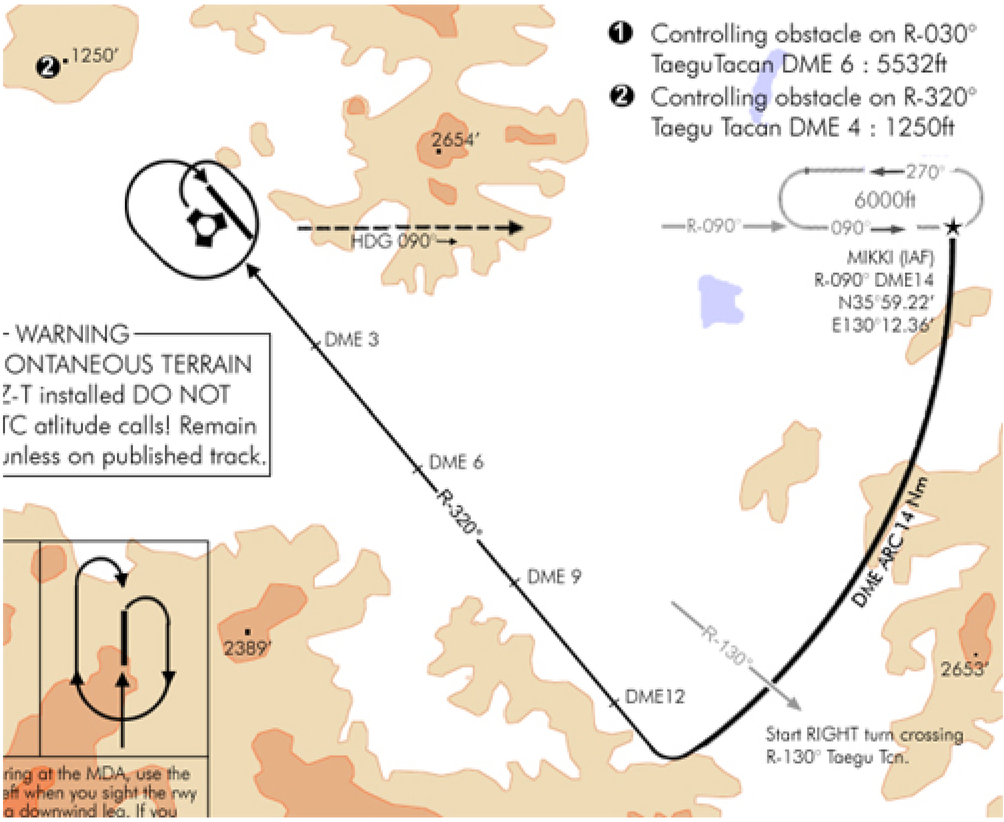


In real life, the holding patterns are rarely published on the charts and the ATC gives the hold instruction on the fly. It's the responsibility of the pilot to visualize the racetrack mentally so he can decide which entry to use.

In Falcon, since the ATC guys are kind of lazy, I decided to publish all the holding patterns, so you can have a quick reference and decide easily which entry to fly. The other aspect is that I didn't always use standard holding patterns (with a right turn) but tried to ease up holding entries keeping in mind both the holding entry and the transition to the final approach. As a consequence, not all holding patterns are standard. Just fly them the way they are pictured on the charts.

3.5. Circle to land

On some airbases, the approach track on one runway can't be flown because of elevated terrain or other restricted airspace. In the Falcon charts, it is the case with Taegu, which is surrounded by high mountains, meaning the glide slope to runway 14 would be too steep to ensure flight safety.

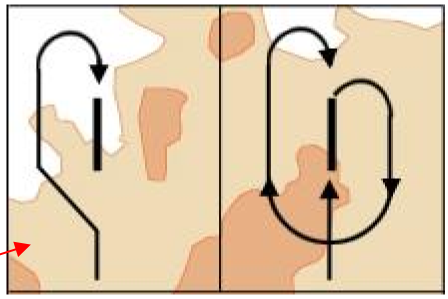


The difficult part of the approach is the non precision final approach which is done visually. Basically, you need to fly the ILS 32 approach, get the airport in sight above the minima and circle the airport at slow speed, remaining at or above the decision height to get on the opposed runway heading.

You cannot leave the decision height until an unobstructed descent to the runway is possible.

In the Taegu example above, there is mountainous terrain all around the airport, so it is critical that you stay very close to the airport whilst performing the circle to land. On many occasions, a pilot thought he was safe because he had the runway lights in sight, but couldn't see the mountain he crashed into.

You don't necessarily have to wait for the minima to fly the circle. You can do it as soon as you have acquired the runway visually. The sooner you have it in sight, the easier the circle will be because you can then enter the downwind leg earlier *(the drawing on the left in the diagram to the right).*



If you get a late visual you need to fly the pattern on the right, which is longer and more difficult.

It does look simple enough for most of you average Falcon flyers. However the circle to land is not an easy manoeuvre because you're low and slow, and need to fly precisely whilst keeping the runway in sight, which - unless you have a Track IR - will induce a new dimension real pilots don't have to cope with: the view panning. Besides - when low and slow, your AOA will probably be close to 13° and forward visibility may be decreased.

If at any time you lose sight of the runway, declare missed approach and climb as fast as you can on the missed approach track.

Navigation Charts Review

Every pilot needs charts, even the fighter pilots. Charts are a means to ensure safety when navigating, especially in an aircraft-rich environment *(around airbases for instance)*. The Falcon charts are heavily inspired from real navigation charts. Unfortunately, many real life aspects are not transposable to Falcon. Such as terrain altitude, runway orientation and type, radio navigation emitters… As a consequence real navigation charts cannot be used in our simulation. I decided to make a chart set for each South Korean airbase using the relevant real navigation charts where appropriate and a lot of guessing when I was lacking real world information. At this time the whole Korea is covered and I'm already working on the Balkan terrain.
Each set is made of an airport diagram, at least one departure chart and one approach chart per runway wherever possible. Some sets have more "special" charts as we will see later in this document.

One of the many downsides of F4 is that we only have tacan as far as radio-navigation stations are concerned. And worse, those tacans are only collocated to airbases. Most of the tacan IRL are also collocated to airbases, but often placed cleverer than in F4 where they are in the middle of the airbase, next to the runway, making tacan approaches always offset. There are also a lot more radio-navigation stations in real life. Especially the NDB (Non Directional Beacons) that are placed between 4 and 7 miles from the threshold and correctly aligned with the approach track. Unfortunately we don't have those in F4 although an INS waypoint can be used to replace them. The tacans we have in most of the currently available Falcon versions are accurate and correspond both in range and channels at the real world data. Although real life data have probably been updated since that work was done back in the SP2 days.

The charts have been created (for most of them) with FF3 and BMS2.0 and the elevated terrain BazT. The elevation figures are correct only when using that version. Although I changed version from time to time, I always tried to check the final work with this 'master' working version.
The charts should remain useable whatever version of F4 you use. FA Allied Forces users should be aware that some tacan changes may have occurred and I can't keep track of all of them to make sure the charts are accurate. I wish I could but I also want to stick as much as possible to the real world data and if F4AF developers decided to change tacan channels for whatever reasons, my bet is that they drifted from real world data and I prefer using these as much as possible. SP4, FF and BMS all have the real world data. Also different in F4AF are all the terrain elevation figures that will be quite lower (because of the lack of BazT) than the ones given by the charts (which is fine since you will then be safe using the charts altitude)

Aside from the above aspects the use of charts will remain the same throughout all flavours of F4.

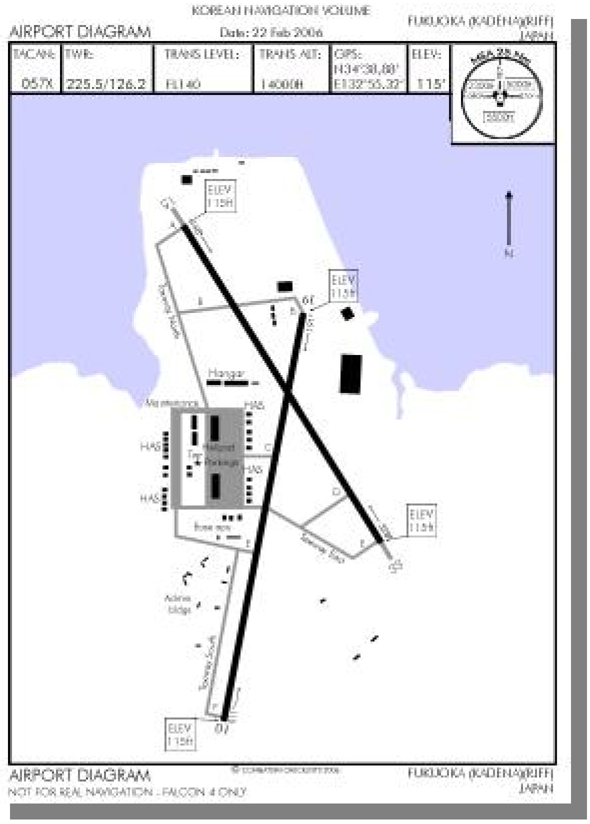
Using charts will greatly enhance your ability to fly safe IFR. But don't make the mistake that you can get into the air without preparing your flight and your procedures. Charts induce a lot of planning, careful review of relevant procedures and you need to be prepared before starting to follow a specific route. Setting correctly the tacan frequencies, the instrument mode or the navigation system may take some time which is very precious when you need to scan the instrument to fly in the blind with a very high level of precision. Add to that the fact that when you really need it, the weather conditions might be very bad (one can hope) or it might be at night with a very high wind situation (and thus great drift) and you will realize that the sooner you set your airplane and the sooner your review the procedure and clear any unknown aspects (for instance the DME ARC initial and final headings) will greatly help you getting safely on the ground.

A final note sounding pretty obvious, but modern times force us to state the following:

The charts are for simulation purposes only – don't use them in real life ☺

4.1 Airport Diagram charts

This chart is a vertical view of the airbase in F4. It has been redrawn from a satellite view in the 3D world, so it corresponds perfectly to Falcon. Although once again, depending on the version of F4 you will use, some objects may change (building missing or other ones placed) The important thing is that the airport and its layout are always the same. The purpose of this chart is pretty obvious, it allows the pilot to taxi to anyplace on the airbase according to ATC instructions or multiplayer procedures of each squadron. The runways are marked with their orientation: 15/33 and 01/19 in the Fukuoka example on the right. 15/33 means that the general orientation of the runway is running along the 150° heading and the reciprocal to 150° which is 150+180=330°. Only two large figures are painted on the runway pavement, there is no room for three.
So it was decided to give the orientation with the two first number of the runway heading.

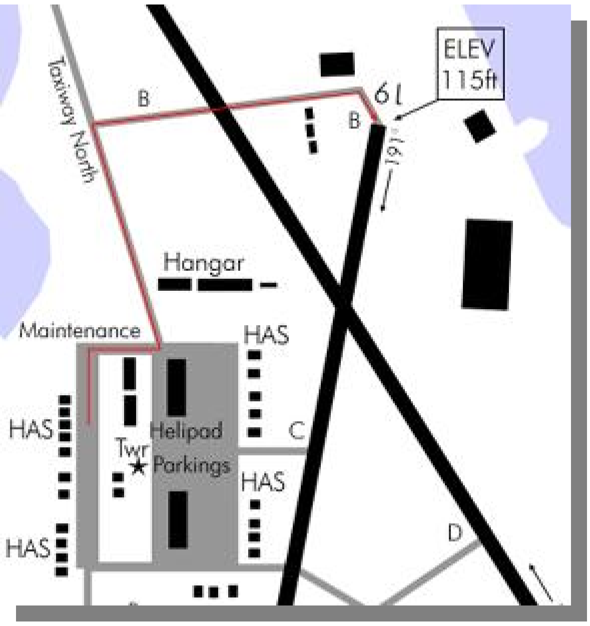


Of course the precise orientation might be slightly different, such as it is the case in our example. Runway 19 of Fukuoka is actually 191°: 1 degree more than 190. So the reciprocal would be 1 degree more than 010: 011°. Indeed, 191-180=011°. The actual heading of the runway is always given along the runway edge, in full, with a black arrow. (See picture on the left)

The RWY lengths are of no importance in Falcon since they are mostly too short anyway, so I decided not to give them.

The taxiways are labelled from A to F or more whenever necessary. That will allow a multiplayer pilot to state is position very easily for other members of its flight. The leader can also state its taxi route from the parking position to the runway for all his flight members: “Sting flight, lead – taxi to runway 19 via taxiway North, Bravo.

Of course it’s the ATC job to give such an instruction to the leader of the flight but since the F4 ATC is kind of lazy, it falls on the leader responsibility to keep his flight informed.



As pictured by the red line *(at left)*, the flight would then follow the assigned taxi route to the runway – provided they were initially parked at the HAS (Hardened Aircraft Shelter) Care should also be taken before crossing rwy 15/33 that there is no aircraft taking off or landing on that strip. Probability is low but better safe than sorry – you won’t loose your life over it, but you may loose more than an hour of mission planning and briefing.

Initially, I marked the place where the player’s aircraft is supposed to appear from the UI as the MIL RAMP, but as my work slowly progressed – the entrance point changed, so the Mil Ramp is not accurate anymore and I even discarded it on the last charts I did.

You may also have noticed, the charts always share the same colour codes. The runway and objects such as buildings and installations are always black. Tower is always a star symbol (★). Taxiways are always grey, ground is white and water is blue. The magnetic North is always pictured by a black arrow – for obvious reasons, I choose not to illustrate the magnetic variation. Most of the airport charts are oriented with the North pointing on top of the page, but in some cases, like the 08/26 airport diagrams, I preferred to rotate the whole airport layout so it may be printed larger. Thus on those charts, you may find a north arrow pointing toward the side.

Most indications on the airport templates are self explanatory.

(I will explain the charts header later)

Taxiways are labelled by capital letters starting with A. On the ground, you see those labels on yellow signs – so use them to taxi correctly. In F4, only the taxiways crossing to a runway are labelled. The ones parallel to the runways are not labelled - which of course is a serious breach of safety. I decided to call these according to their main direction from the centre of the airbase. So you may find taxiway North, South, East and West.

With this information, any taxi route should be clearly stated.

Here's a list of some terms used which may not be understood directly:

HAS: Hardened Aircraft Shelter.
POL: Petroleum Oil Lubricant – basically some large tank
Twr: Control Tower
Apron: parking area for planes - mainly used on the airstrips charts
Base Ops: Stand for base operations; it's just some buildings I designed as such.
Mil Ramp: was initially designating the spot where the player would enter the 3D world but was abandoned in the process.

Each runway end has its elevation in feet given in a square box. Those are MSL (Mean Sea Level – altitude given with the level of the sea as zero.) In Falcon, it will not change because the entire airbase stands on the same tile with a fixed altitude. But in real life, you may have variations from one end to the other, telling the pilot if the runway course will climb or descend.

Sometimes, a warning or a caution or a notice box will also be displayed on the airport charts warning the pilots of any event that may be a concern to flight safety. I admit - some of those boxes might just be eye candy and not really appropriate for the Falcon world. Still do read them, some might be important.

WARNING:
Extensive helicopter traffic all quadrants
Uncontrolled vehicules on parallel taxiways ...
and sometimes runway - use extra caution!

The airbases in F4 are quite always the same because they share the same template according to their runway orientation. There are actually **27** different layouts some of which are not used at all. That is the reason why the F4 airport can't be modelled at this time according to their real world counterpart. Only Seoul, Sunan, Osan and Kimpo have a unique layout in Korea and are modelled close to the reality. All the others are generic airbases categorized according to their runway headings. A 03/21 airbase will always be the same – the taxiway may switch side but the layout will remain identical. So it is not uncommon to see two airports almost identical.

If you are interested in airbase layout and tiles, I wrote a document quite a long time ago about that.

It can be found by following this hyperlink:
http://www.candyparty.com/ST/SP/Airbase_tiles.pdf

4.2 Approach charts

Let's get to the heart of the matter. The approach charts are clearly what makes these charts worthy. The purpose of the approach charts is to ensure that the pilot can land on the assigned runway whatever the meteorological conditions are. As a fighter pilot with modern waypoint needs to be able to hit his assigned target in bad weather, he thus needs to find his way back and land safely in the same kind of weather. Granted, bad weather is unfortunately not common in Falcon. We had a very good weather model in BMS 1.3. That was actually the spark to the charts beginning. Unfortunately, the weather model was abandoned with BMS 2.0 and today, we have no more bad weather in F4, except fog in F4AF. Anyway since we lost the weather, I remained confident it would come back at a certain time, so I continued working on the approach charts.

Once the weather goes bad, the pilot transitions to IFR which stands for Instrument Flight Rules as opposed to VFR (Visual Flight Rules). As the names imply, VFR is flown with the head outside of the cockpit looking for visual landmarks and IFR is flown with the head inside the cockpit, looking at the flight instruments and navigation charts.

Each approach plate is subdivided in five different zones – as pictured on the following page:

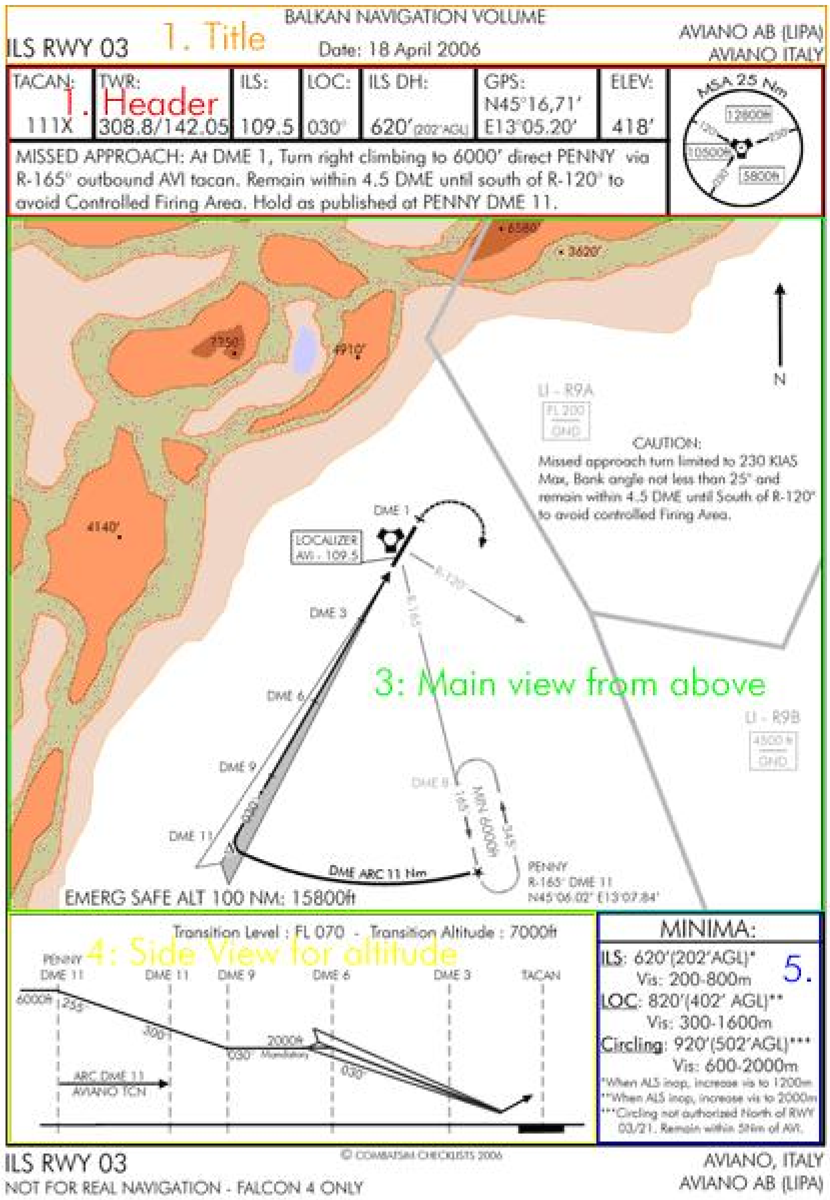
1. Titles (orange)
2. Header (red)
3. Main View (Plan view) which provides a god's eye view around the airport. (green)
4. Side view (profile) of the approach to see the altitude throughout the approach track (yellow)
5. Minima: A window of information about the minimum alt. according to the type of approach. (blue)

In Falcon, we have four different types of approaches

- Visual where no chart is required. This is the standard overhead recovery.
- ILS (instrument Landing System) where the pilot follow the ILS steering cues.
- Tacan approaches when there's no ILS available and the approach is flown along a set tacan radial
- Circle to land approaches when for any reason the approach cannot be made on a certain runway – we use the other runway approach and then circle the airport to land to land on the correct runway.

Once again, there are many more approach types in real life such as NDB, VOR approaches, GPS approaches, radar controlled approaches, etc.

But the charts mainly cover the four type mentioned above.



The above picture illustrates the five different zones of the approach chart for the RWY 03 ILS approach on Aviano – Italy.

Let's see each section in detail but bear in mind that, as the pilot, you will need to read all of them at the same time, according to the position of your aircraft on the approach.

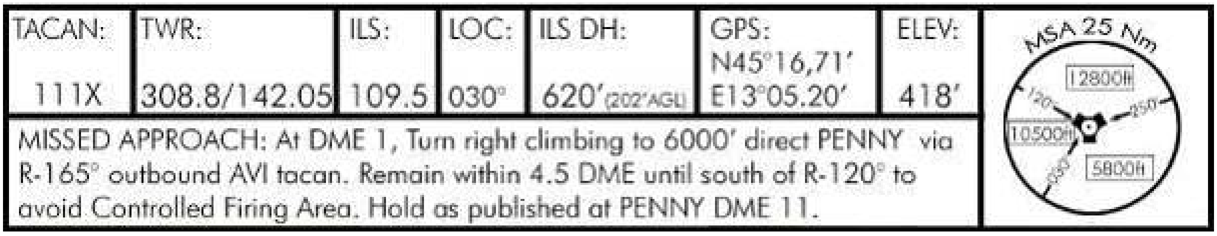
4.2.1. Titles

The titles actually are made of the top and bottom section.

The first indication is for which navigation volume the chart is made for. Here Balkan, but most are made for Korea. Then it clearly states the type of approach, (here an ILS), the runway the approach refers to (here rwy 03) and the name of the airbase: Aviano AB which is in Italy. The second Aviano actually state the city because sometime the name of the airport might be different than the city close-by.

The date is simply the date at which the chart was completed and besides eventually telling you it's the latest one (because no more recent chart is available through my website) it is not important.

4.2.2. Header:



The header section gives the pilot plenty of information relevant to the airbase and approach. The headers are always similar, even for a different approach types. Of course tacan approaches won't mention the ILS, but the Tacan radial and the Tacan DH instead.

The top left section gives the airbase Tacan channel and band. Although this information is not really useful when shooting an ILS approach, it is nevertheless required because most of the navigating before intercepting the ILS will be made using the tacan as the main radio navigation station.

The second section states the airbase tower frequency both in UHF and VHF. Now we don't use that in F4 for the time being. Should we have active UHF and VHF radios, those frequencies would then be inputted in the UFC with the ICP on the relevant COM pages. Failure to do so would prevent the pilot to communicate properly with the airbase ATC drinking beers in the tower. Unfortunately, in current version of F4, we don't need to switch radio frequencies so the tower frequencies are mainly eye candy. They are accurate though … well for most of them anyway.

The third section gives the ILS frequency. For the ILS cues to be displayed the aircraft instrument needs to receive the radio emissions of the ILS. Once again, unfortunately this is automatic in F4 and is tied with the tacan channels. So if you tune in the correct tacan channel, the system knows which ILS you're going to use. This is highly unrealistic as one airbase may have lots of runways with lots of different ILS frequencies. Sometimes, reciprocal runways might share the same ILS frequency but usually different runways each have their own ILS frequency. But currently in Falcon, the ILS displayed is the one of the stations.dat file.

Another consequence of this way of coding the simulator is that we cannot really force the pilots NOT to use ILS when there's no ILS in real life. For instance on Aviano, the approach from the East is not possible because of a live firing range. Unfortunately, Falcon displays ILS steering cues for runway 21 which will probably put the pilot at risk of taking and artillery shell through his wings during the approach!

But there's no such thing as a live firing range in Falcon, you may say. And I'd say yes, you're right! But, some ILS tracks will make you smash in the side of a mountain, for the same reason And that would spoil your mission wouldn't it? ☺

So basically, I decided to make a chart for an ILS approach whenever there's one in reality.
If there's no ILS on an airbase for whatever reason, there will not be an ILS chart, but a tacan approach chart.

The correct way to have the ILS work would be to untie it from the tacan station and be able to manually set the ILS frequency from the T-ILS page of the ICP. In this case, 109500 would need to be punched in the same way we would input the tacan channel in the system *(as explained on page 8 of this document)* Being more than 3 figures, the system will know that the pilot is punching a radio frequency, and being the T-ILS page, the system would know that frequency is for the ILS. This way would ensure that when there's no ILS – there would be no steering cues and the ILS flags would remain red tagged.

The following box gives the **ILS DH** which stands for ILS Decision Height.
It's actually an error I've made…! The section should say ILS D**A** for ILS Decision Altitude.

Indeed, when we talk about height (H) we mean above ground level, while we talk about altitude (A) we mean above mean sea level (MSL). **I will correct this as soon as possible.**
The value is given in feet MSL (here, 620') which is the altitude above seal level where the pilot should have the runway in sight to be allowed to continue the approach. If the runway is not visible, the pilot needs to go around and start the approach all over again. We the say the runway is below minimum. The smaller numbers (202'AGL) is the real D**H** because it's given above ground level. Notice that the indicated altitude given by your altimeter in the F-16 cockpit gives you the altitude MSL – We can't set the altimeter according to the local altimeter setting in our sim.

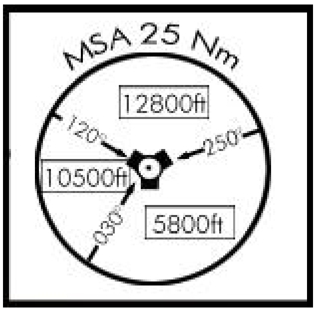
We will talk back later about the minima when covering this section later on.

The next box is the GPS coordinates of the airbase. Due to some projection problem in the way F4 was originally coded, these GPS coordinates don't correspond to the real world. No big deal since the one given on the charts are the ones used to navigate to the airbase by punching them into the STPT page of the UFC.

The ELEV box gives the elevation in feet of the airport above mean sea level. Aviano stands at 418 feet above see level. It means that sitting on the ground, the altimeter should read 418 feet. That information is quite important for landing but – unfortunately - it varies according to the flavour of Falcon you're flying …

The long window is the Missed approach procedure. In case of a go around, the pilot needs to follow this route back to the IAF (Initial Approach Fix) unless otherwise instructed by ATC, which of course in Falcon never happens. A pilot may decide to go around at any moment along the approach but he has to go around if he does not have the runway in sight at the minimum altitude. When going around, the pilot declares missed approach on the radio frequency and starts flying the correct route – The ATC expects no less from you.

The final section is the large square on the right with the big circle in it. It's the MSA information: ***Minimum Safe Altitude***. It gives a topside view of a circle of fixed radius centred on the relevant tacan with safe altitude (MSL) according to quadrants limited by arrival headings.

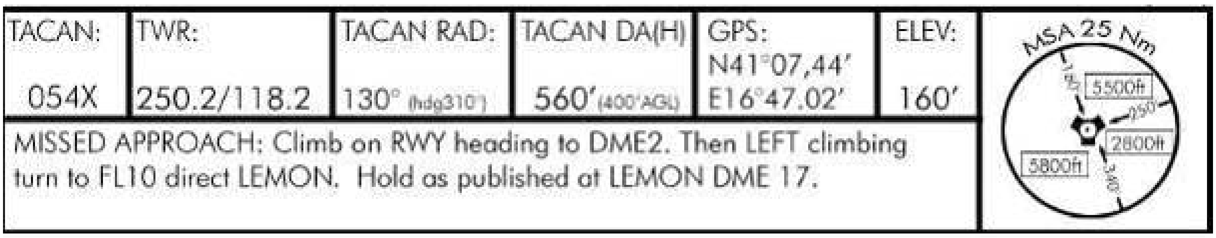


In this example, pilots should notice that the minimal safe altitude between arrival headings of 250° and 030° is 5800 feet MSL. The minimum safe altitude between arrival heading of 030° and 120° is 10500ft MSL and the last sector between arrival heading of 120° and 250° is 12800ft MSL. Basically, it means that we have high terrain at least 11000 ft on the northern sector and high terrain at least 9000ft high on the western sector.

Pilots should stay at or above MSA when arriving to an airbase unless they are on approach track which of course will go lower while remaining safe because clear of known obstructions. In the Falcon charts, the radius of the circle will always be 25 Nautical miles. Those figures are checked in the 3D world and once again are relevant to BazT. Since it's the highest setting we have in Falcon as well as the one closest to real elevation figures in Korea, you can use these even when flying another version of F4 since the elevation figure will be lower anyway.

An empty circle with only the tacan in the centre and only one altitude means that the MSA is valid all around the airbase for the fixed radius.

Tacan approaches charts have a different header since some information such as ILS are not required.



TACAN:	TWR:	TACAN RAD:	TACAN DA(H)	GPS:	ELEV:
054X	250.2/118.2	130° (hdg310°)	560' (400'AGL)	N41°07,44' E16°47.02'	160'

MISSED APPROACH: Climb on RWY heading to DME2. Then LEFT climbing turn to FL10 direct LEMON. Hold as published at LEMON DME 17.

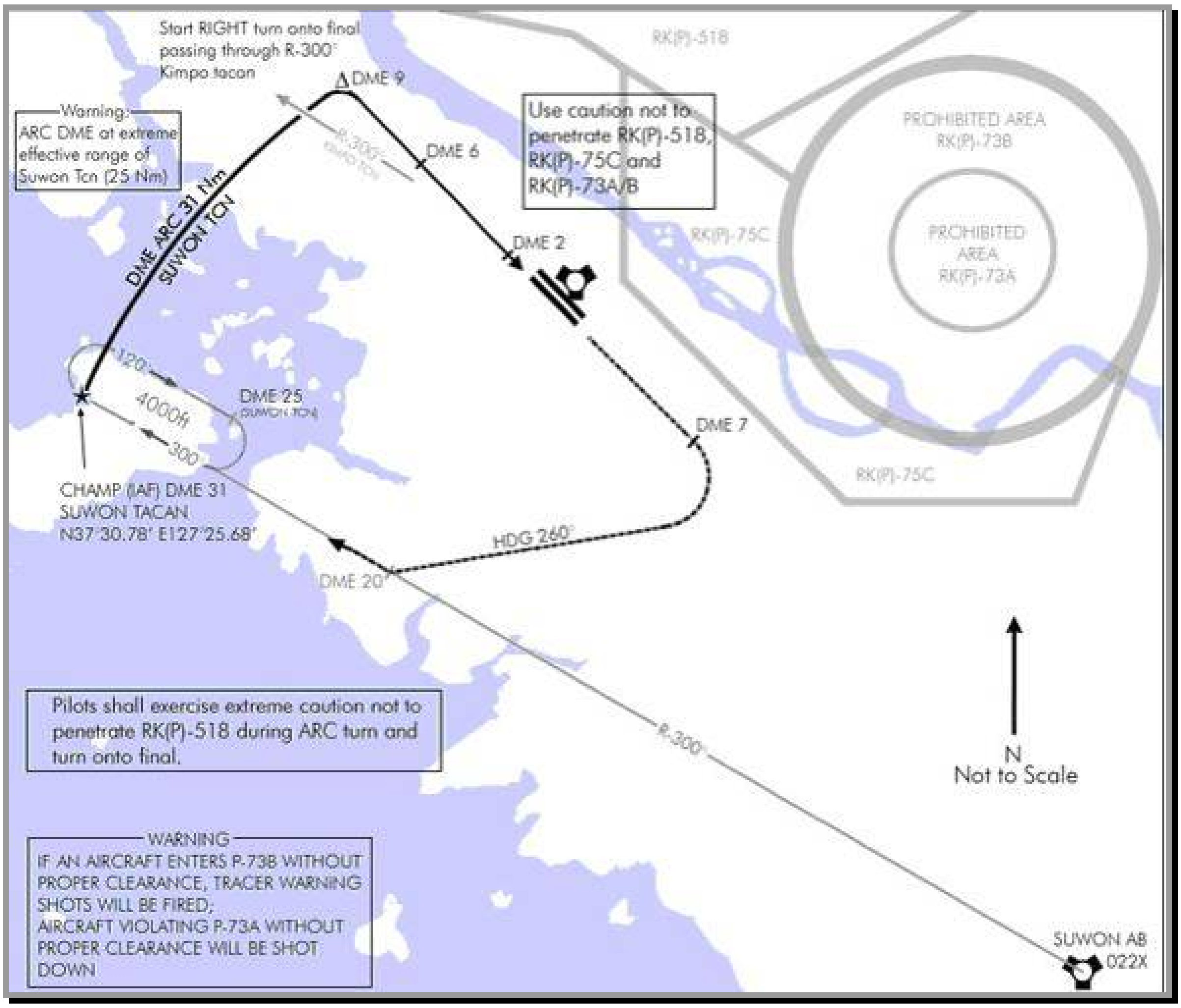
The ILS section is replaced by the TACAN RAD giving the radial along which the approach is flown. Note that the corresponding heading is given as well. The ILS DA(H) is obviously replaced by the Tacan DA(H) giving the corresponding minimum altitude (height) for this tacan approach.

4.2.3. Plan view.

The main view is also called the airport plan view and illustrates the airport and its surroundings with the approach track when viewed from topside. A lot of information is given to the pilot on this view.

The most obvious one is the approach track pictured in black and finishing with an arrow pointing at the airbase. That track always starts at the IAF (Initial Approach Fix) pictured by a star symbol. You also see the runway, correctly oriented and the tacan – properly placed from the runway.
The missed approach track is always pictured as a black discontinued line finishing by an arrow. Relevant radial are dark grey as well as holding tracks and restricted or prohibited no fly zone are in light grey.

In various shades of brown you will find the elevated terrain, the darker brown the most elevated the terrain is. Summits are pictured by a black dot with the elevation in feet MSL. And finally the water is pictured in light blue. You will also find different caution and notice boxes warning the pilot of dangerous items relevant to the approach. And of course the mandatory North pointing arrow will be always displayed with the mention: Not to scale where appropriate.



Before seeing how to follow the approach track, let's talk a little bit about the restricted and prohibited area and maybe some more information about the elevated terrain.

Airspace is always categorized in different zones. For instance, we have class B, C and D airspace around airport in the US (TMA zone in old Europe) – class A airspace above the transition level for jet routes, Class E airspace below the transition level for the Victor airways and finally the class G airspace which is usually closer to the ground for VFR flight.

Amongst all that, and more important to us Falcon flyer (because we don't really care about jet routes and victor airways do we?) we can find prohibited areas, restricted areas and Military Operations Areas. The three concerns us greatly in Falcon – because most often they are military area and although we do explain here a lot of civilian IFR, we after all are flying a military airplane.

Prohibited areas are no fly zones, even for military airplane. They are put in place to protect national interest items such as a city, a presidential palace or a secret airbase for instance. They usually are named with a P. RK(P)-73B as in the example above. RK stands for Republic of Korea. (P) means Prohibited and 73B is the number assigned to that prohibited area. Some prohibited area may be so sensible that you may be fired upon if you enter it, as it is the case here with RK(P)-73A since that airspace is protecting a very high national asset.

Restricted areas are zones where flight operations are subject to certain limitations. You need to be cleared by ATC before being allowed to enter such an area. They may be a firing range or a zone where safety of flight is not assured continuously. They are labelled R such as RK(R)-14 near Kwangju.

MOA are military training areas where you and I go hone our dogfight or mud moving skills, we at least in the Falcon terrain! So we can go there without really bothering. Just be on the lookout for other shit hot pilot trying some new trick on you.

All of those airspaces might be limited in altitude. That information is stated on the charts. The lack of altitude box means that the airspace is unlimited from ground to as high as you can go. But if there is a box such as illustrated on the left, it means the airspace is limited from ground to FL200.

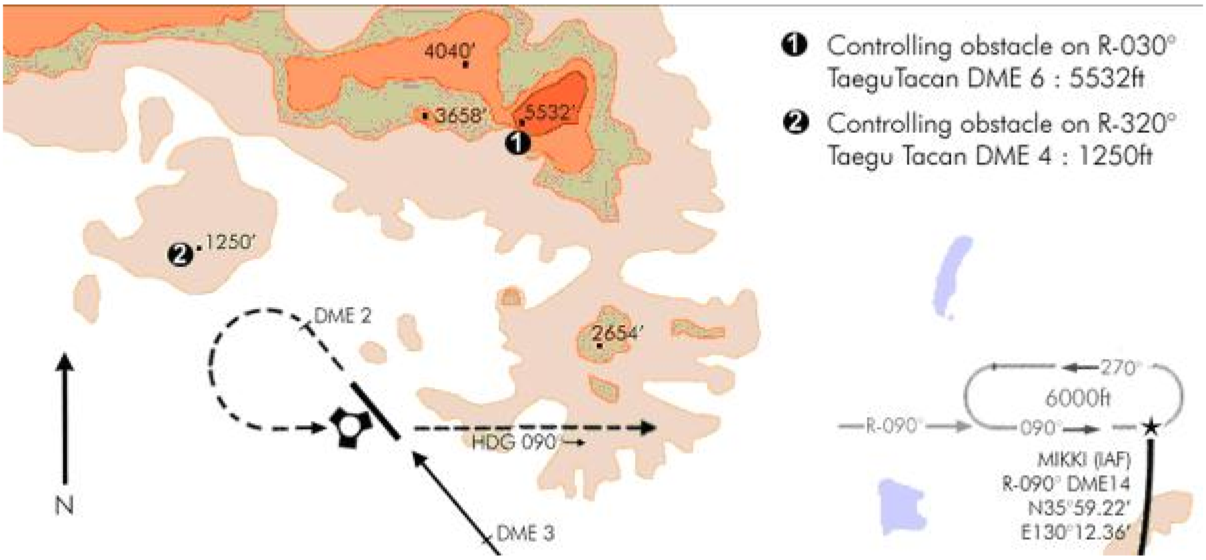
(FL stands for Flight level, that notion will be explained later but basically is an altitude given in hundredths of feet: FL200 = 20000ft) So if you are on FL 250, you can over fly it without any restrictions.

Another item of interest as far as airspaces are concerned are the ADIZ or Air Defence Identification zones. Those are buffer zones where any aircraft coming in from abroad needs to be properly identified before being granted access. Once again, this has no interest in Falcon, but it's somehow nice to play the game, especially when coming back from Indian country or even when crossing from Japan to South Korea.

Bear in mind that air defences may make mistakes and shoot at you if they haven't identified your flight correctly.

To avoid that comply with proper procedures for ADIZ and FIR crossing.

The charts also display the elevated terrain in different shades of brown and water in blue.



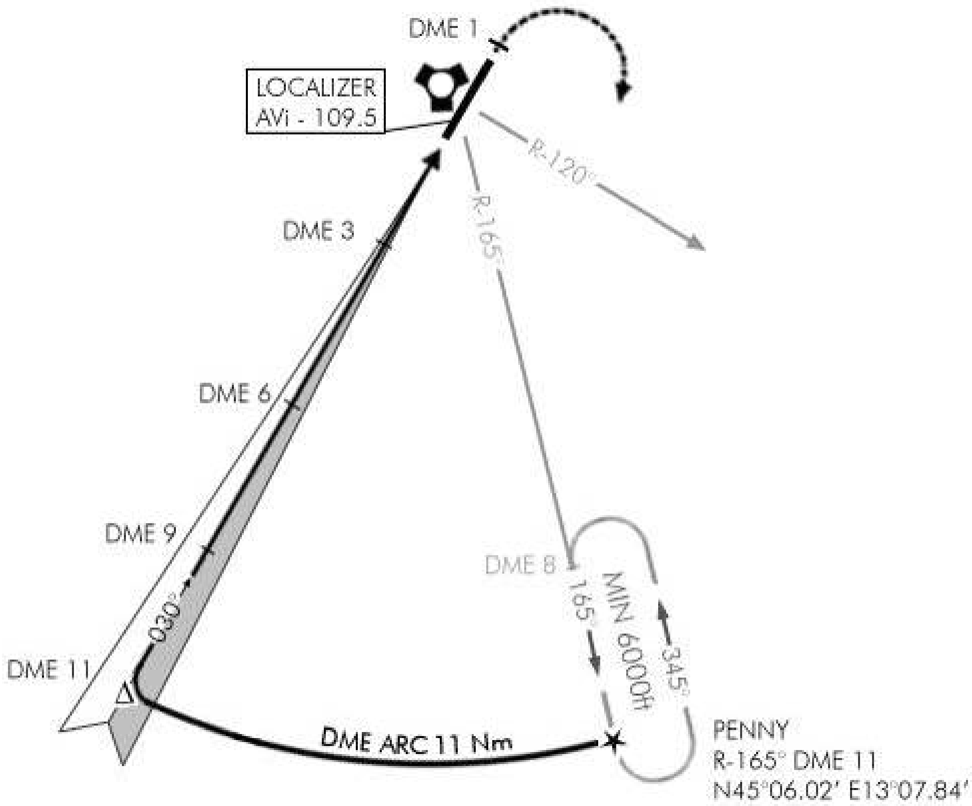
White area pictures terrain up to 999 feet. The lighter brown pictures elevations between 1000 and 1999 feet. The next shade between 2000 and 2999, and so on. The darker the shade, the higher the terrain.

The contour of the terrain and water might not be 100 percent representative of the F4 world. They are for the most of them based on real charts. But doing this I realized the elevated terrain in F4 with BazT installed was indeed very close to the real world. ☺

Highest summits are also displayed as a black dot with their respective altitude in feet next to it. Once again, those numbers represent the BazT elevator terrain for Korea. But if you didn't install BazT, your elevations will be lower and keeping the highest terrain in mind will keep you safe.

Dangerous terrain is also mentioned on the charts by numbered black circles. Usually a radial and a distance from a known tacan are given so you know exactly where the peak is.

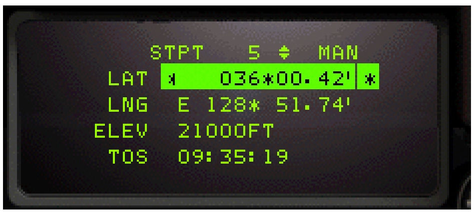
Let's get back to the approach track:
Here's an example for the ILS approach on Rwy 03 of Aviano, Italy, Balkans.



The approach track always starts at the IAF which stands for Initial Approach Fix and marked with a star on the chart. It is named as a fix, usually with a 5 letters name (here PENNY). Its position is given both in GPS coordinates and with a radial from a known tacan and the distance from the station (DME).

R-165° DME 11 means that Penny is on the 165° radial at a distance of 11 Nautical Miles.
To get there, the pilot has two choices, the first would be to intercept R-165° and get to DME11, by flying INBOUND the station if the intercept is done further than 11 DME or by flying OUTBOUND if the intercept is done before 11 DME.

The second possibility, and by far the most used when returning from a mission would be to take the last waypoint of the flight plan before landing and change its coordinates so it is set at the IAF.

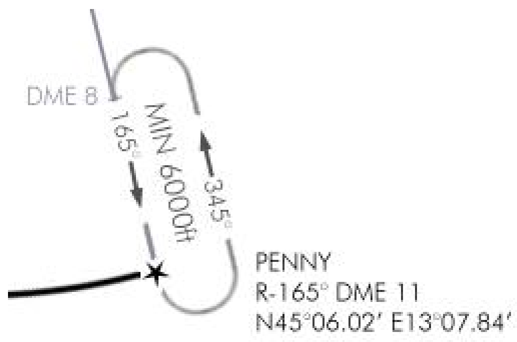


That is quite easily done with the INS system of the aircraft computers. Then all the pilot has to do is to fly to the IAF as he would do for a simple steerpoint by selecting the STPT page (ICP #4) and select the waypoint to be changed by placing the asterisks over its number, then dobber down to the latitude and enter the new Lat. coordinates followed by the enter key and repeat the process for the Long. coordinates.

This change of coordinates can be done automatically by using **Colibri's excellent Pre-Flight Planner program** to move the steerpoint to the IAF. The altitude at the IAF is the minimum altitude of the holding pattern.

You may deconflict altitudes by holding higher but try to leave the IAF with the correct altitude.

Usually, there will be a fixed holding pattern on the IAF. That racetrack pattern in grey in the chart allows a pilot to hold while the airport is busy launching or recovering other aircraft. Leader may also need that holding time to regroup their flight before impressing the brass, landing all together. Usually there's only one aircraft per thousands of feet, but I guess that a leader might fly the holding with a wingman glued to his wing. If more than two aircraft are in the flight, it might be best to send the element a thousand feet higher, which of course is only possible flying with other human pilots.



As you know, the Falcon ATC will not stack you in the holding; it will thus be the leader responsibility to deconflict the airplanes holding. It becomes tricky when more than a flight are using the pattern at the same time – but it doesn't happen often in multiplayer and even then, the leads may talk to each other to ensure flight safety.
As a rule of thumb, the first to get there should take the lowest altitude and other elements should stack by thousands feet increments.

You don't have to fly the holding necessarily when flying the approach. If there's no need to regroup or if the airport is not so busy, you can simply proceed on the approach without holding.

See the advanced radio-navigation section to see how to enter and fly a holding pattern. It's not easy and a lot of practise will be required before you can fly it precisely. Bear in mind that holding areas may be quite filled with airplane at different altitudes, so fly it safe by remaining on track and assigned altitude. Speed control is also an important aspect of holding. Obviously you will want to conserve fuel and since you already are quite low, it is even more important. On the other hand, flying fast will give you less time to make a perfect holding pattern and the turn will also be wider. So pilots should try to fly at a comfortable speed. Unless otherwise noted, the airspeed is at the pilot discretion. In some airspace, airspeed below ten thousands feet needs to be lower than 250 KIAS. I honestly don't know if that rule applies to military fast jets? Personally, I try to fly at maximum 300 KIAS throughout the approach until established on the glide where I adjust my speed to fly the correct AOA.

Solo fliers should contact the AI ATC when leaving the IAF. If the wind is correct, there is a good chance the active runway will be the same as the one you're landing on, since the AI ATC will vector you towards the ILS, the headings calls should be quite close to the headings given by the charts. Just ignore those stupid 2000 feet calls; you don't need to be so low as long as you haven't intercepted the ILS.
When there's a human controller in the game, just bypass the AI ATC and wait for the controller to clears you on the approach before leaving the IAF. Usually such calls should be given in the following way:

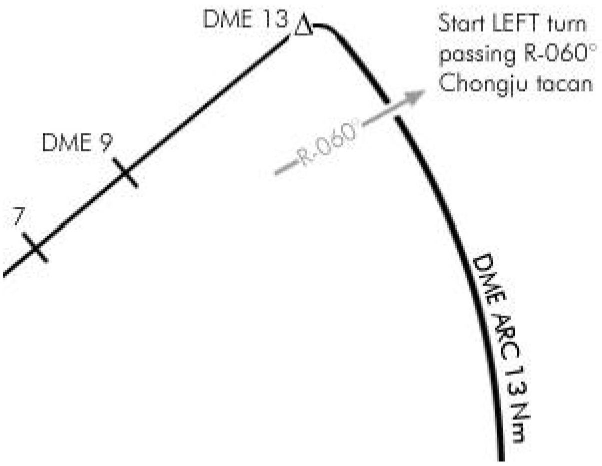
Controller: *"Sting flight, Aviano approach – cleared for ILS 03 approach, report established"*
Pilot: *"Aviano approach, Sting flight – cleared ILS03 approach, will report established"*

Once again, making the approach is usually done single plane and in this case, Sting 1 should leave Sting 2 alone for another holding turn. Still, we do like to fly the approach in flight of two, landing together it much more fun, but I highly doubt it is realistic ☺ But F4 is a game after all! When we do that, only the leader follows the procedures, the wingman just glue his wing to the leader. The lead just has to think about landing on the side of the runway to leave enough room for his wingman.

Most often, the transition between the IAF and the line up is made by an ARC DME. Performing these might seems pretty complicated but with the HSI, it's actually pretty easy. The idea is to remain at the same distance from the station by flying a fixed arc around it. It means you can turn in increments of do a very gentle turn around the stations by lowering the wing pointing towards the station. Correct procedure for flying an ARC DME is explained in the advanced radio-navigation section.
Bear in mind that leaving the holding pattern, you will need to turn usually 90° which takes time and might push you out of the required distance. Try to lead a little your exit so you remain spot on the correct DME.
While flying the arc you will also need to descend to a lower altitude. It adds another aspect to keep in check and you will need not only to check the HSI to fly the arc but continue your scanning so your speed, attitude and altitude remain within limits… which are rather small wouldn't you say?

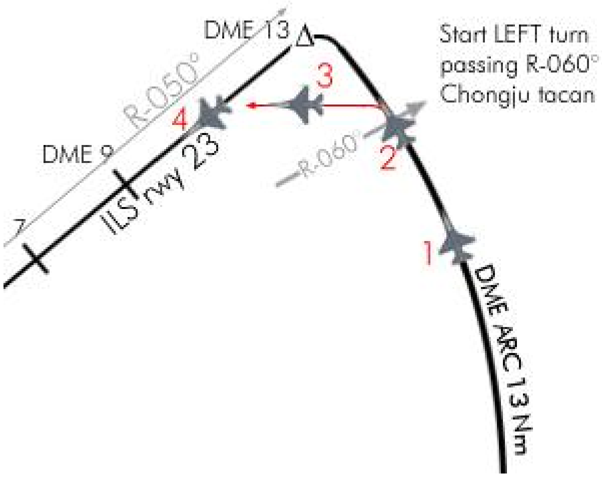
The same lead will be required when leaving the DME ARC to line up on the approach track. You usually have plenty of time to line up properly before intercepting the glide path, but the sooner you're on the correct track, the better. Remember that one, because it's really the key to a correct approach. The sooner you have the proper attitude and speed, the easier the approach will be.

Usually, I would start the line up turn passing the approach radial minus (or plus) 10°. From there, the line up turn doesn't have to be a perfect curve. It can be a hard turn to get a 30° interception on the line-up radial and then intercept it smoothly. Let's take an example.



You will land on ILS Rwy 23R of Chongju airport. You just passed NOSONG IAF and are flying the DME ARC 13 NM, descending to 3800ft. You know you will need to turn left to intercept the ILS. The ILS will also be near the 050° radial of Chongju tacan – although just before since the tacan is offset to the north of the runway.
Your HSI has been set to TCN/ILS mode so you get both tacan and ILS information. The tacan 042X as well as the ILS have been set in the UFC. All you would need is to have a reference point to start your lining up turn on the ILS. That point is given by the intersection of the DME ARC and the 060° radial. And to visualize that point with the HSI, you just need to set the course arrow on the 060° radial. At the beginning of the DME ARC, the CDI will be on the side and as you near the radial, the CDI will centre. When it is centred, you're passing through the radial and you can start a left turn to 270° to have a 40° attack angle on the ILS which is 230°. That interception heading will bring you on the ILS well before DME9.

Once the localizer starts to move in the HSI, line up as you would do with the CDI but remain at the published altitude which is 2600ft for DME 9 on this approach as the chart side view tells you.



A short while after leaving NOSONG, the aircraft is slightly banking left so the red station bearing pointer remains on the 9 o'clock position – to remain at DME 13 from the station. The mode is set to Tacan and radial 060° is set in the course arrow. Note the heading which is 015° - the departure heading from Nosong was 030° (300°+90°=030°) so we already turned 15°

At point 1, the CDI started to centre. The station bearing pointer is still maintained on the nine o'clock position but I drifted a little toward the station since the DME is now reading 12 Nautical miles. The heading is now 330°. It's important to check the heading leaving the IAF, during the DME arc and certainly the exit DME ARC heading which here would be 230°+90°=320° if we were to continue the DME ARC to the ILS localizer. It's good practice to commit these reference headings to memory.

At point 2, the CDI is centred, it is now time to turn left to a 270° heading and switch the mode selector to TCN/ILS so the CDI displays the localizer instead of the tacan radial. This is really a step not to be missed because it induces some confusion as you will see on the next picture.

We are at position 3; although we still need to level out. Heading is 270° and the mode switch has been switched to ILS/TCN. The glide slope is displayed in the ADI (horizontal yellow bar) and it's above is which is fine. The localizer is displayed in both the ADI and HSI. (Vertical yellow bar on the ADI and CDI in the HSI.)

The problem is that the CDI of the HSI is on the other side than the localizer on the ADI.

It is because the course arrow is still set to 060°.

Switch it to 230° (ILS track) and the CDI will be on the right as in the ADI. If you look back at position 3 on the image on the previous page, you will notice that the ILS track is indeed to the right of the small F-16 on position 3. Changing the Course arrow on the HSI is not mandatory; you can rely only on the ILS indications on the ADI.
Still taking the time to set correctly the HSI may salvage your approach later on. The image on the left shows the HSI with the course arrow set correctly on the 230° radial and with the CDI a notch to the right. Indeed, while setting it up, the aircraft got closer to the ILS (we are now at DME11) It's high time we make our final left line-up turn to get properly on the localizer. Luckily, we don't have any passenger on this flight.

We are now at position 4, lined up properly with the localizer and waiting for the glide path to come down on us. We are at DME 9 and should then be at 2800 ft as the side view of the chart instructs us. We should now start a descent of 800ft to pass DME 7 at 2000ft until glide interception.

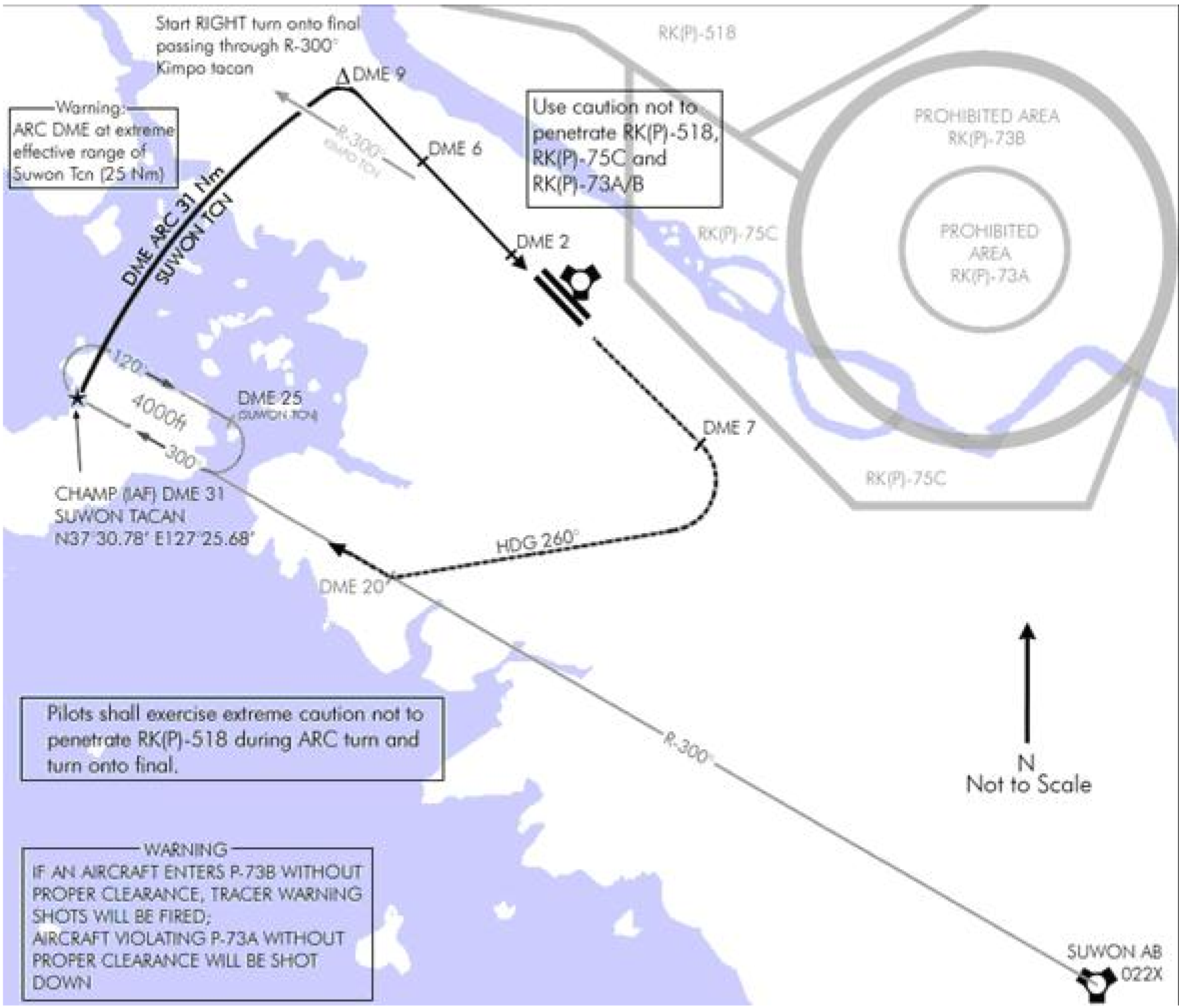
It is thus very important to keep a good speed awareness throughout the procedure because even tough the speed will not really impact your flight path (short of giving you too little time to sort the intercepts) your approach will be spoiled at this point if the speed is too high. As you aim to be on speed AOA as soon as getting on the glide slope, you want to avoid being at point 4 showing 420 indicated airspeed. More like 200 – 220 kts before gear extension.

Once at DME 7 and 2000ft, all we have to do is wait for the glide slope to centre on the ADI and at that precise time, lower the landing gear and get on the correct speed for landing which usually is around 140 kts but depends on your weight. So concentrate on the AOA indicator. Increase speed if the red triangle is lighted, decrease speed if the yellow triangle is lighted. On speed AOA is attained when the green circle is ON.

Most glide slopes are pointing 3° down so push the stick so the flight path marker is halfway between the horizon line and the -5° reference line in the HUD and you should be fine. Remember, AOA is maintained with throttle inputs, no pitch inputs. From there you need to remain heads down on the instrument, carefully following the glide slope and localizer with minimum inputs until reaching the minimum. For this ILS approach on Chongju runway 23R, the minimum is set at 262 feet which is 110 ft above ground level. Reaching 262 feet on the altimeter, you need to look outside for the runways lights and commit to the visual final approach if you can see the runway or declare missed approach and going around if you can't see it. Don't miss the minimum – unless you want to buy the farm.

Of course, you don't really have to keep inside the cockpit for so long on a clear day - when visibility is good. Just remember to train for it because one day you might need the experience to land safely. Still looking up at the minimum and finding your aircraft perfectly aligned with the runway with the correct speed is quite an accomplishment and something you can be proud of!

In case you need to go around, the missed approach track is displayed in the main view as well. Usually it is a direct route from the runway back to the IAF but in some busy airbases, you might have to follow a specific route back to the IAF. Let's consider the example for Kimpo:

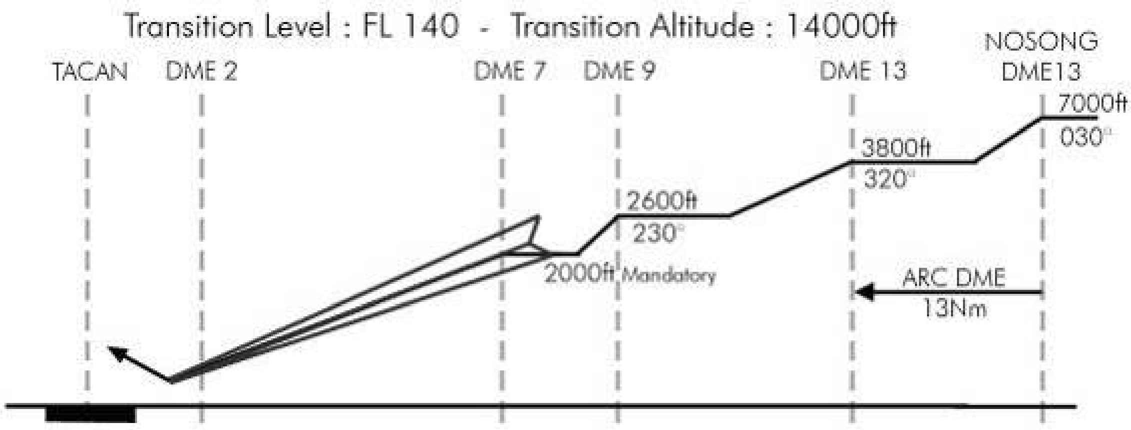


You just looked out of the cockpit; searching for the runway at DME2 but for whatever reason you can't see the runway. So you have to increase power, get a positive attitude and retract the landing gear – over flying the unseen runway. The discontinued line on the chart gives you a gods' eye view of the missed approach track and the text explaining the procedure is in the header of the chart:

MISSED APPROACH: Climb straight ahead outbound via R-140° Kimpo tacan until DME 7. Then turn RIGHT 260° to intercept and proceed outbound via R-300° Suwon tacan to CHAMP fix. Hold at 4000ft.

So your first priority is to get away from the ground and get away from the busy airspace around the airport. The procedure calls for a climb straight ahead to 4000ft (which is the altitude at which you will need to be at the holding point) – using R-140° of Kimpo tacan (which should already be set) but just don't forget to toggle back the instrument mode from TCN/ILS to TCN. As you see on the chart, there's a prohibited area just left of the missed approach track so care should be taken to avoid drifting there, especially with a southern crosswind. At DME 7, a right turn is required to heading 260°. During that leg, the tacan needs to be reset to Suwon 22X because we will need to intercept R-300° outbound from that station which should be reached at DME20. From there, you will just need to track outbound the R-300° until reaching the CHAMP IAF at DME 31 which is at extreme range of the Suwon tacan. Then you can simply fly the approach if cleared by the ATC or enter the holding pattern.

4.2.4. Side view



This view is the same as the plan view but viewed from the side which give the pilot the required altitude at specific points of the approach. Let's get back to the Chongju approach we used as an example for the DME ARC transition to the ILS.

At Nosong (IAF) the altitude reads 7000 ft which is the minimum holding altitude. Between the two vertical grey lines at DME 13, the black arrow displays the DME ARC and its distance: 13Nm. Also of interest near the NOSONG line is the departure heading for the DME ARC: 030° (as we calculated earlier: 120°-90°=30°).

At the end of the DME ARC, the aircraft should be at 3800 ft and with an exit heading of 320°. At DME 9, altitude should be 2600 ft and heading 230° already lined up on the ILS localizer.
A descend to 2000ft is then required, maintaining alignment with the localizer until intercepting the glide slope which should happen between 6 and 7 DME.

We always intercept a glide slope from below to avoid diving to chase it. So the goal is to flight level and let the glide slowly come to you from above. Once established, pop the airbrakes, lower the landing gear, add a notch of power and pitch 3° down to follow the glide.

The altitude levels displayed on the chart are not mandatory – if you can plan your descent to be at the required altitude at each point by flying a constant descend, that's very fine… and actually easier – The levels are just there to emphasize the required altitude at specific DME points.
Between DME 7 and the runway, the 3° glide slope will bring you the minima, where the arrow pointing upwards displays the missed approach track in case you can't land.

The text line on the top of the window gives the transition altitude and transition level.
That imaginary line in the sky is set at a specific altitude (usually fixed for within the same country) where the altimeter setting is switched from local setting to the standard value.

Below the transition, we use local altimeter setting given by the ATC and we talk about altitude given in feet. E.g. 9000 ft. Above the transition level, the altimeter setting needs to be set to standard altitude which is 29.92 inch of mercury (Hg) in the US and 1013 mill bar (mb) in country where the metric system is used. We then mention the level in Flight levels and not in feet anymore. E.g. FL210. Flight levels are given in hundreds of feet so FL210 is actually 21000 feet.

Unfortunately, setting the altimeter in Falcon is not implemented so the ATC doesn't give the local altimeter setting. And the altimeter setting window in some cockpits is remaining blanks.

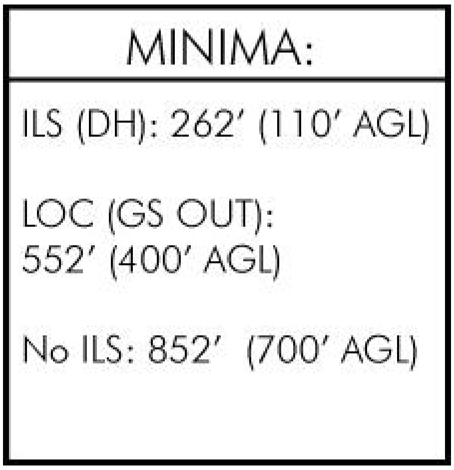
If it were implemented, the pilot should need to set the required altimeter setting in the altimeter by turning the knob on the left until the correct reading is displayed in the red framed window: The unit is mill bar in the MLU European F-16 and Inch of HG in US blocks F-16.

For the charts, I decided to mention the transition altitude to use the correct way to give altitude calls. So above the transition, speak in Flight Level, below the transition, speak in feet.

- The transition altitude in Korea is 14000feet.
- The transition level is FL 140.

- In the Balkans, the transition altitude is 7000ft
- The transition level is FL 070.

4.2.5. Minimum



The minima window just gives the minimum altitude of the approach. When you reach that altitude you should look up outside and have a visual on the runway to be allowed to continue the approach. There are usually 3 minima for an ILS approach:
The first one is the minimum when the ILS is fully working: 262 feet MSL which is 110 ft AGL.
The second one is when you perform an approach based on the localizer only (no glide slope information) It is obviously never the case in Falcon. And finally, the No ILS is when the ILS is inoperative or in case of circle to land that has been explained in the advanced radio-navigation section.

The minima for the Balkan are more complete and induce a notion of visibility that needs to be met as well for the approach to be completed. Plus some eye candy about the ALS (which basically are the runway lights) in case they are inoperative but that never happens in Falcon.
Some supplementary information might be given there as well. In this case, circling is not authorized north of Rwy 03/21 and aircraft should remain within 5 DME in case of circling the airport because of the restricted area (firing range) east of the airport.

4.3 Departure charts (SID)

SID stands for Standard Instrument Departure. It's a published departure procedure from an airport. It decreases the load of communication between ATC and pilots since each know what to do to get to the exit point. In real life, its purpose is also to deconflict traffic and provide noise abatement by avoiding populated area whenever possible. Since the F4 ATC just gives a take-off clearance, it will be the leader responsibility to decide which SID to use, according to the take-off axis. Once again, the lead may elect not to follow any procedure at all and dash towards the flot or simply follow his flight plan.

The advantage of the SID in F4 is to provide a time for the wingman to take off (and we know AI are sometimes slow getting in the air). Usually, the time required for the lead to fly the SID will make a rejoin very easily since the wingman will not need to use afterburner following their leader in a long tail chase. If the flight is not complete at the exit point, the leader may use the published holding point to wait for the rest of its flight.

In multiplayer, the SID is also great to provide a common route for member of a flight which can then be sure to rejoin easily and concentrate on flying their airplane without the stress of a complicated rejoin after departure. If all follow the same route at the same speed, then the rejoin will be natural at the exit point. Just think about deconflicting altitudes at the exit point to avoid mid air collision. The members might not get a direct visual on the other aircraft!

As you may have noticed – and quite logically – the SID don't necessarily point to the North in Korea and you may fly southbound to the exit point before starting your northbound flight plan. Some may say that it is consuming fuel and I would of course agree. But once again, according the fuel load and planning, pilots can elect to discard the SID totally. The reason is that most of these procedures are done for peacetime and we don't want aircraft upsetting the North Korean by coming too close to their airspace. From a fighter point of view, although is increases the flight time, it may also provide a mean to penetrate North Korean airspace from a vector not direct from a known military airbase… because clever tacticians will wait for you right there!

Another consideration is the TOT (Time over target) Flying the SID will certainly push your flight out of your assigned TOT, so care should be taken to adapt the TOS (Time over steerpoint) at waypoint 2 to have plenty of time to fly the SID. Usually, a good idea would be to place waypoint 2 on top of the SID exit point. That can be done during flight planning in a general way, and refine its placement once in the cockpit with the GPS coordinates of the exit point or do so with the **Pre-Flight Planner from Colibri**.

And finally, such departure procedures might be an easy way for AAA servants to deconflict friendly from enemy aircraft. If you're on the SID at the required altitude, you're friendly. Any other aircraft might be fired upon without warning. Sure it's not like this in F4… but with a little imagination ☺

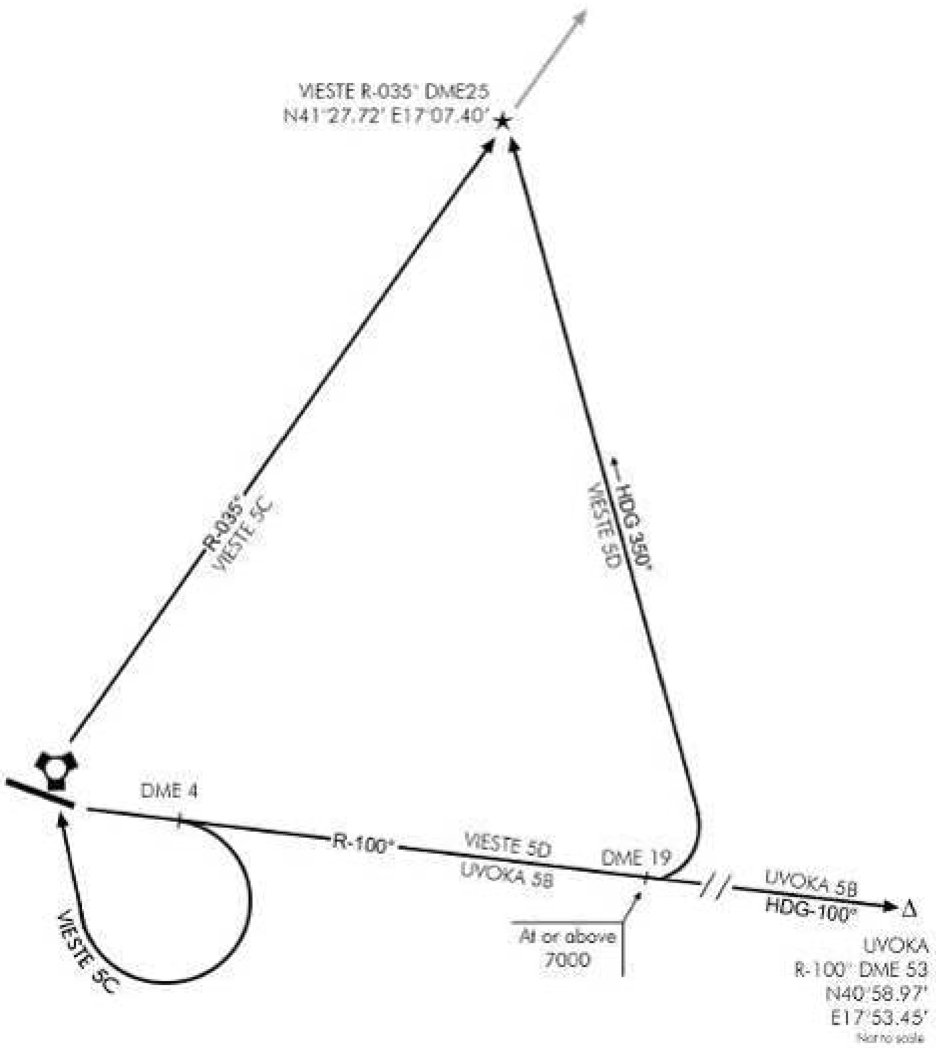
Flying such a departure procedure involves a lot of preparation in flight planning. First you need to be aware which of the runway will be likely to be active. For that you need to check the wind in the briefing. Then you should review the procedure before entering the aircraft and know what radio navigation as well as radials to set in the cockpit. If you stay behind the airplane once in the air, by checking the chart constantly to see what you need to do next, you will probably get out of the published route. Some SID are very easy to follow, other are much more complicated and involve a lot of tacan switching.

4.3.1. SID Review

As the other charts, the SID starts with a title section and a header section. Those two sections are quite similar to the ones we explained on the approach chart chapter. So I won't cover them again here. The main difference is that the missed approach has been deleted and there's no mention of ILS or Tacan for the approach and these are replaced by the Transition altitude and transition level, more important here since we are likely to use it while climbing out.

TACAN:	TWR:	TRANS ALT:	TRANS LEVEL:	GPS:	ELEV:
054X	250.2/118.2	7000ft	FL70	N41°07,44' E16°47.02'	160'

The remaining of the chart is a plan view of the departure route and a written description of the route. There is no side view for altitude. The required altitudes are mentioned on the plan view at key point along the departure.



Let's consider Amendola departure. Amendola is an 11/29 runway and there are three different routes for each runway. Two different exit points in total. One in the North, on a direct route to the Balkans, and the other in the East.

Our first example is for the runway 11 departure. We have the choice between Vieste5C, Vieste 5B and Uvoka5B routes. As you see the Vieste routes share the same exit point obviously named VIESTE to the North. Uvoka5B route share part of the way with Vieste 5B and leads to UVOKA, the easternmost exit point.

The procedure is explained in plain text in the Departure route description. The first thing to do is to read that the section relevant to the departure you will be flying.

DEPARTURE ROUTE DESCRIPTION

UVOKA 5B: (RWY11) Climb on R-100° outbound Amendola tacan. Proceed inbound UVOKA to be reached at assigned FL. Thence...

VIESTE 5C: (RWY 11) Climb on R-100° outbound Amendola tacan. At DME4, Turn RIGHT DIRECT to the station. Intercept R-035° outbound amendola tacan to VIESTE to be reached at assigned FL. Thence, ...

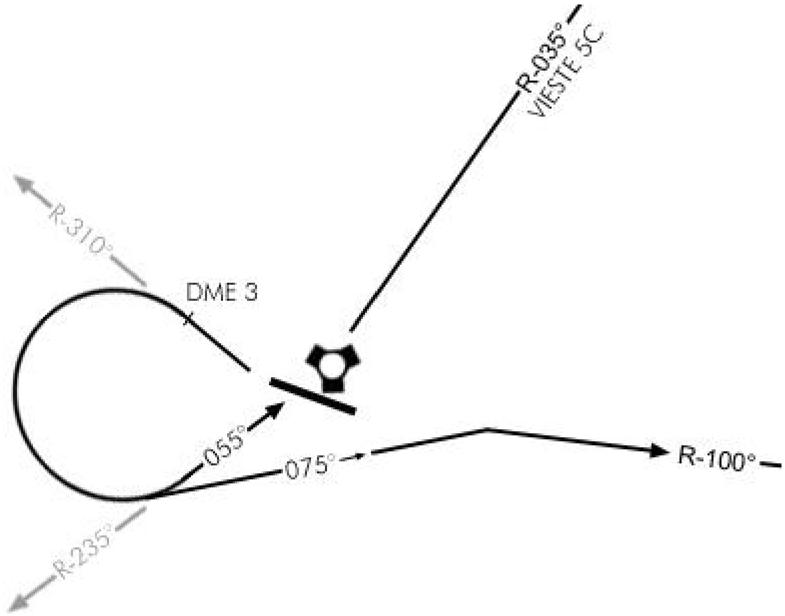
VIESTE 5D: (RWY11) Climb on R-100° outbound Amendola tacan until DME19 to be reached at or above 7000ft. At DME 19 LEFT climbing turn to heading 350° and proceed direct to VIESTE (R-170° inbound VIESTE Waypoint) to be reached at assigned FL. Thence,...

In this example, the runway 11 is active and we will fly Vieste5C. Prior to lining up, the tacan is set to 054X and the course arrow is set on the 100° radial. The instrument mode is obviously in TCN position. Check waypoint 2 coordinates and adjust them to the GPS coordinates of Vieste if necessary.

Once airborne, a climb on R-100° is required until reaching DME4. As the F-16 is accelerating and climbing fast, you should take care to get out of AB as soon as possible and don't climb like a rocket. 8° pitch up is usually more than enough, showing a speed of 300 kts indicated.
Passing 4 DME, turn right gently back direct to the station. You don't need to track a radial back to the station, simply placing the red station bearing pointer on the 12 o'clock position on the HSI will do.

Since you don't need the course arrow on the 100° radial, you can already switch it to the 035° setting so you're ready once over flying the station. Turn right again over flying the tacan to a new heading of 035°. As we saw earlier in the basic radio-navigation section, you need to let the tacan at least 2 Nm behind you before getting on the radial. Since you turned right above the tacan to a 035° heading, there is a good chance you're very close to the radial, so once the CDI stopped moving towards the centre of the course arrow, simply make a tiny adjustment in angle to get on the radial. In the meantime, you probably reached your assigned flight level for waypoint 2 (which you set at the VIESTE GPS coordinates) level out. Finally track the 035° outbound till reaching VIESTE exit point, trying to get a visual on your wingmen joining up on you. Past Vieste, switch to your INS route and go on with your mission.

The other routes are self explanatory. And in the event runway 29 is active, the same routes apply, except the initial part of the route is slightly different.



Vieste 5C will happen quickly and the pilot will be able to switch radials quickly on the HSI.

Start by selecting R-310 and follow it to DME 3, then gently turn left – selecting R-235° or already R-055°. I advise the later since it will be easier to track it.

Once set, observe the CDI and make sure you intercept the 235° inbound before over flying the tacan. For that you will need to make sure the station bearing pointer remains on your left while the CDI centres on the course arrow.

Once it's centred, fly a heading of 055° until over flying the station where you would need to turn a further 20° to the left to fly a heading of 035°, once again setting the course arrow to 035° while over flying the tacan.

It's obvious that you can't do all this in HUD view; you will need to fly on the HSI view, keeping a constant visual scan of the other main instrument.
The Vieste 5B and Uvoka 5B are somewhat easier, just fly a heading of 75° levelling after the initial left turn and set the course arrow on the R-100° radial. Since you're pretty close from the station the intercept angle of 25° (100°-75°) will be more than enough to get on the radial soon after the bearing pointer drifted on the rear left quadrant.

Flying SID is not overly complicated as long as only one tacan is concerned. The trick is to plan the procedure properly before departure. It gets trickier when more than one tacan station are necessary to follow the route and when you have multiple transitions like on Kimpo and Kwangju. Transitions are different routes leading to different exit point of the same departure. *(See next page)*

The SID itself says to climb on runway heading until reaching 2300 feet. Then the pilot has 4 transition routes at his disposal, depending on which direction his flight plan goes: ALADI to the North, IGDOK to the North East, NIKET due East and IPDAS due South.

Also of interest is the black circle with a 1 inside. It gives the position of an obstacle near the route. In this case, a mountain with a highest point at 4480ft (with BazT) Since you're supposed to pass DME12 at or above 5000ft continuing your climb, you should be safe. But it does point of the importance of altitude control throughout the route. Since you're heads down in the cockpit you won't see the mountain that will spoil your mission … and reputation.

KWANGJU 3A DEPARTURE

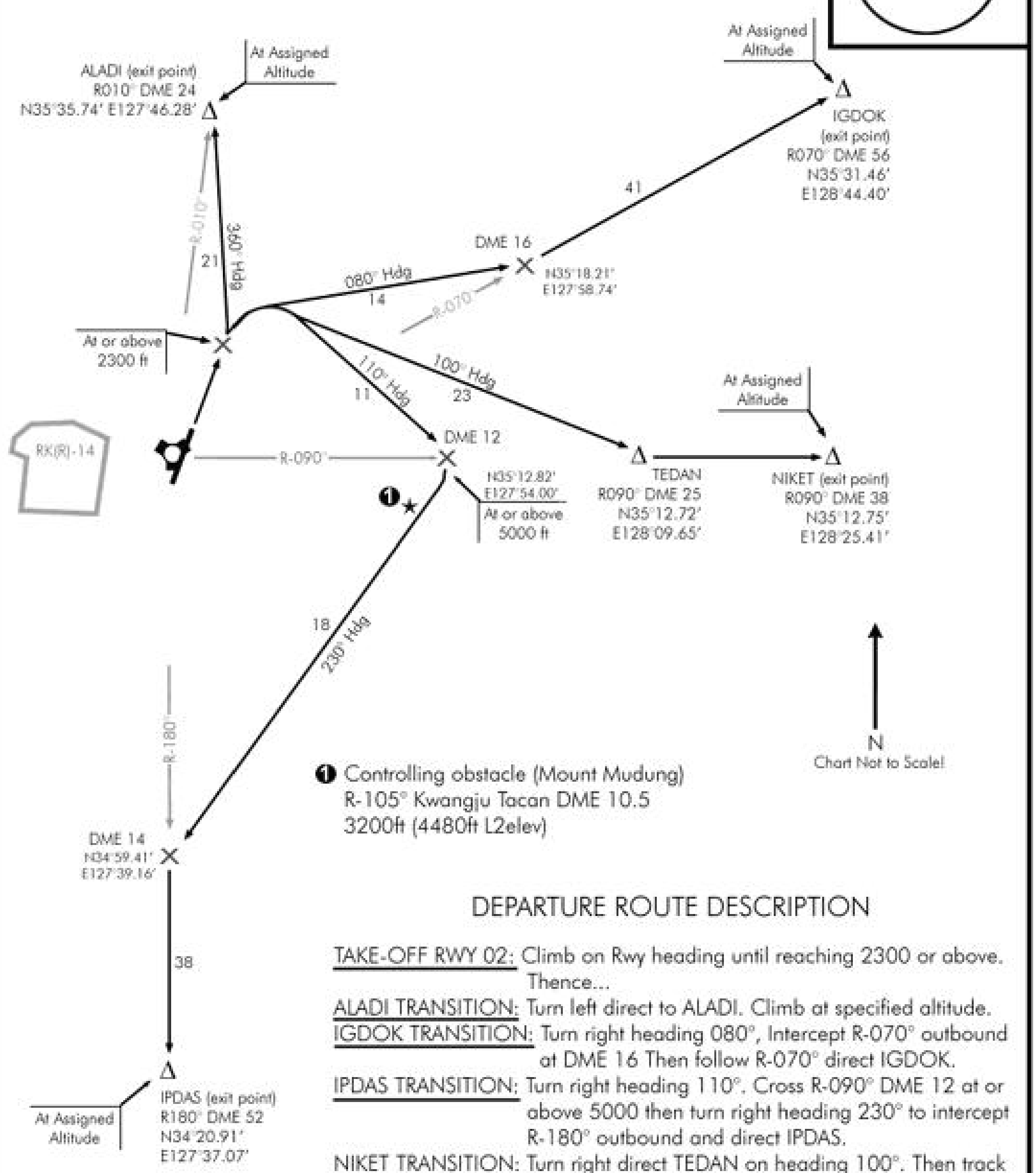
Date: 20 Aug 04

KWANGJU AB (RKJJ)
SOUTH KOREA

TACAN:	TWR:	TRANS LEVEL:	TRANS ALT:	GPS:	ELEV:
091X	254.6/126.2	FL140	14000 Ft	N35°12,99′ E127°40.24′	58

MSA 25 Nm
4900ft

EMERG SAFE ALT 100 NM: 8300ft



1 Controlling obstacle (Mount Mudung)
R-105° Kwangju Tacan DME 10.5
3200ft (4480ft L2elev)

DEPARTURE ROUTE DESCRIPTION

TAKE-OFF RWY 02: Climb on Rwy heading until reaching 2300 or above. Thence...

ALADI TRANSITION: Turn left direct to ALADI. Climb at specified altitude.

IGDOK TRANSITION: Turn right heading 080°, Intercept R-070° outbound at DME 16 Then follow R-070° direct IGDOK.

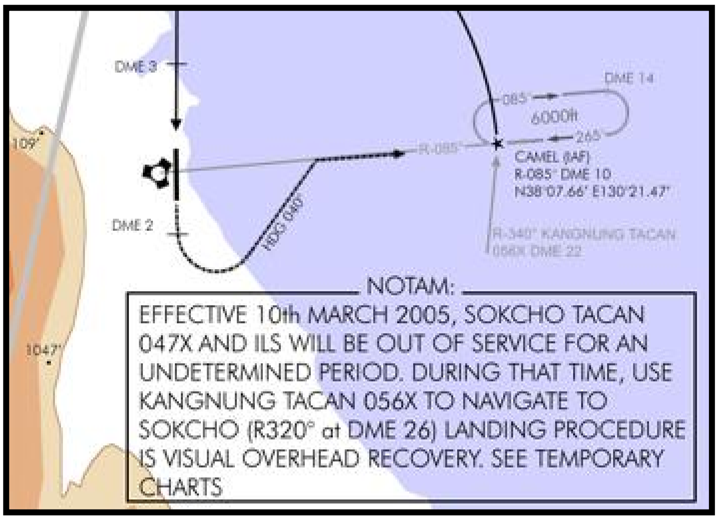
IPDAS TRANSITION: Turn right heading 110°. Cross R-090° DME 12 at or above 5000 then turn right heading 230° to intercept R-180° outbound and direct IPDAS.

NIKET TRANSITION: Turn right direct TEDAN on heading 100°. Then track R-090° outbound direct Niket at assigned altitude.

KWANGJU 3A DEPARTURE (RWY02)
NOT FOR REAL NAVIGATION - FALCON 4 ONLY

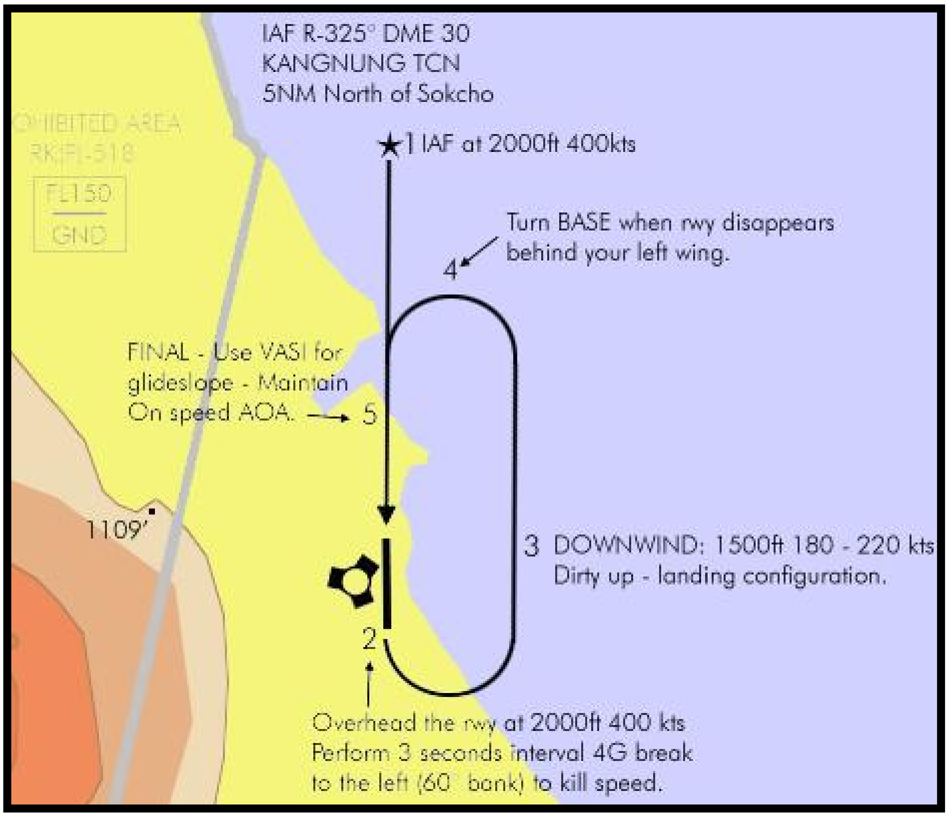
KWANGJU AB (RKJJ)
SOUTH KOREA

4.4 Special charts

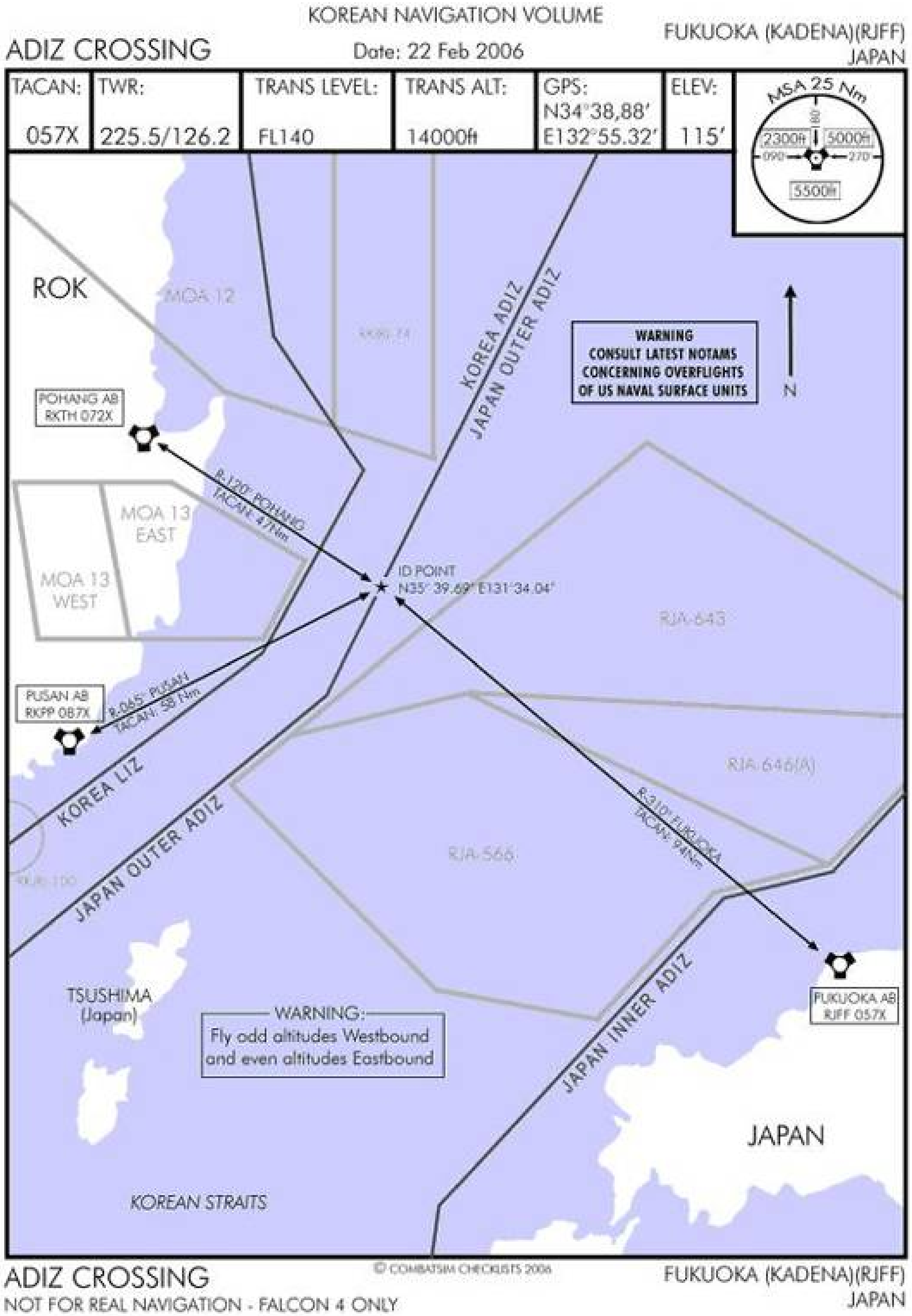


Some airbases have additional special charts. Those are sometime required to document special or temporary procedures. The most obvious one are the NOTAM charts for Sokcho and Hoengsong. These two airports actually are airstrips upgraded to airbase status during the airbase update done for SP2. Since there is no ATC code nor tacan code for airstrips, the assigned tacan and ILS allocated to Sokcho and Hoengsong are not working with current F4 version – although I'm almost certain they worked with the SP series. I don't know what happened in the meantime but the fact remain, the tacan and ILS are unusable. So I decided to make a NOTAM about it on the ILS chart and create a temporary landing chart explaining the Visual procedure to land. Visuals landing pattern should not need to be explained on a chart but I thought it might help beginners, so I decided to do it anyway. The temporary charts should be printed on yellow paper.

Since the tacan is inoperative. You need to use another tacan in the vicinity to pinpoint Sokcho. The chart tells you that Sokcho is on the R320° radial of Kangnung tacan at DME 26. So to get there, just intercept the 320° radial outbound Kangnung and at 26 Nm, you should be overhead Sokcho. To land, switch to the temporary chart for landing on runway 18. The 5 steps of the visual approach are explained on the temporary chart while the altitude profile is displayed in the side view at the bottom of the chart. That's all you need to perform a visual overhead recovery at the airstrip. Beware it's quite short and short field landing techniques are required.

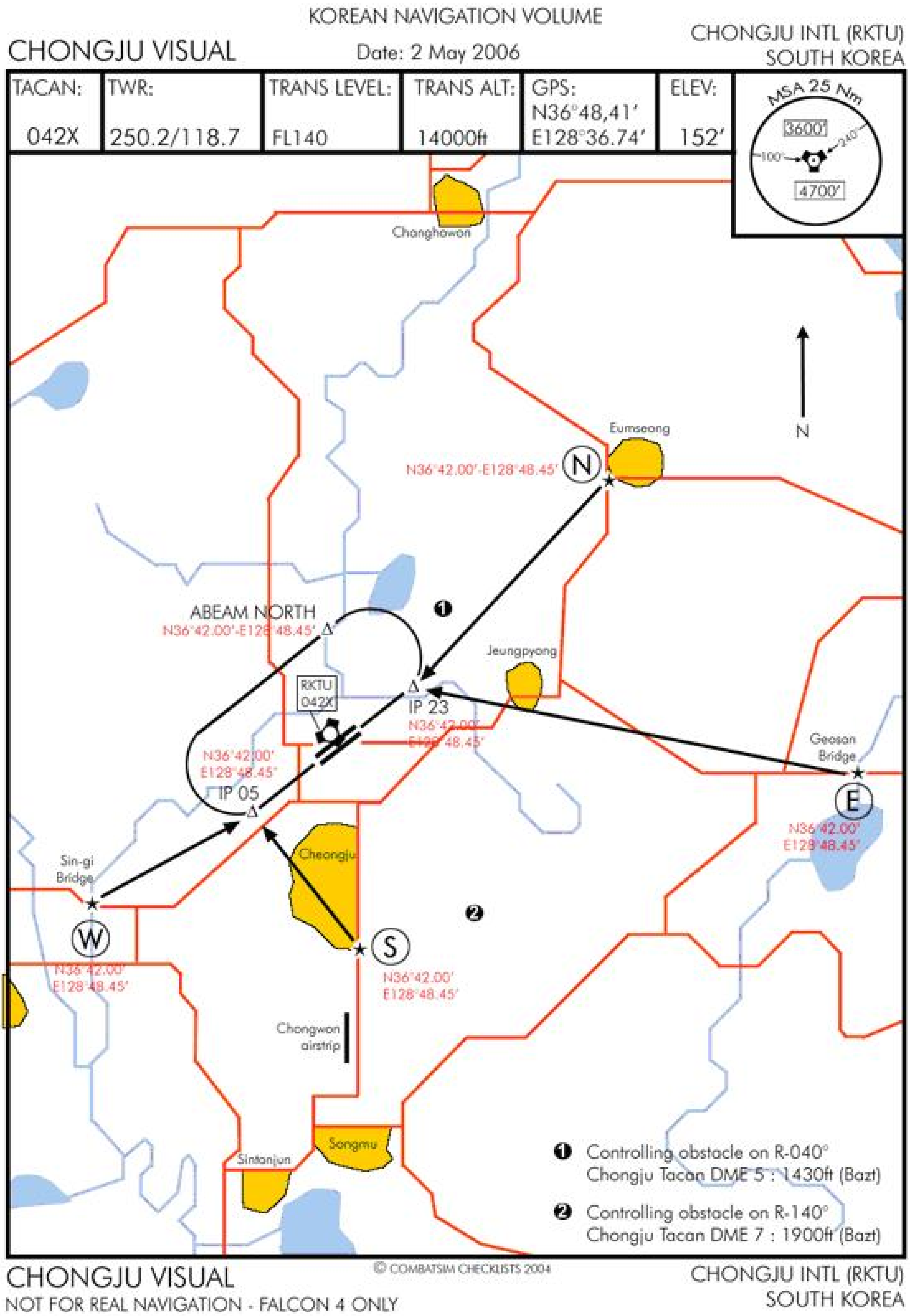


Fukuoka (Kadena) also has its special chart. It's a chart I did for documenting a safe route to cross the Korean straits. During the crossing, aircraft will need to enter the respective country's ADIZ and the aircraft needs to be properly identified at the ID point.



The relevant radials from three main tacan are displayed on the chart: R-120° from Pohang, R-065° from Pusan and R-310° from Fukuoka. Since all aircraft are likely to be on those corridors , westbound aircraft needs to fly at odd altitudes while eastbound traffic needs to be at even altitude in thousands of feet. That will provide at least a thousand feet separation between crossing flights. But don't worry too much. The AI flights will not follow this route. So the chart is mainly for large multiplayer campaigns.

Another chart type I'm still working on is visual charts for airports. A kind of VFR chart where pilots can see the landmarks necessary to pinpoint the 4 cardinal entry point for a visual recovery.



At this time it is only a project I'm working on at the request of Gil who is a French fighter controller. Only Chongju has such a chart but if the project sees the light of the day, probably most airbases will have their own visual chart as well.

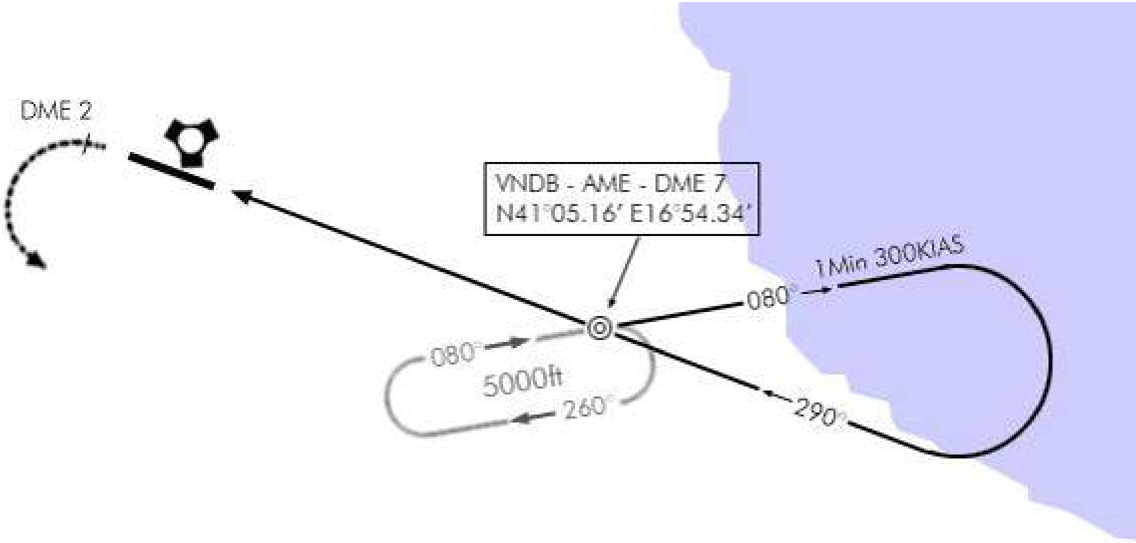
The idea is here quite different than IFR charts since the landmarks are F4 compliant. This means that the road and rivers and cities are exactly displayed the way you see them in the Falcon 3D world.

The roads are in red. Cities are yellow and rivers are blue. The entry points are named according to the 4 cardinal points N, E, S and W. Each entry point has its own GPS coordinates.

The purpose is to enter the controlled airspace around the airport at specific points to make life easier on the (human this time) ATC.

More explanations will be given on those charts on future revision of this Tutorial, but they are mainly multiplayer specific where ATC is provided by a human controller.

In real life, fun approaches to fly are NDB approaches. Unfortunately we don't have these in Falcon. Although we can simulate them by placing a waypoint where the NDB should be – we just need to know its GPS coordinates. That's what I tried to do with the VNDB approach on RWY 29 of Amendola airport.



The VNDB point is placed along the runway centreline at a distance of 7 Nm from the airbase. As you noticed, the GPS coordinates of this specific point are given. This is good because with that information, we can set the VNDB as the last waypoint of the flight plan for instance. Through the UFC, select the last waypoint before landing and enter its new coordinates. Having done that, the waypoint can now be used as a virtual tacan if two conditions are met:

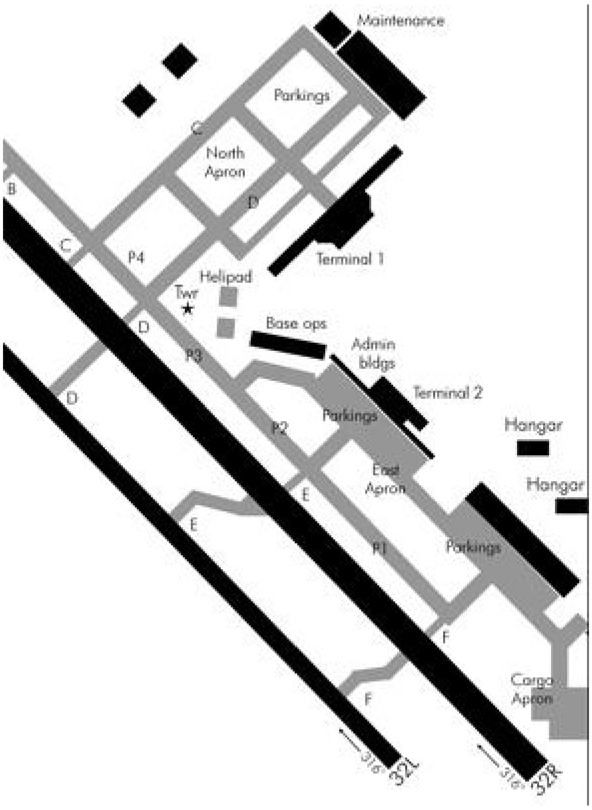
- The waypoint must be selected as the steerpoint of interest
- The Instrument mode switch must be in NAV position.

You can now use the waypoint as a reference point to fly the above published procedure, as if it were a tacan or a NDB. You can track radial from that point, execute a procedure turn as pictured above and fly racetrack patterns on it.

A FULL TRAINING FLIGHT AROUND KIMPO AIRPORT USING THE CHARTS.

5.1. Flight planning

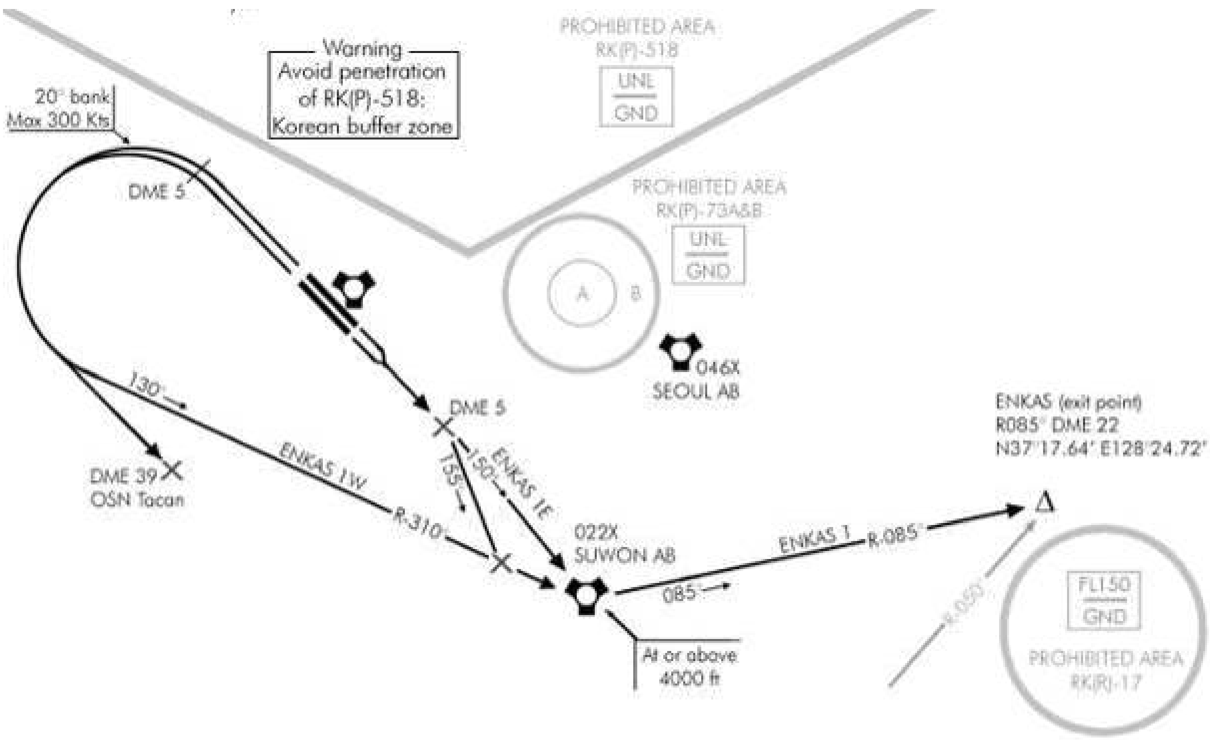
You just arrived in Korea at Kimpo and you have been tasked to an orientation flight in the area. You start at mission planning and have gathered all your charts. At this time, we don't know yet which runway is active, but a quick glance at the weather report on the briefing tells us the wind is at 280°; 5 kts so we can expect a departure on either one of the 32 runways.



We will have a 40° crosswind component, but luckily the wind speed is quite low.
Getting to the runway won't be a problem thanks to the airport chart. We know we will have to take Taxiway P3, P2, P1 and F to get on the last chance holding point.

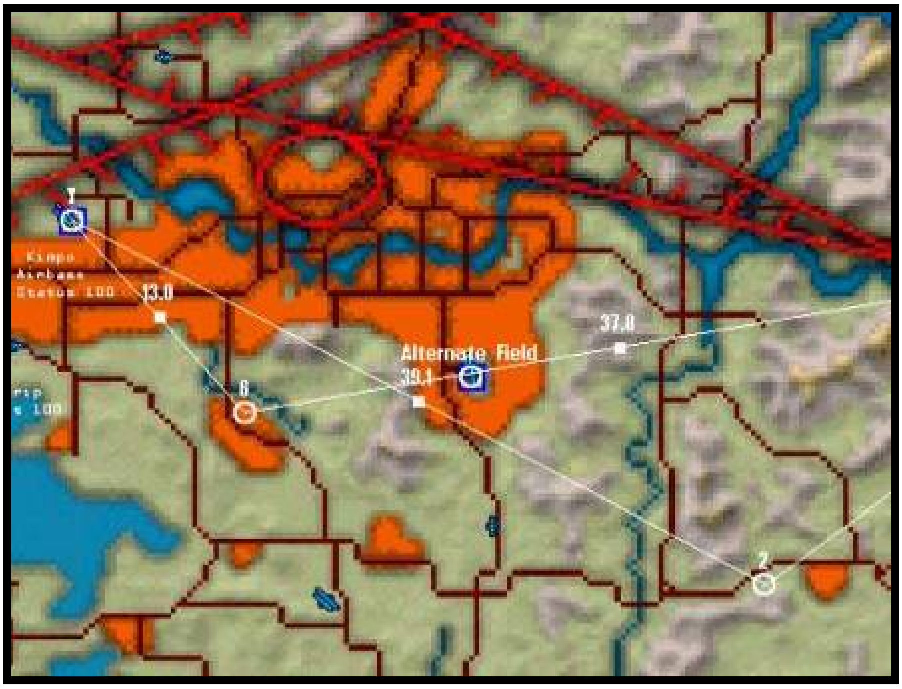
The true heading of the rwy 32 are 316°, so our take off will be done rolling on the 316° mark and we will drift right once airborne due to the crosswind. An important information is the field elevation which is 41ft. Not very high but we still need to commit it to memory. We also have a quick glance at the MSA – no sweat here we will be fast above the safe altitude.

We will fly the ENKAS 1 WEST departure, probably from runway 32L but it might be 32R depending on the ATC today. The important thing here is to review the procedure and commit it to memory before going into the cockpit as once there, we will be very busy doing the check-lists and we won't have time to review the departure.



Enkas 1W, calls for a climb on runway heading to DME 5 or reaching 2500ft where a LEFT climbing turn max 300 kts 20° angle of bank is required. We will roll out still climbing to on radial 310° inbound Suwon Tacan which is 022X, heading 130°. Passing Suwon should be done at or above 4000 ft which will not be a problem for us, we will be much higher already.

Overhead Suwon, we will need to track R-085° outbound till reaching Enkas at our waypoint two assigned altitude. Enkas is checked against R-050° OSAN tacan (094X)
Since Enkas is our SID exit point, we will need to assign it's coordinates to INS steerpoint #2 once in the cockpit. For the moment, we simply place waypoint #2 in the general area east of Suwon on the flight plan and we assign FL200 to waypoint #2 as seen in the picture below:



Lets have a quick review of the no fly zones and we notice we need to be careful not to drift into RK(P)- 518 just after take-off. There is a risk that the 270° wind will push you in that direction, so let's be aware of that possibility. Then reaching Enkas, we need to remain on the 085° radial to be sure to avoid RK(R)-17 but that one is limited to FL150 and we should already be on FL200, so we should be fine anyway.

Finally, in case of emergency requiring an immediate landing at Kimpo, the tacan station is 083X and the active runway will be either one of the 32 (In Falcon, there is no way to know exactly which parallel runway is active before contacting the ATC for take-off.)

There are two waypoints from the flight plan that we will modify once in the cockpit with the relevant GPS coordinates: Waypoint #2 for the SID exit point (Enkas) and Waypoint #6 (Wonko) upon returning from the mission that is assigned as the IAF for approach on any of the 32 runways. In the flight plan above, they are generally placed. Just take into account the TOS for those steerpoint in planning since you will need more time to get to waypoint #2 flying the SID than flying the straight line of the flightplan, so don't hesitate to give enough TOS margin. Let's have a short discussion about alternate landing site. Falcon by default often select a small airstrip close to the original airbase should an alternate be required. I often choose one of my own according to specific considerations:

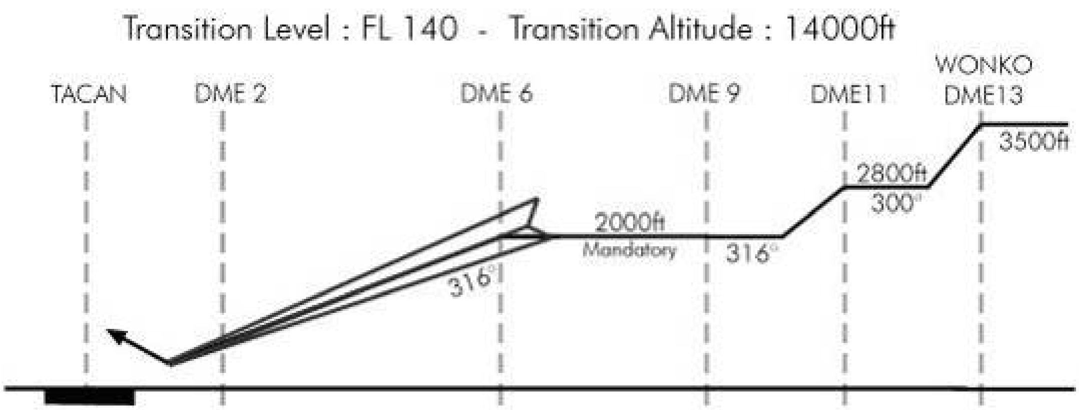
1. Select an airbase with different runway orientation than the planned airbase.
That would prevent a crosswind component making the landing unsafe at both airbases.

2. Select an airbase not too close to the planned airport so significant weather cannot prevent landing at both site.

Note that according to the distance required to reach alternate, careful fuel planning is required as well. You don't want to run on fumes trying to reach the alternate…
In the above example, Falcon assigned R103 airstrip as the alternate. It's quite close to Kimpo. I selected Seoul instead for its totally different runway orientation and since the return leg happens to overfly the airport, it should be very convenient. Granted it's quite close to Kimpo as well and significant weather on Kimpo might affect Seoul … but we know that won't happen for now ☺.

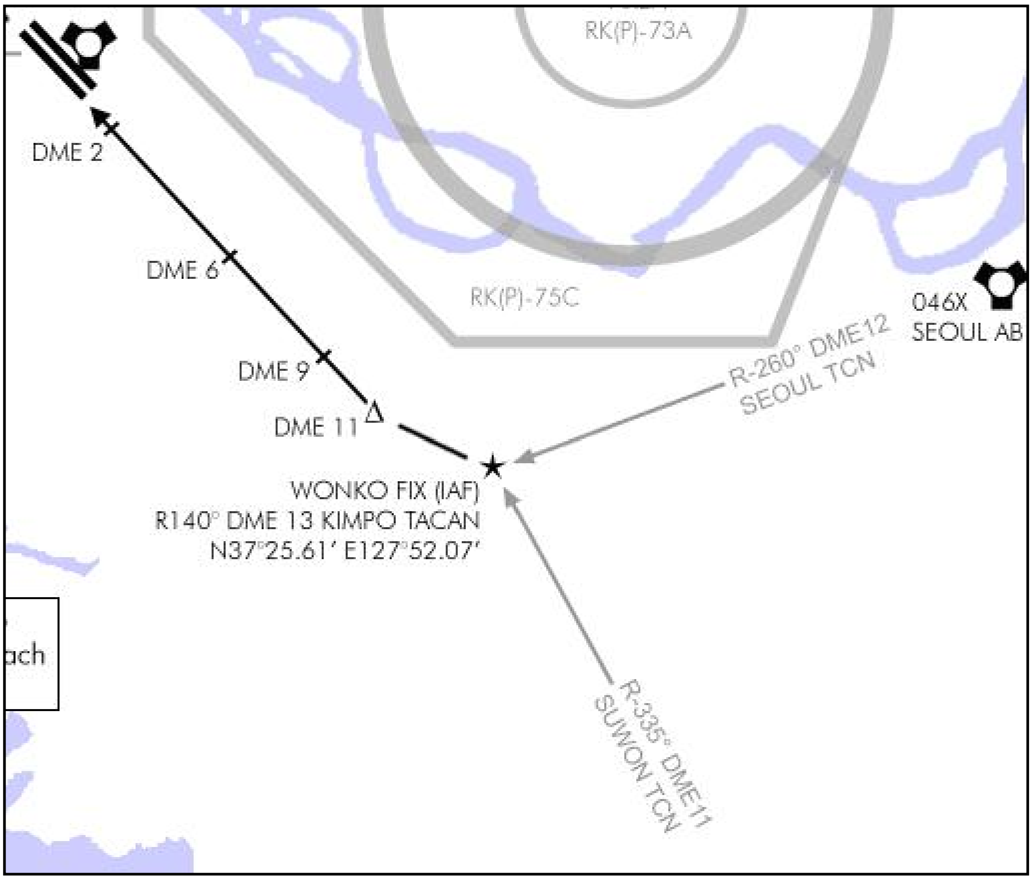
Since Seoul has been selected, proper procedures for that airport should be reviewed and the respective charts should be checked and taken along in the flight kneemap so they are readily available, should they be required.

The flight between waypoint #2 and #6 is a simple INS route and we will not cover that aspect of the flight, so let's go back to the IAF: waypoint #6. As we see on the side view, we need to hit Wonko at 3500ft. The chart MSA says 4000ft for that sector so we will need to remain at 4000ft getting very near Wonko fix.

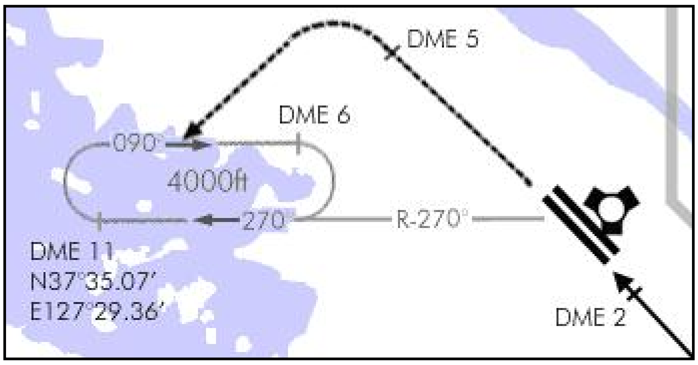


Care should be taken while getting to Wonko not to penetrate RK(P)-75C.

The limit would be R-260° from Seoul tacan. We would come from due East, so no really a problem here but as a reminder, we will cross check against that 260° radial, just to be on the safe side.



The approach will be on 32L or 32R and will be an ILS. ILS frequency is 110.7 for 32R and 108.3 for 32L. Decision height is 200 ft AGL (241ft MSL) and if we have to hold, we will need to go to the holding fix which is at DME11 on the R-270° radial from Kimpo tacan.



In that case, we will maintain 4000 feet and fly to KIMPO and then turn left to intercept R270° and perform a direct entry on the racetrack pattern.

In case we go missed approach, we will need to climb on runway heading to 2500ft and turn left to the holding fix while continuing the climb to 4000ft. We should still good enough on our arrival to fly a direct entry as well. As for the SID, we need to take care not to enter the prohibited area RK(P)-518 while climbing out.

As you just read, using the charts induces a lot of preparation, especially at flight planning. You should review correctly all procedure and be prepared for anything that may happen during the IFR flight. If you are well prepared and know correctly the relevant procedures, you will be more ready if something unforeseen happens.

Of course, we haven't checked the radio frequency changes as this is automatic in Falcon. But if we were to use them, we should review the tower and flight channels as well as the relevant ILS frequencies. For the moment, all we have to take care are the tacan channels.

5.2 Starting engine

The briefing is done, we are all suited up and the aircraft has been pre-flighted. We are now sitting in the cockpit and since there is no clearance delivery in falcon, we made our own during flight planning. Since we are assuming the leader position in a flight of two, we need to coordinate with our wingman.

The checks are performed and the engine is started according to the check-lists. Once the INS is aligned, we input the GPS coord of ENKAS for steerpoint #2 and WONKO for steerpoint #6. Select waypoint #2 from the UFC STPT page and place the asterisks (DCS down) to the LAT line, then enter the correct latitude as given by the chart, then hit the ENTER key.

Dobber down again to select the longitude and do so again, then repeat the whole process for waypoint 6.

The picture at right shows the change of coordinates for waypoint 6. The left part of the image shows wpt 6 before the change and the right part after the change. Note that the selected point in the MFD didn't change a lot because the general placement was almost spot on.

The only way you could tell it changed would be by reading the waypoint bullseye bearing.

We also set the HSI on R-320° in TCN mode. The tacan is set to Kimpo, and the 320° radial will give us a reference point to counter the drift on the climb out. Indeed, since it's on our right and we want to avoid drifting right, passing on the other side of the radial will warn us that we are drifting off course.

When we are ready to taxi, we light up the taxi light. As soon as number 2 lights his, we contact the tower to let them know we are ready. As planned, the ATC guy clears us to RWY 32L and since we prepared our route, we exactly know how to get there.

But for good measure, we tell our wingman.

-Sting 1-2, Sting 1-1, taxiing to RWY 32Left via Papa3, Papa2, Papa1, Foxtrot.
-Two.

Our take-off time is 0545 so we should get on the runway holding area a while before to make the final runups and checks. With the UFC clock displayed we taxi to the holding point. We stop before crossing RWY 32R just to be sure nobody is landing – the ATC won't warn us if it was the case.

At 0542 we are holding short with 3 minutes for the last minute checks. Very quickly we are ready to go and the ATC clears us to take off. While lining up, we do a quick review of the departure: 120 kts raise the nose, airborne at 148 kts. Positive climb, gear up. 10° climb – retard throttle a notch not to accelerate too fast. Remain close of the 320 set radial. 2500ft (or 5DME), LEFT wide turn 20° bank angle. Speed max 300 kts while climbing– Set the Tacan to Suwon 22X after leaving the runway heading – set course 310° and intercept R-310° inbound Suwon on heading 130°. That should cover the initial manoeuvre.

A quick check at the HSI lined up on the runway with a few seconds to spare tells us we are on the 320° heading, selected course is 320° but the CDI is offset to the right, so we are LEFT of the radial. That is confirmed by the station bearing pointer at our five o'clock and the dme reading 1Nm. Kimpo tacan is behind right of us so it's normal the radial is to our right. By flying the runway heading on take-off, and remaining this side of the radial, we will be sure that we will not enter the RK(P)-518 Korean Buffer Zone, so that's perfect. We will take off at 20 seconds interval and the wingman will follow the same route, as briefed (hope he's human in your flight)

5.3. Flying the SID

0545, we are releasing brakes and rolling, the wingman will follow suit. The take-off is routine as usual, once airborne the wind pushes us slightly of course and we correct the heading into the wind to avoid drifting. The 2500 ft are reached very quickly with no serious drift and we start the left climbing turn towards Suwon tacan. Careful on the bank angle, we set 20° and we keep the speed close to 300 kts. At this stage, the tacan needs to be switched to Suwon (22X) and course set to 310°. We will need to intercept that radial inbound Suwon. We don’t expect to smoothly curve our way to the radial from the first time. By checking the CDI during the turn, we can decide to tighten the turn to avoid overshooting the set radial or to flatten the turn to keep a decent interception angle on the radial. Since our roll out heading is supposed to be 130° on the radial, we will fly a 160° heading if the CDI isn’t moving thus keeping a nice 30° intercept angle on the radial. You always want to plan ahead and consider both options of the intercept. The tightening of the turn doesn’t require calculations, but you’d better set the 160° intercept heading before getting to that point. Not doing so will certainly spoil the SID.

The left picture is taken during the turn, the tacan has just been switched to 22X (Suwon and course set to 310°. We are 30Nm from the tacan (just at the limit of its range, so it may go off during the turn, but don’t worry, it will come on at the end of the turn). We are passing through 280° with a 20° bank angle, altitude is passing through 3100ft with a 10° climb, speed is 300 kts. Spot on the procedure. We concentrate on keeping these settings. The next step is the radial interception. Since we set 310° course, the CDI will point backward (yellow arrow) and our reference heading will be 130°.

According to meteorological conditions, the wingman might follow his leader visually by staying close (20 seconds take-off interval) and letting the leader assume the radio navigation. Or he might need to do his own radio navigating (1minute take-off interval) but in that case, the rejoin needs to be done only when visibility permits. In that scenario, speed control has to be closely monitored to avoid a mid air collision.

It’s always better to have the wingman visually stick close to the leader who is head down in the cockpit. Furthermore, using that method, there’s always at least one pair of eyes outside which is not a bad thing at all!

The turn continues with the same settings and reaching the 160° heading (here turning through 170°) we check the CDI which started moving inboard. Should we stop the turn and fly the 160° radial till interception? No, since the CDI is moving, it tells us that we are nearing the radial and we can continue the turn and fly a smaller interception angle to the radial (since we are quite close already) proof that the situation is dynamic and needs to be monitored constantly. From this point on, we will place the aircraft projected flight path (white line) between the CDI and the course arrow (the green lines – remember?) to fly a smooth interception.

Actually, the reason the procedure calls for a 20° bank angle and a speed of 300kts is to provide a roll out very close to the 310° radial of Suwon tacan. So the closer the settings are flown, the closer of the radial you will be on roll out, making the interception easier.

The picture at left shows the radial intercepted at 19 Nm out. Speed is 300kts, altitude is passing 9800 ft, climbing with a 10° angle. The CDI is centered and all we need to do now is to remain on the radial until overhead Suwon. Passing through 14000 feet, we will need to call transition level and set 29.92 in the altimeter if that were implemented.
As we are nearing the station, the CDI will become more sensitive and care should be taken not to overcorrect the heading. Think in small correction headings to keep the radial centered. Instrument scanning also needs to continue to ensure you keep all the parameters in control. It may look like a simple phase of the IFR flight, but it's very easy to screw it, so let's concentrate on the next step still in the idea to keep ahead of the airplane. The next step will be station passage. The CDI will start to drift to one side, at DME zero, we should turn left heading to 085° and set course to 085° outbound Suwon tacan.

Slowly after station passage, the CDI will close to the centre of the dial and final adjustment on the 085° course will be done.

To add another dimension to the manoeuvre, we will probably reach FL200 just above the station, so we will need to plan for the level out.

As pictured above, we are now 2 Nm past Suwon tacan. The course is still set to 310° but we are already flying heading 085°. Altitude is level at FL200 and speed is 280kts. Note the selected steerpoint in the right MFD dead ahead, it's waypoint #2. So at this time we could simply follow the Hud tadpole to fly to Enkas. But let's first check that we navigate along the 085° radial. Set course to 085° and centre the CDI. Getting closer to enkas, we will make a quick check of the accuracy of the navigation system. We know enkas by 3 different systems:

1. The GPS coordinates of the fix entered as waypoint #2
2. The position relative to Suwon tacan: R085° DME22
3. The position relative to Osan tacan: R050° DME not specified on the chart.

Since we have the HUD tadpole somehow picturing the Suwon 085° radial, we can switch the tacan to the OSAN channel 094x and set course to 050° in the HSI. Since we are not over Enkas yet, the CDI will remain on the side but moving inboard to reach the centre of the instrument right at enkas.

The centred CDI on R-050° Osan tacan tells us we are overhead enkas fix. That is confirmed by the HSD that shows us above waypoint #2. That would also be confirmed if we were to switch back to Suwon tacan that would show us on the R-085° at 22 DME.

There you go, having completed your first Standard Instrument Departure. The way it was explained here may sound like the total procedure was done head down in the cockpit: not at all! Since the Falcon weather model is most of the time VMC, I spent most of the time between normal cockpit view and the instrument view.

Quite often on the long legs, I scan the instrument in the normal cockpit view, keeping an eye outside on the wingman, and concentrate heads down only when fine tuning an intercept or at critical moments.

Following the published procedures should not prevent you from looking outside and doing lots of stuff visually but to teach you how to master instrument flight when it's necessary.

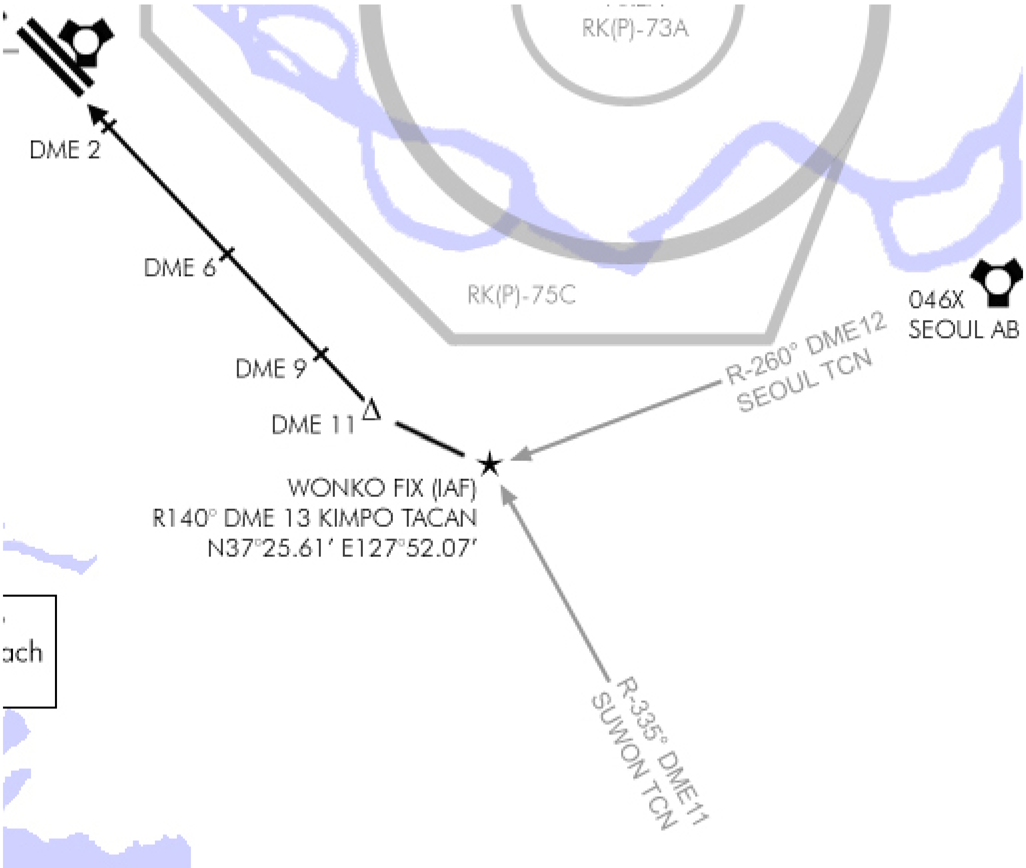
5.4. Transition to normal flight

At Enkas, you resume your own navigation as inputted into the INS system, that's where I whish we had a new communication option in the tower (departure) menu: Reporting the exit point and resuming own navigation.

From there on, you're free to go on with your mission objectives. Depending on the conditions you might need to fly on the instruments, but you will probably fly mainly with the HUD along your waypoints.

5.5. The approach

On the return leg of our flight, still at FL240 we start to concentrate on the approach. If the wind didn't change too much while we were away, we expect landing on either of the two 32 runway. The 32 Left and Right approach plates are taken out and placed on the top of the kneemap stack. Since we are approaching from the East, we will descend to 4000 ft in a while so we can hit Wonko, set as waypoint #6 in the INS, at 3500ft. Since localizer intercept is just 2 Nm from Wonko, careful speed and altitude planning will be required.



At this time, you need to decide what to do with the ATC. We all know it's screwed most of the time but sometime, they just go along the chart procedure very well. I tend to use them as much as I can and when they start to become annoying, I declare aborting the approach and land on my own. The reason I call them initially is to see if the runway they say is in use is the one I expected according to wind conditions and eventually the presence of an ILS. Well apart from wind we have no real control on, they don't follow any specific guidelines ☺ The good stuff about them is when they instruct us to hold for traffic. Now that one I like very much because that's why I created the holding patterns in the charts. So when they tell me to hold, I directly go to the holding point and hold as published until they release me … usually before I start my first racetrack!

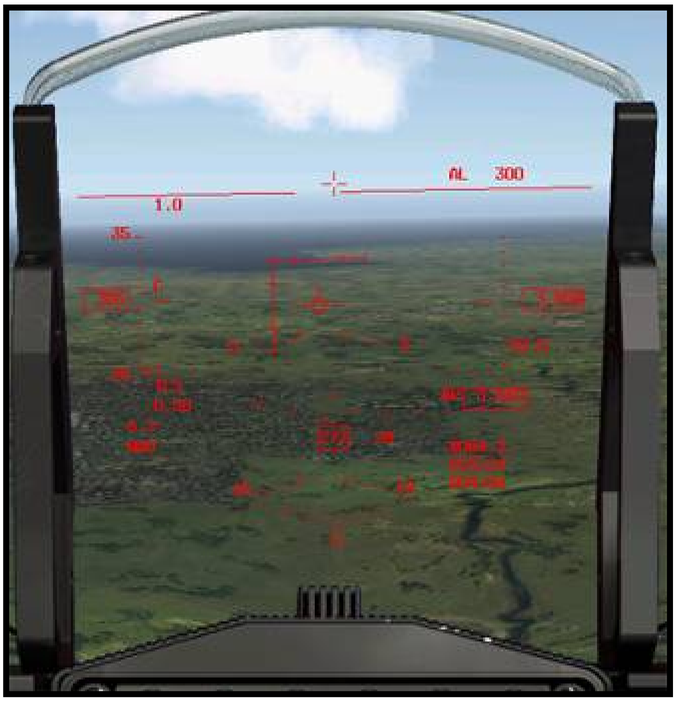
Anyway, back in our flight. We are at FL240 heading due West straight to waypoint #6. We start a gentle descend to FL140 where we should switch the altimeter to local setting, then continue the descent to 4000ft. Speed is reduced to 300kts abeam Seoul tacan. The HSI is set to TCN/ILS mode and the course is set to 320. Strictly speaking setting the course is not really required, but it helps getting a clear picture of the approach. The TCN/ILS mode is chosen because it gives DME reading relative to the selected tacan.

First, let's see what the tower has to say:

- Kimpo approach, Sting 1 flight of 2 ,inbound for landing.
- Sting flight, Kimpo approach, descend to 2000 ft, expect vectors Runway 32L…

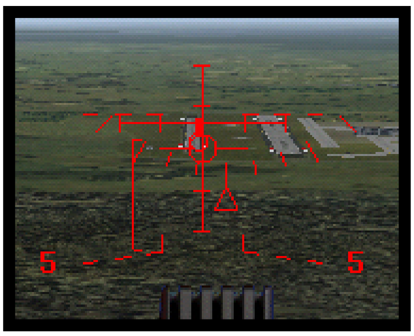
As expected! Note that the AI wingman will get on his own and receive direct instruction from the tower, so beware, he might become a hazard to your approach ☺ Human wingmen can stick to their leader performing a formation landing or go on their own, depending flight conditions.

We disregard the altitude calls and set the ILS to 108.3 in the T-ILS page by inputting 108300 in the scratchpad. CMD STRG is enabled. The approach on 32L is very easy since the IAF is almost the point where the ILS command steering cue will start to guide the pilot on the ILS track. So even if the charts call to first descend to 2000ft to wait for glide interception, we can simply follow the command steering cue in the HUD from Wonko fix to ensure a safe ILS approach.



The three pictures show the arrival at Wonko on a 272° heading. Speed has been reduced to 300 kts while descending and although wonko is some 4Nm ahead, we are at 3850ft. The HSI is set correctly and ILS bars are already displayed in the HUD and attitude indicator (not shown) Note the glideslope (white ball) inoperative in this HSI cockpit.

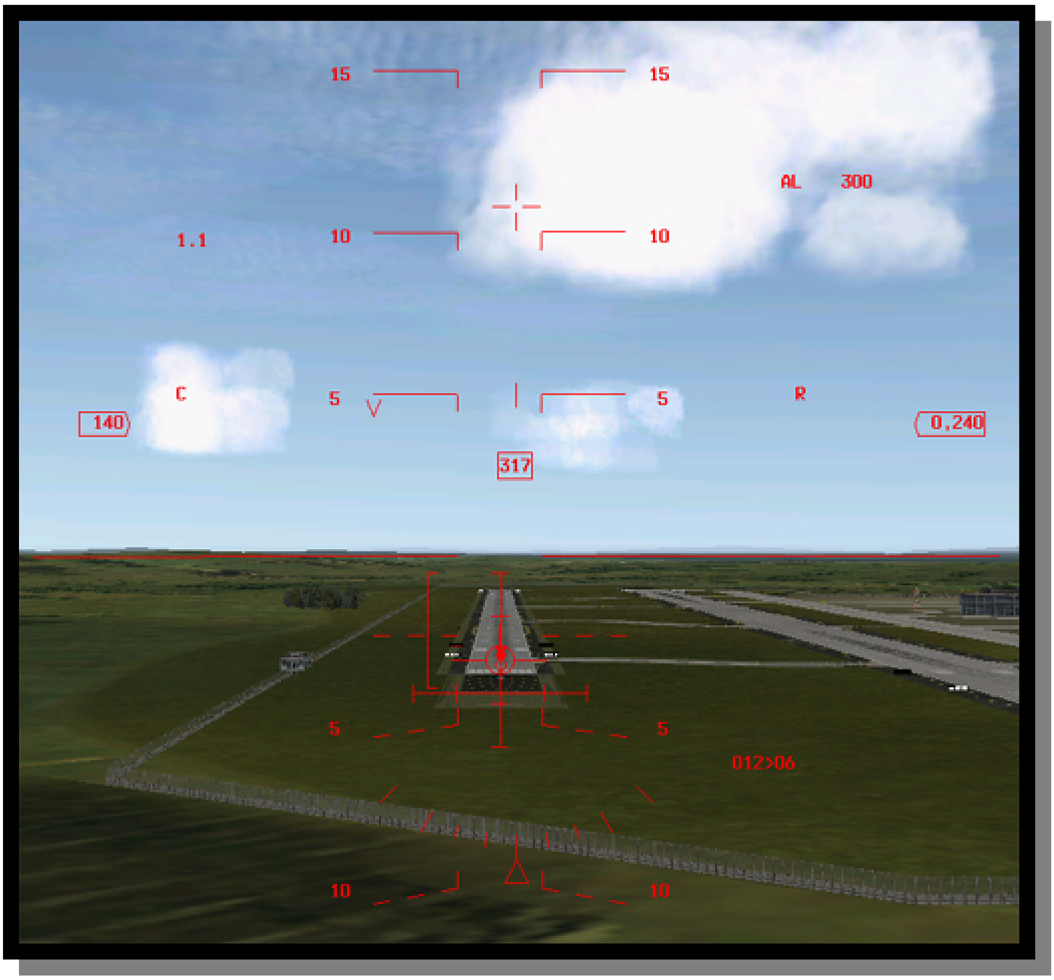
We are passing Wonko fix at 3500ft, 300 kts. The ILS vertical bar (localizer) started moving inboard and the ILS command steering cue just started to move right, calling a right turn to intercept the ILS, just as the chart says. Although the chart calls for a descent, we remain at 3500ft since we already have a valid glideslope signal which is above us. We will start our descent as soon as glideslope is intercepted.



We start a level right turn to superimpose the flight path marker with the ILS command steering cue. At DME 9, we are aligned on the 32L runway and descending with a 3° along the glideslope. We pop the airbrakes and let the speed decrease to 250 kts.
At DME6, we fly over the outer marker, lower the landing gear and while continuing to align the ILS command steering cue and the flight path marker, we concentrate on getting to on speed AOA by placing the FPM in the middle of the HUD vertical bar, this lighting the green AOA doughnut.

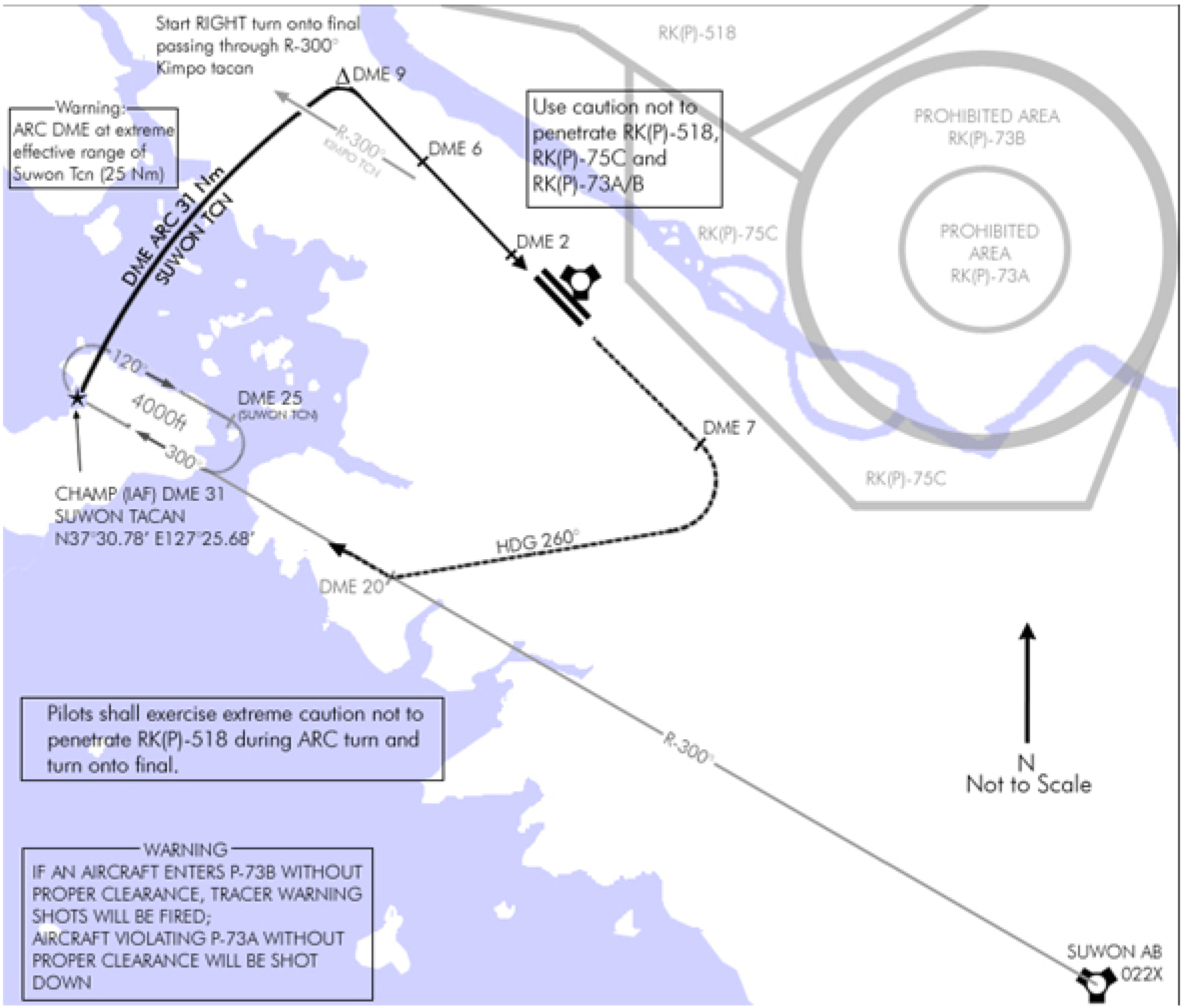
The minimum for this ILS approach is 241 feet. Reaching that altitude, we call minimum and confirm we have the runway in sight (which happened quite a long time ago anyway)

The FPM is on the runway threshold, speed is on speed AOA, VASI confirms, final landing checks are complete, we might be cleared to land depending on the ATC efforts! Let’s do it.



5.6. Let's make another one

Now, for the sake of the exercise, let's imagine the wind dramatically changed since our takeoff, spoiling our (incomplete) preflight planning! On the return leg, we check the wind in the DED and we are surprised to see a wind from 359° at 7kts. That will make any of the 14 runway in use. We get the relevant charts out and review the procedure:



Since we are arriving from the east, we will need to intercept R-300° outbound Suwon tacan to get to the CHAMP IAF. 22X is set in the T-ILS page and course 300 is set in the HSI. Since our heading is 270°, we already have a 30° intercept angle and we are arriving between Seoul and Suwon Tacans, so we should intercept the radial well before reaching the fix. We also start our descent to hit the IAF at 4000ft. And finally we need to change the waypoint #6 coordinates in the UFC to the CHAMP fix coordinates given on the chart.

The picture on the left illustrates our approach on the 300° radial from Suwon tacan. Note that we are not yet abeam of the station (red pointer) so the interception will take another while.

While we close on the radial, we check the notes & warnings of the charts and review the holding procedure if necessary. The warnings tell us two interesting things: First the DME arc will be done at extreme range of Suwon tacan; so the HSI might flag himself during the turn … not good. Secondly, we need to be careful NOT to overshoot the ILS to avoid penetrating the prohibited airspace North of Kimpo. Looks like we will be busy!

By the way, check your instruments while you're studying the charts →
Aviate, navigate, not the other way around.

In the meantime, the CDI centred and we turn right to intercept. Once we are established on course, it's time to contact the tower.

- Kimpo approach, Sting 1 flight of 2 ,inbound for landing.
- Sting flight, Kimpo approach, Hold for traffic…

So we will enter the holding pattern then. Easy enough since we will perform a direct entry arriving perfectly on the inbound leg of the racetrack, hence the importance to get on the 300° radial well before the fix. Tracking the 300° radial for a while before entering the holding will also give us the opportunity to set the required wind correction angle. That WCA will be handful in the racetrack.

Since the wind is from the North, we need to fly a 305° heading to remain on the 300° radial, the WCA is 5°. On the outbound leg of the holding, the required heading will thus be 120-5=115°.

There's no point holding at high speed, so we decrease speed around 300 kts to conserve fuel since we are already at low altitude.

We set the UFC to the clock page through the time button. Since a DME indication is given on the outbound leg, we will not fly a one minute outbound leg but start the outbound turn at DME 25 from Suwon tacan. Still, I like to time my racetrack turns.

Reaching CHAMP as pictured above, we hit the hack time on the UFC and start the turn right with a 45° bank angle 1.5g to heading 120°. The turn should take one minute.
Then we fly heading 115° for wind correction until the DME window of the HSI tells us we are 25NM from Suwon. During the outbound leg, the hack time is reset. At DME 25, start the clock, right turn 45° bank, 1.5G back on intercepting the 300° radial. Here it is more than a one minute turn, it's a radial interception. Luckily, the HSI settings are still on the 300° Course so we don't need to change anything. (Picture at right illustrates the interception out of the racetrack outbound turn)

If the holding was done correctly, the interception should be easy enough. If on the other hand you drifted toward the centre of the racetrack, there is a good chance that you will overshoot the 300° radial on the second turn. Leaving you with a very short time to re intercept the correct course before reaching the FIX.

Established back on the inbound leg on course 300°, we call the tower again to see if the traffic has cleared:

- Kimpo approach, Sting 1 flight of 2 ,inbound for landing.
- Sting flight, Kimpo approach, descend to 2000ft, expect vectors runway 14L

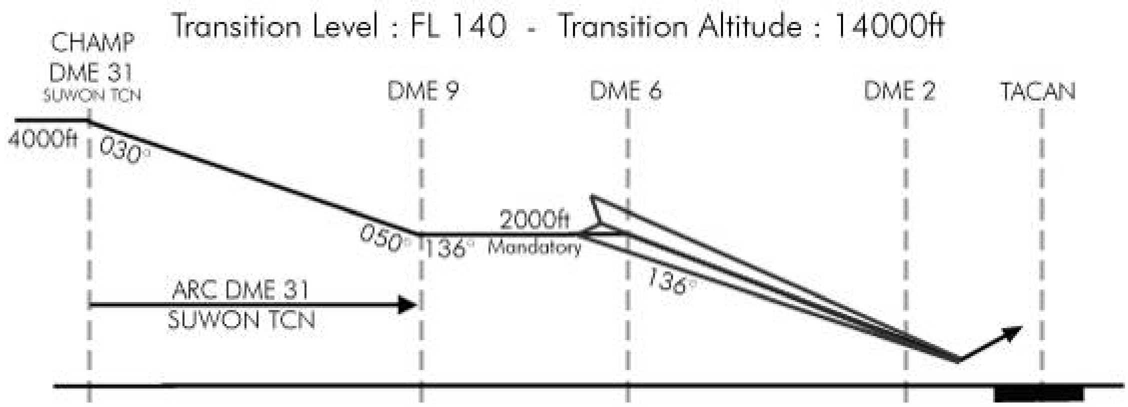
Fine, no holding required anymore. We set 109.9 as the ILS frequency in the UFC and if still possible we plan on leading the 90° right turn by .75 Nm to enter the ARC DME. The initial heading into the DME ARC will be 030°. Since we are at the extreme range of the tacan, the HSI goes off for some seconds but always return to a valid information.

The hard part of this procedure is that we need to be tuned to Suwon tacan for the DME ARC and need also Kimpo tacan since radial 300° will be the reference point to lead the turn out of the DME ARC to the ILS track.
Furthermore, the 320 radial from Kimpo tacan is the radial not to cross over since it pictures the proximity of the prohibited airspace.
Having two NAV radio would clearly help here but we unfortunately have only one – so we might need to switch tacan from Suwon back to Kimpo during the DME ARC, thus loosing the necessary information to continue flying the act without error.
Nevertheless, there are workarounds:

The first one would be not to consider Kimpo tacan but instead the Kimpo waypoint (#7). Selecting that waypoint in the INS and switching the HSI mode to NAV will consider wpt #7 as a virtual tacan and navigation data are provided relative to that waypoint. Granted a minimal error will occur but it's easier to switch only the instrument mode than actually switching tacan stations (the course required is 300° - so it remains unchanged.)

The second one is to simply use the ILS command steering cue at the end of the DME ARC to time the turn out of the ARC into the ILS track, completely disregarding the reference 300° radial from Kimpo. For that to work, the HSI needs to be placed in TACAN/ILS mode. In this mode, it will provide DME capability relative to the tacan selected (Suwon) but the Kimpo 14L ILS guidance will be enabled. The downside of this method is that it may lead to late LOC interception if the initial angle is too great (as it is the case here since we are getting out of a DME ARC with a 90° angle off.

I usually follow option 1, if switching tacan channels is too much of a hassle .



One last thing, don't forget that you are supposed to descent from 4000 ft to 2000 ft AGL during the DME ARC ☺

Getting over CHAMP fix for the second time, we lead the 90° right turn by .75Nm to enter the DME ARC. Initial heading into the DME ARC is 030° and through there, it is only a matter of keeping the red bearing pointer on the 9 o' clock of the HSI throughout the ARC – as pictured on the left (although I overshot the DME ARC by 1 Nm)
Since we know the exit heading of the ARC will be 050°, we can switch to waypoint #7 when turning through 40°, that will give us ample time to continue the ARC and not miss the reference point given by the 300° radial from Kimpo airbase.

First, select waypoint #7 in the UFC through the up and down arrows on the ICP.
Then, make sure the Instrument mode is switched to NAV so the HSI take wpt #7 as the reference point.
In the right MFD, we confirm visually waypoint 7 is the selected steerpoint and the HSI bearing pointer matches the MFD. Course 300° is still set so we don't need to change anything.
Altitude is 2000 ft, level. Speed is 320 kts. We are in a slight right turn and DME reads 10 Nm from waypoint #7. The CDI is still offset meaning we are not on the radial yet. All we have to do is continue our slight right turn until the CDI centres, telling us we are passing through the 300° radial.

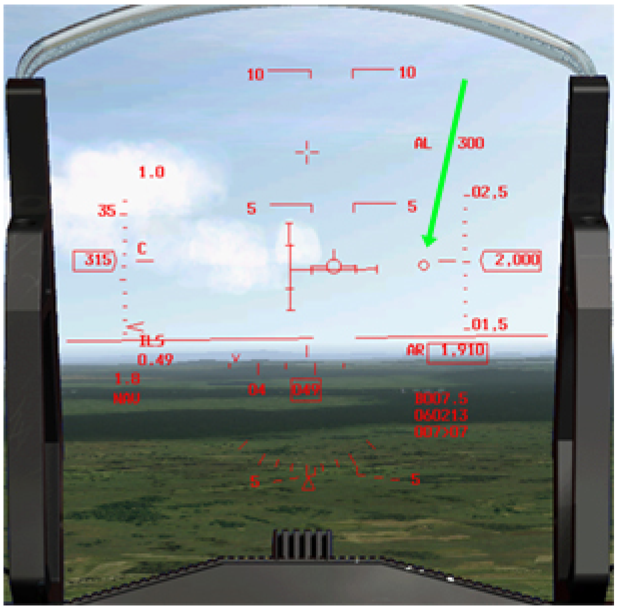
We don't need to intercept the radial, mind you. It is just giving us a reference point to start following the ILS command steering cues. So once the CDI centres, we switch the instrument mode to TACAN/ILS or NAV/ILS and transition to the HUD to intercept the ILS.

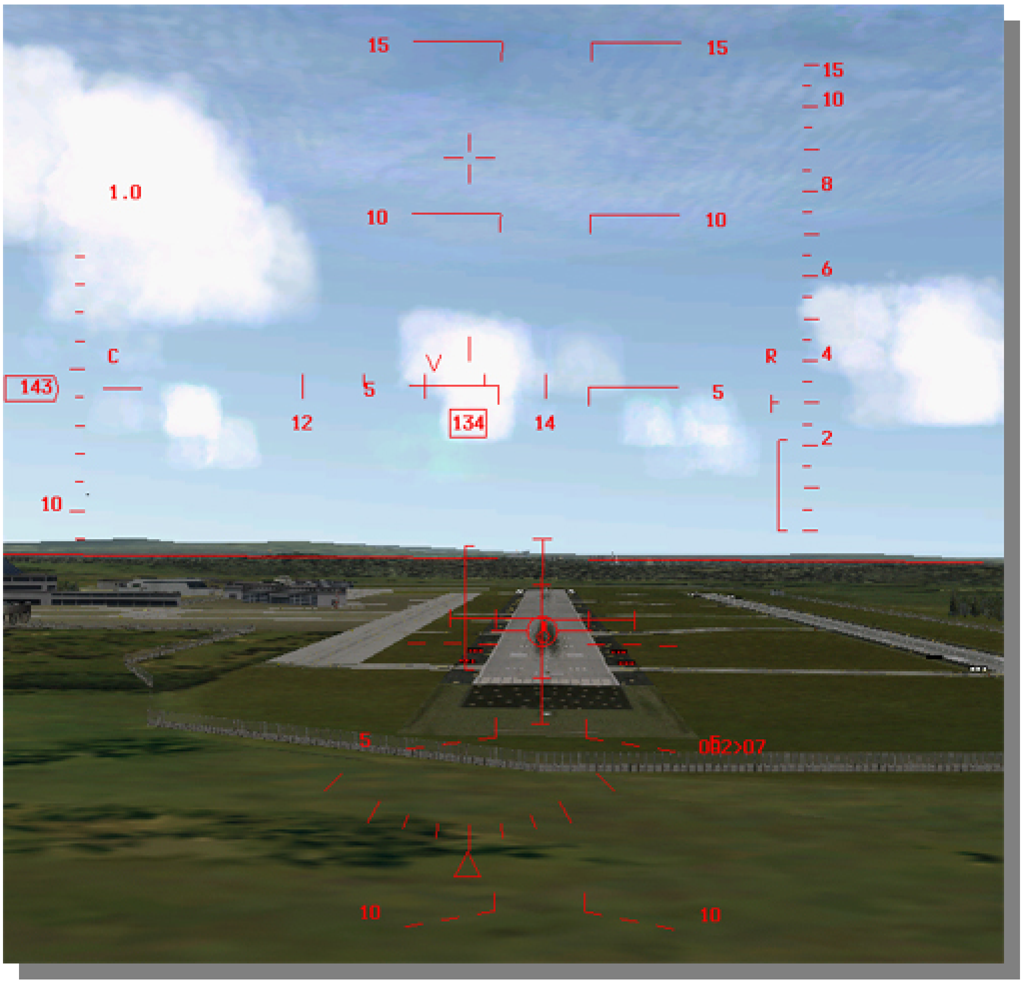
There is the CDI centring on 300° radial, we switch to ILS/Tacan.

The HSI switches to ILS tracking as the ILS bars are displayed into the attitude indicator. In the HUD, the ILS bars are displayed as well and the ILS command steering bar is offset to the right (green arrow) calling a right turn to intercept.

Note we are already on the glide so we better start our descent.

Normally, we should first intercept the localizer and then the glide should descend on us. Kimpo approach, due to different factors such as the extreme range of Suwon tacan in the DME ARC and the prohibited airspaces North of Kimpo makes the approach a little rough.
Anyway, follow the ILS command steering to line up, reduce speed now by popping the airbrakes and lower the landing gear as soon as you are on glide, on LOC.
the rest is ILS as usual and you will be at minimum (241ft AGL) at the inner marker with the runway in sight.





5.7. Conclusions

Obviously, some approaches are easier than others. Kimpo is the perfect example. The almost straight in approaches on the 32 runways are very easy to perform, while the 14 runways are though due to lots of aspects.

Flight planning is paramount and although the ATC is less than helpful most of the time, it can be coped with. Do always read the charts carefully! Some warnings and caution boxes are very important, especially with high terrain around the airport. Usually, the most Caution and Warnings, the tougher the approach, but that is quite expected.

I realize the charts & procedures are not always perfect but I hope you enjoyed reading the tutorial as much as I enjoyed making it.

Olivier

List of abbreviations

With explanations by Snake122

AA T/R - TACAN air to air tracking mode. *In A/A TR an aircraft mounted TACAN can be used for navigation information.*

ADIZ - Air Defense Identification Zone - area surrounding a country where inbound must be identified for security purposes.

AGL - Above Ground Level - height in feet above the local terrain. *Constantly changes even if you do not climb or descend due to hills, valleys, etc. Still an important to know because it is always good to know how far you have until you hit the dirt.*

APRON - The concrete area in front of hangars to park you plane.

CDI - Course Deviation Indicator - a small bar on a VOR or HSI instrument that shows how many radials you are off of the selected radial.

CRS – Course - a knob on HSI used to select the radial to navigate with. Course is also the direction in degrees of a line between two points.

DCS - Data Command Switch - switch on the ICP. *A cursor control for your DED.*

DED - Data Entry Display - the monitor for your ICP. *Shows a multitude of information in its many pages.*

DME - Distance Measuring Equipment - a radio device that tells you how far way you are from the unit in slant range. Slant range is the straight line between you and the station with altitude factored in, not the distance over the ground. *i.e. if you were 6000 feet above the station you would never be less than 1 NM since even when on top of the DME you are still a mile above it (time to join the mile high club!).*

ELEV – Elevation (in feet above Sea Level)

FIR - Flight Information Region, area where flight information and alerts can be given. *It is normally the airspace over a country.*

GPS - Global Positioning System *(a system of satellites to help you navigate all over the earth, best navigation system since the compass* –Snake122)

GS - Glide Slope - the up/down (vertical) guidance for an ILS. *Usually about a 3° slope down to the runway.*

HAS - Hardend Aircraft Shelter, a garage for your plane built to withstand some explosions.

HDG – Heading - a knob on the HSI used to remind the pilot of a certain direction in degrees or with autopilot in heading select mode to make the airplane turn to that selection. Heading is also a course corrected some numbers of degrees for wind.

HIS - Horizontal Situation Indicator - a complex but very useful navigation instrument. *Combines many instruments into one. Example: the Directional Gyro, VOR indicator, DME display, and Radio Magnetic Indicator (RMI). The HSI provides a one convenient place for all of this information in your instrument scan.*

IAF - Initial Approach Fix - a fixed point defined by means of navigational aids such as TACANs and DME beacons, at which an instrument approach begins.

ICP - Integrated Control Panel - the keyboard to your Viper's avionics computer.

IFR - Instrument Flight Rules - the set of regulations outlining how to fly in bad weather.

ILS - Instrument Landing System - a type of instrument approach procedure that has a glide slope, localizer, approach lighting system, and marker beacons to provide guidance to the runway in bad weather. *Normally, it has the lowest weather minimums of any approach so it is the one to shoot when the chips are down.*
ILS DH - Instrument Landing System Decision Height - an altitude on an ILS approach at which you execute a missed approach procedure if you do not have the runway in sight. *It is normally about 200 feet about the ground.*

IMC - Instrument Meteorological Conditions - when the weather is bad enough that flight can only be done safely by reference to the instruments alone.

LOC – Localizer - Navigation system similar to VORs and TACANs except that instead of having 360 radials it only has 3 to 6 radial making it much more accurate. It is the left/right (lateral) guidance component in an ILS and also a stand alone approach system at some airports.

MM - Middle Marker, a marker beacon on an ILS approach path used for range information. It is placed about 3,500 feet from the end of the runway and approximately where the DH is reached.

MOA - Military Operations Area, special airspace for military pilot to practice tactics. *Think of it as a Fighter Pilot's playground in the sky.*

MRK BC - Marker Beacon, a light in the real F-16 cockpit that lights up when crossing an ILS marker beacon. It is not implemented in most versions of Falcon.

MSA - Minimum Safe Altitude

MSL - Mean Sea Level - height where the sea is when waves and tides are averaged out. *Aircraft altimeters are set to this due to differing elevations along the route of flight. If this was not done this way one problem would be if you took off from a mountain top airport with an altimeter set to zero feet, when you landed at a lower airport your altimeter would be less than zero.*

NDB - Non Directional Beacon - a radio navigation beacon. *An Automatic Direction Finder's (ADF) or Radio Magnetic Indicator's (RMI) arrow in the aircraft always points toward the NDB.*

NOTAM - Notice to Airmen - continually updated information about airspace, frequencies, obstructions, airport conditions, restrictions, and regulations.

OM - Outer Marker - a marker beacon on an ILS approach path used for range information. Placed approximately where the glide slope would be intercepted at the normal assigned altitude. The Outer Marker is the outermost marker beacon from the runway.

POL - Petroleum oil liquid tank - really big tanks were they keep the gas.

RWY – Runway - that strip of concrete you are aiming to put your bird down on *(hopefully in one piece).*

SID - Standard Instrument Departure, a published route following radio navigation methods to leave an airport in an organized fashion.

STPT – Steerpoint - a waypoint stored in the F-16's navigation computer.

T/R - TACAN ground tracking mode. *In the T/R mode a ground based TACAN station is being used for navigation information.*

TACAN - Tactical Air Navigation station - a military radio beacon for aerial navigation, can be positioned on the ground or in another aircraft.

TACAN DA - TACAN Decision Altitude - altitude where a TACAN missed approach is initiated.

TACAN RAD - TACAN Radial - the radial that the TACAN instrument approach procedure is flown on.

TRANS ALT - Transition Altitude - altitude flown between instrument procedures on with local altimeter settings *(altimeter settings are not implemented in Falcon)*

TRANS LEVEL - Transition Level - same as Transition Altitude except given in abbreviated flight level speak with the last 2 zeros dropped off, *i.e. FL180 is 18,000 and the altimeter is set to standard pressure of 29.92 in. HG or1013.2 millibars.*

TWR – Tower - the place were those nice ATC people sit and try to tell you what to do.

UFC - Up Front Control - switch position on the Viper's Aux Comm radio panel. *When in this position your ICP controls the TACAN radio frequencies.*

VASI - Visual Approach Slope Indicator, Red and white lights on the side of a runway to help you maintain the proper approach slope to the runway. (*Remember: White over white you'll fly all night, red over white and you're alright, red over red and you're dead.)*

VFR - Visual Flight Rules - the set of regulations outlining how to fly in good weather. *(less strict than IFR).*

VMC - Visual Meteorological Conditions, when the weather is good enough for you to navigate by seeing things outside the airplane.

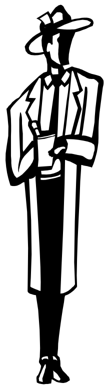
VNDB - *Virtual* Non-Directional Beacon - a user created waypoint for approaches in F4 to simulate an NDB.

VOR - Very high frequency Omni-directional Range - a radio navigation beacon that produces 360 radials for navigation. *Also a name for the instrument used to follow the beacon.*

VORDME - a VOR and DME beacon co-located.

Aragorn's VIRTUAL PILOT Interview

Aragorn: Firstly, would it be true say that the Virtual Pilot is a special breed…?



Joe Pilot: Would it be true to say a Priest is a virgin…?

Aragorn: Not the last three I had sex with. But – hey…! Boston's a great city.

Joe Pilot: Any other questions…?

Aragorn: Is Situational Awareness important to the Virtual Pilot....?

Joe Pilot: OF COURSE. Whilst flying the Virtual Viper, one must CONSTANTLY be aware of one's surrounding environment. Supervisors, co-workers, the wife…. Having your boss sneak up undetected on your "six" could have catastrophic results for your employment.

Aragorn: Pre-Planned threats…?

Joe Pilot: Of course. These must be vectored into ANY successful mission. You plan for the Wife to be thinking that you're fixing the leaking toilet cistern…? Plan for these contingencies…! I have a "boss button" that opens directly to a Plumbing D.I.Y. Page on the Web.

Aragorn: Could you describe a "Typical Day" in the life of a Virtual Pilot...?

Joe Pilot: Sure. We usually wake early, and immediately open our e-mail to check for responses to our Forum posts. Then - off to work. Be SEEN to be working for about 30 minutes, then – if the area is clear of threats - Surf the forums. After lunch, co-workers get a little tired. It's a great time to be downloading the latest mod (SA must be maintained at all times). Get home, check the forums for any new Threads, and then – acting exhausted – bug the wife for dinner. Decline her offer of "watching T.V. together", and tell her "you've got work to catch up on". Milk this "bringing the office home" for all the pity you can. She MAY even bring you a beer…! Be sure to have your "boss button" programmed into your HOTAS (fake Excel page does it). Then, it's time for a quick mission (or two on Friday nights), and finally onto the forums to check for any Flames, before going to bed. (Make sure the wife is already asleep, or she may want sex…!)

Aragorn: Sounds like a busy life, 'eh…?

Joe Pilot: Takes a special breed, to be sure.

Aragorn: So – as a Virtual Pilot, have you suffered any bad experiences....?

Joe Pilot: I once had a Stopworks' Pit, where one of the buttons wasn't clickable…! But – I don't wanna' talk about that. The pain is still a little fresh. Other things…? Hmmmm…. I once read a post by Stang. That hurt. Often, we're subjected to Frugal and his "jokes". Yeah – it's hard sometimes.

Aragorn: So – being a Virtual Pilot is not as fantastic as it's made out to be…?

Joe Pilot: Look, Ara' – we have some pretty dramatic times with what we do. Not everyone could hack it. As I said – it takes a VERY special breed of geek. Things the ordinary person-on-the-street just wouldn't understand. Man – I once lost an AI Wingie, and it really fucked me up, yeah…?

Aragorn: What happened…?

Joe Pilot: I was flying Falcon3.0, and….

Aragorn: 3.0...?

Joe Pilot: Yeah. In F4.0, nobody even cares. Like – you don't even KNOW those AI. You can't "manage" them. War is faceless, dude. They are just a bunch of faces and names, and one snowman.

Aragorn: I see. Go on.

Joe Pilot: Dude had saved my ass MANY a time. He swallowed an Alamo, and was dead before… before he… he… he could… he could push Ctrl + e + e + e...

Aragorn: I'm really sorry, dude. Do you – like – "Remember the Alamo"….?

Joe Pilot: ***Stares***

Aragorn: Sorry, dude. So - it hurt bad...?

Joe Pilot: He was a good mate. We drank together. Often spoke together. He would sometimes come into my computer room, and we'd converse for hours.

Aragorn: er…? Anything ever come from those conversations…?

Joe Pilot: Yeah. The wife had me committed to an institution. I'm still on meds.

Aragorn: So – you know now, that he wasn't a "real" person…? Yes...?

Joe Pilot: Well... Just between you and I... that's what they ***WANT*** you to believe....!!

Aragorn: Yeah. Ah… rock on, dude.

Joe Pilot: You ever lost a wingie, Ara'…?

Aragorn: Huh…? You mean…. Like….. ah… you DON'T KNOW "that" story….???!

Joe Pilot: Don't know what story…?

Aragorn: Nothing. So – Operational hazards…?

Joe Pilot: Oh, yeah…! The "unexpected". Can NEVER plan for it…!
Lining up on final; damaged jet; limping in, and suddenly - gotta' take a piss.
Going "F.E.N.C.E.", adrenaline starts pumping; RUN OUT OF CIGARETTES....!
Pull hard on the HOTAS and spill your beer into the keyboard.

Aragorn: I imagine, that being a Pilot (Virtual) would mean you are up on Technology…?

Joe Pilot: Yeah. We need to stay up-to-speed on technological innovations. 3D glasses; Track IR; X-52's.

Aragorn: Cougar…?

Joe Pilot: It's the only product I know, where you send it in for repair BEFORE you take delivery.

Aragorn: So – tell me about the Social life of the Virtual Pilot...?

Joe Pilot: Because we are an elite group, we Virtual Pilots tend to stick together. Most of my social circle exist within my PC Monitor. Sometimes we mix with the common people. Y'know…? Go to bars, and rattle off technical details of the General Dynamics F-16. Impresses some people.

Aragorn: I guess the people who are impressed are those people not worth impressing, 'eh…? *Hee hee…*

Joe Pilot: What do you mean…?

Aragorn: *Hee h……* er… Nothing.

Joe Pilot: Yeah. But – MOST of my time in bars is spent explaining to people - It's NOT a freakin' GAME...! It's a SIMULATOR. Most just don't get it. They just score with chicks, and go home for sex. Shallow. They wouldn't know a Block 30 from an F-XL…!

Aragorn: er… yeah. Losers… ah… You talked about a "Special Breed". Elaborate…?

Joe Pilot: Special breed of geek, Ara'. Only the elite are cut out for it. Usually - no friends, no chick, no desire to go to gym, no desire to exist in a community which ISN'T behind a PC Monitor. A desire to exist in a vacuum, in which the greatest threat is a B.S.O.D.

Aragorn: Sounds dangerous.

Joe Pilot: It's VERY dangerous. To your mental health, and sense of emotional balance.

Aragorn: I saw a photo of your wife. She's got a hot arse, dude…!

Joe Pilot: No. She just uses a Sidewinder Force Feedback 2. I've got the X-52.

Aragorn: Uh-huh. I'm guessing you don't have sex very often.

Joe Pilot: Too right. THAT time can be used to Dev. or hone my TacEdit Skills.

Aragorn: So, how does one go about becoming a Virtual Pilot…?

Joe Pilot: It's a process. A long process. Start out with a trainer; a survey sim. like LOMAC., move up to a mid-level sim. like Allied Force, and then….. well…. on to the Hard-core versions, like Red VIPER.

Aragorn: Everyone follows this process…? .

Joe Pilot: No way. No. Many never graduate past the LOMAC stage. It's just TOO big a step; too BIG a commitment to move up to Falcon. Too many sacrifices. By the time you're competent at Falcon, it's too late to go back. You've become a Virtual Pilot, and you have many responsibilities to shoulder.

Aragorn: For example…?

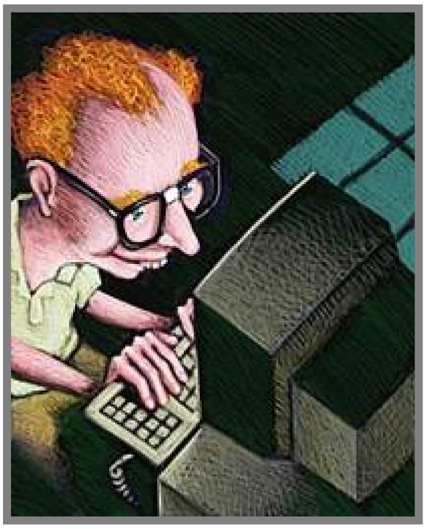
Joe Pilot: The responsibility to Upgrade your Hardware at the release of every new patch. The responsibility to hoard money from your wife, so as to buy G-15's and ICP's and HOTAS and Glasses and Track IR. It's a never-ending process of hoarding, spending, arguing and making excuses. For sure – the best-of-the-best Virtual Pilot can never marry. And – if he DOES marry, he'll usually sleep alone.

Aragorn: Do Virtual Pilots live by any special "code"…?

Joe Pilot: Sure. We follow the "Way Of The Fanbois". It is a zen-like state in which there is no knowledge, but the knowledge of your own sim; no acceptance of "truth" as anything other than a mental state derived from the Sim which you happen to fly. Many have suffered for this Code. It is intrinsic to the VP experience.

Aragorn: Well, thanks for the interview, dude. You are – like – completely mental.

Joe Pilot: Just doin' my job, Sir. Just doin' my job.



Disclaimer: No Cardinals were harmed during the course of this interview

A HANDBOOK

SECTION 1 BVR

SECTION 2 BFM

THE FIVE STAGES OF BVR

- Captain Chris "Dax" Widick

If properly performed, a BVR engagement will remain a BVR engagement through its entirety, which – ultimately - is our goal. It is often said in the fighter jock world that, "If you have to go guns or heaters on your bandit… you've done something wrong." This logic certainly holds true when a strictly BVR fight is desired. Though there are times when a knife fight is preferable to a long range engagement, WVR tactics are outside the scope of this Guide, and - as such - will not be addressed here.

The Five Basic Stages (in chronological order) are:

1. Awareness and Detection
2. Sorting
3. Intercept
4. Defensive Response
5. Kill Confirmation

AWARENESS AND DETECTION

It stands to reason that in order to knowingly engage a suspected bandit, one must first be aware of, and detect said target. As it pertains to this discussion, the difference between Awareness and Detection, must be explained.

Awareness, as the name implies, is the pilot's ability to know, suspect or be aware of an aircraft that *exists* somewhere in the relatively near vicinity, though it may not have, as yet, been detected. This is accomplished through the development of the fighter pilot's most important skill, Situational Awareness ("SA", an especially vital concept discussed later).

Detection, for the purposes of this discussion, will be defined as a confirmed radar contact and/or "strober" indication, unknown or thought to be potentially hostile. For example, a RWR indication of a Slot back type radar, outside of lethal range at 11 o'clock is "awareness" of a MiG-29/Su-27 where as an AWACS call of nearest bandit off the nose at 20 miles and a corresponding "strober" on the scope can be considered "detection".

Awareness may come from a variety of sources. Within the Falcon 4.0 world, AWACS is most often your first indication that a potential threat exists. AWACS is, for all practical intents and purposes, omniscient in the Falcon world and - if utilised properly – can be a tremendously powerful resource.

Awareness may also come from other flights, whether they be AI or Human. Often overlooked, AI Flight communications are an excellent source of information when building your Situational Awareness. They indirectly provide you with information that *adds* to the mental picture of your environment that you ought to be creating in-flight. Though not always relevant, the more information you can acquire by any means the better. Human pilots of other flights will tend to be part of your package and as such, the information available from them will tend to be especially relevant to your flight. And, as common sense would dictate, information from aircraft within your flight is crucially relevant.

There are two primary methods of detection, Radar and Visual. By strict definition, Visual detection has no relevance to the BVR fight (at least not at this stage), and therefore only Radar detection will be discussed.

It is assumed those reading this have a cursory understanding of the mechanics of modern radar and - as such - this discussion will limit itself to topics regarding proper deployment of radar scan techniques.

RADAR & SCAN-PLANS: What is often stated, in one manner or another, is that the greatest weakness of radar is the operator. What this really means is that the inability of a radar to detect an object is most often as a result of the radar looking at the wrong portion of the sky. Radar control and operation ought to be considered fundamental basics; learned and mastered to a level of proficiency that allows the APG-68 to be operated as though it was an extension of yourself.

Part of any thorough preflight briefing should include a "scan plan". It should include altitude blocks and ranges for each member of the flight and specifically scripted with regards to the type of flight, mission, and flight plan. The idea is to have as much coverage over sky that is relevant to your flight and is possible given the resources on hand (i.e. number of radars available to you and your flight).

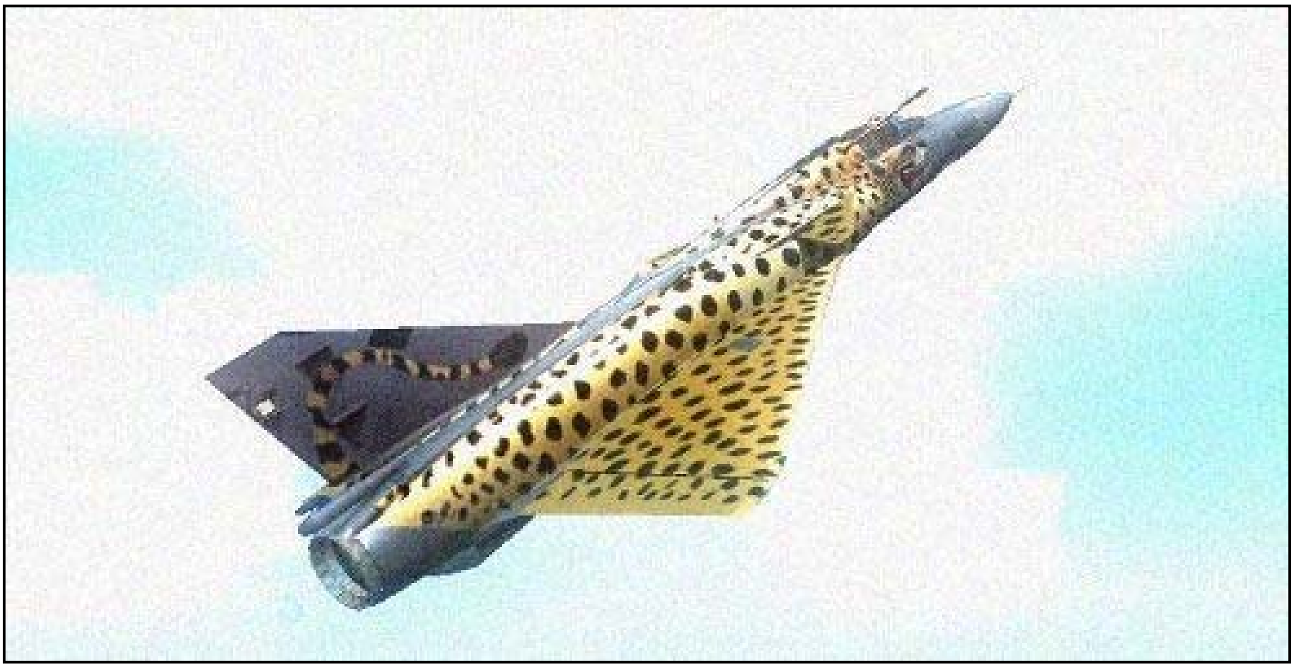
A two ship “scan plan” may consist of something as simple as Lead scanning mid to high altitudes, and wing scanning low to mid altitude, 40 mile range, enroute to target during a strike mission, leaving the longer range scanning responsibilities to it’s escort, if applicable. Furthermore, it may be briefed that should escort flight be engaged within that 40 mile scan area, that the two ship assume long range scan duties until such time as escort can resume.

A two ship “scan plan” in the BARCAP role, may be just as simple, with addition of alternating headings in a holding pattern type orbit, maximizing area coverage at any given time.

Four ship “scan plans” can become more complex as well as more inclusive with regards to the amount of area that may potentially be scanned. Lead element may duplicate a scan pattern similar to the one mentioned above for the two ship strike, only now they may shift their scan laterally off course to the left, while second element follows opposite to the right, thus effectively covering the entire front hemisphere relative to their heading.

Regardless of the pre-briefed plan, the primary goal is to ensure that an understanding exists between all flight members with regards to their area of responsibility. Having four capable radars scanning the same exact area of sky is a horrendous waste of resources, not to mention a perfect recipe for ambush.

Ideally, in the detection stage the decision is made as to whether to push the fight, or to bug out. A thorough preflight briefing should have covered the ROE so as to give the flight members a better level of expectancy when an engage/disengage order is given by lead.



SORTING

Once the decision has been made to continue the engagement the task at hand becomes effectively sorting the bandits. The primary goal is to ensure that each flight member is aware of and has a positive ID on his bandit and/or area of responsibility within the fight.

A sort can quickly become a complicated tangle of communications that can quickly lead to a tumbleweed situation for the entire flight, and - as such - proper brevity and sort techniques must be utilised. Any one of, or combination/variation, of the following methods can be employed to help ensure an accurate sort.

Lateral Sort - The most obvious method is to sort laterally as depicted on the radar scope. Often lead and trailing aircraft are readily apparent and can quickly be sorted and a verification of this should sound something like:

> Falcon11 - *"Bandits, two-ship, Bullseye 270, 40 miles, angels 22… One has lead"*
> Falcon12 - *"Confirmed, two has trailer."*

Vertical Sort - When enough lateral separation does not exist or an altitude difference within the hostile flight is the most distinguishing feature sorting vertically may be implemented.

> Falcon11 - *"Bandits, two-ship, Bullseye 270, 40 miles split vertically.*
> *One has bandit angels 22"*
> Falcon12 - *"Two has second bandit, angels 17."*

All that needs to be accomplished is that the friendlies involved verify their target's altitude which ideally should provide enough of a discrepancy to ensure effective sorting has been accomplished.

Often, within the myriad scenarios Falcon presents, you'll find that other methods may be more effective. The means to the end in this case are incidental, and the primary focus needs to be that proper sorting is quickly and accurately accomplished. Otherwise, far too often, multi-ship flights can easily Fox on one individual bandit, not only wasting valuable missiles but allowing the lost bandit a perfect opportunity to go on the offensive whilst he's unengaged.

INTERCEPT

We've detected, identified and sorted our bandits at this point. Upon entering this stage of the engagement the Flight Lead has essentially two options: Prosecute or go Defensive. Depending on the resources available (i.e. A2A weapons, Escort Flight present within the package, friendly fighters/SAMs nearby) Flight lead may opt to go defensive, which in and of itself offers a few options. At his discretion, he may slow your flight to allow your escort an opportunity to engage, or he may opt to have the flight change heading or even reverse course for a short period of time, again allowing the Escort Flight more room to engage. Given extreme circumstances an abort and RTB order may be given.

Should the Flight Lead determine the bogeys to be hostile, a threat to your flight, and Lead makes the decision to engage, the prosecution stage of the engagement begins. At this point the Flight Lead's workload increases dramatically, and it is all important that his flight react quickly and as a cohesive unit relying on his command decisions. Poor communication and teamwork is the Achilles heel of any Air to Air engagement.

Depending on the threat and the flight's current status, the flight may either push for a WVR range fight or call for a BVR fight. For example, a heavily loaded four ship Strike package of F-16s are no match for a pair of Flankers in the close in arena, without having to drop their mission critical stores. However - given the right circumstances and cohesive teamwork - that same two ship of Flankers can be effectively dealt with, without sacrificing the mission outcome, through a successful BVR engagement.

Conversely, though not often advised, the same Flight Lead may opt to push a WVR fight with a pair of MiG-23s, so long as heaters are available, in an attempt to conserve the number of available AMRAAMs, if more lethal threats are expected. A skilled and practiced flight of four F-16 pilots can just as effectively, as with the SU-27 engagement mentioned above, deal with a pair of Floggers in the WVR arena. Such a decision relies heavily upon knowing the capabilities of your flight.

In any event, within this context the Flight Lead will call for an intercept procedure consistent with a successful BVR engagement, and the flight itself will act accordingly.

Such tactics will be discussed further in this Guide.

DEFENSIVE RESPONSE

Though, in a sense the Defensive Response of your flight in a BVR should be apparent in the BVR intercept tactics given by the Flight's Lead, it is crucial enough in the BVR environment to acknowledge it as a separate entity within the engagement. Given the mechanics of modern day BVR weapons, their threat is often not realized until far too late. Case in point - there is no positive indication of an AMRAAM or AA-12 launch until either visual acquisition is acquired or its own onboard radar goes active. Both scenarios are not a good place to be if you have a strong sense of self preservation. All too often a pilot's family receives a letter of condolence as a result of his failure to react to the potential threat that may be inbound. As a result, careful consideration must be given with regards your threat's type and capabilities. For example → a proper BVR engagement against a pair of SU-27s potentially armed with AA-12s should involve a just barely within Max Range shot of your AMRAAMs, and a subsequent forsaking of the radar guidance until "pitbull". This provides for a defensive posture or maneuver that ensures a higher chance of survival. Conversely, if the capabilities of the Flogger are understood, a BVR launch against a MiG-23 allows the launching F-16 more freedom to close and increase the Pk of his launch.

KILL CONFIRMATION

As self-explanatory as it seems, the final basic stage in the BVR engagement is crucial, yet often deceptively difficult. Once a hit is expected, it should not be considered as such until positively confirmed. Assumed kills have a nasty habit of biting pilots in the ass, unexpectedly.

Targets often fade from radar, RWR nails can be eliminated with the flick of a switch, and even those dark plumes of smoke that so easily provoke the elation of a kill can easily represent nothing more than an injured, and probably irritated, bandit. However, the presence of all three of these criteria is often indicative of a good kill.

A positive visual on a secondary explosion marking the disappearance of your bandit entirely is even better, but not always available within the BVR realm. Much like proper sorting, the means to the end are relatively incidental so long as proper precautions are taken to verify that the kills have been made. Until such time as the kills can be properly confirmed, the Flight Lead should maintain a defensive stance for his flight, and be prepared for a re-engagement or separation, as necessary.

Basic Prosecution of the BVR Fight

Successful prosecution of the BVR engagement relies heavily on a simultaneous execution of both offensive and defensive tactics, when dealing with high threat bandits such as Su-27 and MiG-29S's. Both the Flanker and Fulcrum "Sierra" model are AA-12 capable, making them the most lethal Red aircraft in the sky. As such, Prosecution tactics will be discussed with regards to them. The Soviet Adder indeed has a longer range than that of the AMRAAM, however it's less maneuverable and its radar's cone of vision is slightly smaller than that of the AIM-120. These two deficiencies can almost entirely negate the longer range of the Soviet missile, if exploited properly. In facing the AA-12 in combat, there are several primary methods each of which have their own benefits and deficiencies:

The Beam

The concept of the beam is based on exploiting a flaw inherent to most modern Radar. In order to reduce ground clutter on the radar scope, modern radars filter out what they see as stationary objects through the use of the Doppler Effect. What that this means to you as a pilot, is that if you were able to make you aircraft appear stationary to the hostile radar, it will indeed filter you out just as it does buildings on the ground. Initially you might think this not possible, however "Beaming" your bandit does exactly this. The term "Beam" refers to your 3 and 9 o'clock lines. So following logic, to beam or the act of beaming refers to placing the object in question along that axis of your aircraft. When that object is a Pulse Doppler type radar the end result is that you have effectively zeroed your speed *relative* to the radar. The only closure the radar senses is that of its own aircraft's speed. At this point you are filtered out as being nothing more important to the radar than a tree. At best this will prevent the bandit from locking you solidly enough to engage, but more realistically it will make their life more difficult by providing intermittent chances of locking. In order to apply this technique in a BVR fight the Bandit should be identified and locked by no closer than a 20 nm range. This will give you adequate time to set up for a head on engagement, which is desirable in this situation. While head on, keep a close eye on your range to target, his aspect, and closure rate. You may launch at anywhere inside 20nm and possibly acquire a kill, but generally speaking 12-15nm is preferred depending on closure and aspect (aspect simply put is the number of degrees you are off your target's nose).

Launches at the longer ranges (15nm+) are often successful in spooking the bandit just enough for him to go defensive, which sometimes is an adequate resolution to the engagement, while ranges closer than that dramatically increase your PK (Probability of Kill). In any case, practice in Dogfight type engagements setup in Falcon for BVR will allow you to find the range that you feel allows you both the highest chance of a kill as well as highest chance of survival. With much practice that range will greatly decrease.

Figure 1a: *Depicts just prior to the launch and initial turn into the Beam.*
Notice: Range - 14nm, Heading - 181 degrees, Speed -: 642 knots.

Near Head On orientation to bandits. Jammer on. Immediately after launching on the Bandit the Beam is executed. This is performed by a high G turn either left or right, roughly 90 degrees. Should the Slot back still have his radar active, the RWR will provide an excellent reference to place the boogey on your 3 or 9 line. Should his radar be intermittent or off entirely, some estimation is required as you're sure to bust gimbals (lateral range of your radar) in this maneuver, which means you had better been paying close attention to his heading/aspect before going into your turn. At this point the defensive maneuvers are begun.

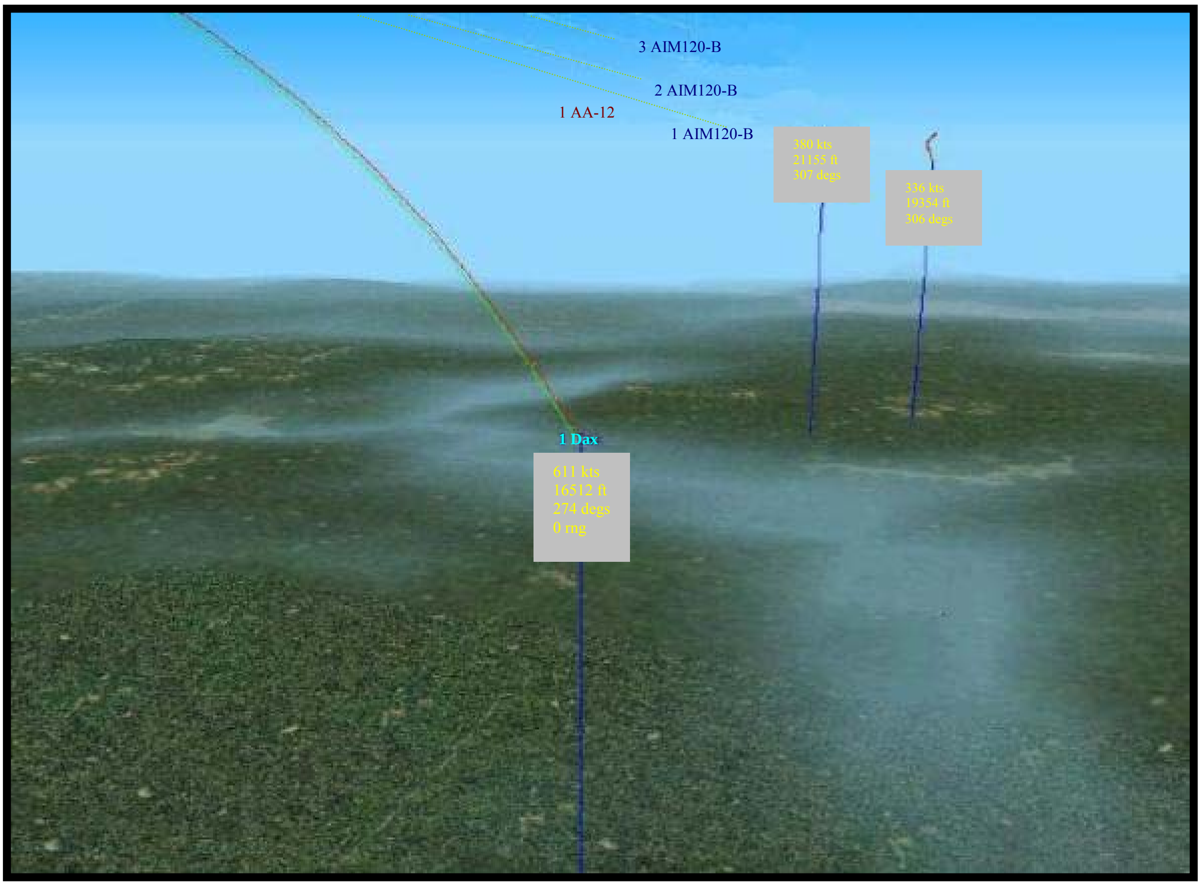


Figure 1b: *Nose down attitude, speed increasing extending from bandits.*
Heading, 274 degrees, nearly a perfect beam (93 degrees of original heading of 181). Jammer off.

If your launch range approached 15nm, it's a safe bet that the Slot back has launched on you. Remember, always defeat the threat, and when a missile is launched it becomes the threat and the launching aircraft should be secondary in your mind…. but still on your mind. Once the Bandit is Beamed several actions must be performed as quickly as possible in order to ensure survival. Any Jammer in use MUST be turned off. Negating closure rate to a radar guided missile, while making you invisible to the missile, does nothing to hide the emissions your ECM pod is broadcasting, and the AA-12 is very capable of locking on to those emissions in HOJ (Home on Jam) mode. At the same time a nose down (anywhere from 10-20 degrees is sufficient), full mil to AB attitude should be established while scanning visually for the missile and several bundles of chaff should be pumped out. This serves a couple purposes.

First, it increases your energy state as you increase your speed, sometimes upwards and past 800kts+. By this time, the missile's motor is sure to have burned out and it is strictly an energy fight at this point. The drastic increase in your speed helps diminish the missile's closure rate, forcing it to continually lose ground in the energy fight. Remember, with less than a 10 second burn time any missile's energy is limited, while that of your jet is relatively infinite.

In addition, you'll eventually level out at close to ground level. If you haven't beat the missile at this point, the un-filterable ground clutter will help mask your presence, possibly spoofing the missile. Furthermore, radar guided missiles fly a lead pursuit (a course that points their flight path ahead of yours for intercept). As a result, radar guided missiles have been known to smack into the deck while trying to maintain a lead pursuit on a lower level aircraft. Finally, being at a low level often allows the option to place a large object (i.e. mountain) between you and the chasing missile.

During your descent a slight turn into the missile helps maintain a proper aspect for beaming. The missile flying a lead pursuit already as an inherent angle on you, small enough to negate the effect of beaming so in order help remove this advantage, a slight bank of 10-15 degrees often creates just enough of a constant change in flight path to maintain effective beaming.

Once on the deck, the priority becomes visually acquiring that missile. The missile may not be present on your RWR, but that is not to say that you have beaten it just yet. All too often overconfidence in the situation has prompted a pilot to turn back into a missile still looking for a target… and found himself the target. Visual acquisition can be relatively difficult at this point as the missile's motor is spent, removing from view the very easy to spot smoke trail. However, once acquired visually, immediate recognition of whether you are still its target

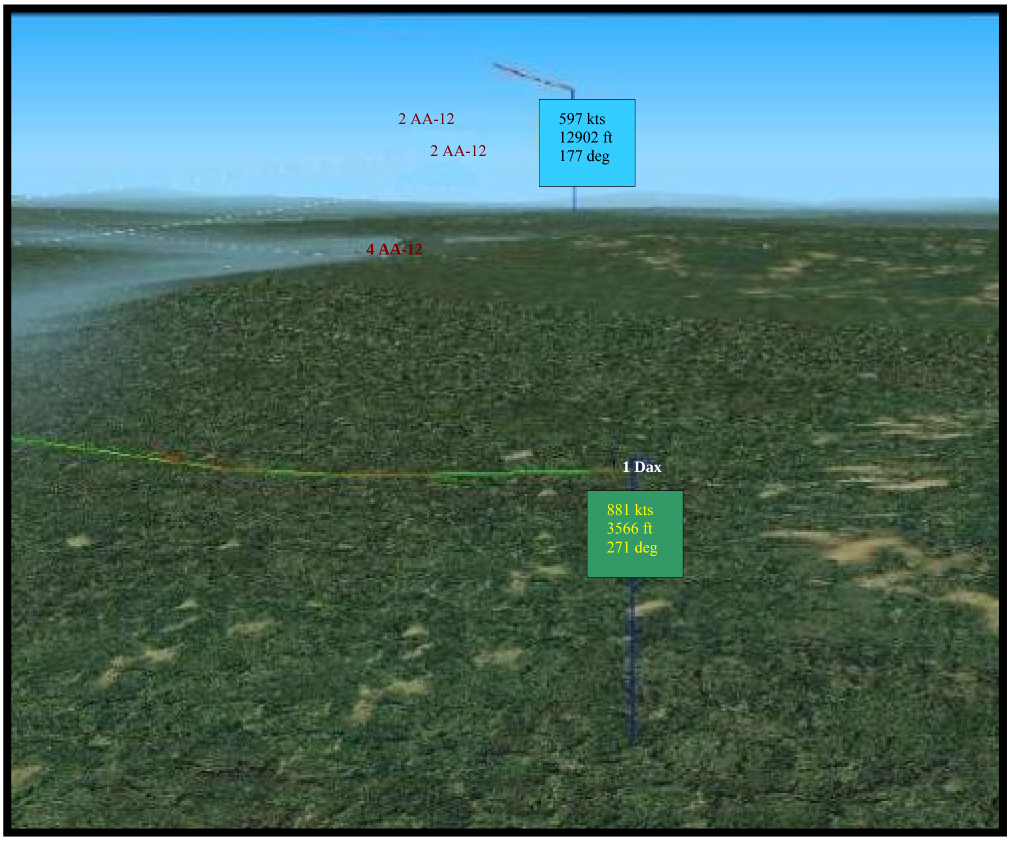


***Figure 1c**: The Beam is established and maintained at this point, maintaining a heading roughly 270 degrees off from original at full/AB. Missiles are effectively beaten and need only be outrun at this point prior to reengagementis required. This is done by observing its relative motion*.

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A visual target, and this applies to aircraft as well as missiles, that has no relative motion (i.e. it is not moving in your canopy) is on a collision course for you (also known as a lead pursuit). With this information at hand we can deduce that if the missile is visually moving to your aft, it has lost its lock on you and is now without a target, or at the very least, you are not its current target. If this is the case, maintaining your defensive stance and current heading or a turn into the missile's point of origin, should spoof the missile entirely. Should the relative motion be towards your nose, a high G turn *into and past* the missile should be enough to place it behind you with no hope of reacquiring you. In the case of no relative movement, it should be considered tracking you, regardless of RWR information. At this point you are in a position of considerable advantage as the missile has been nearly depleted entirely of any sort of effective energy and a well timed high G turn into or above the missile will effectively beat the missile.

Figure 1d: *View from inside the 'pit of visual acquisition of inbound AA-12.*

At this stage in the fight the high G maneuver performs two functions: It burns off even more energy from the missile putting it in an energy state, hopefully, where it may become effectively unable to close in near enough to cause damage. Secondly, at shorter ranges the cone of vision of the radar's seeker is very narrow, and the high G maneuver increases your chances of moving out of the field of view of the radar.

The Beam tactic, as effective as it might be, carries with it some serious disadvantages. Primarily, in performing the maneuver, you effectively lose radar lock and greatly diminish your chances of visually acquiring the Slot back, preventing you from going defensive or even re-engaging it should your initial launch miss its mark. Should this be the case, you will find that unless the Slot back disengaged, he will still be in your forward hemisphere and looking to reacquire you. At this point you will be in a seriously disadvantaged situation: low to the ground with minimum look up capability and most likely tumbleweed as to the Slot back's posit, while he has spent the time of your maneuver looking for you. The Beam tactic is good for a defensive disengagement, but poor on offense after your initial launch.

THE DRAG

"The Drag" concept is the most simple of the options and should be learned to proficiency first. It offers a high chance of survival, however it also diminishes you ability to maintain accurate Situational Awareness, and by its very nature forces you into a very defensive stance. The technique involves a mid to max range shot on the bandits (12-20nm miles) and a Split-S maneuver to reverse and extend from the incoming threat (the AA-12). This is most effective in a nearly head on engagement.

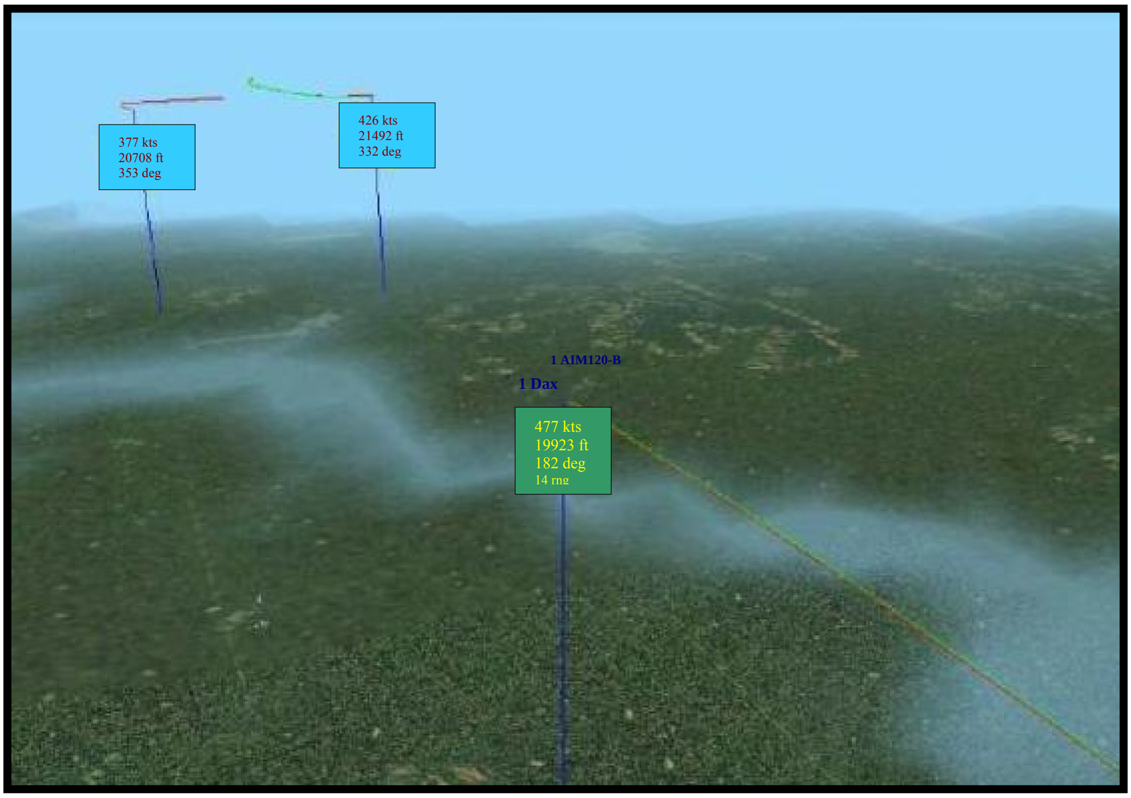


Figure 2a: *Initial setup for the Drag. Head on engagement, range 14nm, positive radar contact on lead bandit. Heading 182, speed well above corner speed. Jammer on.*

The bandit needs to be identified and locked on to by no later than 15nm in order to ensure success. When this is accomplished, preferably prior to 20nm, wait patiently for the range to pass 15nm, unless a low PK shot is desired with the hopes of pushing the bandits to go defensive. In either event, once your AMRAAM is off the rail a negative Split-S maneuver is performed, reversing your course 180 degrees, accompanied by several bursts of chaff.

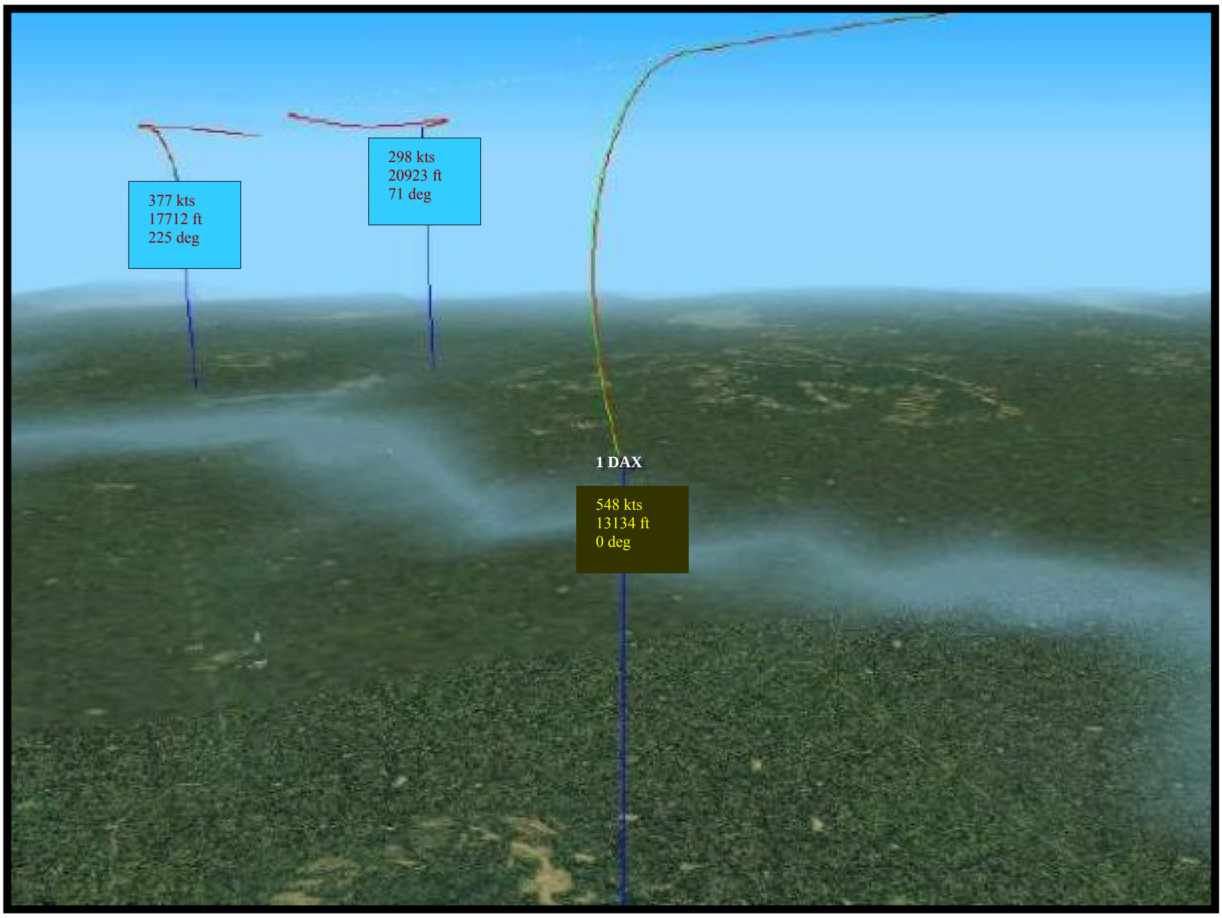


Figure 2b: *The offensive launch has been performed and the Split-S is commenced, reversing heading, increasing kinetic energy state. Jammer is off.*

Several things are accomplished through the Split-S. First and foremost, you are increasing your kinetic energy (speed) while establishing a heading that is more or less directly away from the bandit and its missiles, reducing the closure rate as well as the missile's PK on you. The increase in kinetic energy improves your situation should you need to defeat the missile close in. During the reversal, specifically during the vertically nose down portion of it, you are essentially a target with no relative speed and for a brief moment making it difficult for the hostile radar to maintain lock, effectively beaming the bandit (as discussed above). This in and of itself will not prove effective enough to spoof the missile entirely, however it may provide you with a very few valuable seconds to add to your defensive time. As with the "Beam" above, make sure that your ECM are off, preventing a HOJ situation during the maneuver.

The downward vertical velocity of your aircraft ensures that your chaff bursts will be as effective as possible. Instead of being merely between you and the missile (leaving you as a still very lucrative target in front of the chaff) the chaff are now independent targets while your aircraft is quickly trying to exit the cone of sight of the hostile missile. Once a reverse heading is established, maintain a 10-15 degree nose down attitude, preferably in full AB, for the drag. At this point the inbound missile will be just a few miles aft of you in full pursuit, with more than likely a solid lock on your aircraft. Regardless of the lock, you have a very high chance of defeating the missile in the energy fight. All that is left to do ideally is to maintain best possible forward speed until the hostile missile has lost all its energy and drops from the sky. Should enough distance still separate you and the missile at this point, it will be likely that the hostile aircraft is still locked on to you and guiding the missile, as the missile hasn't closed within range to go active with its own radar guidance (pitbull).

Figure 2c: View from the AA-12s as the Drag is finished, leaving the aircraft only needing to maintain speed and heading as the missiles lose energy and ultimately, the fight.

The benefit in this is that one of two things may happen, either the launching bandit must go on the defensive leaving its missile blind and searching, or your AMRAAM will destroy the hostile, again leaving the missile blind and searching. In either event the hostile missile still has the opportunity to reacquire you, but you've gained another few valuable seconds in the fight.

During the drag, it's advisable to scan your aft hemisphere for the missile. When the maneuver is performed flawlessly, simply out running the missile will beat the missile. However, rarely in a high threat environment do things go exactly as planned. Padlocking the missile will allow you to decide whether you have the missile beat, or if a high G maneuver as described in the above section is needed.

Figure 2d: *The inbound AA-12 is visually acquired, however being directly on the aircraft's 6 o'clock makes padlocking impossible.*

The missile is outlined in red, barely noticeable even at this range. As with the Beam tactic, the Drag is enormously effective and very easily executed. If timed correctly and performed at just the right range, a CAT III loaded F-16 can easily dispense of two Slot backs, with a high chance of survival. The Drag is also the most reliable tactic with regards to evading multiple missile launches as it keeps all missiles launched at you in your rear hemisphere with little to no change in heading on your part to evade. Effectively, this lines up the multiple missiles directly behind you and you need only use the same tactic to spoof them all. The downside, again as with the Beam, is the immediate loss of radar contact, situational awareness and most hope of visually acquiring your bandit. Should the bandit evade your launch, The Drag places him in your rear hemisphere, should he choose to maintain the offensive. Defensively you are in a safe position, high energy with good separation and the option to completely disengage form the fight or drag into friendly controlled airspace. Should your bandit go on the defensive and perform a similar evasion tactic, the separation will be much greater at which point you have the option to bug out or reengage.

Should you reengage, the separation and comparative energy states should be such that you have effectively neutralized the fight. However, kill confirmation is difficult at best in both the Drag and Beam often making it a tough decision to re-engage or bug out. Support from any trailing flights in your package or AWACS can help alleviate this problem. Re-engagement or re-establishing original heading from a Drag evasion can be dangerous and should be performed only when adequate SA has been reacquired. While the Beam and Drag are primarily defensive in nature the remaining two tactics offer a more aggressive engagement that allow for maintaining SA and an offensive stance.

THE OFFSET

The Offset is first and foremost a missile evasion technique. When performed correctly it allows for a high chance of survival while at the same time maintaining the highest PK possible. SA is maintained, and reengagement if necessary is possible in an offensive position with regards to both BVR and transitioning into a WVR fight. Again begin with a lock at ranges preferably greater than 20nm, ideally with the bandit roughly off your nose. At roughly 14-15nm, contingent on aspect, speed and closure, launch your Slammer. Throughout this maneuver you will maintain radar lock until well past the time your A-120 goes autonomous, further increasing your PK.

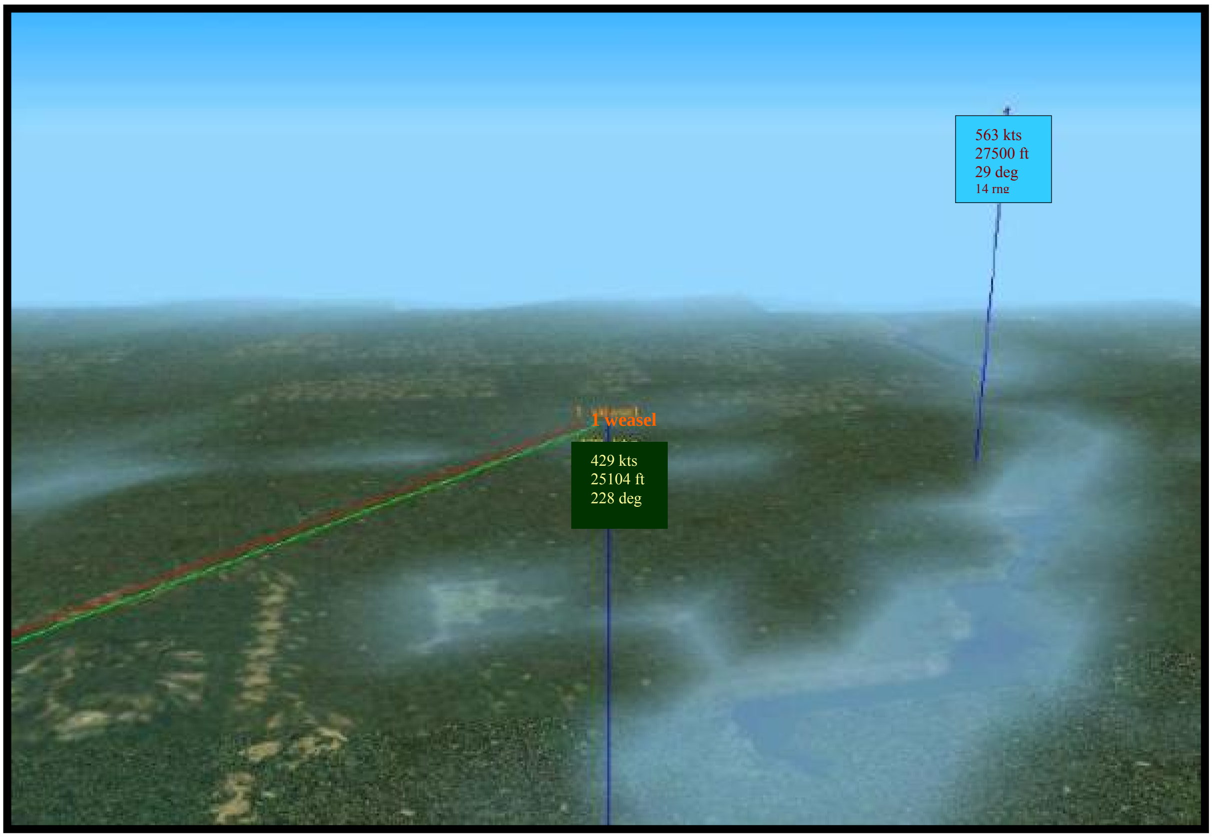


Figure 3a: *The aircraft is in perfect position to implement an Offset maneuver. Head on, 14nm range, and at high corner speed (440Kts), Jammer on.*

Note heading of roughly 230. Immediately after launch, a turn opposite of the bandit (offset) roughly 40 degrees is performed and the new heading maintained putting the bandit's bearing at roughly your 2 or 10 o'clock position. The radar target should be approaching gimbal limits at this time. During the turn simultaneously add or decrease throttle to establish max corner speed (330-440 kts) or slightly higher.

The assumption is of course that the adversary has already launched his missile, so a visual scan is commenced for the missile inbound. It is imperative that the missile be visually acquired for a successful outcome. The missile should be inbound from roughly the same bearing as your bandit. Once acquired, maintain padlock on the missile as well as your current heading.

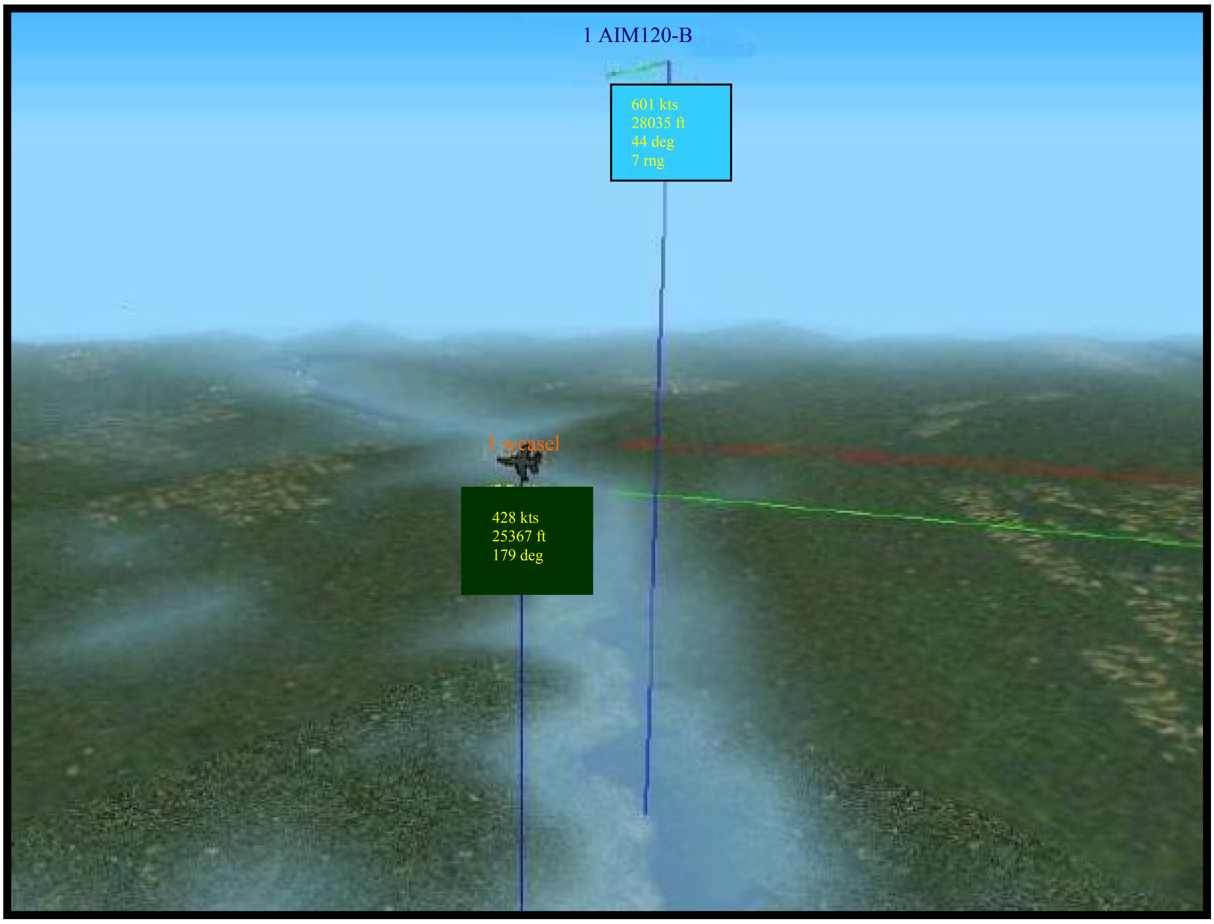


Figure 3b: *The initial Offset is seen here, after launch, establishing a left offset roughly 50 degrees left of original course (180). Once wings level, the pilot will immediately go to visual scanning for the AA-12 (in this example a AIM-120 is being used as the hostile missile), also shown here. Music and Radar off, as the remainder of the maneuver is strictly visual, until reengagement.*

Approximately 5-6 seconds before the missile is expected to impact, a high G turn opposite of your initial offset is executed, 60-70 degrees (or 20-30 degrees opposite your initial heading). The end result should be that inbound missile tries desperately to correct for and maintain a lead pursuit but the angle and distance proves to be too much for its current energy state. The missile will, if the offset is properly timed and executed, either fly harmlessly past you completely unable to reacquire you, or detonate somewhere in your rear quadrant as it sense your aircraft is within its proximity blast radius.

Should the missile explode, it is still very likely that your aircraft will be left unscathed as your angle and velocity allow you to escape the blast radius.

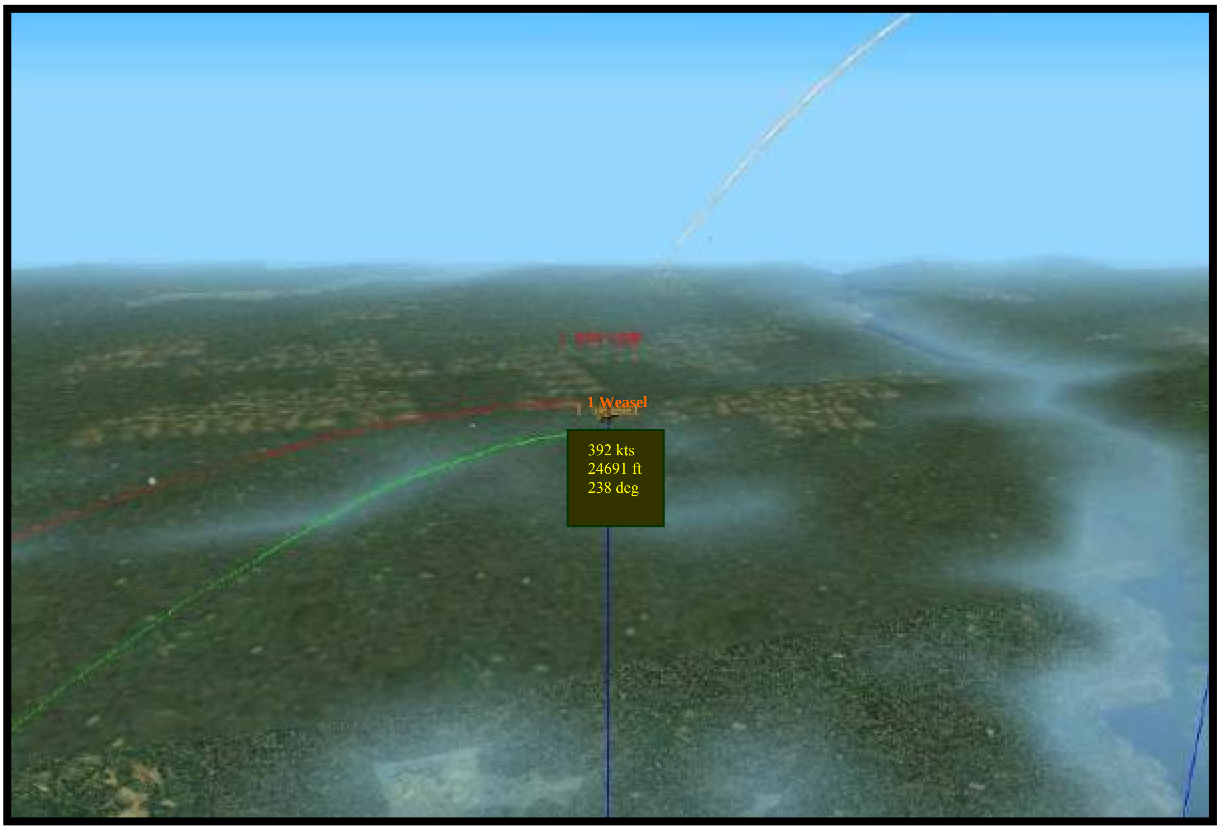


Figure 3c: *The high G turn opposite of original offset angle to a heading of 240 beats the missile entirely.*

Should the initial Aim-120 launch miss its target, the hostile aircraft will be somewhere in the forward quadrant in a perfect position for either another Aim-120 launch, or an intercept into a WVR fight. To be sure a quick scan visually before referring back to the radar scope is advisable. In either event, the follow up is relatively simple as the bandit is sure to be either still performing or just recovering from his defensive maneuvers.

When dealing with multiple missiles inbound, some issues arise with this tactic. If the missiles are launched relatively close together, the Offset should defeat them both. But as the distance between the lead and any missiles in trail increases so does the trailing missiles ability to correct for and maintain its lead pursuit. Extreme distances between missiles may allow for a follow up Offset to be performed, in the opposite direction, to spoof the second missile.

The Offset relies entirely on a visual acquisition of the hostile missile and as a result some practice is required to be able to not only consistently acquire such a small object but to become proficient at judging just the right moment to offset opposite and beat the missile. This sort of practice should be attained only in the Dogfight environment prior to utilizing this tactic in a campaign type mission.

Very high in offense, the Offset is equally effective defensively when mastered. However, it does almost guarantee a WVR fight should your initial launch miss its target, a fact that must be taken into consideration. Under ideal circumstances your initial launch will have forced the bandit into a reversal placing you in his rear hemisphere in perfect position to continue prosecution of the fight in the manner most suitable. At most, this tactic should used against 1v1 or 1v2 situations. In 2v2 or 2v4+ situations the friendly flight should make sure to split the opposing 4 ship into elements prior to launch.

UNDER AND OVER (Orthogonal Break)

Conceptually, this tactic is similar to the Offset. It differs only in the technique deployed to evade the missile. After launch, given the same set up as in the Offset, a 120 degree roll is performed followed by a high G pull into a 40-50 degree nose down attitude making small corrections to make sure that the bandit's bearing is at your 2 or 10 o'clock position. Speed should be adjusted to maintain well above max corner speed (440kts) as the maneuver quickly bleeds energy.

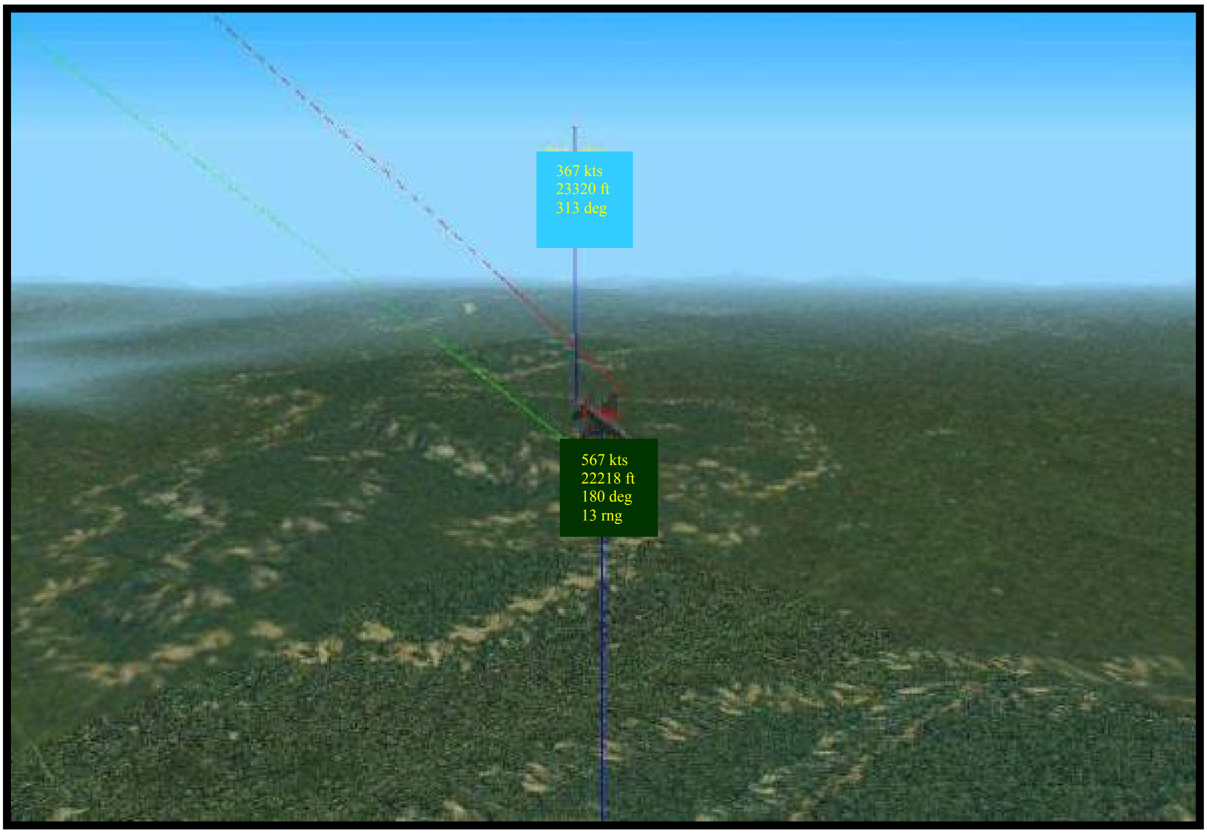


Figure 4a: The roughly 120 degree roll dive is shown here, inducing a turn placing the AA-12 high and at 10 o'clock. The Chaff is clearly visible as well. 20

As with the above tactic, visual acquisition is all important. The missile ought to be off your forward quadrant and high as a result of your dive.

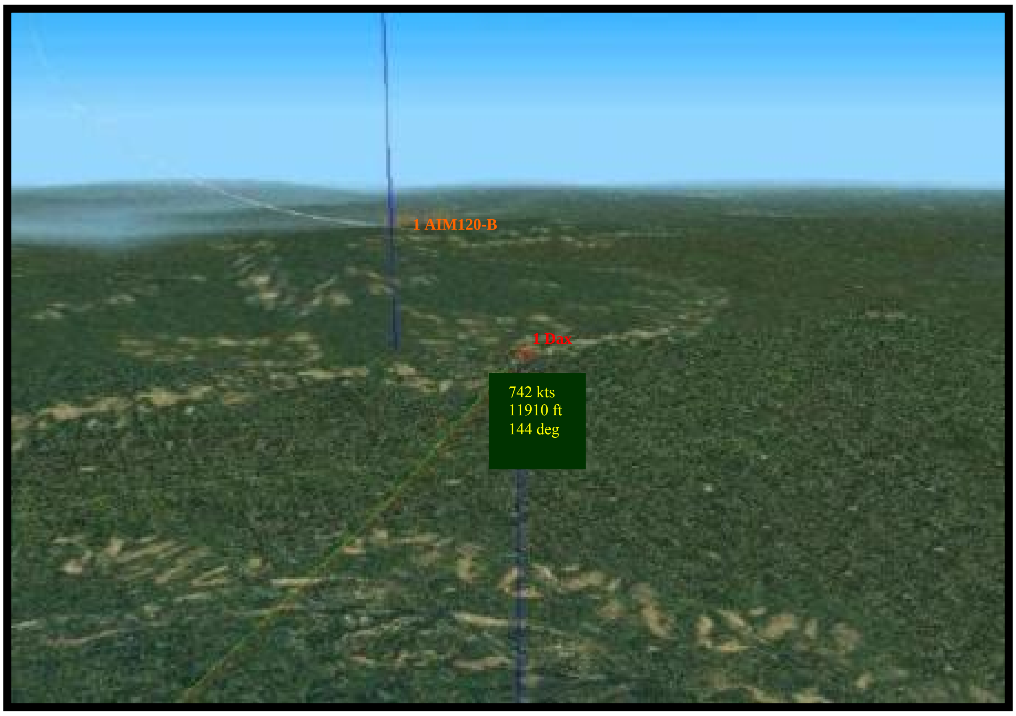


Figure 4b: *The missile is visually acquired by this point and the defensive "over-the-top" maneuver is commenced.*

Shortly before impact, a climbing turn above and into the missile is executed, defeating the missile. The premise is the same as with the Offset, yet a vertical element is introduced, which further helps to spoof the missile in the energy fight.. **Figure 4c:** The combination of both the high G turn and steep climb effectively beats the missile in the energy fight.

This maneuver offers the same benefits at the same cost as the Offset, while additionally keeping the bandit forward of you and above you, making visually reacquiring him much easier should further engagement be required.

Essentially these basics are most useful in 1v1 and 1v2 encounters. Learning to forsake the radar guidance until “pitbull” and trust that the AMRAAM will find its mark, assuming no friendlies are in the proximity, allows for quick ripple shots on multiple hostiles prior to committing to defensive maneuvers for an acceptably diminished PK at the same time dramatically increasing your chance of survival.

In situations of 1v3+, variations of these tactics can be used with the teamwork of your flight. For example, the Drag can be altered into a “pinwheel” or “Drag and Tag” type attack. Lead and wing go into a 3-5 mile trail formation, and lead executes his Drag maneuver. As the Lead is disengaging, the AI flight is most likely still focused on him as their primary threat, leaving the wing free and uncovered, close in to more lethal range before his extension.

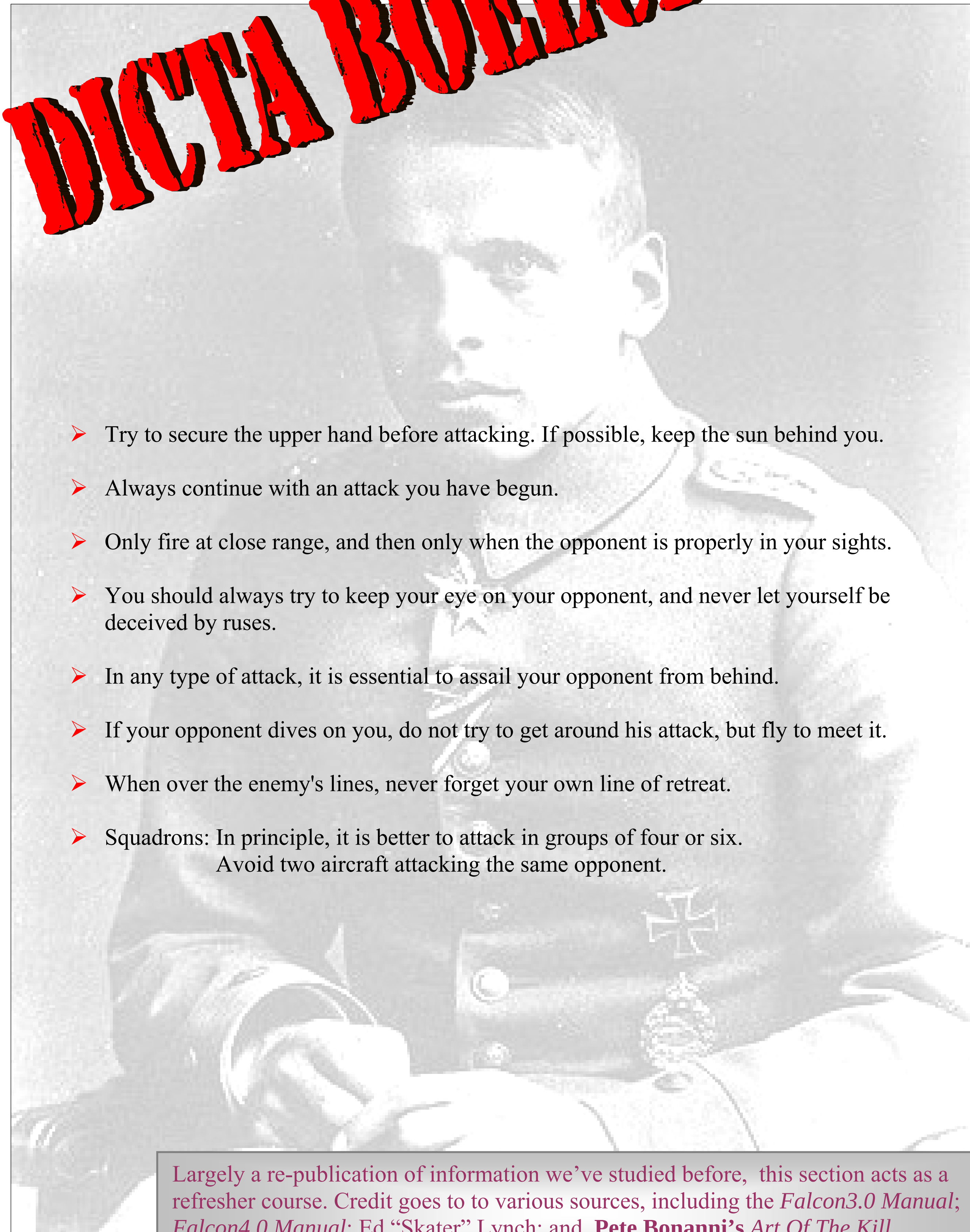
There are myriad variations for every scenario. The importance of every maneuver is to understand its parts and how they constitute a whole. Beaming as a BVR tactic is only one use of the technique. Understanding its effects and limitations allows you to incorporate its use into all sorts of practical applications. Learn to recognize a high PK shot opportunity, as a result of constant scanning of target aspect, speed and closure information without a “Shoot” cue as in all the above mentioned tactics a “Shoot” cue will never be displayed on the HUD.

Five ACMIs are included as support to the above concepts. Four outline the individual maneuvers while the fifth is a demonstration of these tactics in a practical, if wholly unrealistic, application (1v6 Su-27). Despite the final ACMI being an ultimately unsuccessful engagement 4 of the bandits were damaged/destroyed while spoofing 20+ AA-12 launches, thus validating the implementation of these tactics.

With a little practice all of these maneuvers can be executed at ranges that almost guarantee a successful kill. Mastering these fundamental maneuvers provides a staging point for more complex tactics.

-Captain Chris “Dax” Widick
X/O, 162nd Fast and Furious 16th ACCW Flying Tigers

DICTA BOELCKE



- Try to secure the upper hand before attacking. If possible, keep the sun behind you.
- Always continue with an attack you have begun.
- Only fire at close range, and then only when the opponent is properly in your sights.
- You should always try to keep your eye on your opponent, and never let yourself be deceived by ruses.
- In any type of attack, it is essential to assail your opponent from behind.
- If your opponent dives on you, do not try to get around his attack, but fly to meet it.
- When over the enemy's lines, never forget your own line of retreat.
- Squadrons: In principle, it is better to attack in groups of four or six.
  Avoid two aircraft attacking the same opponent.

Largely a re-publication of information we've studied before, this section acts as a refresher course. Credit goes to to various sources, including the *Falcon3.0 Manual*; *Falcon4.0 Manual*; Ed "Skater" Lynch; and, **Pete Bonanni's** *Art Of The Kill*. Some things – you can never get enough of… ☺

In order to achieve victory in air-to-air combat, a pilot must be both aggressive and self-confident.

To be an expert in fighter combat, a pilot must know how and when to engage the enemy. The first rule of WVR BFM is to avoid it… ☺ Colonel Phil 'Hands' Handley says: *"Any thoughtful examination of today's aerial combat arena will show that longevity does not accrue to those who make it their habit to enter into sustained turning engagements… Such action draws enemy fighters like a magnet, and makes you highly vulnerable to the unobserved 'meat shot'…"*

Then – why even BOTHER with BFM…? Because eventually – through design or accident, the pilot IS going to find himself in a WVR fight. And – when this DOES happen – the middle of a knife-fight in a phonebooth is a bad time to START learning BFM. So – let's start now, instead.

TACTICS

As stated, the following is based largely on the teachings of Pete "Boomer" Bonanni – the Virtual Instructor of every Falcon4.0 Virtual Pilot who has ever prowled the Virtual skies.

Tactics background: The nature of air combat has remained largely constant since Fokkers fought Spads over the stinking trenches of WWI. Thus, we still look to the Dicta Boelcke - by famed WWI Fighter Ace; Teacher of Manfred Von Richthofen; Grandfather of Aerial Fighter Tactics: Oswald Boelcke - as a work relevant to today's aerial combat. Boelcke's most famous student - The Red Baron - summed up the foundations of air combat when he said: "Rove your allotted area, find the enemy and shoot him down.... anything else is rubbish." During WWII, history's TOP ace (Erich 'Bubi' Hartmann) accrued 352 kills with the simple formula – *see*; *decide*; *attack*; *break off* .

90 years since Richtofen, these philosophies still hold true. K.I.S.S. - Keep It Simple, Stupid.

Whilst the nature of air combat has remained the same, the mechanics have undergone radical change. Most of this change, has come about very recently as high-thrust fighters such as the F-16 entered service in large numbers and expanded the combat maneuvering envelope. The BFM that many generations of fighter pilots grew up with became obsolete with the introduction of the F-16.

Quite suddenly, in one-versus-one maneuvering, vertical out-of-plane maneuvers such as high yo-yos were replaced with in-plane turn circle BFM.

BASIC FIGHTER MANEUVERS *One Vs One Air Combat*

BFM is the art of exchanging energy for aircraft position.

The goals of **offensive maneuvering** are to remain behind an adversary and to get in a position to shoot your weapons. In **defensive maneuvering**, you turn your jet and move the bandit out of position for a shot on your aircraft. In **head-on maneuvering**, you get behind the bandit from a neutral position.

When you execute maneuvers to accomplish any of these objectives, you invariably bleed off or expend energy. "Pulling Gs" and turning cause all aircraft to slow down, lose altitude, or both.

Let's examine the geometry of the flight and the specific maneuvers needed to be successful air-to-air Falcon pilot.

BFM is flown in the future. Many discussions of BFM describe maneuvers as if they were cards or chess pieces played sequentially in a game of move and countermove. Modern aerial warfare, however, is more accurately compared to a wrestling match. It is a fluid contest of quick reactions with both opponents executing their moves in a blur. Aerial combat requires immediate reaction.

Fighter pilots, as a rule, are not too bright on the ground; in the air, however, they are brilliant for very short periods of time. Within seconds, a pilot must constantly go through the following basic steps:

1. Observe the bandit.
2. Predict a future position in space for the bandit based on that observation.
3. Maneuver the jet in response to this prediction.
4. React to changes in the situation as one executes one's maneuvers.

BFM is flown in the future and not in the present. You must constantly predict the bandit's future position - where he will be a few seconds from the time you observe him - and fly your jet based on this prediction.

BFM GEOMETRY

In order to perform BFM, and discuss his tactics on the forums, the pilot must understand his spatial relationship to the target from four perspectives:

- ***positional geometry***
- ***attack geometry***
- ***the weapons envelope***
- ***the control zone***

Positional geometry: Range, aspect angle, and angle-off - also known as heading crossing angle or HCA - are terms used to describe one aircraft's position relative to another. These conditions, shown below, define the angular relation between two aircraft. This angular relationship in turn tells you how much position advantage or disadvantage you have.

* **Range** is the distance between your jet and the bandit. (fig.1)

* **Aspect angle** is the number of degrees measured from the tail of the target to your aircraft. Aspect angle is important because it tells you how far away you are in degrees from the target's six o'clock, which is – of course – one's desired position. (fig.2)

* **Angle-off** is the difference, measured in degrees, between your heading and the bandit's. This angle tells you relative fuselage alignment. *For example:* if the angle-off were 0 deg, you would be on a parallel heading with the bandit and your fuselages would be aligned; if the angle-off were 90 deg, your fuselage would be perpendicular to the bandit's. (fig.3)

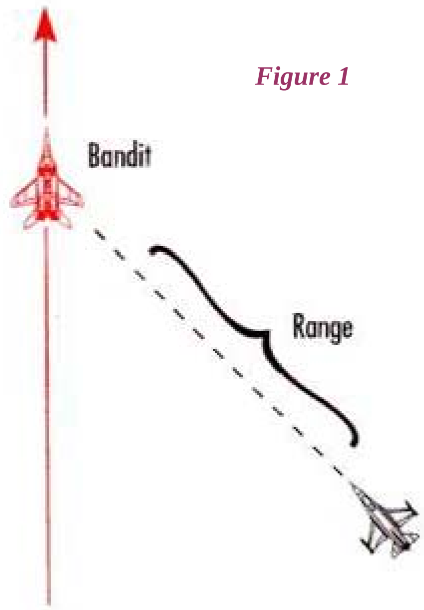


Figure 1

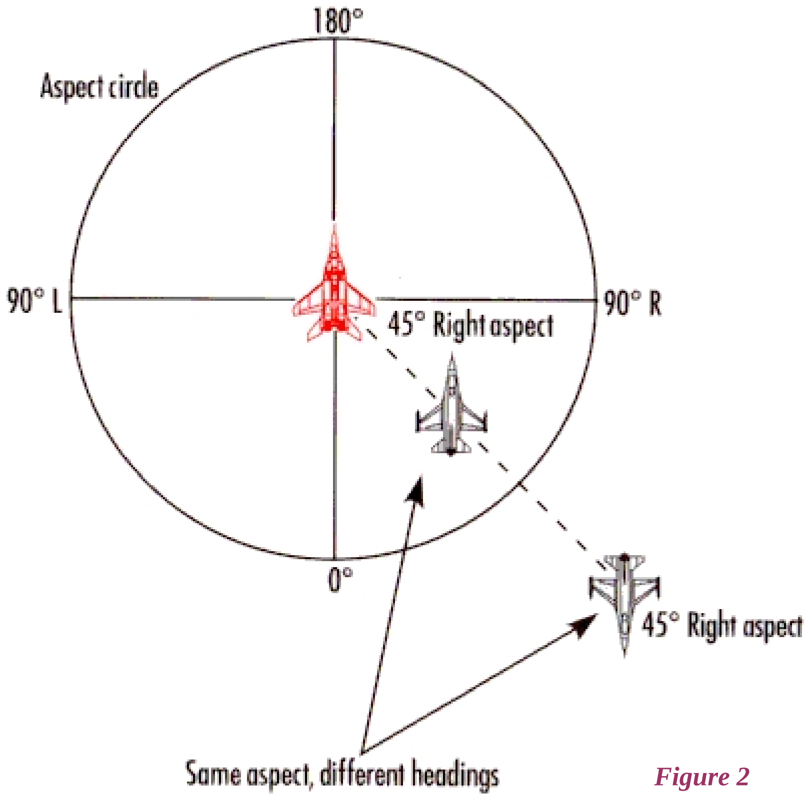


Figure 2

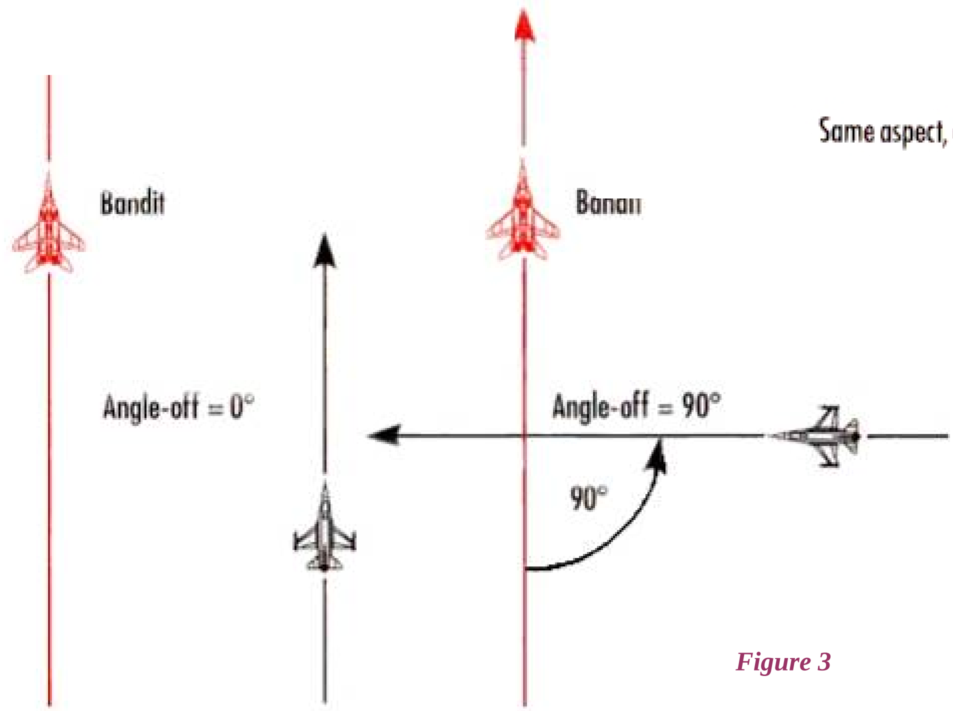


Figure 3

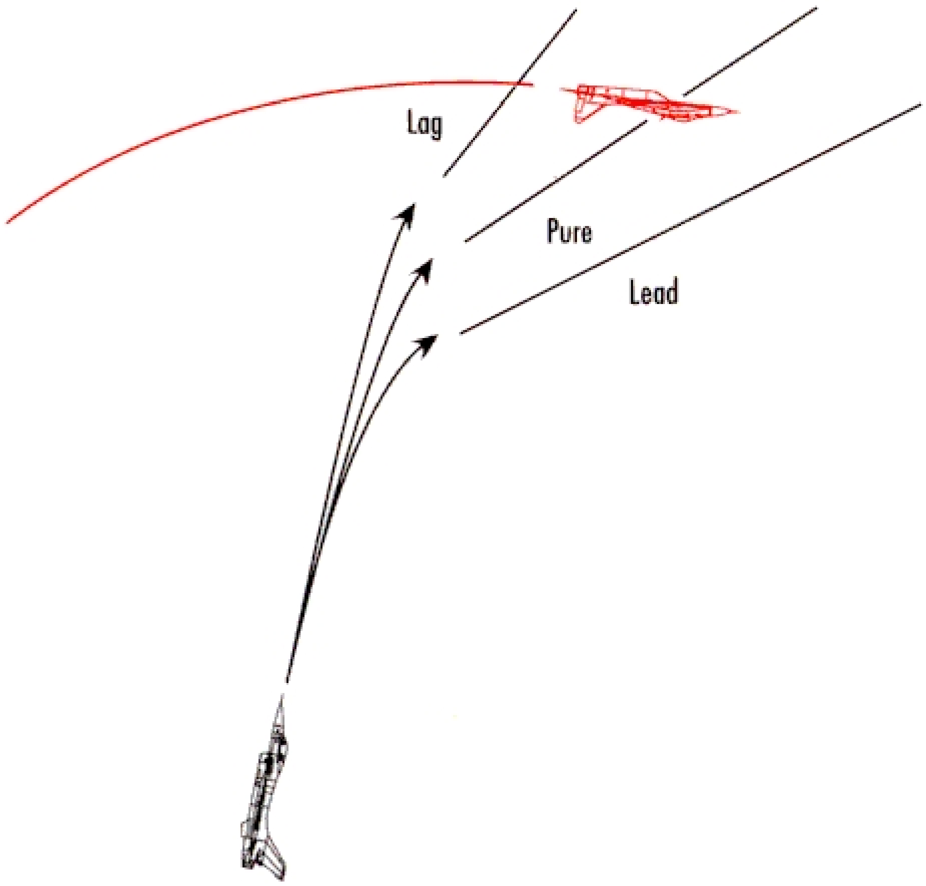
Attack geometry: Attack geometry describes the path that an offensive fighter takes as he converges on the bandit. To start an attack on a bandit, there are three distinct paths or pursuit courses that you can follow:

- ***lag pursuit***
- ***pure pursuit***
- ***lead pursuit.***

* If you are pointing behind the bandit, you are in **lag pursuit**.

* If you are pointing directly at the bandit, you are flying a **pure pursuit** course.

* If your nose is out in front of the bandit, you are in **lead pursuit**.[1]



[1] If you are developing Falcon for profit, you may also be considered "in Lead Pursuit".

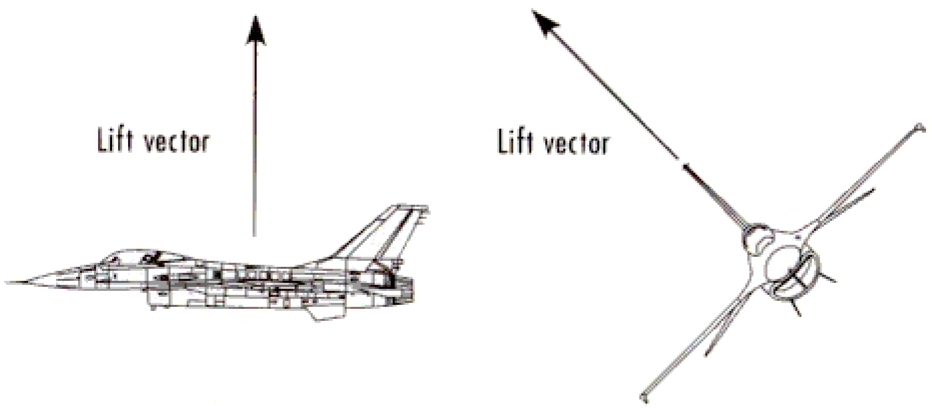
LAG PURSUIT → ***Used for approaching the bandit***. Used when the attacking jet drives "out of plane" . Lag pursuit requires the attacking jet to have a tighter turn circle than the prey. IF the prey has a tighter turning circle, then the attacking jet will NOT be able to rate his nose onto the target, and will thus be "stuck" in lag-pursuit ad-infinitum.

PURE PURSUIT → ***Used to shoot missiles at the enemy***. Flying a pure pursuit course all the way into the bandit will lead to an overshoot. For this reason, you should only point at the bandit when you are going to shoot.

LEAD PURSUIT → ***Used to close on the bandit; Used for gun shots***. Flying a lead pursuit course is the fastest way to get to the bandit because you cut him off in the sky. The problem with establishing a lead pursuit course too early is that you can very easily overshoot the bandit. If you are fighting a similar aircraft, such as the MiG-29, you will not normally be able to stay in lead without being forced into an overshoot. ***It is important, however, to establish lead pursuit at the proper time in the fight because it is the only way that you can get into the gun envelope***.

WHICH PURSUIT COURSE TO CHOOSE…?

- Attacker in same plane of motion as defender → Velocity dictates choice.
- Attacker in different plane of motion to defender → Lift vector dictates choice.

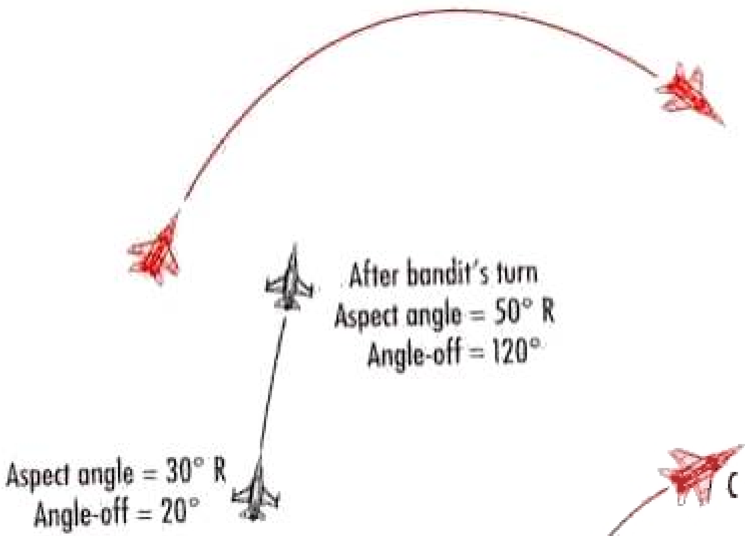


Lift vector describes the invisible line which projects outward from the a/c, perpendicular to the wings. When you roll and pull G's the a/c will track toward the lift vector.

OFFENSIVE BFM

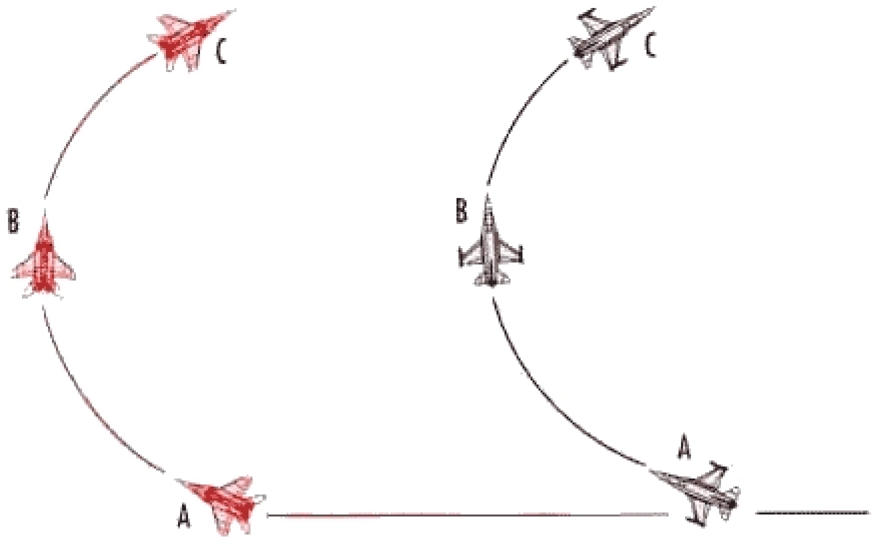
The obvious goal of offensive BFM is to kill the bandit as quickly as possible. WWI produced a steady evolution of "tricks" and "moves" used in aerial combat. The sustained maneuverability of a modern fighter has made a "move-counter-move" discussion of offensive BFM obsolete. Modern aerial combat is more "fluid"; simply a matter of driving one's jet into an offensive position, wherein the distinction between each "move" is blurred.

The primary use of offensive BFM is to counter a bandit's turn. When you are behind a bandit who is flying straight and level, it is a simple matter to control your airspeed with the throttle and fly around behind him. A turning bandit – however - will immediately create BFM problems.



By simply turning, the bandit has changed our aspect angle from 30º to 50º and our angle-off from 20º to 120º.

However, simply following the bandit into the turn will not work, as we simply end up BEHIND him…!



Turns

BFM is largely concerned with turns.

Let's examine the concepts of:
Power for position, *Turn radius*, *Turn rate*, *Corner velocity* and *Vertical turns*.

"Power for position" is an integral part of BFM. Fighters have two types of energy: kinetic and potential. Kinetic energy is simply the velocity or speed at which the jet is traveling. Potential energy is "stored" energy (such as fuel or gravity) that can be converted to kinetic energy. Think of it as a transaction. One may 'purchase' kinetic energy, by 'spending' potential energy. Always remember that – as with cash – you ALWAYS have a limit of how much you may spend.

Potential energy is directly related to aircraft altitude. If a jet is at high altitude, its potential energy is high (more to spend; more kinetic energy to purchase). If the same jet is flying at low altitude, its potential energy is low. One can trade altitude (potential energy) for speed (kinetic energy). But, transactions work BOTH ways. So – one can always convert kinetic energy back to potential energy. Therefore, one can convert aircraft speed back into altitude (potential energy for later 'purchases').

You can also exchange energy for nose position. Anytime you maneuver or turn a fighter; it "costs" energy. When you turn a jet at high G, you "spend" or lose energy.

Apply to weapons. One way to increase a missile's effective range is to launch at a significantly higher altitude than the bandit. This will give your missile a reserve of potential energy that it can convert into kinetic energy

Turn Radius is simply the size of the "circle" in which you are turning in the sky. If looking from above, the distance (in feet) from the centre of the circle to your aircraft is the turn radius.

Turn Rate is simply how fast your nose is moving around that circle.

Corner Velocity is the optimum speed at which your a/c will describe the most efficient circle. One may mistakenly think that going slow will give the optimum turn radius. Not so. Gravity plays an IMPORTANT role in turn radius. At lower speeds, those "Gs" are not available. Conversely, "pedal to the metal" is also ineffective for the same reason. We need a compromise between speed and gravity; rate and radius. This is the corner velocity. ***For your f-16, the corner velocity is 450kts.***

The airspeed of a jet can be controlled by the pilot in the following four ways:

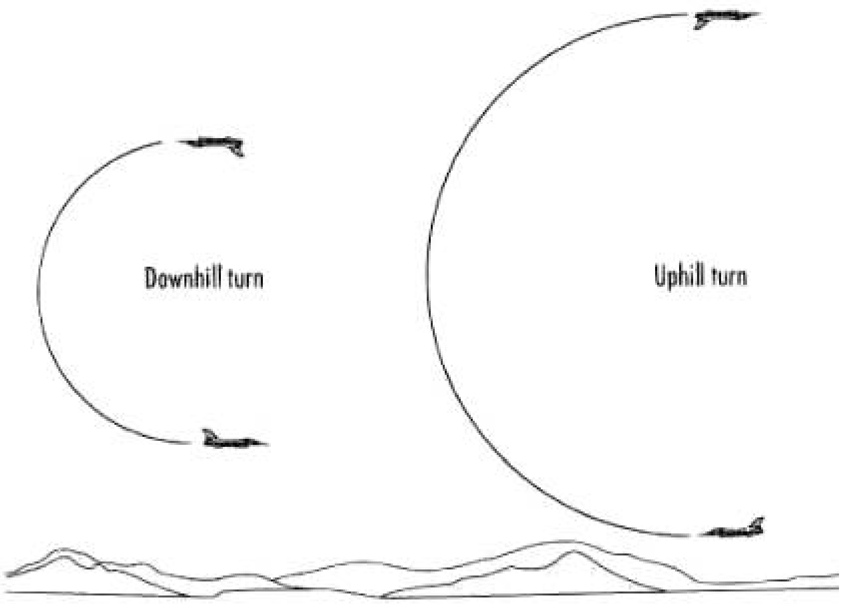
- Throttle position
- Drag devices *(such as airbrakes)*
- Nose position in relation to the horizon *(above costs energy; below buys energy)*
- Aircraft G *(see Vertical Turns))*

No modern fighter flying at medium altitude can stay at corner velocity while pulling max G's for long. As you pull G's, you will get slower. It is important, however, to start maneuvering close to corner velocity because ***the first turn you make is usually the most important in the fight***.

Think in terms of both turn rate and turn radius. Fighter pilots have a simple two-word saying: **"Rate kills"**. The ability to move (or rate) your nose is the primary means of employing weapons. A bandit may have a tight turn circle, but if you can rate your nose on him and shoot, the fight is over.

Vertical Turns: Your a/c attitude affects G availability. If you pull the nose of a fighter straight across the horizon, gravity will have no effect on your turn performance. When you pull the nose up or down, however, gravity becomes a player. The extra G you can get by placing your nose below the horizon when you turn can give you at least 2' per second turn advantage. Most of the time, 1G equates to 3°-4° per second.

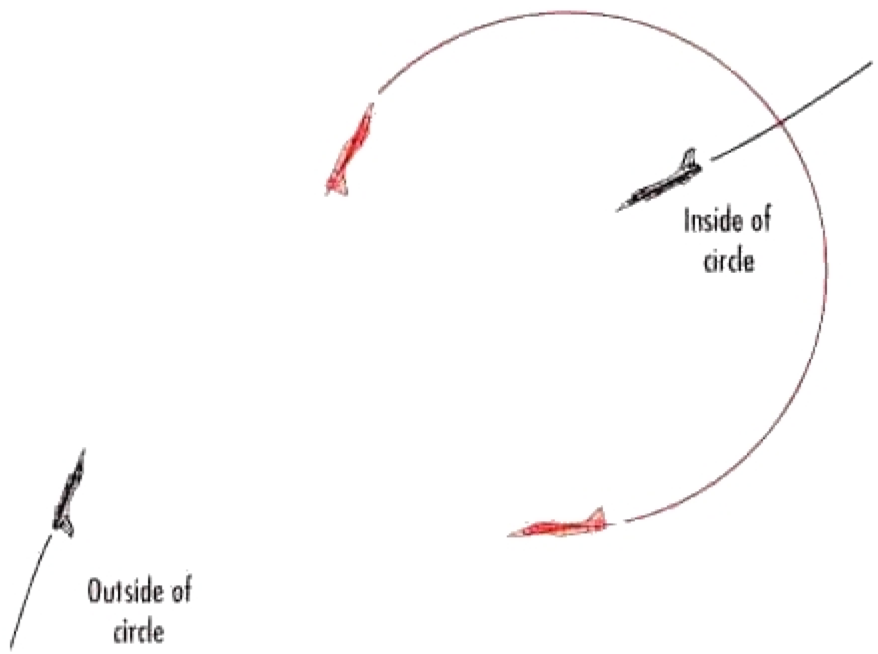
The effect of G can be seen in the image below. Notice that the fighter with his lift vector below the horizon is turning tighter. What is not so obvious in this figure is that the fighter turning toward the ground is also moving or rating the nose faster.



Turn Circles – Turn circles are simply the "circles" that aircraft trace as they turn in the sky. ***For offensive BFM, the attacking jet must stay within the bandit's turning circle.*** If you are outside the bandit's turning circle, the bandit will have time to completely come around, and face you head on. Thus – if you do not drive your jet INSIDE the bandit's turning circle, the fight will become a "Head-On" rather than "Offensive" engagement.

In order to turn and solve BFM problems created by the bandit, you must first drive your jet inside the bandit's turn circle.

Any maneuvering you do outside the bandit's turn circle will delay you from getting inside the bandit's turn circle.



You must be inside the bandit's turn circle in order to turn and solve the BFM problem.

Anytime you can take a shot and end the fight, do it. The problem is that when you start from 1.0 to 1.5 nm behind the bandit and he turns, you will only be in AIM-9M parameters for a very short time. Heaters don't like the high line-of-sight rates generated by targets in tight, turning fights. You have time for one shot. If you miss, you had better be ready to put some offensive BFM on him, or you will end up wearing an AA- 11 Archer. The end result of your best offensive BFM will be a gunshot. Here is how you do it.

The bandit turns. Ask yourself: "Am I inside or outside the bandit's turn circle?"

How do you know? If the bandit's present turn rate will force his nose on you or even close to you, you are outside the bandit's turn circle. For modern fighters at high G, ***you are normally outside the bandit's turn circle at ranges outside 2 nm; at 1 nm, you are normally inside the bandit's turn circle***, and between these ranges, you are in a transition zone. These ranges, of course, do not really matter to a fighter pilot. When you start behind a bandit, you simply fight what you see. As the bandit turns, you predict where he is going and maneuver based on this prediction. For example, if the bandit is only pulling 4 G's, then at 2 nm you are still inside his turn circle.

If you are outside the bandit's turn circle at the beginning of the fight, you are not in an offensive fight-you are in a head-on BFM fight. If that is the case, just think about an AIM-9M shot. The bandit cannot shoot you until he gets his nose around to within about 40° of your jet. You should be able to get one good missile shot at him before he forces you inside Rmin.

Remember, ***to fly offensive BFM, we must drive our jet inside the bandit's turn circle***.

Okay – let's put the theory into practice. Let's drive into the Entry Window…

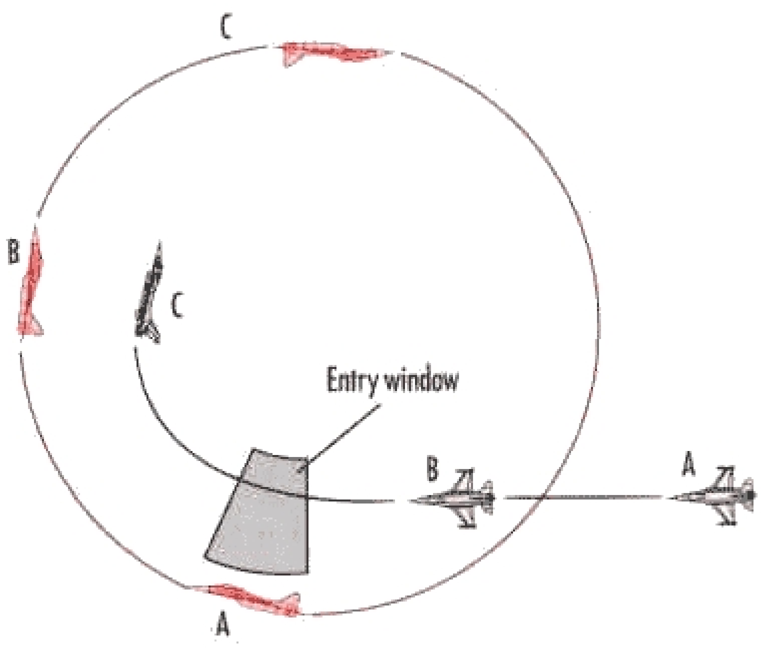
GUNS, GUNS, GUNS

Flying good offensive BFM against a bandit will put him right in your gun sights. You'll get him there by under-standing the dynamics of getting into position, closing and firing.

How and when to turn to stay behind the bandit…? You are inside 1.5 nm on a hard turning bandit, and you need turning room to get around on his six. The first step is to observe the bandit's turn. If you are outside the bandit's turn circle, get ready for a head-on BFM fight. If you are near or inside the bandit's turn circle, you have a positional advantage that you can keep. Shoot, if a shot presents itself, but don't get mesmerized watching your own missile and forget to BFM.

Driving into the Entry Window: Next, drive to where the bandit started his turn. If the bandit drops flares or chaff, he will mark the point in the sky where he started his turn. Drive to this position. This spot is *the entry window*. The entry window is located inside the bandit's turn circle. ***You can start your high G turn into the bandit once you arrive inside this window***.

In the below image, the F- 16 drove in a lag pursuit course to a position inside the bandit's turn circle. By driving to this position, the F- 16 gained horizontal turning room that the bandit can't use or take away. ***You know you are at the entry window and must start your turn when the bandit is approximately 30° off your nose.***



When you get into this relationship with the bandit, start your turn.

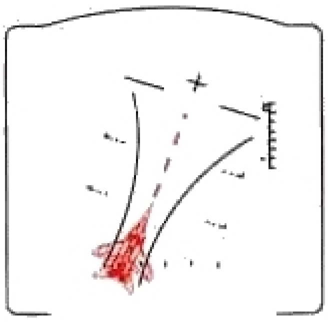
Remember corner velocity. If you arrive at the window too fast or too slow, you will get stuck in lag pursuit because you will not have sufficient turn rate to get your nose out in front of the bandit.

The next step is to pull 7 to 8 G's into the bandit. As you come around the corner, keep your nose in lag. If you see the nose of your jet approaching pure pursuit, ease up on the G. Hold this lag pursuit course until you get within 3,000 feet of the bandit. At this range, go to lead pursuit and get ready for a gun shot.

When you arrive ***inside 3,000 feet on the bandit with your nose in pure or lead pursuit, your throttle controls your overtake***.

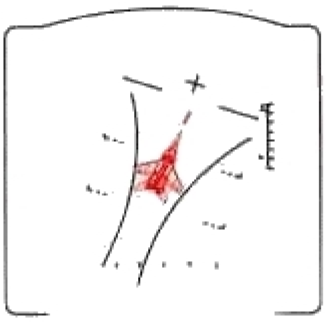
Remember this → In close to the bandit, with your angle-off less than 45° and your nose in pure or lead pursuit, the position of your throttle controls your closure. ***When you get saddled up for a gun shot, you must match airspeed with the targe****t*. In most cases, this will require constant movement of the throttle. In addition to banging the throttle off both stops, ***you may have to maneuver out of plane to control your airspeed***. If a throttle reduction and the speed brakes don't slow you down enough, roll the jet to orient your lift vector out of the bandit's plane-of-motion and pull. Hold this lag pursuit pull for about two seconds; then ease off the G and watch the bandit. When he starts to move forward on your canopy, it is time to pull back into him. Pull your lift vector out in front of the bandit as you pull down.

Taking a Gun Shot: You are inside 3,000 feet on the bandit with your nose in lead.
You must be in range. This range varies, depending on aspect, but it is usually about 2,500 feet at low aspect angles and about 4,000 feet at high aspect.
You must have your nose in lead pursuit. The bullets fired by the gun are unguided projectiles that take time to get to the target. For most gunshots, the bullet time-of-flight (TOF) is .5 to 1.5 seconds. If you point directly at the target and fire, the bullets will pass behind the target. Since the bullet is not moving at the speed of light, you must pull lead. However – at close range - this lead may not be very pronounced.
You must be in the bandit's plane of motion. When an aircraft turns, it carves a circle in the sky that creates a plane. In order for you to hit the target with the gun, you must be turning in the same plane as your target. For example, if the target is flying a loop and creating a vertically oriented plane of motion, you have to be flying a loop in the same plane as the target.



High G & Shoot

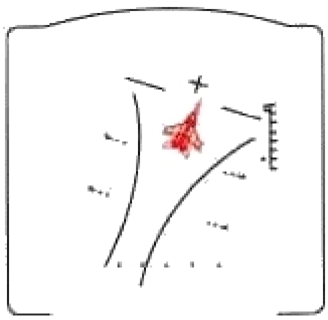
The Gun Sight: EEGS (Enhanced Envelope Gun Sight). The EEGS funnel allows the pilot to match the wingspan of the target with the width of the funnel to determine the proper firing range. The other important gun aiming cue in the HUD is the gun cross. The gun cross represents the departure line of the bullets. You can consider the gun cross as the gun barrel. Bullets pass straight out the gun cross.



Ease off G while shooting

Place the gun cross out in front of the target. Picture the target with a long pitot boom sticking out the nose. The gun cross should be placed on this extended pitot boom. If the target changes his plane-of-motion, then fly to place the gun cross on the new position of this imaginary pole sticking out of the nose of the target.

Next, over lead the target by making the wingspan of the target extend past the funnel. This will place your bullet stream in front of the target's nose.



Cease firing

Fire the gun while easing up on the G. This will move the target from the bottom of the funnel to the top. Cease fire when the target's wings are inside the funnel.

DEFENSIVE BFM

It was stated that offensive BFM is not a set of specific moves but rather a series of fluid maneuvers. The same is true when you start with a bandit behind you. There are no magic moves that will move a bandit from your 6 o'clock to your 12 o'clock. In fact, ***if you fly perfect defensive BFM and the bandit flies perfect offensive BFM, you will get shot down.*** This statement speaks volumes about defensive BFM; it basically tells you all you need to know about being defensive… ☺

Defensive BFM is very simple: ***create BFM problems for the bandit***, and when he BFM's, try to counter his BFM to buy time and survive a little longer. By forcing the bandit to BFM, you may force him to make a BFM error.

Detecting the Bandit: Situational Awareness is PARAMOUNT. SA may mean the difference between being "Defensive" and being "Offensive" [2]. Your three primary SA enhancers are:

> ***RADAR***
> ***TWS***
> ***VISUAL*** [3]

Fundamental A-A Combat Rule: ***Fight the most immediate threat***. Remember this especially whilst defensive. So – a MiG is on your six, and he fires a missile. When that missile leaves the rail and starts guiding on you, the MiG is no longer the biggest threat to your jet. The missile becomes the primary threat, so you must fight the missile.

Defensive BFM Vs Missiles: Fighter pilot axiom: ***"Fight missiles with aspect."*** When a missile is fired at your jet in the aft quadrant, the best way to defeat it is with a maximum rate turn to put the missile on the beam (along your 3/9 line). In this position, the missile will have the worst possible line-of-sight rate problem to solve. Missiles fly lead pursuit courses to the target in order to achieve maximum range. If you hold the missile somewhere on your 3/9 line, you will make the missile pull the maximum amount of lead. You will also be moving across the missile field-of-view at the fastest rate. So → ***CORNER VELOCITY to put the missile on your 3/9 line***. And remember to drop chaff & flares as you turn.

Defensive BFM Vs The Bandit [4]***:*** MiG on your six…? If he fires a missile, you must follow the Fundamental Rule and fight the missile. But – before he does that, you need to create BFM problems for the Bandit. ***Make the quickest, tightest defensive turn you can make, STRAIGHT INTO the bandit.*** As you start the turn, you should place your lift vector directly on the bandit. This will give the bandit the most angle-off and aspect problems to solve. You will also deny him turning room by keeping your lift vector directly on his jet. Remember: CORNER VELOCITY...!

So you have rolled your jet to place your lift vector right on the bandit and executed your best high-G turn at corner velocity. What now? Now you must determine if your defensive turn is working. If the bandit is being forced forward from 6 o'clock toward your 3 or 9 o'clock position, then the turn is working. ***A bandit that starts outside your turn circle will be forced in front of your 3/9 line if you perform the defensive turn correctly***. Your turn is working if you push a bandit forward towards your nose. Keep in mind that he can still shoot you! If the bandit has his nose in lead as you drive him forward with your defensive turn, be ready to defend against a gunshot.

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[2] Fortunate people like T-Rex, for example, can always claim to be offensive.
[3] Track-IR comes HIGHLY recommended by this Editor. *(Thanks ddocg)*
[4] Burt Reynolds and Sally Fields notwithstanding.

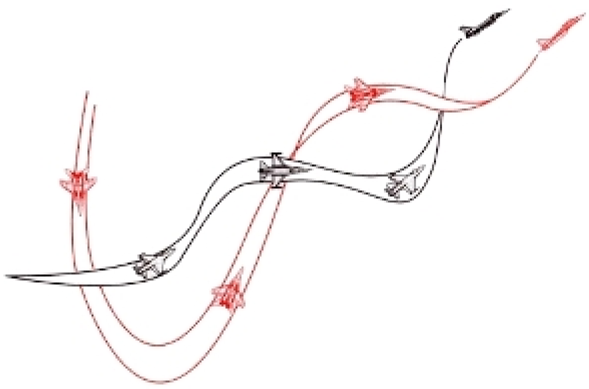
Remember, in order for him to take a gunshot, he needs to meet three conditions: he must be ***in range***, he must be ***in plane***, and he must have his nose ***in lead pursuit***. If the bandit's nose is in lead pursuit, take care…! Even though he will overshoot, the bandit will probably attempt a gun shot at the pass. To defend against this type of gunshot, all you have to do ***is break suddenly out of plane***. Because of the high line-of-sight rates involved, the bandit will not be able to correct in time and will overshoot. ***A bandit that starts outside your turn circle and drives in with his nose in lead for a gunshot will overshoot.***

Defensive BFM Vs Bandit Inside Your Turn Circle: What if the bandit starts at 1 nm? Your reaction should be the same. Put your best defensive turn on the bandit and see what he does. When a bandit starts close to your turn circle, he is a serious threat, and your best defensive turn may not force him forward. The bandit's best option will be to fly lag pursuit to get to your turn circle entry window. When a bandit starts inside your turn circle and drives to lag, you are in for a long day. The best course of action is to ***continue your high-G turn and try to stick his nose in lag***. Unload the jet *(release the G)* and extend for energy…? The problem with an extension is that it is very hard to judge how long to keep the jet unloaded and driving straight. ***If you unload and accelerate, the bandit will move quickly to deep 6 o'clock***, and you will probably attract an AA- 11 shot. Better to continue turning and see if the bandit has a sufficient turn rate to get his nose around on you. If he does, get ready for gun defense.

With LUCK – however - the bandit may not fly perfect BFM.

What if he climbs above you? ***If the bandit pulls into the vertical for turning room, keep the hard turn coming with your lift vector directly on the him***. As you pull up into the bandit, watch him. If he keeps his nose high, you will end up in a neutral position on the bandit because you are slower and have a smaller turn radius.

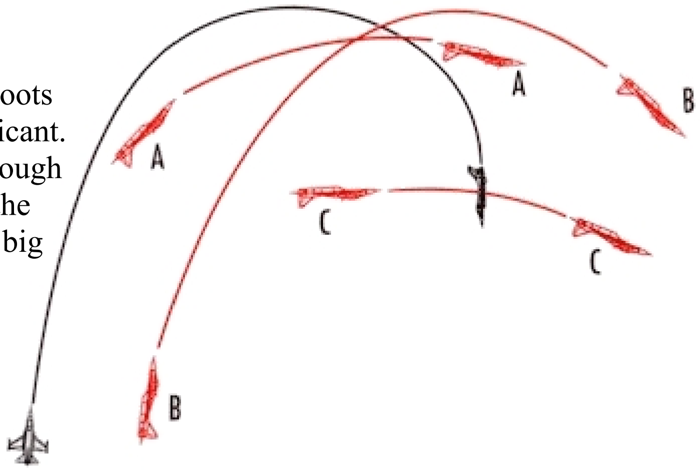
In this type of fight, you will end up in a scissors. Scissors occur when two fighters are in a line-abreast, neutral position. They both pull for each other's 6 o'clock position and, as they pass, they roll back into each other and pull. The scissors is usually won by the fighter that can slow his forward velocity, in relation to the bandit, the quickest.



What if he flies a lead pursuit course? If a bandit starts at 1 nm back and flies a lead pursuit course, he will probably overshoot. In order to force the bandit to overshoot, however, you must be executing your best turn. ***The bandit will not overshoot if you are 50 or more knots slower or faster than corner velocity, or if you are not pulling enough G.***

Overshoots: What if the Bandit overshoots? It depends on the nature of the overshoot. There are two type of overshoots: *the flight path overshoot* and the *3/9 line overshoot*. A 3/9 line overshoot is always tactically significant, while a flight path overshoot may not be.

In the image to the left, *Aircraft **A*** slightly overshoots the F- 16's flight path. This is not tactically significant. *Aircraft **B*** overshoots the F-16's flight path far enough that he **may** end up line-abreast or out in front if the F- 16 reverses his turn. *Aircraft **C*** is obviously in big trouble because he has blundered past the F- 16's 3/9 line.



3/9 line overshoots are always significant.

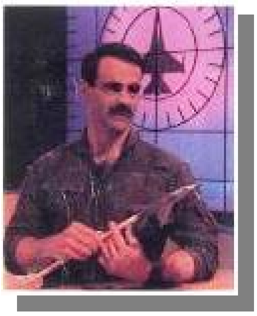
When you predict that a bandit may overshoot, note the range, angle-off, and the line-of-sight rate of the bandit. His position, in relation to you, will dictate how you will reverse. As a rule of thumb, ***the greater the range when he overshoots and the slower the line-of-sight rate, the less chance you have of forcing him out in front of your 3/9 line with a reversal.***

When a bandit overshoots, there are basically two ways to reverse your turn to take advantage of it. ***If you see the bandit is going to overshoot with a high line-of-sight rate, you should perform an unloaded reversal***. To do an unloaded reversal, simply release the G, roll the aircraft to position your lift vector directly on the bandit, and then pull maximum G directly at him. You should only use this reversal method when you are sure that the bandit will overshoot. ***This type of reversal does not "force" the bandit out in front of you***; it just gets your nose on the bandit quickly when he does overshoot.

The other type of reversal should be used with caution. It is called a loaded reversal. ***To execute a loaded reversal, keep the Gs on the jet as you roll and pull toward the bandit***. ***This type of reversal is used to "force" a bandit that is about to overshoot into an overshoot***. The problem with a loaded reversal is that, if you execute it and the bandit doesn't overshoot, you will have a bad guy in your chili at close range, and you won't have the air-speed to maneuver. ***A loaded reversal is used to stop your aircraft in the sky, and if doesn't work, you're in trouble***.

Overshoot rules of thumb → *When in doubt about a bandit's overshoot, don't reverse your turn. It is best to reverse when a bandit is overshooting your flight path inside 2,000 feet with a high line-of-sight rate. Outside 3,000 feet, it is best not to reverse your turn. The bandit has too much room to correct his overshoot and maintain a 3/9 advantage on you.*

Guns Defense: The bandit flew perfect offensive BFM? Here comes the gunshot? When a bandit is closing with his nose in lead, think "snap-shot'. ***To defend against a snapshot, break out of plane***. It is better to make it too soon rather than too late. If you go early, the bandit can correct, but when he does, you can jink out of plane again. If you jink late, you may die. How about tracking gun shots? In a tracking gunshot, the bandit is in a stable position behind you and will take multiple shots. You must make multiple out-of-plane jinks. ***The key to tracking guns defense is to make sudden jinks at least 70° out of plane with the attacker***. Keep a tally on the bandit, and before he gets established in this new plane of motion, jink again. This type of defense is a random guns jink.



PETE BONANNI CONCLUDES: *Offensive* → you must remain aware of your position relative to the bandit's. Control your airspeed or lose the fight. Corner Velocity + Entry Window. *Defensive* → Put your lift vector on the bandit, pull hard and watch what he does. NEVER give up. Push the aircraft to it's limits at all times, and maintain the will to survive.

GORNY'S DOGFIGHTING TIPS

W e l l - it's time. Strap it on..... er..... Strap in, and get ready.

It's time to IMPROVE. It's time to push the envelope.

It's time for a beer; a queer and a small dose of FEAR.

It's time for Ara's **DOGFIGHTING TUTORIAL**…!

1. Choosing Your Ordnance

When dogfighting, it's VERY IMPORTANT to choose the correct BREED of dog.

Poodles and corgis are usually good starting dogs.

And the basset hound can be a MEAN sunvabitch when provoked.

Avoid Pit-Bulls unless you are a closet homosexual who is trying to overcompensate by having a "manly" dog.

Avoid Dobermans because they have stupid ears and look like a Vulcan's' pet.

Avoid Rottweilers unless your children are expendable.

Avoid Irish Red Setters because they are Irish.

(Just joking - I spent two weeks in Ireland one weekend.....)

2. One Circle Vs Two Circle Engagement:

You will notice the lads circling each other. Sometimes once; sometimes twice.

They are - of course - attempting to get on the other's SIX...!

WHY....? What tactical advantage...?

So they can smell the other one's arse WVR.

3. Practice Practice Practice:

You cannot be a successful dogfighter without PRACTICE....!!

Your dog must be regularly "blooded" to keep up his situational awareness.

You can use your wife, or any unwanted children or - preferably - *Pumpyhead* or *Snake122*.

4. It's not the size of the dog in the fight....

I've had a Chihuahua take out a FULLY GROWN ROTTWEILER...!!

TRUE...!! My little Chihuahua KILLED the Rottweiler in a 1 Vs 1 engagement.

They closed rapidly after a "one circle", and the Rottweiler grabbed up my Chihuahua in its massive steel-like jaws and......

........bit him into two pieces.

However - the Rottweiler choked to death on the second piece.

I was ecstatic.

(Especially as I'd stolen the Chihuahua from a homeless drug-user. Cost me nothing…!)

5. Advanced Tactics

FLARES: Smuggle a Flare or two into the dog-fight arena.

As the dogs circle, yell out: “NICE BREASTS” and point to the door.
NOW – while everybody’s attention is turned - light the flare, and throw it on the opposing dog. As his fur ignites, and he bursts into flames, fleeing the arena - proceed directly to the winner’s booth, and collect your prize money.

CHAFF: Before the fight, gain access to the opposing dog.
While nobody is about, smear the dog’s fur with CHAFF *(available from Horse stables).*
Now – when the fight has started, employ a Horse-Whisperer to attract some nearby, hungry horses. The horses will appear, dash into the arena and EAT the opposing hound.

YOUR victory by default…!

DECOY: If you can get your hands on a Guide dog that STILL has the Blind person attached, you are a sure-bet…! Great tactic. I’ve had considerable success with it.

With the Blind Person still holding onto the lead, you send the Labrador into a two-circle engagement. The Blind Person clutching the lead - half running; half being dragged behind - will vainly attempt to catch up with their snarling, snapping Guide Dog. This is called a “Lead Pursuit”.

On the SECOND pass, the OTHER dog will lunge at the helpless Blind Person, snap it’s jaws firmly into the flesh, and begin to rend them into pieces. This is called a “Blender”.

NOW – your dog is free to strike. As the OTHER dog tears the Blind Person limb from limb, YOUR Labrador leaps in, and “BANG”….! Pit-bull becomes another smokin’ hole in the ground.

6. FEEDBACK - Q & A with Ara' .

Ripsaw writes: Ara' - why do dogs lick their own balls...?

That's simple, Rippy - BECAUSE THEY ***CAN***...

T-REX writes: They say I'm HUNG LIKE A GREAT DANE...! Comments..?

Yes. Though, I believe the great Dane they refer to is Hamlet's MOTHER.

Hustler asks: Ara' - what is "DOGGY STYLE"...? Any pointers...?

I believe it's when you sniff your girlfriend's bottom.
(Collar and Leash are OPTIONAL...!)

New BLOCKs On The Kid

Letters, Designations, Blocks…? Sometimes, Falcon™ can be a little confusing.
More "blocks" than a Pre-school Convention. So – what does it mean….?

Okay – Let's start with the basics.

There are single-seat and twin-seat versions of the F-16.
The early single-seat Vipers are the **F-16A**. The early two-seat Vipers are the **F-16B**.
The later single-seats are **F-16C**. The later two-seaters are **F-16D**.

But – what of "**G**" and "**J**"…?
"**G**" is an earlier 'block'. "**J**" is a later 'block'.
CG = Block 40/42. **CJ** = Block 50/52 **DG** = Blk40/42 (twin seat) **DJ** = Blk 50/52 (twin seat)

Okay, then. But – WHAT is a "BLOCK"….?
A "block" is like a "Model" or "Version".

So – as later 'models' (or versions) are released, they are given new "Version" numbers.
These numbers are – **BLOCK** numbers.

Why "**50**" and "**52**"…? Engines…! But – read on and all shall be clear…!

F-16XL

Two of the original eight FSD (Full Scale Development) airframes were later converted to the unique F-16XL variant. F-16XL-2 was rebuilt as a two-seater, and it was fitted with a General Electric engine.

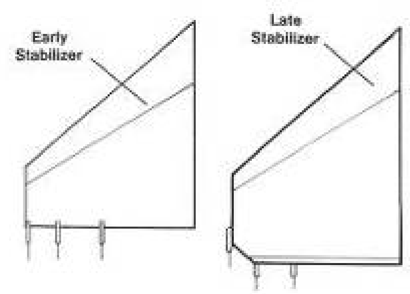
F-16XL-1 remains a single seater with a Pratt & Whitney engine. Both airframes were fitted with the extended rudder dorsals and drag chutes to accommodate the heavier weight of the modified aircraft when landing.

Block 01 – Block 10

The first production F-16A and F-16B aircraft were called Block 01 airframes. They were quickly followed by the Block 05 and Block 10 versions. All three blocks are virtually identical externally, all were powered by the F100-PW-200 engine, used the Westinghouse AN/APG-66 radar, and all had the smaller square-tipped horizontal stabilizers. Blocks 01 and 05 were characterized by black radomes, later replaced with the now standard gray radomes. After the Block 10 entered service, all Block 01 and Block 05 airframes were upgraded.

Block 15

This block represented the first major change to the production F-16. Most noticeable were the larger horizontal stabilizers and the re-arrangement of some of the instruments in the cockpit. Also included internal changes such as: inlet hardpoints for mounting sensor pods and stronger wing hardpoints. The Block 15 aircraft were still equipped with the same F100-PW-200 engine and AN/APG-66 radar.



MLU *(F-16AM and F-16BM)*

The Mid Life Update (MLU) program refurbished older **NATO** *(not USAF)* Block 10/15 airframes with the new Modular Mission Computer, HUD, Colour MFDs, etc., bringing them up to the latest avionics standards. The MLU can also be referred to as F-16AM and F-16BM. *("A" being the single seat; "B" being the twin-seat).* The MLU aircraft did not receive new airframes, but MLU-modified Blocks 10 and 15 airframes.

Block 25

These were the first F-16's to be commonly called the **'second generation'**. Changes were numerous, but largely internal. Externally, Block 25 introduced the enlarged rudder dorsal and a slightly different vent pattern on the gun muzzle panel. The cockpit was completely redone, with 4"x4" monochrome (green) Multi-Function Displays replacing the older Stores Control Panel LED display and many of the dial-type indicators ("steam gauges"). A larger HUD, a new **AN/AGP-68** radar, and many other improvements found their way into the Block 25. All Block 25 aircraft were powered by the F100-PW-200 engine, and most have been upgraded to the -220E with increased thrust and Digital Electronic Engine Control (DEEC).

Block 30 / 32

Block 30 introduced the **General Electric F110-GE-100 engine** as a power-plant option. This was the first time any engine other that a Pratt & Whitney had been offered in a production F-16.

Block 32 airframes were powered by the F100-PW-220 engine. In spite of the so-called Common Engine Bay, the two power-plants are not interchangeable.

Thus – we have both the "30" and "32" production Block designations.
GE engines in the Blk30 & PW engines in the Blk32.

Block 30/32 also added the capability to carry and fire the **AIM-120A AMRAAM** missile, additional chaff/flare dispensers, and RWR antennas ("beer cans") on the leading edge flaps for the AN/ALR-69 RWR.

General Electric (Blk 30/40/50)

Pratt & Whitney (Blk 32/42/52)

The BIG MOUTH *

There are two different types of air intake for the Viper.

Due to a higher air-mass flow, the F110-GE engine can take advantage of the Modular Common Inlet Duct (MCID). We know this as the "Big Mouth" intake. The original intake, referred to as the Normal Shock Inlet (NSI), is now called the "Small Mouth" intake.

For example → **All Block 32 jets have the** (NSI) **Small Mouth intake** mated to their F100-PW engines.

MOST Block 30 jets have the (MCID) **Big Mouth intake** fitted to their F110-GE power-plants.

(NOTE - This can be a point of confusion. Not ALL Blk 30's have the "Big Mouth".
SOME Block 30 airframes (powered by the F110-GE) still use the NSI or Small Mouth intake.)

BIG MOUTH intake.

SMALL MOUTH intake.

I know it looks bigger.
But → look at the horizontal *plane*

* *Occasionally used as a designation for FRUGAL.*

This Block is known as the ***LEGO BLOCK***.

Block 40/42

This Block introduces features that enhance the air-to-ground role without sacrificing the air-to-air role. This includes a Wide Angle Raster (WAR) HUD capable of displaying sensor imagery, LANTIRN (AN/AAQ-13 navigation pod and AN/AAQ-14 targeting pod) capability, an upgraded AN/APG-68(V) radar, GPS navigation, automatic terrain following, and many other features. Block 40/42 F-16D models have an extra HUD repeater display mounted on top of the glareshield in the rear cockpit. This allows the back-seater to see the same sensor imagery and symbology as the front seater sees through the WAR HUD.

Externally, Block 40/42 airframes have larger main gear wheels and tires, and the main gear doors have been bulged outward to accommodate them. The landing light has been moved from the starboard main gear door to the front of the nose gear door to avoid having the LANTIRN pods cast huge shadows during landing/takeoff. Block 40/42 F-16s are often called "Night Falcons" because of their increased ability to fight at night.

All Block 40s have the F110-GE-120 engine with MCID large mouth inlets, and all Block 42s have the F100-PW-200 engine with NSI small mouth inlets.

Block 50/52

This Block combines the structural improvements of the Block 40/42 with avionics upgrades. The radar is further upgraded to an AN/APG-68(V5), and the RWR is now an AN/ALR-56M. While Block 50/52s can physically carry LANTIRN pods, they have the same WAC HUD as Block 30/32s so they cannot display sensor imagery on the WAC HUD. More commonly seen on Block 50/52s is the AN/ASQ-213 HARM Targeting System (HTS pod) used in conjunction with the AGM-88 HARM missile in the SEAD (Suppression of Enemy Air Defenses) role.

All Block 50s have the F110-GE-129 engine with MCID large mouth inlets, and all Block 52s have the F100-PW-229 engine with NSI small mouth inlets.

The newest Block 50/52s delivered feature the same MMC and CMFDs as the Block 20 and MLU aircraft. USAF has an ongoing program to retrofit all Block 40/42/50/52 aircraft to this standard over the next several years.

Block 50/52 "Plus" airframes are Block 50/52s with the latest avionics (MMC, CMFDs) and provisions to carry the Conformal Fuel Tanks (CFT). All two-seat "Plus" airframes include the enlarged Avionics Dorsal Spine. This compartment adds 30 cubic feet for more avionics with only small increases in weight and drag.

Ara's Euro Madness.

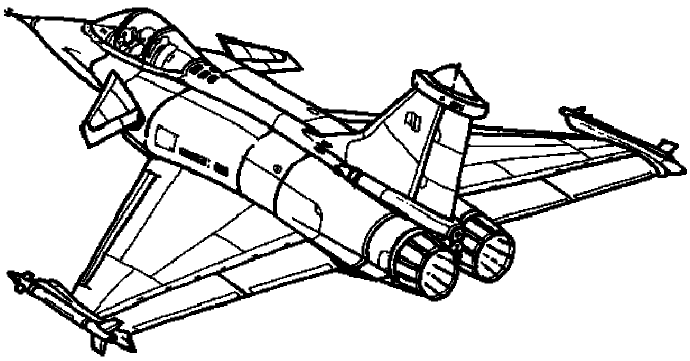
Whilst most of us are familiar with Hornets, Eagles, Falcons and Tomcats, some of we non-European types become confused with the variety of non-US aircraft in FreeFalcon.

So – here's a very brief look at some of the non-US A/C we see in Falcon.

This is NOT meant to be a detailed or in-depth look at European A/C. It's just a very brief "side-by-side" to help curtail some of the confusion which may be felt by our non-European pilots; to help us pick a Viggen from a Gripen…!   ☺

Let's look at the:

- Mirage
- Viggen
- Rafale
- Gripen
- Eurofighter.



Country - France
Company - Dassault
Primary Role - Interceptor

Mirage -2000

Viggen

Country - Sweden
Company - SAAB
Primary Role - Strike

Country - UK (+ Germany + Spain + Italy)
Company - BAe /EADS/EADS CASA/Alenia
Primary Role - Air Superiority

Eurofighter (Typhoon)

Rafale

Country - France
Company - Dassault
Primary Role - Omni-Role Attack Fighter

Country - Sweden
Company - SAAB
Primary Role - Fighter

Gripen

Snail's Euro- Madness Aircraft Recognition Guide:

The *(West)* European fighter/attack aircraft in FreeFalcon/RedVIPER all have a delta wing configuration. So - at first glance – they look quite alike. But for the trained eye *(which you will have after reading this article)* they are reasonably easy to recognise.

Let's start with the **Mirage 2000**. This one is easy: it's the only one without canard fore planes:

Another delta: the **SAAB Viggen.** This was the first modern fighter plane with canards. The Viggen sports some easily recognisable elements.

Seen from the side: the big diameter of the fuselage, the thrust reverser opening near the end of the exhaust, the almost always present centreline tank, the main gear with 2 wheels at each side

Seen from above: the multi-edge main wing with 'saw teeth' and the relatively big, fixed canards with flaps.

When you have seen a Viggen once, you will easily remember its unique shape.

Again an aircraft from SAAB: The **Gripen.**
This was the first of the really modern European fighters.

Compared to the Eurofighter and the Rafale, the Gripen is a small aircraft.
It is further recognisable by two distinctive features:

Unlike the Eurofighter and the Rafale, the Gripen has a single engine.

But in case you forget: the long distance between the back of the main wing and the back of the exhaust is also easy to spot.

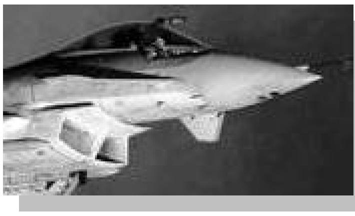
Eurofighter & **Rafale:**
The Eurofighter and Rafale look quite similar, and both have two engines.
But luckily they have some differences that make them easy to differentiate… ☺

The air intakes are very different.

Rafale

Note the Rafale intakes are curved and located on the side of a curved fuselage below the cockpit.

The intakes of the Eurofighter have a more rectangular shape, and are located beneath the fuselage:



Eurofighter

Also → The Rafale has a fixed refuel probe while the probe of the Eurofighter is retractable.

Further, the Eurofighter has an antenna 'on the nose' which the Rafale has not.

Finally, the canards of the Rafale are placed behind the cockpit, whereas the Eurofighter canards are placed much further forward.

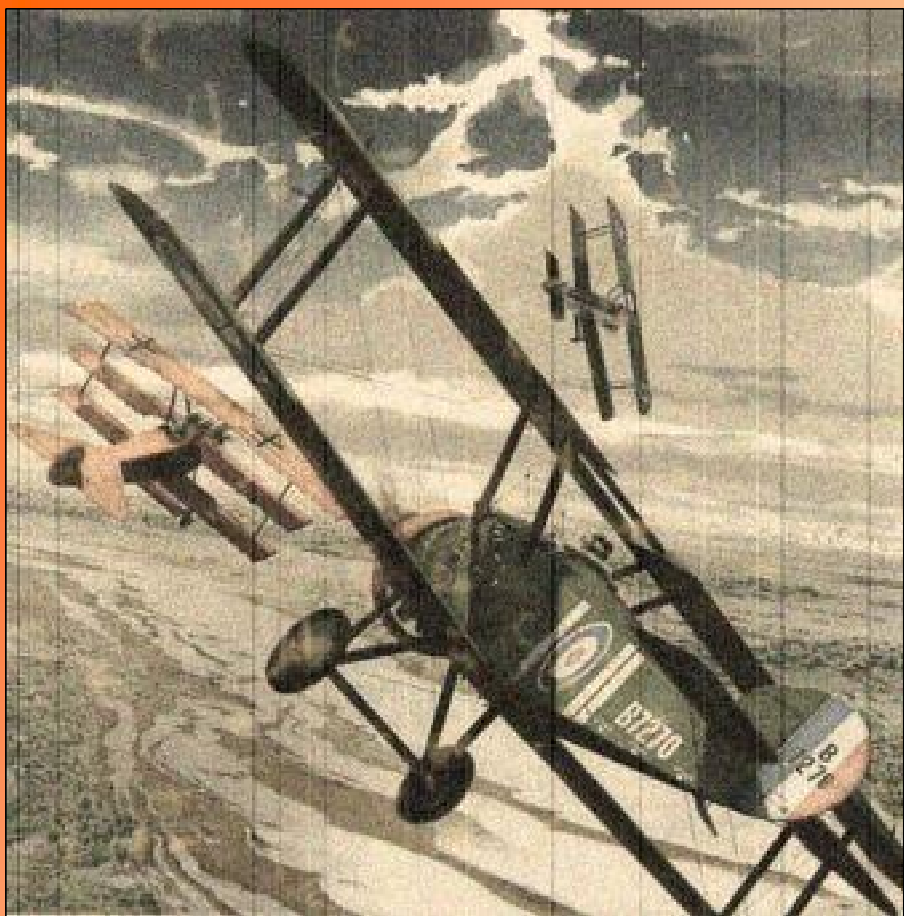
Congratulations. You're now an expert on recognising West European fighters in FF/RV…!





r a g o r n ' s

ACE OF Base



Flying Ace refers to a military pilot or aviator who has shot down five or more enemy aircraft in air-air combat in a non-training environment. The term originated in World War I in France, when French newspapers described Adolphe Pegoud as a *"flying ace"* after he became the first pilot to shoot down five German aircraft.

Adolphe Pegoud receiving an award

With Flight Simulation, one can often lose touch with the reality of aviation & history; the human face of sacrifice and death. This humanity is lost within the glow of a crt monitor and the safe, two-dimensional world of simulated death, and resurrection at the "click" of a reset button.

I have always been fascinated with anecdotes of WWI aerial combat; the facts more noble and chilling than any screenwriter's misguided flights of fancy. This Section of the Manual, strives to share the Face of Aviation History. The human face of death and aerial combat. And – in so doing – perhaps encourage an appreciation not just of where we are, but where we've come from; an appreciation of those flesh and blood people whom - through simulators - we attempt to emulate.

WORLD WAR 1.

WWI aerial combat was the most dangerous of all sports - and the most fascinating. It aged men 40 years in 40 days; it ruined nervous systems in an hour. It was a fast game - the average life-span of a pilot at the Front was 48 hours. And, to many, it seemed an Age...."

\- Elliot White Springs, WWI ace

The thing that always struck me about WWI fighter pilots was the short time in which they were expected to die. Their lifespan varied according to the campaign, theatre, and year, but – during the entire course of WWI - averaged out to about three weeks. There are not many jobs I know of where you are expected to be dead within 21 days.

During a one month period in 1917, ***the average life expectancy of an RAF pilot was 17.5 hours***. Contributing to this was the ceaseless production of new aircraft; up to one new model every month. Active fighter pilots thus became "test-pilots"; that "testing" happening live, in combat.

Consider - these pilots were flying this war only ELEVEN YEARS after the Wright Brothers first flew Kittyhawk…!! Early air to air combat was conducted with PISTOLS and RIFLES…! Soon, machine-guns were mounted on the planes for back-seat gunners. Later – to facilitate single-seat fighters – guns were mounted to the side of, or above the propeller. Some guns were mounted in front of the propeller, their blades capped with steel to deflect the bullets which struck the prop…! Finally, the machine guns were synchronized to fire through the propeller.

Early air to ground missions entailed dropping – by hand - sticks of dynamite, bricks, rocks, and barbed wire from the cockpit…! [1]

[1] Amazingly enough – this practice persisted as late as the Vietnam conflict…! A Vietnam pilot I interviewed for this Manual shared the following: *"One day I flew with this O-1E driver on a mission to a target just north across the river from Bien Hoa. As we were climbing out from Bien Hoa, my foot kicked something hard that had rolled out from under my seat. I looked down and saw a half-dozen small frag bomblets that he had filched from a cluster bomb assembly. They were rolling around loose under my seat and looked about as inviting as a nest of baby rattlesnakes. I said, "Holy ##$#! What are you doing with these things!" He replied, "If we need to use them, hold one out the side window, pull the fuse pin, and drop it when I give you the word." Shades of WWI ! This guy was fighting his own private war!"*

The Greatest Fear

To a Falcon4.0™ pilot, fire is sometimes a problem which necessitates ejection. In WWI, fire meant death. Slow and hellish; skin melted from bone as you plunged thousands of feet to a fiery, cataclysmic death. The fear of fire was well-founded. Consider the aircraft in which these men fought. Made of plywood, piano wire and linen (often patched with needle and thread by the pilot himself), the aircraft was coated with a highly flammable dope (for waterproofing). As the engines ran, flammable oil was spat from the engine, covering both the fuselage and the pilot with a highly flammable mixture. One spark; one flame, and the entire package would burst into a fireball. No ejection seat. No parachute.

The German and British airforces did not issue parachutes to pilots for two reasons. Firstly – a parachute deployable under these conditions was still in development. Secondly – it was considered that the issuing of a parachute may affect the pilot's will to fight. Perhaps he would jump from a damaged craft instead of continuing the fight, or abandon his plane instead of trying to guide a damaged aircraft back to base. Terrifyingly, it was not uncommon for WWI pilots to bail out of their planes. Without parachutes. Low and slow – there was a small chance of survival. Up high…? Well – it was better than burning to death…

Hammer & Gun

As in today's jet-fighters, WWI pilots were issued certain sundry equipment before each flight. As opposed to today's waterproof matches, GPS devices and emergency rations, the WWI pilot was given a revolver and a hammer. The revolver was ostensibly for use behind enemy lines, but it was implicitly understood that the revolver would offer a far quicker death for the pilot in case of fire. A sobering prospect - to consider watching a comrade (or enemy pilot) put a gun to his own head and pull the trigger as he fell burning from the sky. More sobering to consider being faced with that choice yourself.

The hammer was used for bashing the machine guns mounted on the aircraft. These guns were notorious for jamming, and did so on a regular basis. This not only necessitated the bashing of the gun with a hammer to (hopefully) clear the jam, it also affected air to air tactics. Because of the limited amount of ammunition, and the threat of jamming, WWI pilots got close – REAL close – before pulling the trigger.

Range

Holding fire until within 30' was often used as a benchmark, and certainly anything outside of 50' was considered pointless. How close did they fly? Unlike today's BVR and even WVR engagements, the pilots of WWI would recognise each other – not only by the personalised livery of the aircraft, but – by the FACES of the pilots. So close did the aircraft fly to each other, that communication was done – not by radio, but – by hand signals.

It is perhaps this "closeness", this fundamental recognition of the opponent as a Human Being which affected the general conduct of WWI fighter pilots; which made that conduct so much different than that of later aerial warfare.

Ingenuity

Ingenuity and resourcefulness were essential requirements of the WWI Fighter Pilot. In 1917, after completing a forced landing in the dark behind enemy lines, RAF pilot Lt. R.Warneford sat beneath his plane and smoked a cigarette. He then used the cigarette holder to repair his broken fuel-line and – after having been on the ground for 35 minutes – took off and returned to base.

Flying French Morane aircraft, two Russian pilots - Ivan Smirnov and Alexander Kazakov - trailed boat anchors on ropes behind their machines in order to pull the wings off of enemy aircraft…! Once, when the winch attached to his anchor jammed, Kazakov swooped at an enemy plane, and tore it's top wing off with the Morane's LANDING GEAR…!!!

The jacket lining of pilots' flight jackets were actually maps of France, so – in the case of forced landings - they could use the jackets to walk back home.

Knights of the Sky was a term oft' used to describe WWI Fighter Pilots. From primary source documents, and anecdotal record, we can establish that ideas of "chivalry" and "fair play" were very much a fact of life in the skies above the battlefields of WWI. As the war progressed, this chivalric code became under threat, and – by the closing stages of the war, had been discarded by many pilots. By World War II – chivalry had been consigned to the margins of quaint history.

In WWI, the fundamental nature of air-warfare was more personal; less structured. Harking back to the days of the Knight Errant, mission-briefings & planning stages - which form an integral, essential, and core-element of today's aerial missions – were often discarded by the more experienced WWI pilot. Often, did he also discard his squadron…! It was considered normal for certain aces to simply climb into their planes, and take to the skies to patrol and hunt alone. These hunters – predators, searching the skies for prey upon which to swoop – took off alone, and flew solo, whenever the urge to hunt beckoned.[2]

Perhaps due to their perilous lifestyle, an empathy existed between enemy pilots. Certainly, there were not many people who could share an understanding of what it felt like to be expected to die within 17.5 hours of reaching the front…! Perhaps, also – the close proximity within which these aerial knights fought; the experience of seeing each other's faces, all contributed to a feeling of – if not comradeship, certainly – familiarity.

It was not unknown for a pilot – after forcing an enemy into a crash-landing – to land his plane, and check that his adversary was okay…! Shooting down the enemy was the goal. But – this did not mean that one's humanity needed to be checked at the door. In the modern realm of BVR fighting, the enemy is – necessarily – faceless; empathy rendered an obsolete concept.

After the great German ace Oswald Boelke was killed, the RFC made a flight over his airfield and dropped a wreath. Attached to the wreath was a note which read: *"To the memory of Captain Boelke, our brave and chivalrous opponent."*

After The Red Baron was killed by a chance shot from Australian ground fire[3], The British decided to hold a grand funeral for their late adversary. Laid out on a lorry, covered with flowers, escorted by Australian and British troops, and RAF officers, his body was taken to a hangar, where it lay in state for a day. Hundreds of British & Australian soldiers filed past to view the Red Baron. The next day, the burial itself was another military pageant, with six RAF Captains as pallbearers, a fourteen-man firing party with rifles reversed, a flower-draped coffin, a service conducted by a robed chaplain, and a bugler blowing "The Last Post." Memorial Photographs were taken of the funeral, and British planes dropped them over his airdrome at Cappy, with the following message:

TO THE GERMAN FLYING CORPS: Rittmeister Baron Manfred von Richthofen was killed in aerial combat on April 21st, 1918. He was buried with full military honours.

From the British Royal Air Force

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[2] It may be noted that The Red Baron was both an avid and a skilled hunter before he became a pilot. He relied on the same skill-sets for both endeavours, and often stressed the similarities. As an aviator, he was considered average.

[3] The erroneous claim that Canadian Ace Capt. Roy Brown killed Richtofen has been laid to rest based on two pieces of evidence. Timing and entry wound. It has been demonstrated that Captain Brown attacked the German triplane from the south-east, that is from Richtofen's left side. The entry wound was in the right side of Richtofen's chest, so Capt. Brown could never have inflicted the fatal wound. Further proof is evident in the fact that – after Capt. Brown's attack – Richtofen continued to pursue and fire his guns upon Lt May for over one minute. As the exit wound was about three-quarters of an inch external to the left nipple this means that the bullet would have passed through the heart and would have been rapidly fatal. von Richthofen would have lost consciousness within 20 to 30 seconds, and certainly could have not continued to fly his aeroplane and fire on Lt. May for over a minute. Credit for the kill of Richtofen goes to one of three men: ***Gunner Robert Buie*** (Lewis Gun) Australian 53rd battery #3801; ***Gunner Sgt CB Popkin*** (Vickers gun) with the Australian 24th machine gun company; ***An unknown Australian soldier*** with a Lee-Enfield .303

Navigation was done by looking at the ground below, and following roads or rivers; targeting consisted of a wire circle attached to your constantly jammed machine guns; cockpits were open – pilots often losing consciousness and plummeting to their deaths due to lack of oxygen at altitude; the torque of the spinning propellers and engines would pull the planes viciously to one side – often leading to fatal spins; avionics consisted of a MkI eyeball; air to air communication was conducted with hand signals; flying too fast or turning too hard would see your plywood and piano-wire craft disintegrate around you; mid-air collisions were a constant threat, the enemy so close that his exhaust fumes would fill your nostrils as he flew past.

Let's meet a cross-section of these Knights.

We'll begin with athe most famous pilot of that most fabled of airforces – the Luftstreitkräfte (Luftwaffe). A legend within itself, this airforce gave rise to such aces as: **Manfred von Richthofen** ("*der rote Baron"), **Oswald Boelcke** *(the first master tactician of "dogfighting")*, **Hermann Göring**, **Werner Voss** *(who died whilst fighting alone against eight opponents, several of whom were famed allied aces, and none of whom escaped unscathed before Voss was finally shot down)*, **Ernst Udet**, and **Max Immelmann** *(the first airman to win the Pour le Mérite, Imperial Germany's highest decoration for gallantry, as a result of which the decoration became popularly known as the "Blue Max"; inventor of the famed "Immelmann Turn").*

Undoubtedly, the most famous Ace of all time is **Manfred Von Richthofen**. Known popularly as The Red Baron (*der Rote Baron*), Richthofen was NOT – in fact – a Baron, but a "Freiherr". [4]

Richthofen was also known to French pilots as "*le Diable Rouge*" (the Red Devil), and "*Le Petit Rouge*" (Little Red). He was also known to many as the Red Knight.

Richthofen's passion from an early age was hunting, and most of his childhood was devoted to it. After joining the air-corps, he became an observer, and back-seat gunner. Richthofen was no great airman. His very first landing resulted in a crash, and it wasn't to be his last.[5]

Richthofen seemed destined for an obscure career until he was interviewed by the famed Oswald Boelcke, and invited to join Boelcke's new Jasta 2 group. Under Boelcke's tutelage, Richthofen rose to meet his vast potential.

Boelcke died soon afterward in a mid-air collision, and – after his 16th kill, Richthofen was awarded the Blue Max *(visible in the photo above)*. After this – he organised his own squadron: *Jagdstaffel 11;* the squadron known to the world as "The Flying Circus". In late 1916, Manfred von Richthofen painted his aircraft red. The Red Baron was born.

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[4] This meant that Richthofen held free-title property, as opposed to property in exchange for feudal service.

[5] At one time, Richthofen shot down an allied aircraft. The damaged allied plane made a successful forced landing, at the same time as Richthofen himself crashed whilst trying to land…!

The Red Baron was known for his detached, methodical ways. He was precise and calculating, always figuring the odds before commiting; calculating position, angles, ranges and burst duration before swooping upon his prey. Usually attacking from higher altitudes, out of the sun, the Red Baron seldom engaged in prolonged dogfights. His enemy was quite often dead without ever having seen the famed red triplane. It is important to note that Richthofen has never been considered an especially gifted pilot. In fact, his younger brother Lothar von Richthofen *(a 40 kill Ace)* was a much more natural aviator - being more skilled in aerobatic maneuvers. Rather than engage in such tactics, Manfred von Richthofen adhered strictly to the Dicta Boelcke (a work which Richthofen was to expand upon) in order to ensure the greatest chance of both squadron and individual success. While his piloting skills were not as renowned as some, Manfred von Richthofen viewed his plane as simply a platform from which to fire his guns. His skill as an aerial marksman rank with any fighter pilot of his era.

In short, Manfred von Richthofen was a hunter, not a fighter.

Richthofen led his squadron with tight order and discipline; his fellow pilots being required to both study, and commit to his tactics. Another famous German Ace – Ernst Udet – described Richthofen's Jagdgeschwader 1, *(comprising Jasta 4, 6, 10, and 11)* thus:

Other squadrons live in castles or small towns, twenty to thirty kilometers behind the front lines. The Richthofen group dwells in corrugated shacks that can be erected and broken down in a matter of hours. They are rarely more than twenty kilometers behind the foremost outposts. Other squadrons go up two or three times a day. Richthofen and his men fly five times a day. Others close down operations in bad weather; here they fly under almost any condition.

However the biggest surprise for me is the forward combat airstrips. Just a few kilometers behind the lines, often within range of the enemy artillery, we are on fully dressed standby, lounging in reclining chairs in an open field. Our aircraft, gassed up and ready to go, are right alongside. As soon as an opponent appears on the horizon, we go up - one, two, or an entire staffel.

For each of his kills, the Red Baron ordered a plain two inch high silver cup from a Berlin silversmith. Within six months of forming the Flying Circus, 31 small silver cups adorned his cabinet. In a country at war, terrible hardships were endured by the general populace, whilst the trenches themselves were bloodied, muddied hells – piled high with the stench of human waste, and the rotting carcasses of shredded corpses. The Red Baron became a beacon of hope which shone brightly through the dark hell of WWI. The German press adored him, and the general populace worshipped him. Every Richthofen victory brought a new light to fight back the darkness; a new surge in morale to the German people. He became larger than life; the dreams of an entire nation borne upon his shoulders, and – by June, 1917 – his collection of silver cups had reached fifty six.[6] So popular did he become, that Richthofen would exchange autographed photos of himself to quartermasters and supply officers. It was said that – because of the desire of others to have his signed photograph - his squadron was never short of ham, cheese, wine, beer, or any other supplies that could be expected to be rationed during times of war…! Rumour has it that - in 1918 - Richthofen had become such a legend that it was feared that his death would be a blow to the morale of the German people. His superiors asked him to retire, but he refused

The British, too, obsessed over him. His defeat became a priority for the English War Machine. At one stage, an entire bomber squadron was assigned with the task of bombing The Red Baron's airfield in an attempt to kill him. Whilst the entire airbase was destroyed, Von Richthofen – having been warned of the attack – later emerged from a bunker in which he had played cards, drunk wine, and exchanged ribald stories with his fellow pilots, as hell rained down all around.

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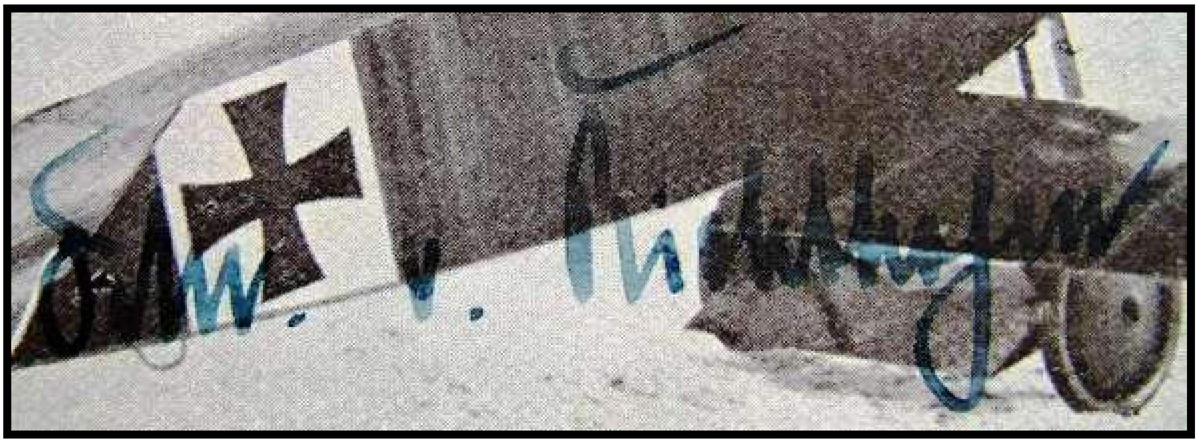
[6] His cup collection had to be capped at sixty, due to Germany's silver supply being blockaded.



Manfred von Richthofen's autographs are still traded today.
This sample above retails for US$3,400.

It is sometimes asserted that The Red Knight increasingly became more The Red Devil. Rumours and stories spread about his heartlessness. It was widely believed that he machine-gunned helpless enemy pilots as they ran along the ground; that he machine-gunned pilots as they climbed from wreckage; that he carried a gruesome photo of a British Pilot whom he had sawn in two with his machine guns. But – the facts don't seem to support these claims. For example, when he downed 2nd Lt. H. J. Sparks *(Richthofen's 64th kill)*, he sent the hospitalised British pilot a box of cigars. And – after his 80th (and final) kill, Lt. D. E. Lewis walked away from his wreck. Hardly possible if Richthofen were straffing him…

The Fokker Dr.1

Richthofen's death stunned people of all nations. In that fatal flight, The Red Knight seemed to have broken many of his own rules, and those of the Dicta Boelcke. Why had he flown so low across the enemy lines, in a shallow dive that exposed his entire body and head from the waist up to the Australian Vickers machine guns, Lewis machine guns and powerful bolt-action 3.03…? Why was Richthofen suffering from target fixation as he followed Lt May against all of the principles he had written and taught…? It may have been brain damage.

On July 2nd, 1917 - Manfred von Richthofen had his skull grazed and partially splintered by a British bullet. From that time on, his skills were never quite as sharp, and he was prone to the most extreme headaches; the pain excruciating and debilitating.

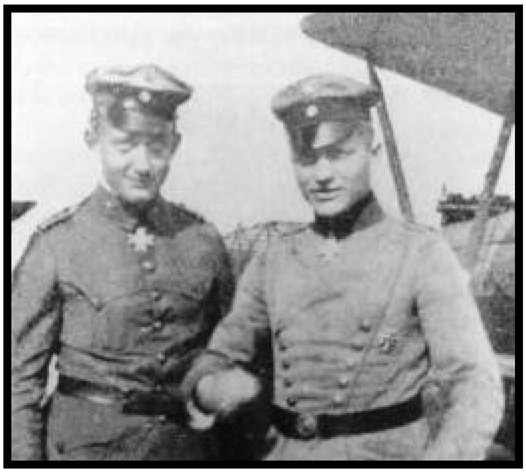
As the scar tissue, bone splinters and bone thorns continued to disturb his cranial regions, Manfred von Richthofen may have become increasingly more prone to attention deficiencies; a lack of concentration, and a weakening of his spatial awareness. He was also being rendered more easily subject to combat fatigue.

Whatever the cause, Manfred von Richthofen died on April 21st, 1918.

He was nine days short of his 26th birthday.

Arriving at the Cemetery : 3 Squadron lays to rest an old adversary, Bertangles Cemetery, France, 22 April 1918

Saluted in death.



Friends: Werner Voss & Manfred Von Richthofen

Werner Voss was both Manfred von Richthofen's friend, and a fellow student of Oswald Boelcke

On several occassions, The Red Baron stated on that Voss was the only person in the world who could possible best his tally of kills.

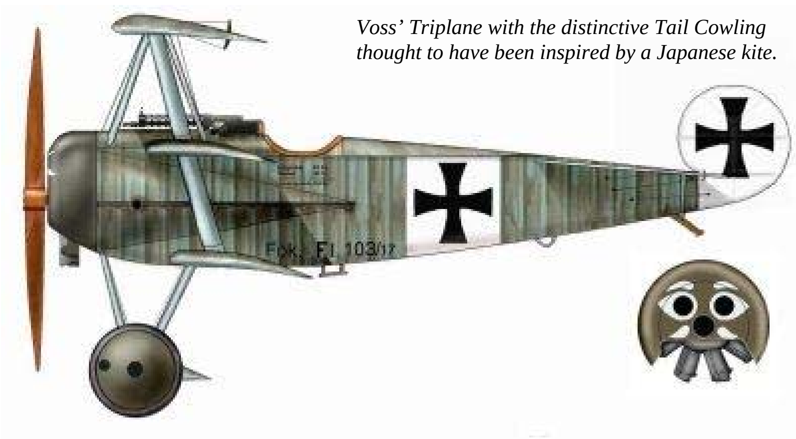
A more gifted pilot than Richthofen, Voss combined natural flying skills, with the same killer instincts as the Red Baron. A remarkable aviator and a calculating hunter; Werner Voss was the perfect WWI airman.

On the 23rd of September, 1917, Werner Voss died at the age of twenty.

It is for this final battle he is most remembered.

Patrolling alone north of Frezenburg; a tally of 47 kills, the young Werner Voss came across "B" Flight of the RAF's 56th Squadron. Amazingly – the seven pilots in this flight were ALL aces. Not only were they ALL aces, but – within that group of aces were two of the most OUTSTANDING Allied Aces of the war: James McCudden and Arthur Rhys Davids.

For whatever reason, Voss decided to take them on…! One man against SEVEN of the best aces of the war. For a full TEN MINUTES, Voss not only weaved and buzzed around the skies avoiding the British, but he managed to score mulitple hits on EVERY BRITISH PLANE…! As he emptied his spandaus into the British, they fought hard to take out the German. However – Voss flew circles around ALL SEVEN ACES. They were simply unable to get a shot at him.



Voss' Triplane with the distinctive Tail Cowling thought to have been inspired by a Japanese kite.

"His flying was wonderful, his courage magnificent and in my opinion he is the bravest German airman whom it has been my privilege to see fight." - James McCudden.

The encounter remains one of the best-known aerial dogfights of the war. A testimony to the skills of this outstanding pilot. *"I shall never forget my admiration for that German pilot, who single handed, fought seven of us for ten minutes." - James McCudden*

Suddenly, Voss' propellor stopped turning, and went into a shallow dive. Whether it was a malfunction, whether his fuel tanks were damaged or empty, or whether he was signalling a desire to end the battle will never be known. Rhys Davids swooped on the silver-blue triplane, and shot it from the sky. *"I saw him go into a fairly steep dive and so I continued to watch, and then saw the triplane hit the ground and disappear into a thousand fragments, for it seemed to me that it literally went into powder." - James McCudden*

Davids was always to regret his actions, often confiding in fellow pilots his wish that he could have brought the German down alive. Interestingly, Voss' death marked the end of the "Lone Wolf" era.

The end of the "Lone Wolf" pilot.

Germany	Manfred Von Richthofen	80 kills
France	René Fonck	75 kills
UK	Edward Mannock	73 kills
Canada	Billy Bishop	72 kills
Sth Africa	A. F. W. Beauchamp Proctor	54 kills
Australia	Roderic Dallas	50 kills
Belgium	Willie Coppens	37 kills
Italy	Francesco Baracca	34 kills
America	Eddie Rickenbacker	26 kills

Top Allied: **René Fonck** **75 kills**

WWI Ace of Aces:

Manfred Von Richthofen **80 kills**

WORLD WAR II.

Amazingly, in the list of TOP 20 World War Two Aces – ALL are German.

In fact, in the list of TOP 50 aces of WWII - ALL are German.

TOP 100 ACES…? ***ALL*** are German.

Germany fills out the first 109 positions in the list of WWII aces.

WWII spawned history's Ace of Aces – Erich Hartmann.

The German pilot survived the war with a staggering 352 confirmed kills; 345 of which were Russian aircraft.

Hartmann was known as "The Black Devil", and seemed an incredibly lucky pilot - surviving 825 combat missions, escaping captivity[7], and living through 14 crashes…!

Hartmann managed to first trump the "Ace in a Day" feat, by making SEVEN kills on July 7th, 1943. It would not be his last time. So prolific was his kill-rate, that even the German High Command had trouble believing it. His kills were double and triple checked, and – so good was he – a dedicated observer flew with his squadron for the sole purpose of confirming his kills.!

Hartmann's aircraft featured a black tulip design around the spinner of his aircraft, and enemy pilots would often stand-down, and refuse to approach him. So fearful was "The Black Devil", that this same design was used on the aircraft of novice pilots, as a means of protection. Russian aircraft were reluctant to attack out of fear it was Hartmann.

Hartmann achieved his 300th kill on 24th August, 1944. On that ONE day, he killed ELEVEN enemy aircraft…! He was immediately grounded by German high command, fearful that the death of Hartmann would devastate German morale. Hartmann appealed this decision and was soon back in the sky. In a fighting style similar to The Red Baron, Hartmann estimated that 80% of his kills had never actually seen him.

For having achieved over 300 kills, Hartmann became one of only 27 German soldiers in WWII to receive the diamonds to his Knight's Cross. Hartmann played down his kill tally by always maintaining he was prouder to have never lost a wingman.

Eric "Bubi" Hartmann passed away on Sept. 20th, 1993. He was 71 years old.

[7] Having crashed, and been caught by the Russians, Hartmann feigned illness, and – taking his chance - jumped from the truck in which he was being carried. He then eluded his Russian pursuers, and walked back to the German lines.

Germany	Erich “Bubi” Hartmann	352 kills
Finland	Ilmari Juutilainen	94 kills
Japan	Hiroyoshi Nishizawa	87 kills
Soviet Union	Ivan Kozhedub	62 kills
USAAF	Richard Bong	40 kills
USN	*David McCampbell*	*34 kills*
USMC	*Greg “Pappy” Boyington*	*28 kills*
UK	James Edgar Johnson	38 kills
Sth Africa	Adolph Malan	32 kills
Canada	George Beurling	31 kills
Australia	Clive ‘killer’ Caldwell	28 kills
New Zealand	Colin Gray	27 kills
Italy	Adriano Visconti	26 kills

Erich “Bubi” Hartmann.

History’s ACE OF ACES.

Total kills – ***352***.

fini

Aragorn's Interview with Chuck Norris

There's a little bit of Chuck Norris in all of us. Mainly due to rape.
And – today, Ara' welcomes Mr. Norris to the World of Falcon.

Aragorn: You were involved in the Vietnam conflict?

Norris: Yes – I actually birthed the Navy SEALS.

Aragorn: You mean you were responsible for the implementation of the SEAL Programme..?

Norris: No – I mean I LITERALLY *gave birth* to the NAVY SEALS…!

Aragorn: But – you're a man. You don't have a womb.

Norris: I needed one; I took one. I don't think the nun was using it, anyway.

Aragorn: Did you actively participate in Vietnam?

Norris: Apart from actually instigating the conflict?

Aragorn: Yeah. Apart from that.

Norris: Yeah. I was a defoliant. Before Agent Orange, I used to clear swathes of Jungle by glaring.

Aragorn: By "Glaring"….?

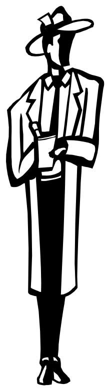
(Chuck Norris glares).

(Ara' pulls down GLARESHIELD.)

(Norris intensifies his glare)

Ara's Glare shield melts*.* (Ara' rips off the molten glare shield)   **yelps

Aragorn: Have you ever KILLED anyone with that glare?



Norris: Is that including my own grandmother?

Aragorn: Uhhh… No.

Norris: The disabled...?

Aragorn: No.

Norris: Orphans and war-displaced…?

Aragorn: No.

Norris: Well – no, then. I haven't.

Aragorn: Is it true that you once flew in a B-52 bomber...?

Norris: No. I ***WAS*** a B-52 bomber.

Aragorn: Why did you STOP being a B-52 bomber…?

Norris: Because there was NO man alive who dared call me a "Big Ugly Fat Fucker".

Aragorn: Understood. So – I shan't be calling you "BUFF" today, 'eh…? (smiles)

(Norris Glares)

Ara's eyeballs start bleeding   (Ara' ceases smiling) (Dabs eyes with toilet paper)

Aragorn: Hey, "BUFF", do you have the time…?

Norris: Two seconds.

Aragorn: Two seconds to wha.… ****THUNK****   **Aragorn roundhouse kicked in the face**

Aragorn: You enjoy meat, yes?

Norris: I enjoy cow.

Aragorn: Beef?

Norris: No. "Cow". I eat cows.

Aragorn: Is it TRUE that you once ate four 72 ounce steaks in 57 minutes….?

Norris: Yes. I spent the first 45 minutes eating the waitress.

Aragorn: You performed oral sex on the waitress..?

Norris: No. I 'ate' her. Literally.

Aragorn: Would you consider yourself a "metro-sexual"…?

Norris: Would you consider yourself a man with two seconds to live…?

Aragorn: No. Actually, I thi……… ***THUNK*** **Aragorn roundhouse kicked in the face**

Aragorn: I once read a Playboy interview with you, in which there seemed to be a misprint.

Norris: Really?

Aragorn: Yes - it said that Chuck Norris masturbates to pictures of Chuck Norris.

Norris: That's no misprint.

(In his hand-held notes, Aragorn notices a small publicity shot of Chuck Norris. Aragorn **worries**.)

Aragorn: You're into Software Development. Today, I tried out the new *"Chuck's Combat"* from Sega™.

Norris: What did you think?

Aragorn: Great. Rocked and rolled. But – if you don't mind me saying - I found a small 'glitch'. It seems that EVERY key; EVERY combination of keys, produced a simple roundhouse kick.

Norris: That's no glitch.

(Aragorn pops a breath mint.) (Chuck Norris pops a razor blade.)

Aragorn: Let's talk about Jets. Do you envy the man who wakes each morning and faces a day of Fighter-Jet flight? The man whose office is the cockpit of a modern advanced air-superiority fighter? The man who controls the awesome power of the missiles and ordnance slung beneath the wings of his angel of death; as he hurtles thru the speed barrier and pushes his metal beast thru the demon-jaws of mach 2? Do you envy the jet-fighter pilot who has the earth at his feet, and calls the air his home; he who controls the ultimate expression of death; he to whom the Fighter-Jet is a home; he to whom the Fighter-Jet belongs…?!?!

Norris: No. Because I can just kill him and take his.

Aragorn: What does it feel like to kill a man?

Norris: I have no feelings.

Aragorn: Is it true that you once ran around the world, and punched YOURSELF in the back of the head…?

Norris: Yes. That's true.

Aragorn: Is it true that you eat yoghurt?

Norris: Yeah right…! Like – someone's gonna' believe that, right...? (Norris rolls his eyes)

Aragorn: Do you smoke after sex, Chuck….?

Norris: Yes. I light the woman's pubic-hair on fire, and suck smoke thru her anus.

Aragorn: Do you support the theory of Evolution…?

Norris: There is NO evolution. Just a list of things I haven't killed yet.

(Aragorn shifts his posture in the chair.) (Norris rearranges his own internal organs by clenching.)

Aragorn: You entered last year's New York Hot Dog Eating Competition, yes…?

Norris: Yes.

Aragorn: Kobayashi ate 50 hot dogs in 12 minutes.

Norris: Yes.

Aragorn: You...?

Norris: I ate Kobayashi…

Aragorn: Well – at least it was mercifully quick...

Norris: ...and then – I squeezed him from my sphincter, and roundhouse kicked him to death.

Aragorn: Sphinctersayswhat?

Norris: What?

Aragorn: Er… so… ah…. do you often fly?

Norris: Yes. Quite often.

Aragorn: What kind of plane do you usually use?

Norris: Plane….?

Aragorn: My bad.

(Aragorn takes a sip of water.) (Norris eats a glass of water)

Aragorn: Your mother died at child-birth…?

Norris: Yeah. Some doctor slapped my arse, so I roundhouse kicked everyone in the room to death.

Aragorn: You were proficient from a young age, then?

Norris: As a child I'd stand at the ocean shore, and kick the waves as they rolled onto the beach.

Aragorn: That's sweet.

Norris: I did it again on December 24th, 2004, whilst visiting a little beach in Indonesia…….

Aragorn: What got you interested in Military Aircraft Sims?

Norris: I was an "extra" in Black Hawk Down.

Aragorn: What role did you play?

Norris: The Black Hawk.

Aragorn: I heard you're familiar with the F-16?

Norris: Yeah. I once took out an entire flight of airborne F-16s with a single roundhouse kick

Aragorn: Really?

Norris: Yeah. That's when Bonanni came after me…..

Aragorn: I read about that at Frugalsworld. An epic battle with Pete Bonanni?

Norris: He came at me in his Viper – Mach 1.5, so I clenched and released my glutes, and dragged his F-16 into the crack of my arse…

Aragorn: That must have hurt.

Norris: No.

Aragorn: Then…?

Norris: Bonanni popped his canopy. ***THAT*** hurt. (Norris winces)

Aragorn: How did he find his way outta' your butt?

Norris: SAR flew a helo up my butt, and got him. Anyway – Bonanni's angry, like – and he came at me!

Aragorn: Why didn't you Glare him to death?

Norris: Aviator sunnies…! Anyway, my roundhouse kicks were pulling 8 or 9 g's, but Bonanni's moustache was up to the task – it was twitchin' up and down, blockin' everything I had. So, I dropped my dick back down to CATI, and went at him with my moustache. His moustache and My moustache engaged in a 2-circle fight.

Aragorn: In the booth! Sounds "hairy"…. *Hee hee*… Do you get it…? "Hairy"….? Get it….?

Norris: I'm laughing on the inside. Anyway, Bonanni tries a 'Split-S', and his lips get tangled together, so I go into the vertical, and bring my moustache up and engage his eyebrows…

Aragorn: You get the kill….?

Norris: Nah'! Bonanni's a fighter pilot. They got eyebrows like Neanderthals…! Anyway – Bonanni pulls an 'Immelman', and brings his moustache down on top of my head…!

Aragorn: Holy shit…!

Norris: Yeah – but luckily, I'm wearing my Walker – Texas Ranger Stetson, so it takes most of the damage. I jettison the Stetson, and trade altitude for energy; I got my moustache down near his crotch. Bonanni senses danger, and called in Support…!

Aragorn: Sounds tense, dude.

Norris: Yeah. Don't call me dude. "Tense" isn't the word…!

Aragorn: What is the word.

Norris: No idea. I'm illiterate. I don't have to read to kill people.

Aragorn: Sorry.

Norris: So – Bonanni sees an Escape Window and disengages, because he's got a B1 inbound, and it's carrying a B-61 Mod 7 tactical nuke…

Aragorn: What did you do?

Norris: Well, the B1 drops it's ordnance, and I stand my ground. At the last second, I suck the nuke UP my bum, and it detonates…! "BOOM!" 350 kilotons of high-explosives….!

Aragorn: Effect?

Norris: Cured my hemorrhoids AND gave me a lovely prostrate massage…

Aragorn: Mr. Norris, you've mentioned your "arse" 6 times in this interview. Are you anally fixated?

Norris: I don't "fix" things; I BREAK 'em…. Anyway - We only got about 6 seconds left until.

Aragorn: What? Well, Mr. Norris, it has been a pleasure. I'd like to thank you, and I'm sure that all of ou...

THUNK **Aragorn roundhouse kicked in the face**

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FEAR NOT…!! You are NOT alone. Free-Falconeers are waiting to take your call…!

You just gotta' know where to look.

*Note that all of the LINKS below are **ACTIVE**…! If you "click" on them, your Web Browser will take you directly to the site. Ol' Gorny thinks of everything, 'eh?*

Band Of Virtual Brothers

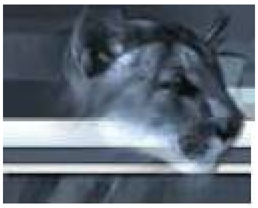
The most obvious place to start is – of course – the HOME of FreeFalcon 4.0

http://www.freefalcon.com/

FreeFalcon/Viper

http://www.frugalsworld.com/

Join the serious simmers - Military & Otherwise



http://cougar.frugalsworld.com/

Trouble with the COUGAR...?

For all things VIPER, check out **F-16 Net**

http://www.f-16.net/index.php

The French Falcon site

http://www.checksix-fr.com/

The Simulation Community Headquarters

http://www.simhq.com/

A Pit Builder's Paradise (and more...!)

F-16C Reference Library

http://www.xflight.de/f16/index.htm

FIGHTER OPS

http://www.fighterops.com/

Falcon4 Headquarters

http://www.f4hq.com/

BLIMEY, GUV'NOR - FalconUK

http://falconuk.co.uk/

REDDOG'S - Combat Sim Checklists

http://users.skynet.be/bs999158

Combat360 (SAAFOPS)

http://www.saafops.com/

YOU MAY ALSO ENJOY A VISIT TO →

Cockpits NL (Aeye's) http://www.cockpits.nl/

Patrick's Aviation site http://www.patricksaviation.com/

Stopworks' Cockpit Design http://www.stopworks.us/

HiTiles **(high resolution terrain textures)** http://www.hitiles.com/

German FreeFalcon Fans http://freefalcon.amxx.org/

Pre Flight (Hebrew) http://www.preflight.us/HE/

Korean FF Café http://cafe.daum.net/freefalcon

Virtual Italian AF http://www.viaf.it/

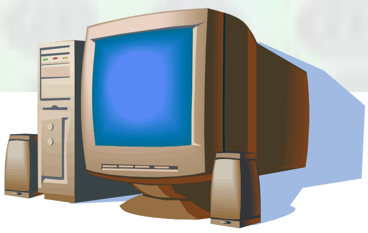
Buddy-Spike.com – (**German** *F-16 community*) http://www.buddy-spike.com/

Falcon5.NL (**Dutch**) http://www.falcon5.nl/

13EFW Fighter Weapon School (**Japanese**) http://www.13efw.net/

CN101 Griffin Squadron (**Chinese**) http://www.cn101tf.com/

Puma's Log http://www.pumaslog.addr.com/



Your FreeFalcon WebSite

The FreeFalcon/RedVIPER WebSite consists of various Forums in which you can join discussions, offer opinions, and both seek and offer help to the members and guests of the FreeFalcon Community.

Boasting over 3,000 registered members, the FreeFalcon/RedVIPER WebSite boasts a 24hour a day, 7 day per week active membership.

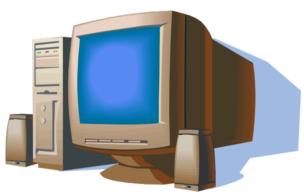
Although no action is required to freely browse the site, in order to actively participate *(thru the posting of threads and polls, etc.),* you are required to freely register as a member. This will ensure you have full privileges.

The various public forums available include:

FreeFalcon	- Ask questions or discuss features about the FreeFalcon
Ara's Support Forum	- the NEW forum for **RV1** & **Official Add-On** Support
Open Development Library	- Tools, files and things for Falcon development
User Submitted Mods	- Download skins, mods etc submitted by the community!
Information	- A mini-FAQ in progress
Falcon Tactics	- General discussion about Falcon4 tactics
Theaters and Terrain	- Discussion on new Terrains and Theaters
Cockpit Development	- For sharing info about making and editing cockpits in Falcon 4.0
The Hangout	- OT and friendly discussion
Multiplayer Contact	- Find folks to fly with online, or recruit for your Squadron

Those are ACTIVE LINKS….!

Click on them now and choose to open the Link in your Web Browser…!



Falcon Archeology

With T-REX

"When I started writing F4Patch I briefly toyed with the idea of charging for it but I decided against it for a few reasons. First and foremost, I was already enjoying the fruits of several other people's labor (Sylvain's & Paul Wilson's) and they weren't charging for the work they were doing so I thought it would be quite unfair to charge for mine... Third, charging for F4Patch would start a precedent I didn't like. Everyone likes free stuff!"
- *Joel "Jackal" Bierling* (Executive Producer, Lead Pursuit), *June 22nd, 2000, Delphi*

"Our concern is people might continue to develop non standard alternative products based upon previously released modifications (you mentioned SP4 and FF which are as good an example as any). Although they may be well meaning in trying to continue to push the envelope, they are no longer permitted or acceptable to the IP holder or Lead Pursuit."
- *Froglips* (CEO of Lead Pursuit), *July 10th, 2005, interview with Vosene of the* 185th

"For those of you interested in flying other planes but are frustrated with having to wait till its in the air, try this...."
- *Orto, September 6th, 1999, Delphi* ("NEW Hex codes section")

"During one extremely boring weekend I attacked the Falcon keyboard file....With this test file you can change almost anything in the graphics while in flight, become invincible, or find your exact world location."
- *Froglips (CEO Lead Pursuit), September 9th, 1999, Delphi* ("NEW Hex codes section")

"I wish MPS would come out and tell us where some of the stuff … was."
- *Shawn Agne, September 13th, 1999, Delphi* ("NEW Hex codes section")

"When you guys were dinking around in the file structure did you happen to come across the skins for the AC...It would be cool to be able to do tail art & repaints, but you need the .gif first."
- Cyborg8, September 19th, 1999, Delphi ("NEW Hex codes section" thread)

"Some more info I've found on the CT file."
- *Codec,* (Lead Pursuit) *October 1st, 1999, Delphi* ("NEW Hex codes section")

"OK I am thinking of buying Falcon 4. Is it worth it. Should I not bother. Is it really hard core or medium tech level. Should I wait as something better is coming out soon. Is it more of a pain than fun and does it get boring. Any advice would be appreciated. Thanks."
- *Michael, October 3, 1999, Combatsim*

"Has anyone ever seen a scud or frog impact the ground?"
- *Rhino, October 26th, 1999, Delphi* ("NEW Hex codes section")

"It's the hexers out there that will get this game right, I know."
- *Rhino, November 9th, 1999, Delphi*

"Well since MPS is disbanding the F4 team any other changes are up to us."
- *Shawn Agne* (Lead Pursuit), *December 7th, 1999, Delphi*

"Falcon 4 is not dead."
- *Rhino, December 14th, 1999, Delphi*

"I participate in the HEX Editing portion of the F4 website and I've released some file..."
- *Shawn Agne* (Lead Pursuit), *January 5th, 2000, FW*

"Anyone using a GeForce GPU with a 450 CPU or higher? Any improvements on frame rates?"
- *Jem, January 3rd, 2000, FW*

“We're committed to protecting our brands and licenses to the full extent of the law.”
- **Hasbro press release**, *February 8, 2000*

Sims will become much dumber to appeal to the great stupid majority, then one company will “start noises on how their current project is super-real. Could take years. Luckily for us, we have F4 to keep us occupied! Should just about start to show it's age by then..”.
- *DM, Feb. 8, 2000, Combatsim*

“Long live the king of flight sims, F4. Also, long live the hex editors!”
- *JimG, Feb. 18, 2000, Combatsim*

“Does anybody knows how to find out easily if there are replies to my posts or even to which threads I've posted?”
- *Sylvain Gagnon, Feb. 29, 2000, Combatsim*

"Guys, are you using F4browse? Here are a few things I would like to see tweaked. If I knew what to do, I'd try to do it myself. It concerns damage values. I found the menus in F4browse for these items, but haven't a clue what they do…”
- *JimG., March 7th, 2000, Delphi*

“This is amazing, is F4 better off without MPS and Hasbro???”
- *Thomas ‘AV8’R’ Spann, March 9, 2000, Combatsim*

“Btw, the falcon4.exe has been decompiled and posted on the hex thread on Delphi. It's in pseudo assembly code (much easier to read than plan assembly code, but still not C) so you can expect even a better future for Falcon4 fans.”
- *Sylvain Gagnon, March 9, 2000, Combatsim*

“Something in this industry model has got to change to allow complex PC games to survive.”
- *Mike Laskey, April 3, 2000, Combatsim*

“In about a years time, when the current flood of mostly mediocre sims has disappeared, and the market is ready for some new ones, it's going to be a developers market.”
- *Scoob_SBM, April 3, 2000, Combatsim*

“Falcon 4.0 has passed through the first steps of childhood, the pain and pleasure of adolescence and it has finally reached a mature age. The last of a breed, it stands alone in its excellence. If you have the hardware to run it and $20 to buy it - there is no excuse not to fly it.”
- *T-Bone, April 3, 2000, Combatsim*

“The bottom line is, Falcon 4 will last until someone comes up with a sim that at the very least equals F4's feature set and improves on the graphics.”
- *DaleReeck, April 5, 2000, Combatsim*

“BTW, some of you are making flight sim history...keep smiling....one day in the future we'll all be talking about the good ole' days when we really GOT into F4.”
- *JimG, April 9, 2000, Combatsim*

“Hasbro screwed us as consumers and the developers as employees...If they're *smart* they'll admit the genie is out of the bottle and GPL the code. That way no one can profit from it and the end-user is the winner.”
-*TSpec, April 9, 2000, Combatsim*

"I've erased the source code from my hard disk..."
- *Sylvain Gagnon, April 10, 2000, Combatsim*

"If Hasbro is willing to let us use the code, I won't mind to pitch in (money and time)"
- *Sylvain Gagnon, April 11, 2000, Combatsim*

"Falcon4 is alive and as such it will grow and should grow."
- *RP, April 12, 2000, Combatsim*

"We are building our own F-16 (MiG-45) using data obtained from the source code. Thank you comrade."
- *Ivan Mikyon-Gourevich, April 15, 2000, Combatsim*

"Actually Falcon isn't even scratching the surface what recent drivers offer."
- *eRazor, May 4, 2000, Combatsim*

"THIS PUPPY IS 99% FIXED!...18 months later!"
- *Uh_Duh, May 4, 2000, Combatsim*

"They don't charge you for anything, you can download the Realism Patch 2A or not. No one made you do it. You should all realize how incredibly BLESSED we are!!"
- *Tazzman, May 18, 2000, Combatsim*

"And if you think you'll be getting any future commercial release of any F4 derivative for free (unless you pirate it), you're truly as stupid as you look (then again, I'm sure you already knew that)."
- *Derek Smart, May 20, 2000, Combatsim*

"As for F4, right now, it stands a 50-50 chance of being resurrected. It all comes down to Hasbro and money."
- *Derek Smart, May 21, 2000, Combatsim*

"Sylvain has just released a new patch that enables you to change from CAT III to CAT I"
- *Ed9* (Lead Pursuit), *26th May, 2000, CombatSim*

"What patches do i need to get and where can i get them? I read somewhere that a third party company was patching F4 instead of Microprose so i am kinda confused about the situation."
- *Joram1, June 21st, 2000, FW*

"Was technical evolution ever stopped by ethical issues?"
- *Terrapin, July 3, 2000, Combatsim*

"We are doing this all for free in our spare time so we cannot guarantee that any of the proposed bug fixes/feature requests etc. will ever make into the patch. Honestly, when I released the patch I was not aware of the huge amount of feedback (thanks guys!) it would generate."
- *eRazor, July 4, 2000, Combatsim*

"Does anybody know what the hierarchy of these patches is? That is, starting from the Falcon 4 disk out of the box what do you have to download and install in order to reach RP3?"
- *Beresford, July 20th, 2000, FW*

"Although I plan to take a few weeks break after I've sent the changes to eRazor, I'm already thinking about RP5."
- Sylvain Gagnon, Nov. 22, 2000, Combatsim.

"Someone PLEASE explain the history of all this mess to me.. i just jumped in and I don't know where and how to start!"
- *dpp, December 23rd, 2000, FW*

"Also, don't forget that eRazor and RP4 will work as one, combining the best of both worlds."
- *Mower, December 30th, 2000, FW*

"Happy New Year to all of you. 2001 is going to be a very exiting year for Falcon 4. With 10799 I think it will be fair to call it Falcon 4.5 and by the end of 2001 it will be Falcon 5 without a shadow of a doubt."
- Frugal, December 31st, 2000, FW

"Long live F4, all the best to eRazor AND the RPG for all the work that is ongoing - it's certainly keeping a lot of people interested that may have disappeared a long while ago if it wasn't for the enthusiasm of all these individuals."
- *Mike Laskey* (Lead Pursuit) *January 11th, 2001, FW*

Best of luck to them, I am patient. I will wait and continue to use RP4. My only regret is that I have no talent to offer in assistance to any of these groups.
- Dann, Feb 1st, 2001, Combatsim

"I am one of the dumbasses that just can't get the patching process down."
- Dusty Rhodes, February 26th , 2001, FW

"BTW, you hexers are doing an astounding job, keep it up people..."
- Dusty Rhodes, February 26th, 2001, FW

“On June 18th, 2001, the F4Terrain Team will release the first all new and complete add-on theater for Falcon 4.0, The Balkan Theater. We would like to recognize **Force** 12, G2 Interactive, and Eric Marlow and Claude Cavanaugh for their unwavering support of the Falcon community. They have embraced the energy of the community and no doubt will take Falcon to the next level that so many of us have dreamed of for so long.”
- *Froglips* (CEO, Lead Pursuit), *June 7th, 2001, FW*

“Help. Last night I killed my wingie - with an AGM-88....!!”
- Aragorn, October 5th, 2003, FW

“I went shopping for falcon 4. and ran across this: ‘ALLIED FORCE’...”
- Given, April 13th, 2005

“This might actually get released...”
- Given, April 22nd, 2005, FW

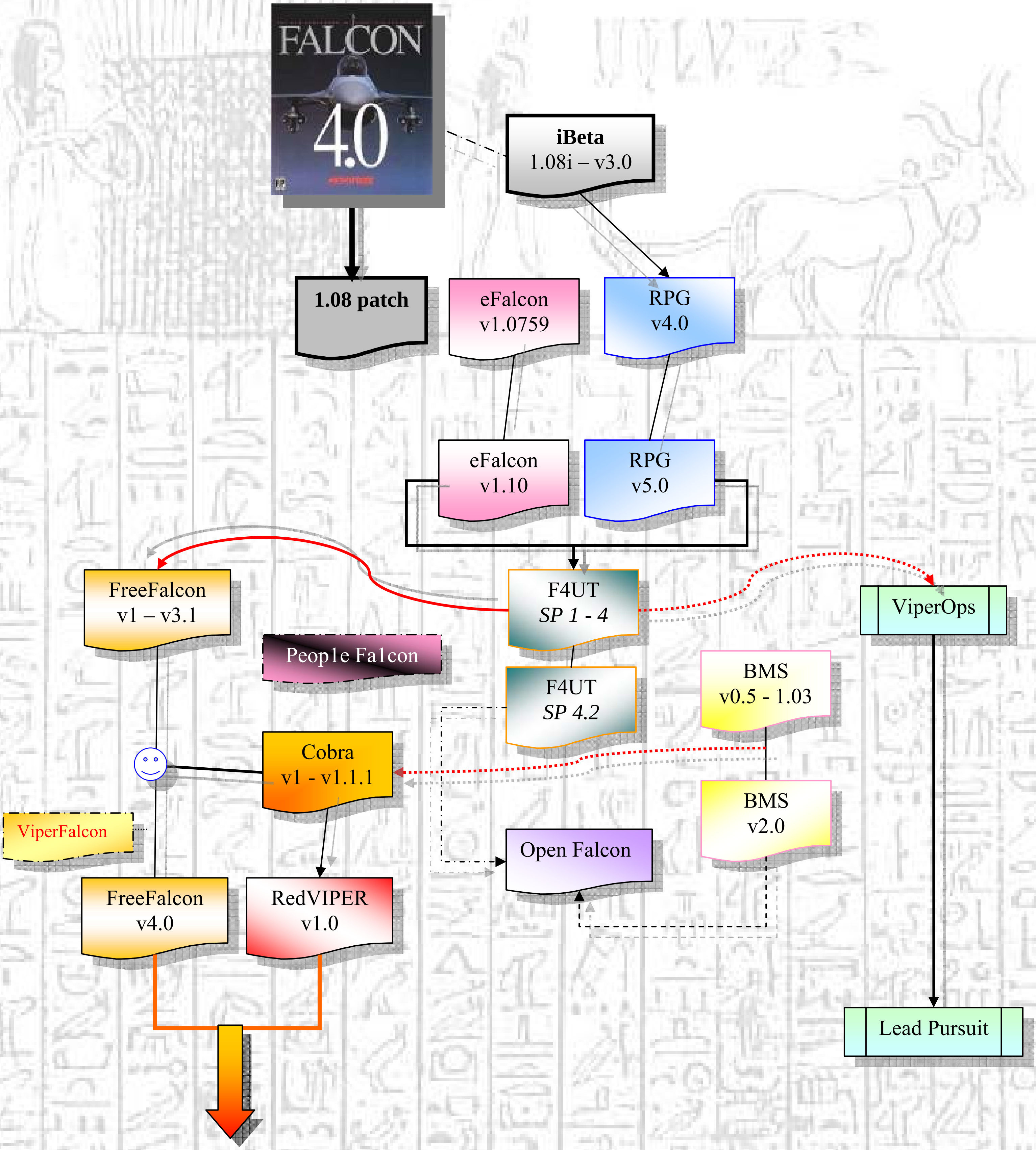
“I doubt it.”
- Xeno, April 22nd, 2005, FW

“If this is just some money-making ploy, we're all screwed. Why? Because if people are trying to make money off of some bullshit version of Falcon 4, they're certainly going to want to put an end to 3rd party work that can easily best it.”
- VF-142 Raptor, 22nd April, 2005, FW

“I see that Falcon AF is coming out.... (And) since this version is being released, we can assume that... this will bring unity to the falcon 4 world.”
- Uh Duh, 7th May, 2005, FW

“Screw this... Let's go beat off to porn!”
- Spyder-F16, 17th May, 2005, FW

“I love this sim.”
- *Jeanguichard*



http://www.falconhistory.com/

http://web.archive.org/web/20040208100926re_/www.hzebv.nl/~falconhistory/history.html

Falcon 3.0 Release – Dec. 1991

Falcon 4.0 Demo – Dec. 17th 1997

Falcon 4.0 Release – Dec. 11th 1998

1.03 Patch Release – Dec. 20th 1998

Hasbro Fires F4 Team – Dec. 7th 1999

iBeta 1.08i2 Release – Dec. 26th 1999

Source Code Leak – Apr. 9th 2000

F4Alliance MiG29 Release – Dec. 2000

SuperPak 1 Release – Nov. 13th 2001

FreeFalcon 1 Release – Apr. 26th 2003

BMS 1.0 Release – Dec. 2003

CCCXXXV

An F-16 was flying escort for a C-130 Hercules, and the two pilots were chatting to pass the time.

Talk came around to the relative merits of their respective aircraft. Of course the Viper driver wouldn't shut up about his jet having superior speed, maneuverability, weaponry, A-G and A-A capability, and so on and so forth, whilst all the time putting down the Herc's deficiencies in these areas.

After taking this for a while, the C-130 pilot says: "Oh yeah? Well, I can do a few things in this old girl that you'd only dream about in that pissy Viper."

Naturally, the Viper driver challenged him to demonstrate.

"Just watch," cames the quick retort.

And so he watched. But all he saw was that C-130 continuing to fly straight and level..

After about 10 minutes, the Herc pilot cames back on the air, saying: "There!! How was that?"

Not having seen anything, the fighter pilot replied: "What are you talking about? What did you do?"

And the Herc pilot says:, "Well, I got up, stretched my legs, got a cup of coffee, then went back to the "head", and took a piss."

A Fighter Pilot - dressed to kill in his dress blues - went to a bar and ordered a drink.

As he sat there sipping his whiskey, a young lady sat down next to him.
After she ordered her drink she turned to the captain and asked him: "Are you a real fighter pilot?"

To which he replied: "Well, I fly F-16s every single day of the week, so I guess I am."

He then asked: "What are you?"

She replied: "I am a lesbian. I spend my whole day thinking about women. I get up in the morning thinking of women. When I eat, I think of women. When I shower, watch TV, clean – I think of women. Everything makes me think of women."

A short while later she left, and the fighter pilot ordered another drink.

Another woman sat down next to him and asked: "Are you a real fighter pilot?"

"I always thought I was," he answered, "but I just found out that I'm a lesbian…"

Official Add-Ons

In addition to our extensive offering of User Submitted Mods, the FreeFalcon Team is delighted to begin building our collection of **Official Add-Ons**.

These will be available from the **RedVIPER SUPPORT FORUM**.

As well as dedicated D/L links, FF will offer "support" for OFFICIAL Add-Ons in the RedVIPER SUPPORT FORUM.

The rationale behind Official Add-Ons is as follows:

1. *(to) Foster excellence in 3rd party Dev'ing.*
2. *The recognition of excellence in 3rd party Dev'ing*
3. *The creation of a general air of professionalism in the Falcon Modding Community*
4. *The fostering and support of excellence in community dev'ing*
5. *Increased motivation in the Falcon Modding Community*
6. *Active involvement & awareness of Community Mods by the FF team.*
7. *The fostering CLOSER ties with the Modding Community.*
8. *The sharing of knowledge and resources between the FF Team and the Modding community.*

Avoiding exclusivity →

Official Add-Ons in no way DIMINISH the importance of our User-Submitted Mods.

These remain what they have ALWAYS been: Fantastic work of the highest standards.

With the Official Add-Ons, FF are simply recognising: a. Excellence. b. Compatibility. c. Utility

To provide an example → *A Mod of the UTMOST excellence may be submitted, yet a Mod of the same standard may already be present in our Install. In this case, the Mod would be added to our User-Submitted Mod FORUM. In no way would this detract from the standard of the submission.*

At the time of Release, the following Add-Ons will be the vanguard of a growing and expanding List.

We are honoured to include work of such an admirable standard; thereby setting the benchmark for all future Official Add-Ons.

- Topolo's Mirage Package *
- Rogue's FTT v4
- FF4_TileUpgrader
- Bird's NEVADA Theatre [1]
- 2D-Cockpits.nl Package

* *Included in your Install.* Being completed, we opted to install it for you.
Following the release of FF4.0/RV1, you will be able to D/L all Add-Ons and install them at your leisure.

[1] Presently a Work In Progress, still in it's infancy. It is only included here as an example of work we would consider as an Official Add-On.

Topolo's Mirage Package

High Res Skins for

Mirage 2000-C (RDI)
Mirage 2000-5F
Mirage 2000-D
Mirage 2000-N
Super Etendard Modernisé (SEM)

2D Pits for

Mirage 2000-C (RDI)
Mirage 2000-5F
Mirage 2000-D
Rafale M

3D Pit for

Mirage 2000-C

Falcon Tail Team Version 4

FreeFalcon

Artist: Jared “Rogue” Childress
Email: roguesqdn@mac.com
Forums: ***RogueSqdn***
ICQ: 164226448

For nearly four years, the Falcon Tail Team collection has set the Falcon 4.0™ community standard for accuracy and degree of detail. Starting with Panther’s skins, then Ron “Red1” Nair’s, and later Harald “Hrenner” Renner’s, the package has been adopted by users of FreeFalcon, and others as the ultimate in realism for any Falcon 4.0™ installation. Now we present the latest generation of this art package, **FTTv4** - made especially to enhance Ron Nair’s new F-16 skins for FreeFalcon 4.0…!

Featuring:

- ✓ Markings for every USAF F-16 unit
- ✓ Covers F-16A, B, B, CG, DG, CJ, and DJ models.
- ✓ Covers Blocks 15-52.
- ✓ Markings for wing/squadron commander aircraft, as well as “generic”, but accurate F-16 tail numbers.
- ✓ Over 200 sets of markings in easy-to-use DDS format.

Made on a MAC

F F 4 T I L E U p g r a d e r

V a r i o u s N E W t e r r a i n t i l e s … !

Covering airbases, and MORE. 512x512 resolution. Less pixilation down low.

Gaze down upon more buildings, parking lots, golf courses, highways, and more…

Both *Allied* and *DPRK* bases are covered, as well as various city tiles, highways and ports.

Higher resolution, more detail, greater variety.

For the use of this Add-On, we recommend that you have twaelti's HiTiles installed.

PayWare Tiles are recommended for the use of this Add-On, although the FreeWare version also achieve fine results.*

I M M E R S I O N P L U S +

** "Edges" where New tiles meet surrounding tiles will be noticeable if this Add-On is installed over the Default Tiles.*

BIRD's NEVADA THEATRE

Climb into the T-38 Trainer Jet; adjust your harness and take to the skies in Bird's Nevada Theatre.

Fire up your Viper for some Red Flag…!!

Specifically designed for Training and the honing of Situational Awareness and Jet-Jockey Skills.

Follow the TE Tutorial in this Guide to create your own OPFOR and DACT Training Exercises.

INCLUDES **The Nevada Campaign** → sharpen your skills, and test the systems before entering the fierce arena of the FF4/RedVIPER hostile environment campaigns…!

The 2D-Cockpits.nl Package

Various Freeware 2D Pits from Cockpits.nl

Enhance your fly-any-plane obsession with this simple Installer add-on.

With the kind permission of Cockpits.nl, the virual pilot can now install a series of 2d Pits which have been rendered ***FULLY compatible with RedVIPER***.

The *F-4 Phantom*; The *SU-27 Flanker*; The *C-130 Hercules* & The *F111 Aardvark* 2D pits can all be added to your install with this simple, one-click Add-On.

Many thanks to the generosity of Cockpits.nl *in making these pits available to all RedVIPER drivers.*

Why dredge up these old lectures you ask…? Simple. There are many n00bs and returnees who didn't have the opportunity to catch these lectures the first time around. And – I believe – they should have the SAME opportunity to hate me, as the veterans in the community. I therefore present:

Gorny's Flight Physics 1.01

There has been MUCH ado recently about flight models and characteristics and technical stuff like that. Time for the TECH-SMURF to SET YOU STRAIGHT. Welcome to Smurf's new course:

GORNY'S FLIGHT PHYSICS 1.01

Plane of the Wing Surface: It seems that the wind must hit a certain plane. That plane is on the wing of the plane. Therefore, it's quite plain that the plane's plane must be the cause of lift. That the plane's plane creates lift is - I hope - very plain.

Please remember - then - the plane's plane is plain.

Lift: is that force which lifts you. *(cf. Theme song to "An Officer and a Gentleman")*

It is accomplished by the plane's wing's plane's angle of attack.

This is best demonstrated by sticking your hand out of the car window when you are driving.

As you drive, tilt your hand upward, and you will find that your hand will be torn from your arm by any oncoming Bus-mirror. That is an example of a poor angle of attack.
Please stem the blood flow and go directly to a hospital.

Angle of Attack: I will teach you this very important concept with an example.

I am in a bar-fight with a big dude, and I am only a little dude.
I swing at the big dude with a bottle - He's too tall - I miss under his chin...!
(note: the Japanese word for Penis is "chin-chin").

What do I do? SIMPLE - use AOA....!

I stand up on a bar-stool and smash him on TOP of the head.
Do you see?? I've changed my "Angle of Attack".

So - you can see - Angle of Attack is very useful.

(Note: Your chin-chin is ALSO quite useful.
The AOA of your chin-chin can also be adjusted, according to the following FORMULA:

chin-chin AOA = BS + VPL x VN

where BS = bust size, VPL = visible Panty line, VN = Visible nipples.)

Thrust: There are two variables with Thrust. These are the "duration", and the "power".
If you lack power in thrust, it can affect performance. So can a limited thrust duration.

Strangely enough, my girlfriend often complains about my limited thrust duration and power.

I simply point out that an increase in "BS" would probably help...

Yaw, Pitch and Roll: This is the name of an obscure three-piece 70's rock outfit.
(They died in 1974, when their Cessna stalled during a “Buddy Holly Tribute” tour.)

Yaw, Pitch and Roll is ALSO what you do when you are spastically-drunk, and try to walk up a moist, grassy slope.

There are several forces acting upon an aircraft at any given time. This is well illustrated in Star Wars, where the pilots – before combat missions – were urged to “Remember the Force”. I can’t stress this enough.

"G's": Finally we come to the idea of "pulling G's". "G" is gravity.

It is that force which makes your vomit RETURN to your face AFTER it's left your mouth.

An experiment to do at home: Get a REALLY REALLY big fat person to sit on your face.

This simulates what pilots call a "black-out". *(note: some men actually **pay** for this)*

If the REALLY REALLY big fat person has hemorrhoids, and sits on your face, naked - you can experience what Viper-drivers like to call a "red-out"....!!

hem·or·rhoid (hem-roid) n.
An itching or painful mass of dilated veins in swollen anal tissue.

(note: do NOT try this without adult supervision...!)

The lesson, therefore, is that we SHOULDN'T attempt high-G pulls whilst big, fat, naked people bleed on our faces.

“Bernoulli”

After one of my lectures, I received this e-mail from SunScream. I think it raises some points worth mentioning.

“I was discussing your lecture with my wife, and we believe the Bernoulli effect has a fairly minimal action on the wingfoil surface and the primary lift (and drag) vector is produced by the Coanda effect, particularly as the falcon has a low aspect wing. The Coanda effect dictates that when in hard left turns I would lose less altitude by continuous rapid rolling of the aircraft to the right...”

Most of you would not understand this e-mail, so allow me to enlighten you:

Mr. Bernoulli was a fine producer of opera in 19th century France.
As such, I believe that there would – indeed - be "minimal action".
I find that opera-shit boring.

The “Canada effect”...? Well – as you probably know - Canadians rate right up there with Opera in the “excitement” stakes. So, naturally - they would tend to produce "drag".

I spent three weeks in Canada one weekend.

I think the REAL problem, here was that SunScream was talking about aerodynamics with his wife, when he SHOULD have been drinking champagne, and making love on rose-petal covered, silken sheets.

That concludes this lecture.

Hope you have a better understanding of the physics of flight.

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APPENDICES

MOAL
Mother Of All Lists

Hunting for *F.P.S.*

Rilex's Falcon 4

Then & Now…

What JDAM Hath Wrought

Carrier Ops (Falcon)

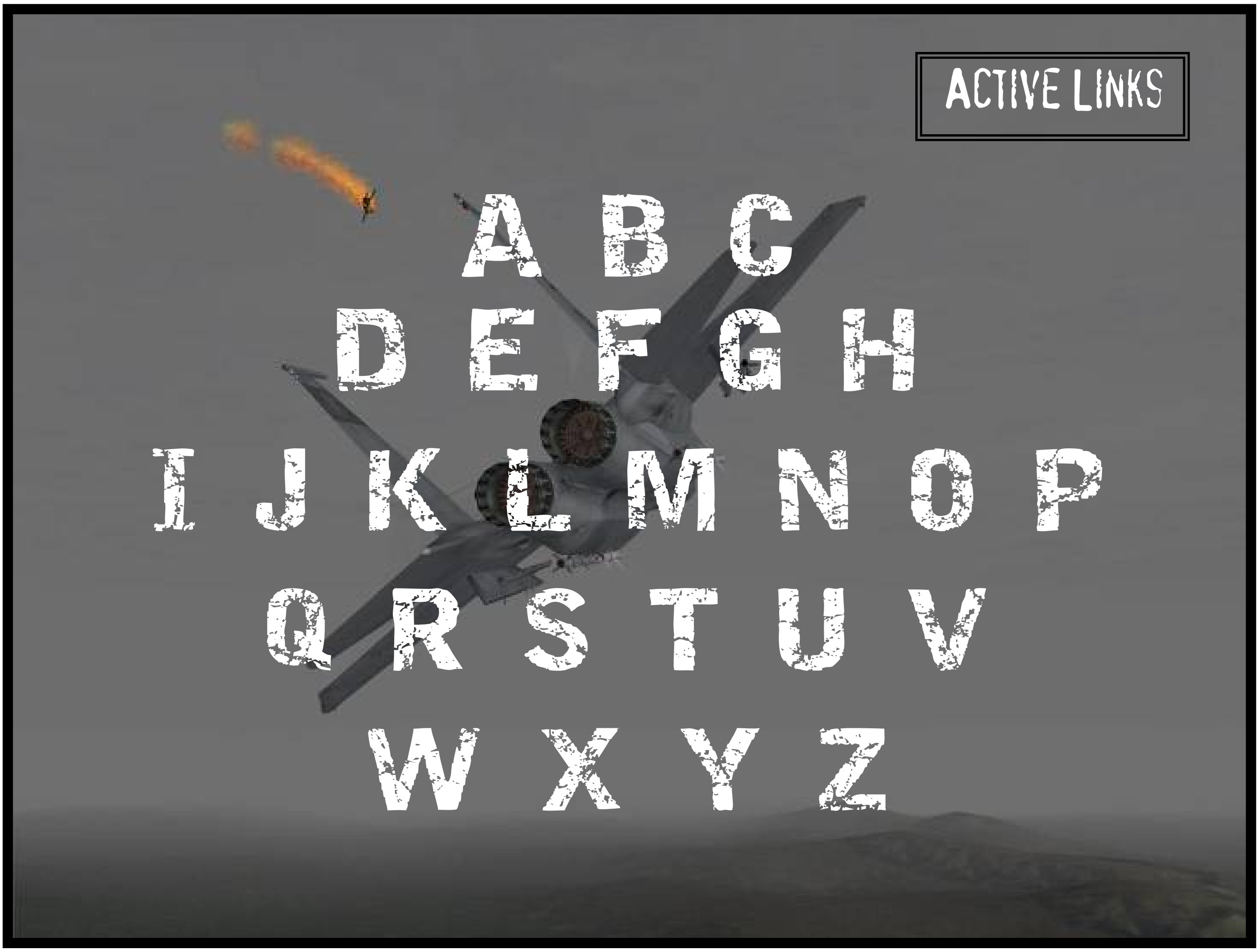
Flight Models

Gorny's

MOTHER OF ALL LISTS

Whether you are reading a Manual; posting or reading on the Forums; reading a book, or flying the Sim…

…this collection of Terms, Acronyms & Abbreviations, will be your friend. Give it love.



A

A-A - Air-to-air.

AAA – Anti-Aircraft Artillery.

AAI/APX - Air-to-Air Interrogator.

AAM – Air-to-Air Missile.

AAR - Air-to-Air Refuelling.

Aardvark - F-111.

AAW - Anti-air Warfare.

AB (A/B) - *Afterburner. (also: Airbase)*

ABCCC - Airborne Battlefield Command and Control Centre.

ABORT - Directive to cease action/attack/event/mission.

ACA (Airspace Coordination Area) - A three-dimensional box in the sky defined by grid and/or land references and an altitude block (AGL). The intent of an ACA is to allow simultaneous attack of targets near each other by multiple fire support means, one of which is air.

ACBT - Air Combat Training; a general term which includes *(D)BFM*, *(D)ACM*, and *(D)ACT. (where "D" is dissimilar)*

ACC - Air Component Commander.

Acceleration Manoeuvre - An offensive or defensive manoeuvre, flown in the vertical plane, if possible, designed to increase or reduce distance from an object. A low Yo-Yo is an acceleration manoeuvre.

ACE - Airborne Command Element (AWACS/ABCCC).

Ace - having attained a certain number of kills according to the threshold of the Airforce in question.

Ace of Base - The most *Sierra Hotel* Pilot at the Airbase. *(also a really LAME Nordic Band)*

ACM - Air Combat Manoeuvring; training designed to achieve proficiency in element formation manoeuvring and the coordinated application of BFM to achieve a simulated kill or effectively defend against one or more aircraft from a planned starting position.

ACM – Air Combat Mode. A short-range air-to-air radar that automatically acquires the closest threat

ACMI – Air Combat Maneuvering Instrumentation. This allows you to record and play back a visual record of your flight.

ACO - Airspace Control Order. Document that details all approved airspace requests. The ACO will complement the ATO cycle and serve as the single planning document for airspace considerations.

ACT - Air Combat Tactics; training in the application of BFM and ACM skills to achieve a tactical air-to-air objective.

Action - The point of the initial position-to-target run where the pre-briefed manoeuvre is begun.

ADA - Air Defence Artillery.

ADI – Attitude Direction Indicator. The gauge in the center of the inst. panel that shows aircraft pitch and roll.

ADIZ - Air Defence Identification Zone.

Adnan 1 - Iraqi AWACS aircraft.

Adverse Yaw - The tendency of an aircraft to yaw away from the applied aileron while at high angles of attack.

Advisory Control - A mode of control in which the controlling agency has communications but no radar.

Aerodynamic Centre - A point on the wing chord through which aircraft lift is directed. The aerodynamic centre is usually defined as the point on the longitudinal axis of the airplane where the lift vector is centred. The distance between the aerodynamic centre and the centre of gravity is static margin, and is the major factor affecting the longitudinal static stability of the aircraft.

AFAC - Airborne Forward Air Controller.

AFAIC – As far as I'm concerned.

Afterburner – Acceleration above normal military power, achieved by spraying fuel directly into the engine.

A-G - Air-to-Ground.

AGL – Altitude above Ground Level.

AGM – *(American designation for)* Air-to-Ground Missiles.

AGM-65 - An optically-guided A-G missile. *(see Maverick.)*

AGM-88A – High-Speed Anti-Radiation Missile or *HARM*.

AGR – Air-to-Ground Ranging.

AH-64 – Designation of the *Apache* Attack Helicopter

AHC - Advanced or Aircraft Handling Characteristics; training designed to gain proficiency in and to exploit the flight envelope of the aircraft, consistent with operational and safety constraints.

AI - Air Interdiction/Air Intercept.

AI - **A**rtificial **I**ntelligence

Aileron - A trailing-edge wing control surface used to roll aircraft.

AIM – Air Intercept Missile.

AIM-120 – Radar-guided *AMRAAM*.

AIM-7 – Medium-range radar-guided missile known as the Sparrow.

AIM-9M – All-aspect IR Air Intercept Missile.

AIM-9P – Rear-aspect IR Air Intercept Missile.

Aiming Funnel – An element of the HUD display in air-to-air gun mode. See *EEGS*.

Aiming Reticle - An indicator on the HUD that shows point of impact for specific weaponry. A visual aid to help improve probability of hitting a target. If a target is inside the reticle, you have a good chance of hitting it.

Aimpoint True – Radio call indicating weapons have hit target with desired effects.

Air Refuelling Time - Planned lapsed time from ARCT to drop off.

Air Refuelling Track - A flight path designated for air refuelling.

Airborne Order - A command authorization for tactical flight (departure time will be specified).

Airfoil - Curved wing or blade surface designed to produce lift when air passes over it. This is achieved by airflow creating a low pressure condition above the airfoil surface.

Airframe - Basic construction of the aircraft.

Airspeed - The velocity of the aircraft in relation to the surrounding air. *(see Airspeed Tutorial)*

AEW - Airborne Early Warning.

Alamo - Russian-built, radar-guided missile.

ALIC - Aircraft launcher interface computer.

All-aspect - Weapons which are effective at any angle to the target.

ALO - Air liaison officer.

ALPHA CHECK - Request for bearing and range to described point.

ALQ-131 - A jamming pod mounted on the underside of the F-16 designed to counter enemy radar.

ALT - Altitude above sea level.

AMRAAM - Advanced Medium Range Air-to-Air Missile. *(see AIM-120)* *(also: Haz')*

ANCHOR - Orbit about a specific point; ground track flown by tanker. Information call indicates a turning engagement about a specific location.

Anisotropic - sharpens the details of the fading-away part of a 3D object that recedes into the distance.

Angels - Altitude of friendly aircraft in thousand of feet. Viper is at angels 23" means that the pilot is at 23,000 feet. It is also the name of the U.S. Navy demo team.

Angle of attack - The angle formed by an aircraft's direction of flight and its longitudinal axis.

Angle of climb - The angle of the aircraft nose above the horizon.

Angle of dive - The angle of the aircraft nose below the horizon.

Angle of Tail (AOT) - Angle formed between the flight path of an attacking aircraft and its target.

Angle-off - The distance, measured in degrees, between heading and the bandit's heading. This angle tells you relative fuselage alignment.

Anti-aliasing – used to reduce the "blocky", "stair-step" effect seen in your graphics. Costs "FPS" hit.

Anti-Christ – *See: "Hustler"*

Anti-radiation missile - A missile which homes on radio frequency radiation. *(see HARM)*

AOA - Angle of Attack.

AOB - Air Order of Battle.

Apache - AH-64 attack helicopter.

Apex - Russian-built, radar-guided missile.

APG-66 - Designator for an earlier type of radar installed in the F-16.

APG-68 - Designation of the currently installed radar in the F-16

Aphid/Archer - Russian-built, all-aspect heat-seeking missile.

A-POLE - The distance from the launching aircraft to the target when the missile begins active terminal guidance.

Aragorn – *(see: Attention Whore)*

AR/NWM - Air Refuel/Nose Wheel steering system.

ARCING - Cut-off in plane of target motion to decrease range to target. Defender allows attacker to use cut-off.

ARCP - Air Refuelling Control Point; the planned geographic point over which the receiver(s) arrive in the observation/pre-contact position with respect to the assigned tanker.

ARCT - Air Refuelling Control Time: the planned time that the receiver and tanker will arrive over the *ARCP*.

ARIP - Air Refuelling Initial Point: the planned point to enter the refuelling track.

ARM/ARMED (Safe/Hot) - Select armament (safe/hot), or armament is safe/hot.

Armament Safety Check - Action taken by an aircrew to review armament selection switches to preclude the inadvertent - launch/release of armament (Switches Safe).

ARS - Air Rescue Service.

As Fragged - Fighter, FAC, mission package, or agency will be performing exactly as stated by the air tasking order.

Art of the Kill - Instructional video by Pete Bonanni (Fighter Pilot/Instructor) covering *BFM*

ASAT - Advanced Situational Trainer.

ASM - Air-to-Surface Missile.

ASOC - Air Support Operations Centre.

ASPECT - Request/comment regarding target aspect information. *(see Aspect Angle)*

Aspect angle - This is the angle formed by the intersection of two lines: the line from you to the target and the line through the target's longitudinal axis/. On the *HUD*, the aspect angle is represented by a caret on the aiming reticle. If the MiG is coming at you head on, the aspect angle is 180 deg and the indicator will be at the top of the Aiming Reticle.

ASUW - Anti-surface Warfare.

ASW - Antisubmarine Warfare.

Attention Whore – You know who you are.

ATO - Air Tasking Order - Assigns air-to-air and air-to-surface targets, TOTS, and mission support info. *(See: FRAG)*

ATOC - Allied Tactical Operations Centre (NATO).

Atoll - Russian-built, rear-aspect heat-seeking missile.

ATTACK AXIS - An orientation direction usually thought of as an imaginary line passing through the target on some particular heading example, the range run-in heading.

Attack geometry - The spatial relationship between an attacking pilot and his quarry.

Attack Restriction - Ingress, ordnance delivery, or egress restrictions depending on e.g. threats, weather, terrain, ROE, etc.

AUTHENTICATE ("___") - To request or provide a response for a coded challenge.

AUTONOMOUS - Aircrew is operating without benefit of GCI/AWACS control.

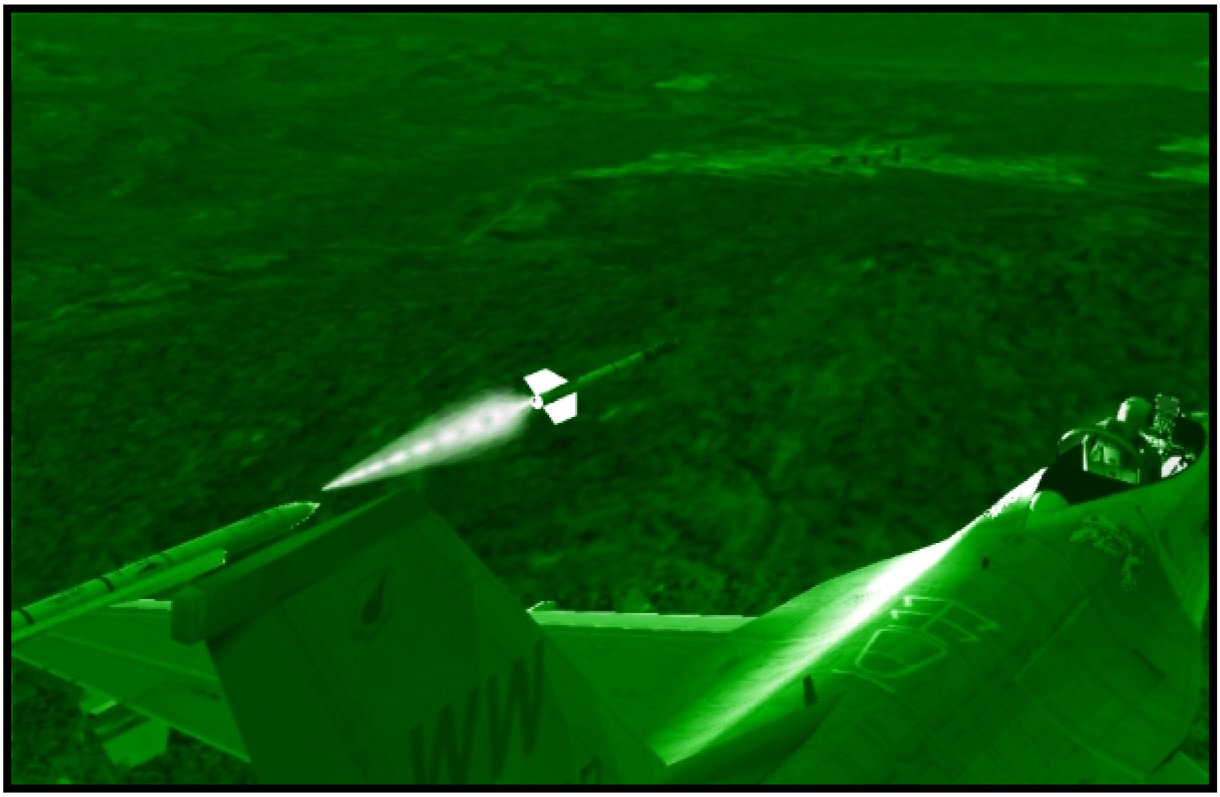
AUTONOMOUS INTERCEPT - Intercepts initiated by aircrew when no target information is being received from command and control sources.

Autopilot - A feature of the flight control computer allowing it to fly the plane.

Avionics - An aircraft's electronic systems.

AVTR - Airborne Video Tape Recorder.

AWACS - Airborne Warning And Control System.



B

Backfire - Tu-26.

Badger - Tu-16.

BAI - Battlefield Air Interdiction.

Ballistic - Enjoying the aerodynamic qualities of a brick. Out of control. Literally relating to or characteristic of the motion of objects moving under their own momentum, and the force of gravity.

Bandit - A plane identified as an enemy aircraft.

Bank - To roll left or right in the air so that your lift vector is no longer vertical.

BAR ALT – Barometric Altitude

BARCAP - Barrier Combat Air Patrol

BARO – Barometric

BARREL ROLL MANEUVER - A vertical rolling manoeuvre used to reduce aspect angle while keeping sight of the bogey and maintaining nose-tail separation.

BASE (Number) - Reference number used to indicate such information as headings, altitudes, fuels, etc.

BCE - Battlefield Coordination Element.

BDA - Bomb Damage Assessment. *(Summary of enemy surface targets destroyed or damaged.)*

BDZ - Base Defence Zone (NATO).

BEAMING - *See “Notch”*

Bear - Tu-95.

Bear-F - Tu-142.

BELLY CHECK - A momentary unloaded bank to check the blind side of a turning aircraft.

BENT - *(“___” bent)* Identified system inoperative.

BFM - Basic Fighter Manoeuvres: Strategy. What you do to kill the other pilot once you are in a fight. BFM implies a single plane rather than a formation. *(see Art of the Kill)*

BFM Advantage - The command or use of manoeuvring airspace usually *OUT OF PLANE* of a *BANDIT`S* turn to allow the attacker to gain or maintain an offensive advantage or close to a gun solution. Requires positional and/or energy advantage.

Bingo - Fuel level is such that immediate RTB is required.

Bitchin’ Betty - An electronic female voice utilized in the F-16 to warn the pilot of potentially dangerous situations.

Black Hawk - UH-60 transport helicopter. *(Sometimes “Down” in movies)*

Blackbird - SR-71.

Blackjack - Tu-160.

Blackout - A loss of vision /or consciousness/ due to pulling too many positive Gs.

Blast fragmentation warhead - A warhead designed to explode with a large of shrapnel.

BLIND - No visual contact with friendly aircraft; opposite of term "VISUAL."

Blinder - TU-22.

Blip - The image of a radar return appearing on the REO.

BLOW THROUGH - Directive/informational call that indicates aircraft will continue straight ahead at the merge and not turn with target/targets.

BN – Bombardier / Navigator

Bogey - An unidentified aircraft. *(Not to be confused with “Bandit”)*

BOGEY DOPE - A request for bearing and range to bogey and as available, heading, speed, and altitude.

BOMB RANGE (BR) - The horizontal distance a bomb will travel from release to impact.

BOMB TRAIL - The distance that represents bomb drag in weapon ballistic computation.

BONE - Term used to indicate the formation will remain in a Racetrack-type holding pattern (with all wingmen's turns into lead); exit formation must be specified by lead.

Bone (The) – B1 Lancer

BOX - Groups/contacts/formations in a square or offset square.

BRA - Bearing, range, and altitude of target *(also: something to remove with your teeth)*

Bracket - A manoeuvre in which a pilot and his wingman separate to both sides of an oncoming bandit. This forces the bandit to commit to one plane, leaving him vulnerable to attack from the other. A bracket is followed by a drag manoeuvre.

Break (Up/Down/Right/Left) - A defensive combat manoeuvre used when a plane is attacked from the rear. It is performed by turning sharply into a pursuer’s line of attack in an attempt to make him overshoot.

Break Away - Tanker/receiver call: immediate vertical and nose/tail separation between tanker and receiver is required.

Break Turn - A purposeful, erratic, sudden High-G turn INTO a missile which is tracking on your aircraft. Designed to send the missile out of gimbal limits.

BREVITY - Term used to describe a radio frequency which is becoming saturated/degraded, with subsequent transmissions to be briefer.

Brewer - Yak-28.

BROADCAST - Request/directive to switch to Broadcast Control.

Broadcast Control - A mode of control that passes target information by referencing a designated location, series of locations, or grid system.

BROKE LOCK - Loss of radar/IR lock-on (advisory).

BUDDY SPIKE (Position/Azimuth/Altitude) - Receiving friendly AIRWR.

BUFF - Big Ugly Fat Fucker; (B-52). *(Also used to describe T-Rex’s Grandmother, but **NEVER** Chuck Norris)*

Buffer Zone (BZ) - Airspace of defined dimension and adjacent to or near borders which may have special restrictions.

BUG OUT (Direction) - Combat separation for low fuel, loss of tactical advantages or accomplishments of mission objectives; intent is to permanently separate from that particular engagement/attack.

BULLSEYE - An established reference point from which the position of an aircraft can be determined/transmitted. Sometimes referred to as "broadcast control" if more than one bullseye is used, designate by Alpha, Bravo etc.

BUMP/BUMP-UP - A fly-up to acquire line of sight to the target or laser designation.

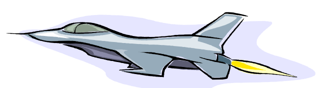
BUNT - A pushover manoeuvre.

BURNER - Directive to select/deselect afterburner (generally to fly at maximum speed).

Buy the farm - Die.

BUZZER - Electronic communications jamming.

BVR - Beyond Visual Range.



C

C^2 - Command and Control.

C^3 - Command, Control, and Communications.

C^3CM - Command, Control, and Communications Countermeasures.

C^3I - Command, Control, Communications, and Intelligence.

C3 - Command, Control and Coordination.

Call sign - A codename for a particular fighter pilot. *(also: Handle)*

CAP - Combat Air Patrol.

CAS - Close Air Support.

CAS – Calibrated Air Speed

Cat 1, 2, 3 - Load Category, where Cat 1 is the lightest.

CATA - Collision Antenna Trail Angle. The azimuth of your radar antenna when tracking (locked on) a target that is on a collision course with your aircraft.

CBU - Cluster Bomb Unit.

CCA - Command and Control Agency.

CCIP - Continuously Computed Impact Point. The HUD designation for air-to-ground bombing mode using

Mk84 bombs.

CCT - Combat Control Team.

Cell - Two or more tankers/bombers flying in formation.

Central Command - Main command centre in any theatre.

Centre of Gravity (CG) - That point along the horizontal axis, fore and aft of which airplane weight is equal.

Centre Point - The exact centre of the HUD.

CFT – Conformal Fuel Tank *(Also: Composite force training; Cockpit Familiarisation Training.)*

Chaff - Packages of tiny foil strips dropped from F-16 that confuse radar-guided missiles.

Chainsaw – A maneuver in which you launch and leave an AIM-120.

CHAMPAGNE - An attack of three distinct groups with two in front and one behind. The leading two groups are attempting to bracket with the trailing third group flying up the middle.

CHANDELLE TURN - A near vertical turn up, used to attack a high bandit from a medium to front quarter aspect. Does not require as much altitude separation as the Immelmann turn. Should terminate in a rear hemisphere weapons envelope with overtake.
Charlie - Pilot speak for: "Yes". *(e.g. "That's a charlie.")*

CHATTERMARK - Begin using briefed radio procedures to counter *comm* jamming.

CHEAP SHOT - A qualifying statement to indicate the shot had low probability of success.

CHECK ( ) - A directive statement made to momentarily monitor (specified items/systems). No response is required if status is normal.

CHECK LEFT/RIGHT - By GCI: Alter course ( ) degrees left or right momentarily for airborne search positioning, then resume original heading.

Check Six – Radio call indicating you should look behind you for any enemy aircraft or missiles.

Check turns: Manoeuvres / Turns made by an aircraft in order to expose blind areas.

CHICKS - Friendly fighter aircraft. *(see: Pigeons) (also: What loves Aragorn)*

CHRISTMAS TREE - Directive to briefly turn on exterior lights to enable visual acquisition.

CIRCLE (RIGHT/LEFT) - Flight-lead-directed defensive manoeuvre in which the flight establishes a circular holding pattern for mutual support.

CL Max - Maximum Coefficient of Lift: Occurs at that angle of attack at which lift is maximum, thereby creating the maximum turn rate and maximum G loading for any condition of flight.

Clean – An aircraft that is not equipped with any external stores.

Clean and Naked – Radio call indicating no enemies in sight on radar. No spikes on the RWR.

CLEAR - No enemy aircraft are a threat to your rear quadrant that is, your six is clear. Also used when flight lead is authorizing change of command or role swap for wingman from supporting to engaged.

CLEARED - Requested action is authorized (no engaged/support roles are assumed).

CLEARED DRY - Ordnance release not authorized.

CLEARED HOT - Ordnance release is authorized.

Clock Code - Description of position using the aircraft laid upon an imaginary clock face as a reference.

Close Control - A mode of control varying from providing vectors to providing complete assistance including altitude, speed, and heading.

CLOSE CONTROL - The maximum degree of control that GCI can provide.

CLOSING - Bandit/bogey/target is getting closer in range.

Closure - Relative velocity of one aircraft in relation to another. *(see Vc)*

Closure rate - The rate at which a targeted aircraft MiG is closing on your F-16
(note the number can be "+" (getting closer) or "-" (pulling away).

Coalition - A combined force of allies.

COLD - In context; attack geometry will result in a pass or roll out behind the target; or, on a leg of the CAP pointed away from the anticipated threats. Air-to-surface, dry or no-ordnance attack.

Cold – Situation where the tail end of an enemy aircraft is towards the pilot.

COLD SIDE - The side of the *REO* opposite that where collision antenna train angle occurs.

Collision Course - A flight path along which an aircraft is directed towards a point at which it will collide with another aircraft.

COMAO - Combined Air Operations.

COME OFF (Left/Right/High/Low/Dry) - A directive to manoeuvre as indicated to either regain mutual support or to deconflict flight paths for an exchange of engaged and supporting roles. Implies both "visual" and "tally."

COMEBACK HIGH/ LOW/LEFT/RIGHT - Informative call requesting the addressed fighter to reposition accordingly.

Comm Jamming - Attempt to interrupt enemy communications.

COMMITTED/COMMIT - Fighter intent to engage/intercept; weapons director (WD) continues to provide information.

COMMS - Communications.

Company – An army unit consisting of four platoons.

Comparison Diagram - A chart comparing turn rate, radius, and excess power for two different aircraft. Also called energy/manoeuvring (E/M) diagrams.

Composite Force Training - Scenarios employing multiple flights of aircraft, each under the direction of its own flight leader. Requires a minimum of three different types of aircraft in three different mission roles.

Condition of Vulnerability - A condition with the defender in the lethal envelope of the attacker's weapon system. It is possible for combatants to arrive at a mutual condition of vulnerability, particularly during a head-on pass.

CONNING - Leaving contrails or otherwise marking aircraft position.

CONTACT - Radar and/or IP and/or IR pick-up at the stated position. Position usually stated in magnetic bearing, range, altitude (BRA), Bullseye, or geographic position format if locked on. Friend or foe unknown.

CONTINUE - Continue present manoeuvre; does not imply clearance to engage or expend ordnance.

Continue as Fragged – Radio call indicating you are to continue mission as briefed.

Continuous wave radar - A radar which emits a continuous beam of energy. Also known as doppler.

Contrail Layer - The altitude at which contrails form.

Contrails – Trails of vapor left in an aircraft's wake. Sometimes generated by high G turns.

Control zone - The area behind the bandit where the attacking pilot can establish a stable position from which to employ his weapons and counter any defensive move.

COPY - To repeat a received communication in order to verify your understanding.

Corner velocity - The minimum speed at which an aircraft can pull its maximum rated Gs.

Corsair - A-7

COUNTER-OFFENSIVE MANEUVERING - Manoeuvres which are performed by an aircraft under attack and which are designed to negate the present threat and proceed to an offensive position as the attacker.

Court-martial - A trial before a board of field grade officers for a serious breach of the ***UCMJ*****.** *(see: UCMJ)*

COVER - Directive to assume briefed support position and responsibilities.

Cover – Radio call indicating a wingman is to adopt a cover role and protect the leader.

CP – Contact Point. A steerpoint at which to contact the *FAC*.

CR - Control and Reporting.

CRANK (Direction) - *F-Pole* Maneuver to maintain the target within the gimbal limits of your radar, whilst reducing the *Vc.* It is used after shooting missiles BVR to reduce the speed at which you approach the objective, whilst at the same time allowing you to continue illuminating your objective with radar. Usually broken when missile is *Pitbull*.

CRC - Control and Reporting Centre.

CRM - Combined Radar Mode

CROSS TURN/CROSS - A 180 heading reversal by a flight where aircraft turn into each other.

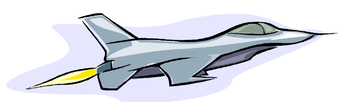
Crusader - F-8

CS - Antipersonnel chemical incapacitating agent (tear gas).

CSAR - Combat Search and Rescue.

Cub - AN-12

CUTOFF - Request for, or directive to, intercept using cut-off geometry.



Gorny's Tips'n'Hints:

FLARES…! There are many things to consider before you decide upon FLARES. The most important consideration is probably waist size. The line of the flare dictates that your waist should appear smaller than the "peak" of the flare. So – tighten up that belt. Also – shoes are another consideration. Avoid anything too shiny; drawing too much attention to the flare itself. Finally – "Retro". Is it really YOU…? Flares can be terribly unfashionable. However – YOU play with Flight Simulators. This means you are already considered "uncool", and have difficulty with women. So – luckily – wearing Flares probably won't have too much of an adverse effect. Check Six, cats. See you in the 21st century.

D

DAISY CHAIN - Numerous fighters in-trail manoeuvring for shots on one another.

Dart – A-A practice dummy target.

DCA - Defensive counter air.

DEADEYE - Informative call by an airborne laser designator indicating the laser is inoperative.

Dead-reckoning - Navigating without instruments.

Death Dot - CCIP HUD mode indicator showing where the bombs will hit.

DED - Data Entry Display

DEFENSIVE (Spike/Missile/SAM/Mud/AAA) - Aircraft is in a defensive position and manoeuvring with reference to the stated condition. If no condition stated manoeuvring is with respect to A/A threat.

Defensive Spiral - A descending, accelerating dive using high G and continuous roll to negate an attack and gain lateral separation.

DEFENSIVE TURN - A planned turn designed to prevent an attacker from entering/ remaining in the defender's vulnerable cone. This manoeuvre has limitations since it may allow arcing; however, done early enough and properly executed, allows defender to keep sight, makes attacker's BFM more difficult, and may cause attacker to overshoot.

Delta Dagger - F-102.

Delta Dart - F-106.

Delta Sierra - Dog Shit. (BAD) *"This weather is Delta Sierra."*

DEPLOY - Directive for the flight to manoeuvre to briefed positioning.

DGFT - The HUD designation for air-to-air gun mode.

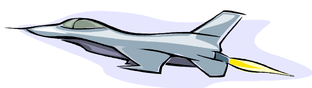
Diamond X - A missile-mode HUD indicator.

DirectX - HAL - Hardware *(Video Card)* Application Layer ***(T&L)*** - Transform & Lighting

DISC - Disconnect.

DISENGAGE - Discontinue the current attack.

DIVERT - Proceed to alternate mission/base.



DLZ - Dynamic launch zone.

DMPI - Desired mean point of impact.

Dogfight - A manoeuvring air-to-air engagement with an enemy plane.

DOLLY - Data link equipment

DOPE - Directive to "delay the engagement."

DR - Dead reckoning; navigation technique estimating position based on last known position,

Drag - An ACT in which one plane decoys the enemy into a chase while the other sneaks behind for the kill. *(also – the retardant effect of friction, caused by moving through air)*

Drag factor - An index for the increase in drag caused by loading an external store.

Driver - The pilot in a two-seater. Also: the pilot in a one-seater like the F-16.

DUKE IT OUT - Meet the enemy head on to engage.

DUR - The HUD designation for air-to-ground bombing mode using Durandal bombs.

Durandal - A bomb that drives into an airstrip before exploding, making repairs much more difficult.

Duty Roster - The crew chief's list of available pilots.

E

Eagle - F-15

EC - Electronic Combat.

ECCM - Electronic counter-countermeasures. *(see ECM)*

Echelon (Cardinal direction) - Formation with wingman displaced approximately 45 deg behind leader's wing line.

ECM - Electronic Countermeasures.

EEGS - Enhanced Envelope Gun Sight. A gun sight that displays a funnel to help track a target in a dogfight.

Egress - Flying out of the target area.

EID - Electronic Identification.

Elbow - Also known as “control zone”. The area behind the bandit where the attacking pilot can establish a stable position from which to employ his weapons and counter any defensive move.

Element - A flight of two aircraft.

ELINT - Electronic Intelligence Equipment.

EMCON - Emission control.

Engage - Commence BFM.

ENGAGED (Fighter) - Indicates the fighter or element is manoeuvring to attain or deny weapons release parameters, or is in the visual arena manoeuvring in relation to the target. *WC* stops providing specific target information and continues with situation awareness information.

Engagement - Manoeuvres by opposing aircraft attempting to achieve/prevent weapons firing positions.

Envelope - The safe or effective ranges of operation for aircraft or missile systems.

E-O - Electro-Optical.

EOB - Electronic Order of Battle.

EON - AMRAAM Engagement Order Number.

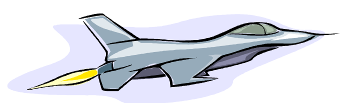
EPA - Evasive Plan of Action.

E-Pole - The range from a threat aircraft that a drag must be accomplished to kinematically defeat any missile the bandit could have launched or is launching.

Escape window - A pilot’s opportunity to successfully disengage from a dogfight.

ETA - Estimated Time of arrival.

ETAC - Enlisted Terminal Attack Controller.



EW - Electronic Warfare/Early Warning.

EW radar - Early Warning radar.

EWO - Electronic Weapons Officer.

EXTEND (Direction) - Gain energy and distance using proper energy profile with the possible objective of re-entering the fight.

EXTENSION - A straight-line unloaded (slightly less than 1 G) acceleration manoeuvre. This manoeuvre may be interrupted by a series of *check turns* so that the extending fighter can maintain sight of the attacking aircraft.

EYEBALL - Fighter with primary visual identification (VID) responsibility.

F

FAC - Forward Air Controller.

FACP - Forward Air Control Post (radar station).

FADED - Previous radar contact is lost

Fagot - Mig-15.

Falcon - F-16. *(also: Fighting Falcon)*

Fantail - La-15.

Fargo - Mig-9.

Farmer - MiG-19.

FAST - Target speed is estimated to be 600 knots ground mach 1 or greater.

FCC - Fire Control Computer

FCR - Fire Control Radar

FCS - Fire Control System.

Fencer - Su-24.

FEBA - Forward edge of the battle area as set during the scenario briefing. *(see: FLOT)*

FEET WET/DRY - Flying over water/land.

FENCE - Boundary separating hostile and friendly area.

FENCE CHECK - Set cockpit switches as appropriate. ***(See TUTORIAL SECTION)***

Feather - Yak-15, 17.

Fiddler - Tu-28P.

FIGHTER DOPE - Request for bearing and range to friendly aircraft.

Fighter jock - A slang term for a fighter pilot.

Fire and Forget - Designates a self-guided weapon.

Firebar - Yak-28.

Fishbed - MiG-21.

Fishpot - Su-9, 11.

Fitter - Su-7, 17, 20, 22.

Flagon - Su-15, 21.

Flak - Shrapnel from an AAA battery.

Flanker - Su-27.

Flanker-D - Su-33.

Flaps - A wing control surface designed to increase lift.

Flares - Magnesium-based packages designed to fool heat-seeking missiles when released from your F-16.

FLANK/FLANKING - Target with a stable aspect of 120 deg. to 150 deg.

FLARES - Flares have been detected or directive to deploy flares.

FLASH (MODE) - Temporary activation of IFF transponder on desired mode/code.

Flashlight - Yak-25.

FLIR - Forward-looking infrared.

FLOAT - Directive/informative to expand the formation laterally within visual limits to maintain a radar contact or prepare for a defensive response.

FLOB: Form Line of Battle [*Old Naval description used when preparing a broadside*]

FLOT - Forward Line of Own Troops. *(see: FEBA)*

Flogger - B - MiG-23.

Flogger - D,J - MiG-27.

Flora - Yak-23.

Fly the needles - Follow the ILS flight path indicators.

Fly-by-wire - A design whereby all the controls of the plane are controlled directly by the flight computer based on input from the control stick. The stick and throttle do not use mechanical linkages to other parts of the aircraft. *(e.g. F-16)*

Fokker - German WWI fighter plane.

FOLLOW DOLLY - Follow data-link commands.

Forger - Yak-38.

Fox - Air-to-air weapons employment.

FOX ONE - A radio call from a friendly aircraft announcing that he is firing a radar-guided missile.

FOX TWO MIKE - A radio call from a friendly aircraft announcing that he is firing an AIM-9M Sidewinder.

FOX TWO - A radio call from a friendly aircraft announcing that he is firing an AIM-9P Sidewinder.

FOX THREE - Simulated/actual launch of AMRAAM/Phoenix missile.

FOX FOUR - Bomber gunner has simulated firing on a target.

Fox Mike - VHF/FM radio.

Foxbat - MiG-25.

Foxhound - MiG-31.

Foxtrot Uniform - Fucked Up. "My radar is Foxtrot Uniform."

F-Pole - The distance from the launching aircraft to the target at missile impact.

Frag - Fragmentary Order *(Also: ATO).*

Frag list - A list of military targets ordered by priority.

Freestyle - Yak-141

Fresco - Mig 17

Frogfoot - Su-25.

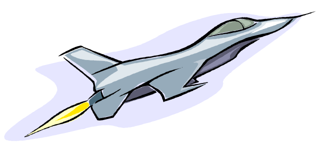
FSCL - Fire Support Coordination Line.

Fulcrum - MiG-29.

Furball - A frantic dogfight.

FUSELAGE REFERENCE LINE (FRL) - A basic reference line extending through the fuselage, parallel to the longitudinal axis of the aircraft

FWIW – For what it's worth



G

G - Gravitation force.

G suit - A suit worn by pilots to counter the physiological effects of high G force.

GADGET - Fire control radar / Emitter of radar equipment.

GADGET SICK - Airborne FCS/ ground equipment is degraded.

GADGET BENT - Airborne FCS/ ground equipment is inoperative.

GADGET WELL - Airborne FCS/ ground equipment is working.

Gainful - SA-6 Sam.

Gazelle - SA-342, French light attack helicopter.

GBU - Guided Bomb Unit.

GCI - Ground Controlled Intercept.

Gilman Louie - The man behind the original Falcon3.0 and Falcon 4.0, and Electronic Battlefield concept. His face is featured in the opening scene of the Falcon4.0 intro.avi. *(A big fan of Aragorn).*

Gimbal Limit – The maximum area within which radar or LOS can function. Exceeding the gimbal limit causes missiles to lose their lock.

Glare screen - Term for the HUD.

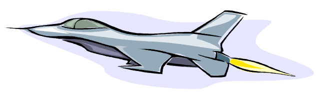
Glare shield - Term for the HUD.

Glide Slope Deviation /GSD/ - Vertical deviation from the ILS beam.

GLCM - Ground Launched Cruise Missile.

GLOC - Gravity Induced Loss of Consciousness.

GM - Ground Map



GMT - Ground Moving Targets

Good landing - One you walk away from.

GO ACTIVE - Go to briefed Have Quick net.

GOB - Ground Order of Battle.

GO SECURE - Activate secure voice communications.

GORILLA - Large force of indeterminable numbers and formation. *(also: Sometimes found "in the Mist".)*

GPS - Global positioning system.

GPU - Graphics Processing Unit *(PC's Video Card)*

Grail - SA-7 shoulder-launched SAM.

Grecko - SA-8 SAM.

GREEN (Direction) - Direction determined to be clearest of enemy air-to-air activity.

GROUP - Radar target(s) within approximately 3 NM of each other.

GUN (Direction) - Visual acquisition of gunfire, AAA site, or AAA fire.

GUNS - An air-to-air or air-to-surface gunshot.

GUNS - Indicates a simulated guns shot.

GUNS BREAK - Directive call to perform a break out of the plane.

GUNS JINK or JINK (DIRECTION) - Directive call to perform gun defensive manoeuvres.

H

Hack Clock - Chronometer in the *DED*. Can be used as a Timer/Stopwatch, as required.

Handle – Call Sign *(see call sign)*

HARM - High Speed Anti-Radiation Missile (AGM - 88).

HARD (Direction) - High-G, energy sustaining turn.

HARD TURN - Maximum G turn sustaining energy. Whether to use AB or not is a briefing item.

HARM - High Speed Anti-Radiation Missile

HARMONIZATION - The adjustment of a gun and sight of an aircraft so that when within effective range, the tracking index will indicate the impact point of the bullets.

Harrier - AV-8

HASSLE - Two or more aircraft involved in an air combat manoeuvre.

HAVCAP - High Value Asset Protection Combat Air Patrol

Have Quick - A UHF jam-resistant radio.

HAWK - Staying above the flight.

Hawkeye - E-2.

HCA - Heading Crossing Angle.

HEAD - Target with an aspect of 160 deg. to 180 deg.

HEADS DOWN - Call to inform aircrew that leader/wingman is head-down in the cockpit and wingman/leader is responsible for clearing.

HEADS UP (Direction/Altitude) - Enemy/bogey got through; no kill.

Heat signature - An *IR* "portrait" of an aircraft or other object which determines its vulnerability to heat-

seeking missiles.

Hercules - C-130

HFR - High Fidelity Radar.

HIAC - HARM interface adaptor computer.

HIDACZ - High Density Airspace Control Zone.

High Angle (Snap) Shot - A gun shot made with a high track-crossing angle, normally attempted because a tracking shot was not possible or desired.

HIMAD - High- and Medium-Altitude Air Defence.

HIMEZ - High Missile Engagement Zone (NATO).

HIGH - Target above 30,000 feet MSL.

HIGH DEFLECTION GUNSHOT - Gun attack during which the fighter is firing as the bandit passes through the pipper at high angle-off. Tracking is impossible due to excessive line-of-sight rate of the bandit. High deflection gun shots normally terminate in close-in overshoots of the target's flight path by the attacker.

HIT - Radar return in search (A/A). Weapons impact within lethal distance (air-to-ground [A/G]).

High yo-yos - An out-of-plane fighter manoeuvre.

Hind - Mi-24 attack helicopter.

Hog - unflattering nickname for the A-10 *(also: Warthog)*

HOLD DOWN - Directive to key transmitter for DF steer.

HOLDING HANDS - Aircraft are joined in formation, implies visual contact by all flight members.

HOOK (LEFT OR RIGHT) - Directive to perform an in-place 180 deg. turn.

HOOKING (LEFT OR RIGHT) - Directive/information call to approach target from a single/indicated side.

Home plate - Home airfield or Carrier.

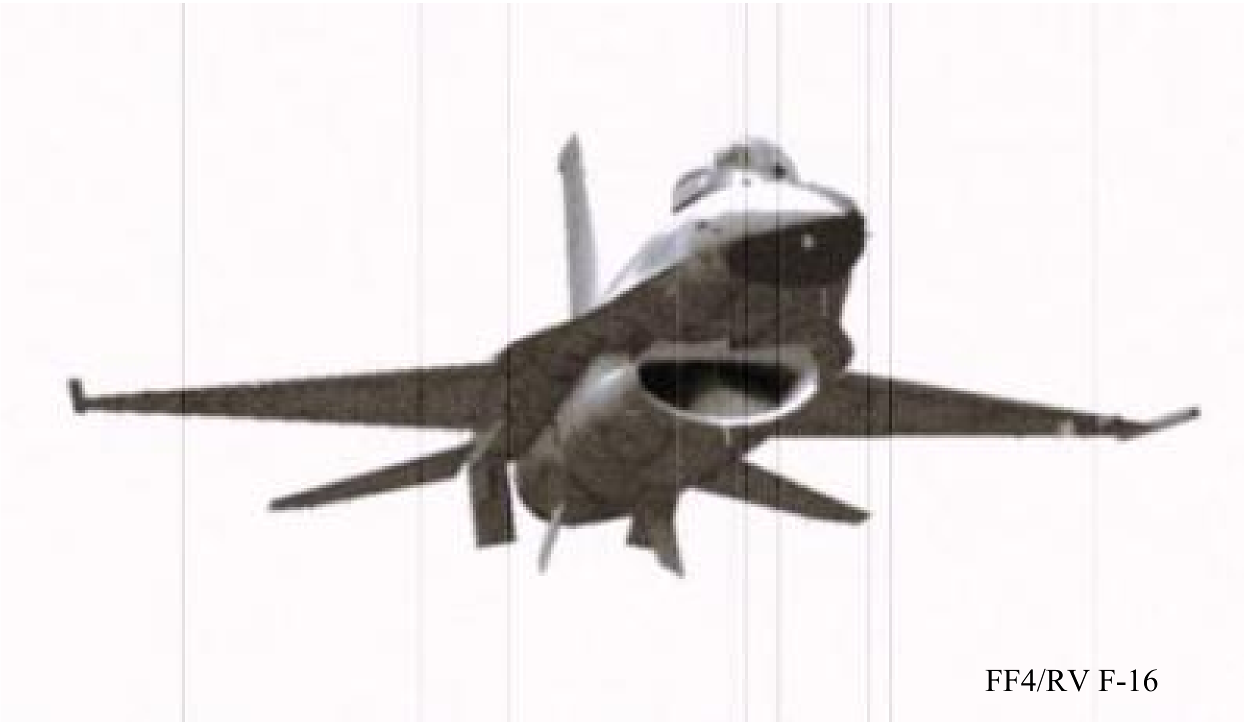
Horizontal axis - The line running from wingtip to wingtip of an aircraft.

Hornet - F/A-18.

Hostile - A contact positively identified as enemy in accordance with (IAW) operational command *ROE*.

HOTAS - Hands On Throttle And Stick.

HOT ASS - My Japanese Girlfriend. *(An "Arse Model", no less.)*



FF4/RV F-16

HOT - In context; attack geometry will result in rollout in front of the target; or on a leg of the CAP pointing toward the anticipated threats (A/A). Ordnance employment authorized, expected, or completed (A/G).

HOT SIDE - The side of the *REO* where the collision antenna train angle is located.

HOTEL FOX - HF radio.

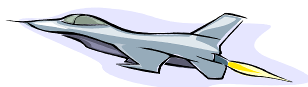
HOUND DOG - Call made by supporting fighter or a wingman indicating he has visual, tally, and a clear path to the bandit and is in an advantageous position to engage. Clock position and distance are normally added to indicate bandit position relative to the flight, or wingman position relative to the leader.
(**also**: *You ain't nothin' but a rabbit, and you ain't no friend of mine)*

HUD - Heads Up Display.

Hunter-Killer - Flight mix of F-4C; Wild Weasel and other aircraft employed in SEAD operations.

Hustler – Stand Up Guy.

HVAA - High Value Airborne Assets



I

I'm a dot - I'm outta' here, I'm leaving this area.

IADS - Integrated Air Defense System.

ICP - Integrated Control Panel. The control panel directly under the HUD.

ID - Directive to intercept and identify the target; also aircrew ID accomplished, followed by type aircraft.

IFF – Identification Friend or Foe.

IFF/SIF - Identification Friend or Foe/Selective Identification Feature.

IFV – Infantry Fighting Vehicle.

IIRC – IF I recall correctly

IL-76 – The Candid is an extremely large Soviet-built transport aircraft.

ILS – Instrument Landing System. Horizontal and vertical lines that appear in the center of the HUD to assist in landing.

ILS beam - A composite radio beacon broadcasting the optimal landing approach to a runway.

IMC - Instrument Meteorological Conditions.

IMHO - In my humble opinion *(also: In my honest opinion)*

IMMELMANN TURN - A vertical turn up designed to solve a high angle-off and high aspect angle attack situation. Optimally performed, the Immelmann turn should terminate in the defender's 6 o'clock, within heat missile range and a relatively high energy state. Normally performed from head-on aspect with large altitude separation. Named after the famed German WWI Ace, Max Immelmann.

IN PLACE (Left, Right) - Perform indicated manoeuvre simultaneously.

IN TRAIL - Perform suggested manoeuvre maintaining relative position in formation.

Ingress – Entering or approaching an objective.

In-plane manoeuvre - A manoeuvre performed without leaving the horizontal plane.

INS – Inertial Navigation System. Navigational equipment in the aircraft that keeps track of your position based on movement following takeoff.

Intel - Military Intelligence. *(see: oxymoron)*

Intercept - A phase of an air-to-air mission between the commit and engagement.

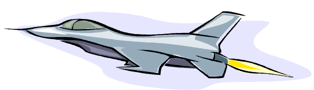
INTERROGATE - Interrogate the designated contact of the IFF mode indicated.

Intruder - A-6.

IR – Infrared. *(Also the designation for heat-seeking missiles)*

IRCM - Infrared countermeasures.

Iron Bombs – Standard free-fall bombs that detonate on impact.



J

JAAT - Joint Air Attack Team - Coordinated employment of attack helicopters and fighters, employed against enemy ground vehicles and personnel.

Jamming - The act of confusing enemy radar systems with radio frequency noise.

JATO – Jet Assisted Take Off

JFACC - Joint Force Air Component Commander.

JFC - Joint Force Commander.

Jinking - Aircraft manoeuvres designed to change the flight path of the aircraft in all planes at random intervals (usually to negate a gun attack).

JINKOUT MANEUVER - Unpredictable manoeuvres to negate a gun tracking solution. A series of changes in roll, pitch, and G performed to prevent an attacker from achieving a gun tracking solution. This manoeuvre will not be effective against missiles.

JMO (AIR) - Joint Maritime Operations (AIR).

Joint - US/Multi-Service.

JUDY - Aircrew has radar/visual contact on the correct target, has taken control of the intercept and only requires situation awareness information; weapons director (WD) will minimize radio transmissions.

JUDY ANGLE - Call made by the fighter stating the fighter will position himself in azimuth and GCI will provide range info to the target from the fighter.

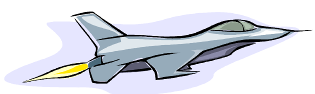
JFS - Jet Fuel Starter.

Joe Pilot – the default F4 pilot. *(also: the official FreeFalcon Proof-reader)*

Joe Strummer – One of my major musical influences. (RIP)

Joker - Fuel level is such that plans for egress and RTB should begin.

JSTARS - Joint Surveillance and Target Acquisition Radar Sytem.



K

KIA - Killed In Action

Kill circle - The Aiming Reticle for an A-A missile.

KILL - Directive to commit on target with clearance to fire in visual or beyond visual range; implies hostile and *ROE* compliance; in training, fighter call to indicate KILL ROE has been fulfilled.

Killing Me Softly – Strumming my pain with his fingers. *(Roberta Flack).*

KNOCK IT OFF - Terminate any intercept / engagement in progress.

Knife fight - A hot and heavy fight with an enemy plane at close quarters.

Kts - Knots: A measure of speed. One knot = One *Nautical mile* per hour. *(see: Nautical mile)*

L

LADDER - Three or more groups/contacts/formations in trail. *(Don't walk under)*

LAG CORNER - A manoeuvre, executed from an offensive position, where excess energy is used to drive to defender's blind cone, then a high G turn is used to solve angle off. This manoeuvre is only effective if the attacker has an obvious turn performance advantage.

LAG ROLL - A rolling manoeuvre, executed from an offensive position, performed opposite the direction of target turn in an attempt to reduce aspect angle and/ or control closure. Used to achieve rear aspect heat missile parameters.

Lag pursuit - A manoeuvre where a pursuing pilot aims the nose of his aircraft just outside his opponent's turn circle.

LANTIRN - Low-altitude navigation and targeting, infrared for night.

Lateral (Pitch) Axis - A reference line running left and right through the centre of gravity of an airplane.

Lawn Dart - to drive your aircraft nose-first into the ground. *(Perfected by MOWER)*

Lethal Envelope - The envelope within which the parameters can be met for successful employment of a munitions.

LEAD PURSUIT ATTACK - An attack geometry that will cause the attacker to fly in front of the target. The nose of the attacker's aircraft remains pointed ahead of the defender's aircraft.

LEAD TURN - A turn which is initiated prior to passing the opponents 3/9 line.

Leading a target - Aiming a gun or unguided weapon just ahead of an enemy's flight path to allow for the distance he will travel before the bullets or missile impacts.

Lift - The force that counters the weight of the aircraft and enables it to fly.

LINE ABREAST - Two groups/contacts//aircraft side-by-side. *(also: what you see in a queue at a nudist beach)*

Line of Sight Rate - An image's rate of movement across the canopy.

Line Up - Fighter briefing to FAC.

LGB - Laser-Guided Bomb.

LNH - Launch.

Load factor - The highest amount of Gs that should be pulled dependant on weapons load out.

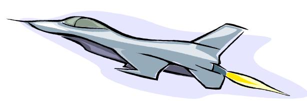
LOC – Line of Communication

Localizer Deviation /LD/ - Horizontal deviation from the *ILS* beam.

Lock on *(Lock)* - To acquire a target with radar for the purpose of firing a weapon. *(also: LOMAC flight sim)*

Locked - A call indicating a radar lock-on or *Maverick* lock-on.

LOL – Laugh out loud *(© Butcher_SS)*



LOMEZ - Low Missile Engagement Zone (NATO).

Longitudinal axis - The line running from the tail to the nose of an aircraft.

LOS – *(Line of Sight)* - An imaginary straight line from an observer's eye to a target.

LOW - Target altitude below 10,000 feet AGL

LOW YO-YO - A manoeuvre, executed from an offensive position, used to close on the target aircraft by the effective use of cut-off and acceleration.

LORAN - Long-Range Navigation.

LUFBERRY - A circular stagnated fight with no participant having an advantage.

LZ - Landing Zone

M

Mach - Unit of speed measurement equal to the speed of sound at sea level /about 760 ft/sec/.

MAD - Mutually Assured Destruction: The belief that ownership of a nuclear arsenal acts as a deterrent on the use of nuclear weapons.

Madcap - An-74.

MADDOG - AMRAAM missile launch without RADAR *lock*. The missile will engage any target within it's *LOS* when the missile's *RADAR* goes *active. (also: talented South African Developer)*

Magic - French-built, all-aspect heat-seeking missile.

MAGNUM - launch of AGM-88 HARM. *(also: If you're "feeling lucky", used to "make my day")*

Mainstay - IL-76, Russian AWACS aircraft.

Manoeuvrability - The ability to change direction and/or magnitude of the velocity vector.

MANPADS – Man Portable Air Defense Systems.

Maverick *(Mav)* - The nickname for the AGM-65.

May-A - Il-38.

MARKING - leaving contrails or otherwise marking aircraft position.

Maximum Coefficient of Lift - *See CL Max*.

MAXIMUM TURNING PERFORMANCE - Turn performance during which the maximum obtainable turn rate is achieved.

MAXIMUM PERFORMANCE - Performance near the limits of the manoeuvring envelope, includes minimum speed, maximum speed, low G, and placard G.

MEDIUM - Target altitude between 10,000 feet AGL and 30,000 feet MSL.

MEL - Directive to select military power.

MERGE (D) - Informative that friendlies and targets have arrived in the same visual arena. Call indicating radar returns have come together.

MIA - Missing In Action.

MICKEY - Have Quick time-of-day (TOD) signal.

MIDNIGHT - Informative call advising that command and control functions *(GCI/AWACS)* are no longer available.

MiG - Mikoyan/Gurevich, common designator for Russian-built fighters.

Mike–Mike – Code for millimeter that is used to describe calibers of AAA *(e.g. "20 Mike-Mike" = 20mm round)*

Mk I Eyeball - Use of the eyes to pick out an object, as opposed to electronic means.

MIL (Mill radian) - An angular measurement (17.45 mils equal 1 degree). *Also: see military power.*

Military Crest - A position along a ridge or hill two-thirds the distance from the base to the summit.

Military power - *(MIL)*: 100% RPM / thrust.

MINIMUM ATTACK PERIMETER (MAP) - An imaginary circle centred on the target which depicts the distance from the target at which rollout occurs and tracking begins. The radius of this circle varies with planned delivery parameters.

Mirage - French-built fighter aircraft.

Missile growl - An audible cue produced by the Sidewinder seeker head.

MISS DISTANCE (MD) - The distance and direction of bomb impact from the target due to imperfect release conditions.

Mixed Force - The employment of a single flight of different types of aircraft, performing the same tactical role, under the direction of a single flight leader.

MIW - Mine Warfare.

MORT - Simulated kill on a friendly aircraft in ACBT.

Moss - Tu-126.

Mover - A moving target on the ground.

MRM - Medium Range Missile.

MR/MS - Mission Ready/Mission Support.

MRU - Military Radar Unit.

MSA - Minimum Safe Altitude as defined in the FLIP General Planning Document.

MSL - Mean Sea Level.

MSLS - The HUD designation for air-to-air missile mode.

MUD (Direction-Type) - Indicates unknown RWR ground threat displayed; followed normally by clock position.

MUSIC - Electronic radar jamming. On AI radar, electronic deceptive jamming.

MUTUAL SUPPORT - The coordinated manoeuvring of two or more aircraft to provide combined firepower and survivability. This coordination can be achieved via position, radio, fire control system or a combination of these factors.

N

Nautical Mile - Measurement of distance; A nautical mile is equal to:

* 1,852 meters
* 1.852 kilometers
* 1.1508 miles
* 6,076 feet
* 72,912 inches *(this one is a little anal)*

NAEW - NATO Airborne Early Warning.

NAKED - No RWR indications. Opposite of term "spike".

NAM - Normal Air Mode.

NATO - North Atlantic Treaty Organization.

NCA - National Command Authority.

NCC - Naval Component Authority.

NEGATIVE CONTACT - Lack of radar and/ or SIF contact.

Negative Gs - The force you would experience if you were swung in a circle by your ankles. Blood is drained TO the head.

No joy - I don’t see it.

NOB - Naval Order of Battle.

NOE /Nap-of-the-Earth/ flying - Flying as low to the ground as possible to avoid enemy radar.

NOOB - Inexperienced; Newcomer *(Also: Nugget)*

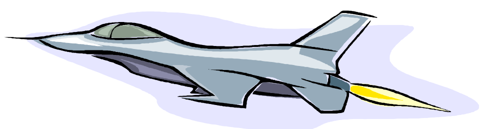
NORDO - No operative radio.

NOTCH = Defensive maneuver to place to the threat on the 3/9 line. It is used to confuse the missile's radar guidance. When the emitting radar faces our 3/9 line, we spoof it to think that we are stationary *(Also called beaming)*. Notch is preferred to *pump* when the threat is too close and it is not possible to flee.

NUDET - Nuclear Detonation.

NWS - Nose Wheel Steering. (*Virtual Pilots* → “shift” + “/” *and R.T.F.M.)*

NWSS / LGSI - Nose Wheel Steering System / Landing Gear Status Indicator.



O

OCA – Offensive Counter Air. OCA missions are flown against the enemy's air-to-air capability. There are 2 types of OCA missions: **OCA Sweep** and **OCA Strike**.

OCA Strike – OCA Strike missions are essentially air-to-ground missions flown against targets in and around an enemy airfield.

OCA Sweep – OCA Sweep missions are the air-air component of OCA whose purpose is to shoot down enemy aircraft. Since you are not tied to protecting something or someone in Sweep missions, they offer the most flexibility to the pilot. In an OCA Sweep mission, you fly along a route and engage any enemy fighters that you detect.

Offensive Manoeuvring - Manoeuvres against an opponent to achieve weapons parameters.

OFF (Direction) - Informative call indicating attack is terminated and manoeuvring to the indicated direction.

OFFSET (Direction) - Informative call indicating manoeuvre in a specified direction with reference to the target.

Off-Station - Not in position.

On-Station - In position, ready for mission employment.

On the beam - Aligned to the ILS landing beacon.

OPEC - Organization of Petroleum Exporting Countries.

Ops Check - Periodic check of aircraft systems performed by the aircrew (including fuel) for safety of flight.

Optimum Turn - A turn during which energy remains constant and turn rate is maximized.

Ordnance – The weapons carried by an aircraft.

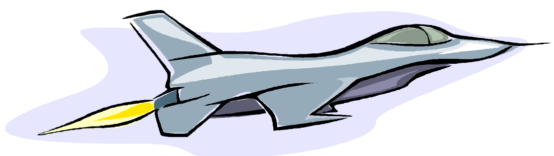
Orion - P-3 anti-submarine aircraft.

Outlaw – A suspected hostile aircraft. *(see Bandit; Boogie)*

Out-of-plane manoeuvre - A manoeuvre which entails leaving the horizontal plane.

Overshoot - To fly past a pursued enemy aircraft.

Oxymoron – *See Military Intelligence*



P

P-3 – Orion

PACKAGE - Geographically isolated collection of groups/contacts/formations.

PADLOCKED - Informative call indicating aircrew has "tally" and cannot take eyes off an aircraft/ground target without risk of losing tally/visual.

PAINT - Friendly AAI/APX interrogation return.

Painted - To be illuminated by a search radar.

Parasitic drag - Skin friction drag.

PARROT - A military IFF transponder. *(also: A deceased Norwegian Blue)*

Pd - Probability of damage.

Pb - Probability of hit

Peop1e Fa1con – a subversive group of guerrilla falconers led by The Penetrator

PERCH - Position from which an attack can be launched.

Phantom - McDonnell Douglas F-4. *(see: Rhino)*

Pickling - Setting a weapon to fire at one specific location, similar to a lock-on.

PICTURE - Situation briefing which includes real-time information pertinent to a specific mission.

PIGEONS (Location) - Magnetic bearing and range to a specified point.

PIPPER - A HUD symbol representing an aiming line of sight. The pipper is in the centre of the reticle.

PIROUETTING - Rolling an aircraft about its longitudinal axis while pointed up or down at low G thus effecting a rapid change in heading when higher G is again applied.

Pitbull - Missile in flight goes autonomous; now guided by it's on-board RADAR.

PITCH/PITCHBACK (Left/Right) - Directive call for fighter/flight to execute a nose-high heading reversal.

Pigeons - Friendly aircraft. *(see: Chicks)*

Pincer - Simultaneous attack on bandit from opposite sides. *(also: What a crab calls his hands)*

PIREP - Pilot-reported weather conditions.

Pitch - The movement of a plane in the vertical and longitudinal axes.

PJ - Para-rescue man.

Pk - Probability of kill.

PLACARD G LIMIT - The limiting cockpit G for the particular configuration.

PLANE OF TURN - Plane defined by the flight path of an aircraft and its turn radius.

PLAYTIME - Amount of time aircraft can remain on station.

POINT - Directive for an element to turn towards each other either as a defensive response or to re-establish a mutually supportive formation.

Point of impact - Point along the leading edge of an airfoil where the air separates and flows over the top and bottom surfaces.

POL - Petroleum, Oil, Lubricants.

POP UP - Starting climb for air-to-surface attack.

POPEYE - Flying in clouds or area of reduced visibility.

POSIT - Request for position; response normally in terms of a geographic landmark, or off a common reference point.

POST ATTACK (Direction/Heading) – *WD / WC* assigns desired direction/heading after completion of intercept/engagement.

POST HOLE - Rapid descending spiral; diving to the ground to avoid radar detection by an oncoming bandit.

Positive Gs - The force you would experience if swung in a circle by your wrists. Blood is drained from the head.

POW - Prisoner of War.

POWER - Reminder to set the throttles appropriately considering the IR threat and desired energy state.

PRESS - Directive / informative call to continue the attack. Normally given by supporting fighter in response to engaged fighter's statement of intentions and means he is in a position to attack should the engaged fighter's position deteriorate.

Primary Force - The flight(s) that are being protected/escorted.

PRESSING - Term describing a delay resulting in releasing ordnance closer and/or lower to a target than planned.

Pre-strike-sweep - A sweep flown in advance of an attack force to clean the area of enemy fighters.

Ps - Specific excess power; Probability of survival.

Pucker factor – the degree of anxiety.

Puke - An insult to another pilot. An F-16 driver could call an Eagle driver “A twin-engine puke". Also used as a disparaging term for a member of a different branch of service.

PULLING - Descriptive of the situation where the bandit is behind the one stating "I'm pulling."

Pulling lead - Purposely aiming in front of an enemy plane while figuring in the distance to target and the target’s speed to insure the weapon scores a hit.

Pulse-doppler radar - A type of radar which emits a pulsed rather than continuous signal.

PUMP - Maneuver of low angle of aspect to **move away from** a threat. During a pump, the pilot STOPS closure on the threat or geographical boundary whilst maintaining *SA*. *(Also called "dragging")*.

Punch out - Eject.

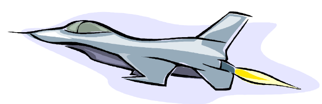
PURE - Call indicating pure pursuit is being used or directive call to go pure pursuit.

PURE PURSUIT ATTACK - An attack geometry that will cause the attacker to fly directly at the target. The nose of the attacker's aircraft remains pointed at the defender's aircraft.

PUSH (Channel) - Go to designated frequency.

PUSHING - Descriptive of the situation where the bandit is in front of the one stating "I'm pushing".

Q



QUARTER PLANE MANEUVER - A manoeuvre, executed from an offensive position, used to preserve nose-tail separation and a positional advantage for future manoeuvring when presented with an impending flight path overshoot, or to counter a reversal attempt by the defender. An aggressive, exaggerated rolling pull out of the bandit's plane of motion at close range to reposition the attacker's lift vector at least 90 degrees away from the bandit's plane of motion. This manoeuvre is often performed instead of a high yo-yo when the attacker realizes too late how quickly the aspect is increasing.

Quarter Pounder™ - My preferred burger at McDonalds™

R

R/C - Rate of Climb

Ra - Maximum aerodynamic missile range.

RAD - Radial

RADAR - **Ra**dio **D**etection **A**nd **R**anging

RADIAL G - The vectored sum of cockpit G and gravity.

RANCH HOUSE (Altitude) - Directive or informative indicating subject fighters will return to CAP.

RANGE WIND - That component of a wind that is parallel to the attack axis. (i.e. headwind or tailwind.)

Raptor - F-22 *(also: Flight Modelling Guru & nemesis of Lesbian.)*

Rate of Turn - Rate of change of heading, normally measured in degrees per second.

RAYGUN (Position/Azimuth/Altitude) - Radar lock-on to unknown aircraft. (Request *Buddy Spike* / *Naked* reply.)

RCC - Rescue Coordination Centre.

RDY - Ready.

Recon - Reconnaissance.

RECCE - Reconnaissance.

RED (Risk Estimate Distances) - These distances are reasonable figures for employing weapons near friendly forces in combat and are not minimum safe distances for peacetime training use.

Redout - A loss of vision due to pulling too many negative Gs.

REFERENCE (Direction) - Directive to assume stated heading.

REFERENCE (HEADING) - Heading to fly as directed by the flight lead. Reference 270.

Relative Wind - The oncoming, instantaneous wind. For practical purposes, the direction of the relative wind is exactly opposite the flight path of the airplane.

Release cue - Cross hairs used to determine the time to release your bombs if the bombsight is not displayed in the HUD.

REMF - Rear Echelon Mother Fucker. Support staff based at the rear of/distant to the *FEBA*.

RENO - Multiple radar contacts are observed and aircrew is able to distinguish the assigned target from *chicks.*

REO display - Radar/Electro-Optical display.

RESCAP - Rescue Combat Air Patrol

REVERSAL - A counter-offensive rolling manoeuvre designed to reverse roles on an attacker after he overshoots.

RIFLE - AGM-65 launch.

Rhino - Unflattering nickname for the F-4 Phantom II.

RIO - Radar Intercept Officer: US Navy term for back-seat weapons and targeting systems operator. *(see WSO)*

Rmax - Maximum weapons range.

Rmin - Minimum weapons range.

ROCC - Regional Operations Control Centre.

Rockeye (MK 20) - CBU with armour-piercing capability.

ROE - Rules of Engagement.

ROFL – Rolling on the floor laughing

ROFLMFAO – Rolling on the floor, laughing my fucking arse off. *("F" is optional)*

Roll - Rotate the aircraft around the longitudinal axis. *(also: what you do when you laugh on the ground)*

ROGER - Indicates aircrew understands the radio transmission; does not indicate compliance or reaction.

ROLLING SCISSORS - A series of rolling manoeuvres in which each of two opposing aircraft is attempting to roll to his opponent's 6 o'clock. An energy depleting, maximum performance situation which frequently ends up in a slow speed, high AOA descent. *(also what happens when your scissors fall off the table)*

Rookie - Pilot without flying experience.

ROZ - Restricted Operating Zone (NATO). Temporary area restricted from fighter aircraft due to specialized operations.

RPM - Revolutions Per Minute. The percentage of power being produced by your engine.

RT - Retarded

RTB - Return To Base.

RTFM - Read the fucking manual

Rudder - A vertical aircraft control surface used to turn the plane without bank.

RUMBA - Ownship manoeuvring and ranging (OMAR), F-15 angle on ranging (AOR), F-16.

RUN/RUNNING (Direction) - Directive/Informative

RV1 – RedVIPER 1. Release Version 1.0 of the RedVIPER executable.

RWR - Radar Warning Receiver.

S

SA-6 Gainful missile - A SAM designed in 1967, and launched against aircraft flying at medium heights.

SA-7 Grail missile - A shoulder-launched SAM designed to be used against low-flying targets.

SA-8 Grecko missile - A truck-mounted, short-range, low altitude SAM.

S & D - Search and Destroy.

SA - *Situational Awareness* - Pilot's ability to keep track of his surroundings and foresee possible actions in combat.

SAC - Strategic Air Command.

SAD - Situation Awareness Display.

SAG - Surface action group.

SAM - Surface-to-Air Missile. *(also: Situation Awareness Mode)*-

Sanitized - Area clear of threats.

SANDWICH - A situation where an aircraft/element finds themselves between opposing aircraft/elements.

SAR - Search and Rescue

SARH - Semi Active Radar Homing. Refers to a missile which requires radar lock until impact.

SATCOMM - Satellite Communications

SAUNTER - Fly at best endurance. Loiter.

SCISSORS - A series of turn reversals designed to cause an attacking aircraft to overshoot and lose nose-tail separation.

Scooter - A-4.

SCP - Stores Control Panel.

SCRAM (Direction) - Emergency directive to egress for defensive or survival reasons.

Scramble - Takeoff as quickly as possible.

Screen - A type of defensive patrol. Differs from CAP in that a screen is flown between the defended area and a threat, while a CAP is flown directly above the defended area.

SEAD - Suppression of Enemy Air Defences.

SEARCH Left / Right / High / Low - Search area indicated as briefed and report all contacts.

SEPARATE - Leave the fight/engagement due to loss of advantage, change of odds or situation. Similar to bugout, except bugout is usually a permanent separation. May or may not re-enter.

SEQUENTIAL ATTACK - Swapping of roles of engaged and supportive fighters as one or the other comes into a more favourable position to achieve a kill.

Semiactive - A system wherein the receiver uses radiations or reflections from the target which has been illuminated by an outside source.

Sentry - E-3 *AWACS* aircraft.

Separation - Distance between an attacker and defender; can be lateral, longitudinal, or vertical.

SHACKLE - One weave; a single crossing of flight paths; manoeuvre to adjust/ regain formation parameters.

SHADOW - Follow indicated target. *(also: Claude)*

Shaped charge - An explosive device designed to penetrate armour, concrete or other defensive shields.

Shilka - ZSU-23-4 mobile AAA battery.

SHIFT - Directive to illuminate second target with laser designator.

SHOOTER - Aircraft designated to employ ordnance.

SHOTGUN - Launch of anti-radiation missile by Wild Weasel *(see: Shrike)*

SHORAD - Short Range Air Defence.

Shrike - AGM-45A anti-radiation missile.

SICK - Described equipment is degraded.

Sidewinder - The nickname for the AIM-9 air-to-air missiles.

Sierra Creek - Shit Creek: Bad place/situation to be. *"Up Sierra Creek without a paddle"*

Sierra Hotel - Shit Hot: Good. Great. *"This pilot is Sierra Hotel."*

SIGHT PICTURE - Term used to describe the position of the pipper at release.

SIGNAL CHARLIE - Landing area is clear; commence approach.

SIGNAL DELTA - Landing area is foul (not clear); commence standard holding pattern.

SIGNAL BUSTER - Use maximum speed (burner for those so equipped).

SILENT - "GO SILENT" directive to initiate briefed EMCON procedures.

Silk – Parachute.

Six o'clock - The area directly behind the pilot/jet. *(see clock-code)*

Skin friction - Aircraft wind resistance.

SKIP IT - Veto of fighter commit call; used by radar facility when higher priority target is present, usually followed with further directions.

SLCM - Sea Launched Cruise Missile.

SLICE - An informative call for fighter to execute a nose-low heading reversal to reposition as stated . Often used to obtain a change in flight path direction while maximizing radial G and sustaining airspeed or accelerating.

SLICE/SLICEBACK (Left/Right) - Directive to perform a high-G descending turn in the stated direction; usually 180 deg.

SLOC - Sea lines of Communication.

SLOW - Target with ground speed of less than 300 kts.

SLUFF - Slow Ugly Fat Fellow, or the A-10.

Smart weapon - An A-G weapon which can lock onto a target and guide itself to the point of impact.

SNAFU - Situation Normal; All Fucked Up. *(Often used in Falcon4.0™ Dev'ing circles)*

Snake-eye - A high-drag version of the Mk82.

SNAP SHOT - High angle off Attack or passing gun shot. Attacker's turn rate does not equal defender's LOS rate, whether intentional or unintentional.

SNAP (__) - An immediate vector (bearing and range) to the group described.

SNAP VECTOR - A quick vector to the requested position.

SOC - Sector Operations Centre.

Soft target - A target without armour or other defensive reinforcement, such as infantry, trucks etc.

Sonic boom - The shock wave created by breaking the sound barrier.

Sortie - A mission.

Sorting - Using any available info. such as radar presentation, *GCI* information, etc., to determine which bandit to attack.

SORTED - Criteria have been met which ensure individual flight members have separate contacts; criteria can be met visually, electronically (radar) or both. Final radar lock taken.

Sound barrier - The large increase in air resistance encountered by aircraft approaching the speed of sound.

Spad - A WWI fighter. *(Popular in Ara's Flame Posts)*

SPARKLE - Target marking by a gunship or FAC using incendiary rounds.

Specific Energy - Total mechanical energy per pound. Can be loosely described as an airplane's total energy resulting from airspeed and altitude.

Specific Excess Power (PS) - A measure of an airplane's ability to gain or lose energy in terms of altitude, airspeed, or combination there of also called energy rate and expressed in feet/second or knots/second.

Spectre - AC-130U *(also: Mike)*

Speed brakes - Aircraft control surface used to make a quick reduction in speed while flying or to help stop the plane after it has landed on the runway.

Split-Plane Manoeuvring – Aircraft manoeuvring in relation to one another, but in different planes and/or altitudes.

SPIKE - RWR indication of AT threat is displayed. Add clock position, and type threat (radar/heat) if able.

SPITTER (Direction) - An aircraft that has departed from the engagement.

SPLASH - Missile time of flight is expired or missile destroyed; target or bomb impact.

Splash one MiG - Statement commonly spoken after successfully downing an enemy.

SPLIT - Request to engage a threat; visual may not be maintained, requires flight lead acknowledgement (air-to-air). *Also: directive to begin briefed manoeuvre/attack.*

Spoof - Slang term for "fooling" an enemy missile with flares or chaff.

SPOOFING - Informative that voice deception is being employed.

SPOT - Informative that laser target designation is being received.

SQUAWK ( ) - Operate IFF as indicated or IFF is operating as indicated. *(also: See Norwegian Blue)*

SRM - Short Range Missile.

Stall speed - The minimum speed at which an aircraft will stall.

Stall - A loss of control of the plane due to low airspeed or radical manoeuvring in high altitudes.

Starfighter - F-104

STACK - Two or more groups/contacts/formations with a high/low altitude separation in relation to each other.

STATUS - Request for an individual's tactical situation; response is normally "offensive," "defensive," or "neutral" with number of targets. May be suffixed by position and heading.

STERN - Request for, or directive to, intercept using stern geometry. *(also: Navy-speak for "rear")*

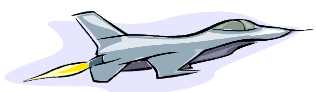
STERN ONLY - Intercept to be completed using stern geometry. Conversion to a "CUTOFF" will not be attempted.

STFU - Shut the fuck up

STINGER - Formation of two or more aircraft with a single in trail.

Stick - A pilot's directional controller.

STOP - Strategic Orbit Point.



Stores - Anything which can be loaded onto an aircraft.

STRANGER - Unidentified traffic that is not a participant in the mission.

STRANGLE ("___") - Turn off equipment indicated.

STRATFOR - SAC advisors to Tactical Air Forces (formerly SAC ADVON).

Stratofortress - B-52. *(also see: BUFF; also see: Interview with Chuck Norris)*

STRF - Strafe.

STT - Single Target Tracking.

STROBE - AI radar indications of noise radar jamming.

STRIKE - An attack which is intended to inflict damage, seize, or destroy an objective.

Super Sabre – F-100 *(see: "Vietnam Memories"; also see: Appendix #4)*

Suppressor - Aircraft designated to employ ordnance against defences.

SUNRISE - Informative call that command and control functions are available from GCI/AWACS *(see: MIDNIGHT).*

SUPPORTING - Assisting the engaged fighter in killing the bandit, whilst maintaining overall battle *SA*.

SWITCH/SWITCHED - Indicates an attacker is changing from one aircraft to another.

T

TAC-A (Tactical Air Coordinator-Airborne) - An airborne agency located far enough away from threats and jamming to provide a communications relay between fighters, FACS, and ground agencies. Typically aboard a FAC aircraft, ABCCC, or AWACS.

TACC - Tactical Air Control Centre.

TACP - Tactical Air Control Party.

TACS - Tactical Air Control System.

TAF - Tactical Air Forces.

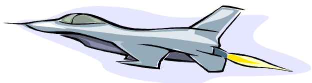
TARCAP - Target Combat Air Patrol

Target - Object being attacked.

TFR - Terrain-following radar or reference to low altitudes pertaining to terrain-following radar.

Tally (ho) - I see it. *(originated in WWI aerial combat)*

Target bearing - The angle of the target from the front of your F-16.



TAS - True Airspeed.

Taxiing - Steering your aircraft around while it is on the runway.

TC - Transit Corridor (NATO). Air lanes established for transit in the rear area of the battle theatre.

TD box - The Target Designator box on the HUD.

Terrain masking - Flying behind terrain features to prevent radar detection.

THAAD - Theater High Altitude Air Defense *(thank Lesbian for this pointless addition)*

Threading the needle - Flying through the gaps in the air defence radar systems.

Threat - (GCI/AWACS) Informative that an untargeted bandit/bogey is within 10 NM of a friendly.

Thrust - RPM.

Thunderchief - F-105.

TIC - Troops in Contact..

TIED - Positive radar contact with element/aircraft.

Tiger - F-5.

Tigershark - F-20.

TL - Transit Level (NATO). Altitude blocks for deconfliction and identification of inbound/outbound air traffic.

Tomcat - F-14.

Tone - An audio cue emitted by missile control systems to indicate that the target has been acquired and is being tracked; an indication that it is time to launch a missile.

TOF - Time of flight or actual time of flight. The time from weapon release to weapon impact

TOT - Time Over Target.

Total G - Indicated G.

TP – "**The Penetrator**". (Gaz') The BEST LAD in the Falcon Community.

TRACK - A series of related contacts indicating direction of travel.

TRACKING - Stabilized gun solution.

TRAIL - Tactical formation of two or more aircraft following one another.

TRAILER - The last aircraft in a formation.

TRASHED - Informative call; missile in flight has been defeated.

TTA - AMRAAM time to active.

TTI - AMRAAM time to intercept.

Track Crossing Angle - See Angle Off.

TROLL - One who browses forums for the express purpose of creating discontent via provocative posting.

TTP - Tactics, Techniques, and Procedures.

TUMBLEWEED - Describes one who is "NO JOY", *BLIND,* and rapidly losing situation awareness, in a request for directive commentary and orientation. Colloquially NO TALLY; NO VISUAL, NO CLUE!

Turn circle - The radius of the turn circle.

Turn rate - How fast your plane is moving around its turn circle.

TWI - Threat Warning Indicator.

TWS - Threat Warning System

U

UCMJ - Uniform Code of Military Justice. The legal systems governing the conduct of the U.S. Armed Forces.

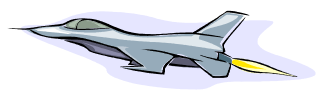
UI - User Interface. Where "Setup" selections are made.

UNIFORM - UHF/AM radio.

UPWIND AIM POINT (UAP) - A point on the ground whose distance and direction from a target represents an adjusted aim point, usually for wind compensation in manual bombing.

UTAR – Up Tight Anal Retentive *(© Aragorn)*

V



Vc - Closure between fighter and target expressed in knots, relative velocity.

VECTOR - Aircrew request / WC directive for a cut-off heading to the entity described.

Vectored thrusting - Changing the direction of an airplane engines thrust with angled nozzles or vanes.

Vertical axis - The line perpendicular to both the longitudinal and horizontal axes.

Velocity Vector - A line representing the current direction and magnitude of the path of travel.

Vertical Rolling Scissors - A defensive descending rolling manoeuvre in the vertical plane executed in an attempt to achieve an offensive position on the attacker.

VIC - Three groups/contacts/formations with the single closest in range and an element in trail.

VICTOR - VHF/AM radio.

VID - Visual identification.

Viper - Unofficial designation for the General Dynamics F-16 "Fighting Falcon". Anecdotal evidence suggests that pilots of the F-16 thought that "Fighting Falcon" sounded a little "gay" *(not that there's anything wrong with that*), so decided to RE-Designate their jet - The VIPER. This term was "lifted" from the popular 70's Sci-Fi Movie / TV series - Battlestar Galactica. The "fighters" in this series were lithe, and possessed an incredible acceleration factor. The early F-16 pilots associated this kind of acceleration with their "Falcons", and - so - the VIPER designation was born.

VISUAL - Visual contact with friendly aircraft. Opposite of *"BLIND"*.

Vmax - Maximum possible speed for that altitude.

Vmaxp - Maximum sustainable speed for a given altitude.

VMC - Visual Meteorological Conditions.

Vmc -Practical manoeuvring cruise speed.

Vmin - Slowest practical speed.

Vk - Target velocity.

Visual - I see whatever it is you are describing.

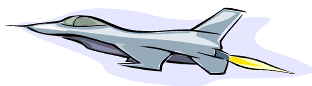
VMS - Voice Message System

Voodoo - F-101.

VSTOL - Very Short Takeoff & Landing *(e.g. Harrier Jump Jet)*

VTOL - Vertical Takeoff & Landing *(e.g. Harrier Jump Jet)*

W



WALL - Three or more groups/contacts/formations line abreast/side-side.

Warthog - unflattering nickname for the A-10 *(also: hog)*

Waterline - An artificial horizon line.

Wave drag - The drag caused by the shock waves created by supersonic flight speed.

Waypoint - Locations of targets as computed by the F-16's navigational computer.

WC - Weapons Controller.

WC^3 - Warning, Command, Control, and Communications.

WD - Weapons Director.

Weapons System - In regard to an-airplane, weapons system refers to the combination of airplane/aircrew/ordnance/ground crew/avionics, etc.

Willy - What you call your wee-wee.

Willy Pete - A white phosphorus smoke, rocket, grenade, or artillery round used to provide a ground reference. Can be employed as a bomb to provide a smokescreen. Can also be used to cause catastrophic injury to unprotected ground troops. Classified as a "Chemical Weapon". *(edited for political content. Go "GW")*

Weapons envelope - The area surrounding the enemy plane where you are within the correct range, aspect angle and angle-off parameters to shoot a missile or gun with a high *Pk*.

WEAVE - Continuous crossing of flight paths by members of a formation.

WEDGE - Tactical formation of two or more aircraft with the single in front and the other aircraft laterally displaced on either side behind the leader's wing line.

Wedgy - When the bully at school pulls your underpants right up your butt. *(I kinda' enjoyed it…)*

WEEDS - Indicates that aircraft are operating close to the surface.

WELL - Described equipment is functioning properly.

Whiteout - The inability to distinguish colours during the initial stages of a blackout.

WHAT LUCK - Request for results of mission/tasks.

What's that - Usually said when you don't know what something is. Hope this helps.

WHAT STATE - Report amount of fuel and/or armament remaining as requested; for training, repeat ordnance as follows:

\# *Radar* = number of radar missiles shots remaining.
\# *Heat* = number of IR missiles shots remaining.
\# *Gun* = Gun on-board and bullets remaining.
\# *Fuel* = pounds of fuel or time remaining.

WILCO - Will comply (with received instructions).

Wild Weasel - The hunting of SAMs by using your own aircraft as bait; *also* the aircraft used for this mission.

Winchester - Out of ordnance / weapons. Reliant on guns only (“gone Winchester”).

Wingman/Wingie - Flying partner. Combat aircraft generally fly in pairs. (*Target for Ara’s HARMS.)*

WOC - Wing Operations Centre.

Womb Comb - Fighter Term for MOUSTACHE *(Thanks “Hatch”)*

WORKING - Wild Weasel is gathering EOB on a designated emitter.

WSO - Weapons Systems Officer: Rear-seat weapons and targeting systems operator. *(also: RIO)*

WTF – What the fuck? *(***also***: WTH – What the hell?)*

WVR - Within Visual Range.

X

X-Men - An uncanny group of mutants. Vipers chase them in the 2nd movie.

Y

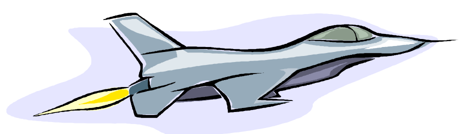
Yaw - Movement around the vertical axis of the aircraft.

Yo-Yo - An offensive manoeuvre that uses vertical manoeuvring to stay inside the enemy’s turn radius.

Z

Zero-Zero ejection seat - Pilot Seat that will EJECT from the (stricken) aircraft. Usable parameters down to Zero airspeed and Zero altitude [as long as the aircraft is not inverted].

ZIPPER - Acknowledge radio transmissions with two clicks of the mike button. *(also holds your wee-wee in your pants - pursuant to having a wee-wee)*



Appendix #2

Hunting for F.P.S.

There is no "order", rhyme nor reason to the following tips. I simply present a series of strategies for gaining F.P.S. Some of these come at the cost of Graphical Quality, some do not. They have not been "rated", nor is there any hierarchy with regards their application. This is simply a "pool" of strategies into which you can dip, in your hunt for Frames per second (FPS).

Good Hunting.

RAM → You should have ***AT LEAST*** 1gigabyte. 2GBs preferred.

Tweaking XP *(incl. Services)* – Please visit the following site for some tips on increasing your FPS via the streamlining of your OS →

http://mywebpages.comcast.net/SupportCD/OptimizeXP.html

Over-clocking → Not recommended. But – if you really need to do it, use the software which came with your card and always choose the "**AUTO optimized**" setting. This way, your 3rd Party software will recommend the SAFEST setting for overclocking. It IS a good way to get extra FPS, but you RISK frying your GPU.

Dedicated Drive for Falcon. It helps if you have a separate drive for Falcon. Failing this, a drive which is NOT full, and which is regularly defragmented *(O&ODefrag is recommended)*

RILEX – See Appendix #3, and visit Rilex's site for instructions on setting up your OS specifically for Falcon. *A **MUST SEE** for all Falconeers.*

http://falcon.unroutable.net/Lists/Falcon%204%20Information/AllItems.aspx

Recommended **3rd Party Software**:

XP Smoker automates many tweaks with regards your Windows OS.
"Game Boost" can be applied and unapplied with a single button push.

System Mechanic + *Norton System Works* + *RegVac* + *Registry First Aid* + *O&O Defrag* are all software which maintain system cleanliness, and speed.

Anti Virus = OFF. Make sure you disable all anti-virus software before starting Falcon.

Programs in the background = All unnecessary services should be turned **OFF** before starting Falcon *(eg. spoolsv, adobehlp, GoogleToolbarNotifier, etc. etc.)*. 3rd party software such as ***XPSmoker*** can automate this task. For more information, visit the following site:

http://mywebpages.comcast.net/SupportCD/OptimizeXP.html

Rilex has advice with regards background services.

Read an interesting thread here:

http://forums.frugalsworld.com/vbb/showthread.php?t=92338&highlight=background+services

Resolution: 10 X 7 Vs 16 X 8. The higher your resolution, the lower your FPS.

REDVIPER CONFIG EDITOR →

Use old sound algorithm = FPS Gain

Disable 3D sound = FPS Gain

Display Trees (???) = This is NO LONGER an option in FF4.0/RV1

Disable High Alt. Fartiles = FPS Loss *(see RV Config Editor Section)*

Tex Detail Factor = FPS Loss

Aircraft respawning = **The higher the time, the lower your FPS.**
Try lowering the time to 6 mins, or 2 mins, or – in extreme cases – 00 mins for more FPS around airbases.

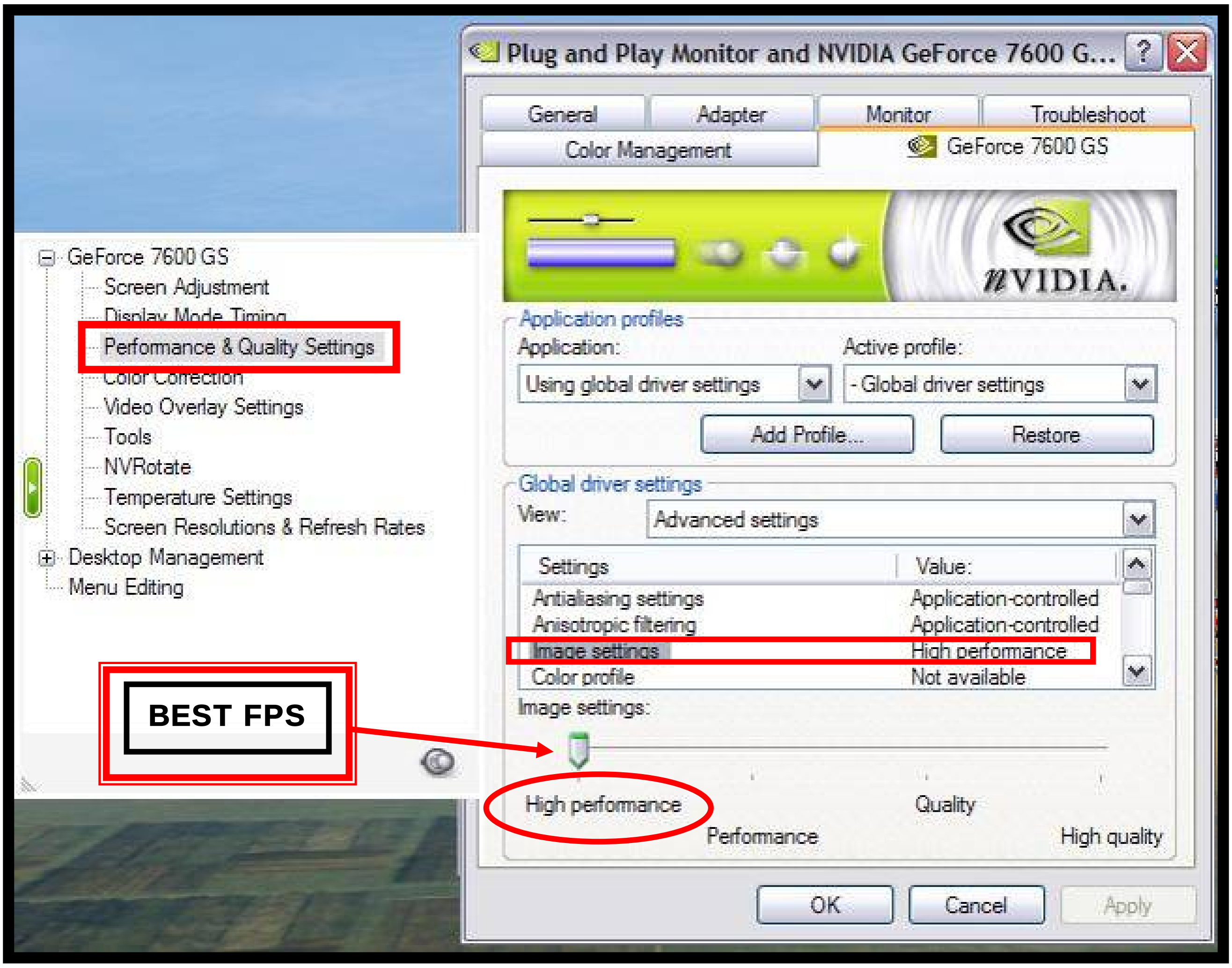
Percentage Available Aircraft → 50 or 75 = FPS Loss

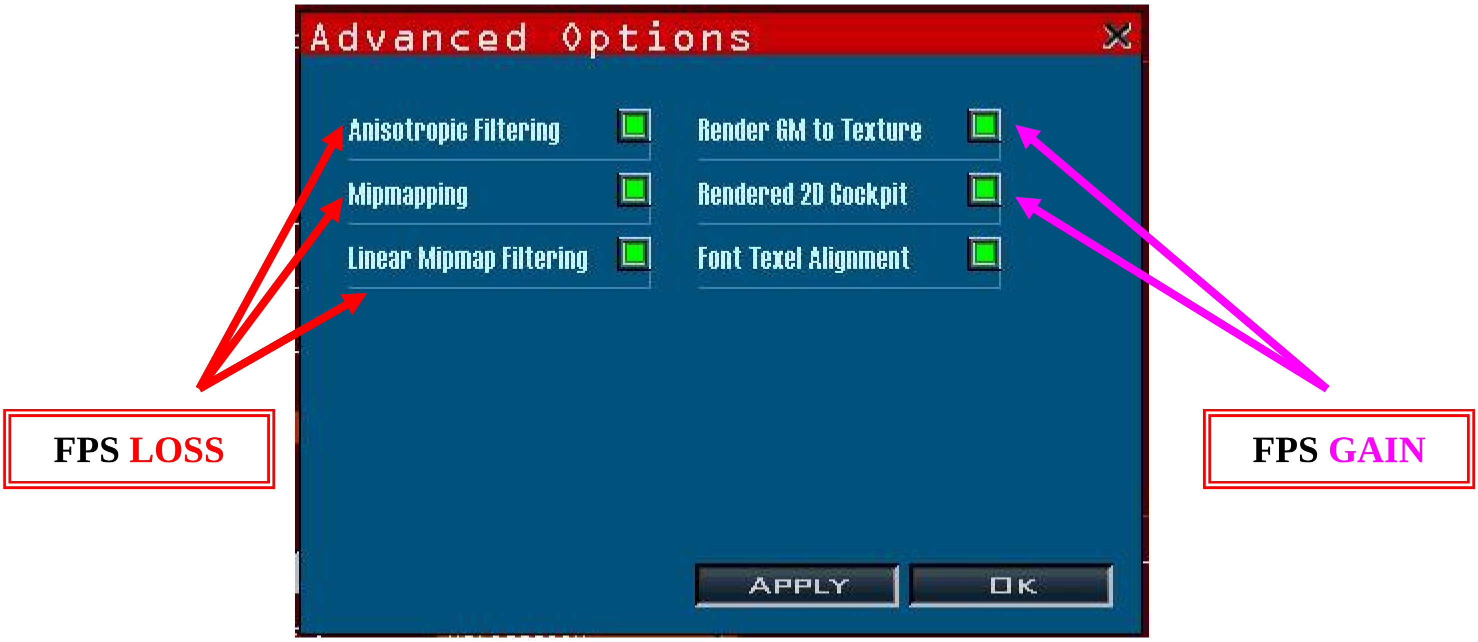
Weather → **Thunder & Lightning** = FPS **LOSS**. **Fine** weather = FPS **Gain**.

Contrails. Have you adjusted or lowered your contrail level…? ***DON'T***. This can be a BIG mistake. By lowering your contrail level to 10k' for example, you can experience a drop from 30fps to 8fps or less. This is because all jets in the theatre are now emitting contrails, each of which is using the GPU to draw the white vapour trails.

Latest Drivers…? See *Driving Miss Gorny* Section for further information.

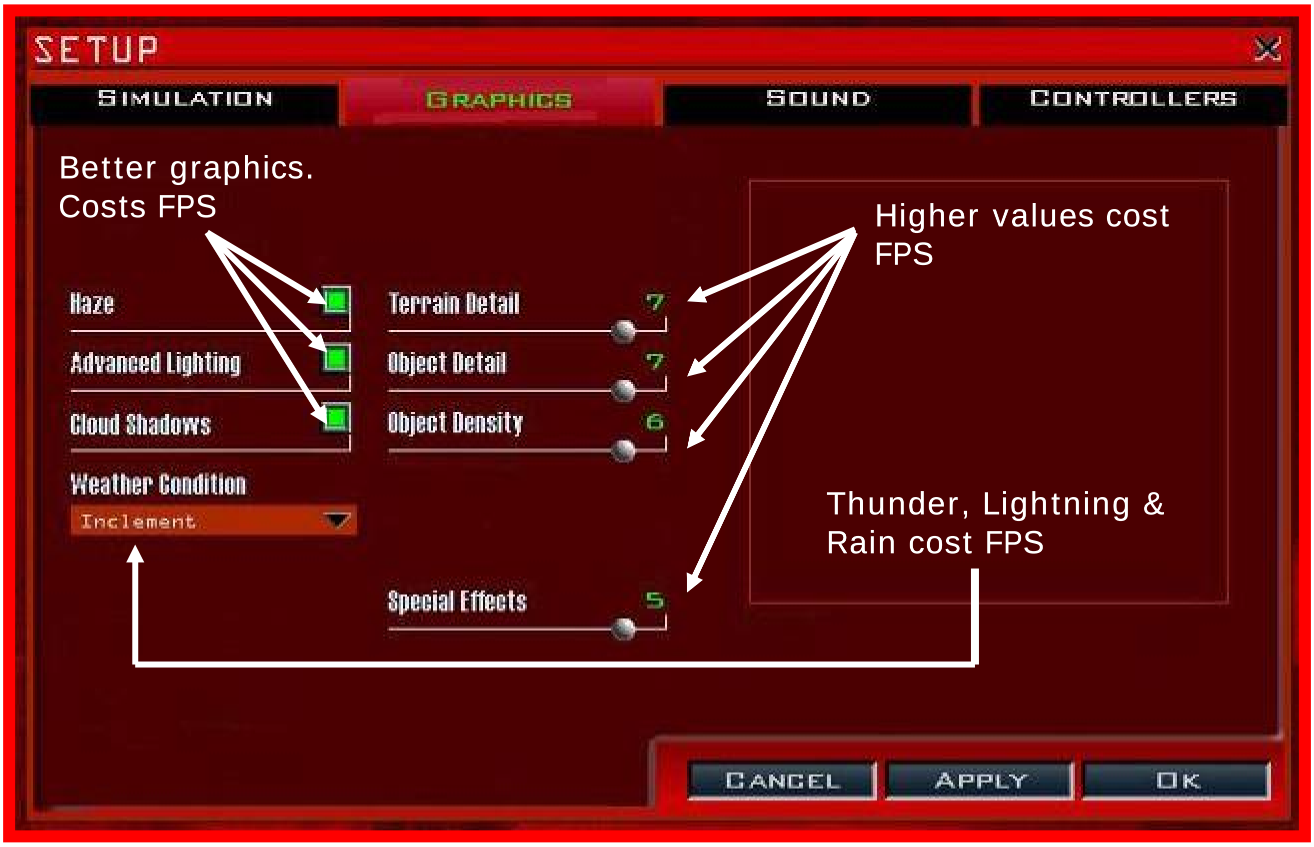
Did you know…? ***Flares*** cause a big FPS hit.

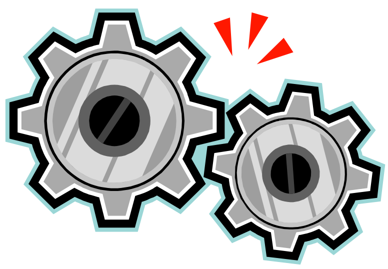

Plug and Play Monitor and NVIDIA GeForce 7600 G...
General
Adapter
Monitor
Troubleshoot
Color Management
GeForce 7600 GS
GeForce 7600 GS
Screen Adjustment
Display Mode Timing
Performance & Quality Settings
Color Correction
Video Overlay Settings
Tools
NVRotate
Temperature Settings
Screen Resolutions & Refresh Rates
Desktop Management
Menu Editing
BEST FPS
Application profiles
Application:
Using global driver settings
Active profile:
- Global driver settings
Add Profile...
Restore
Global driver settings
View:
Advanced settings
Settings
Value:
Antialiasing settings
Application-controlled
Anisotropic filtering
Application-controlled
Image settings
High performance
Color profile
Not available
Image settings:
High performance
Performance
Quality
High quality
OK
Cancel
Apply


Advanced Options
Anisotropic Filtering
Mipmapping
Linear Mipmap Filtering
Render GM to Texture
Rendered 2D Cockpit
Font Texel Alignment
APPLY
OK
FPS LOSS
FPS GAIN

Antialiasing – **Costs FPS**. If you MUST use it, and you have a nVidia card, any Antialiasing modes ending in 'Q' - provide a higher level of visual quality for a lower level of performance loss. Best FPS = *Set to "Off"*

Anisotropic Filtering: **Costs FPS**. The possible sample rates of Anisotropic Filtering here are Off, 2x, 4x, 8x and 16x. In general, the higher the sample rate of Anisotropic Filtering used, the clearer textures remain as they fade into the distance. The higher the sample rate, the greater the FPS COST. Best FPS = *Set to "Off".*





Appendix #3

RILEX's Falcon 4

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Rilex's Site

Editor's Note: As the editor of this Manual, there was one document I was always determined to include: *Rilex's Guide to Falcon 4.* I've always considered it a "must-read" for any Falconeer. With Rilex's kind permission - for the benefit of all Virtual Pilots - I am very happy to re-publish it here.

Please be aware, that this is an appended version of Rilex's Guide. His Guide has – in fact – been superseded by an on-line version. Rilex's Site may be reached via the active link (Rilex's Site) appearing throughout this Feature. There is information there which has not been included in this iteration of the Guide. ***Please visit the site for UPDATED INFORMATION.***

Setup

Welcome to Setup. This section includes information on what type of Hardware Abstraction Layer to select to choosing a strong password.

In this section we will begin to change a few of the defaults to help improve memory usage as well as secure the installation. We will also look at what you need in the way of updating your OS.

BIOS Setup

One will need to modify their BIOS twice. Before setup of NT and after setup of NT.
Before setting up NT, you'll want to change the following settings:

- Plug and Play OS = No
- Video/BIOS caching = No
- Turn off any IRQ or memory reservations

After setting up NT, you'll want to change your IDE channel settings to where the CDROM is no longer recognized by the BIOS (typically a setting of [None] where the CDROM is will be what one is looking for). Note that this will make the CDROM not bootable and it may remain unrecognized in other OSes as well. However, what this will do is properly set DMA settings for CDROMs, CDRWs, and DVDROMs.

Choosing HAL type

On to the setup. First choice: ACPI or not? I strongly recommend ACPI if you have a compliant board and compliant hardware. Each PCI slot does not use an IRQ, but instead an INT line. Each INT line has an IRQ assigned to it. Many motherboards with 4 PCI + 1 AGP do INT sharing (typically AGP is shared with PCI slot 0). However, Windows 2000 will present IRQ information as nearly every PCI device being on a single IRQ. You will have no control IRQs, DMA resources, or other memory resources. The only way to modify these resources is to reinstall Windows with a Standard HAL. If you are used to the way Windows 9x works where you can freely modify device settings, you may be more comfortable with the Standard PC HAL.

To choose the HAL type:
1. Put the CD or use diskettes to launch Windows 2000/XP setup.
2. When it prompts you to "Press F6 now if you need to use a third-party SCSI or RAID driver", press F5. You may then choose your HAL type.

Partitioning and Formatting

You'll eventually come to the drive setup. Here you can create a partition and modify its size (similar to fdisk for Windows 9x), format the partition, and choose which partition the OS will be installed on. It is recommended that NTFS be the chosen format. There is a slight speed loss in certain situations, but in a few others there is also a slight gain over FAT32. NTFS is more resilient against things like power outages due to having a file system journal. Also a FAT32 partition formatted with the Windows 2000/XP setup, or with the Windows 2000/XP Disk Administrator are limited to 32GB in size. This is not a FAT32 limitation, but rather something Microsoft has done to "encourage" users to not use FAT32. You are free to format a disk with FAT32 using fdisk and format as your tools, instead. Windows 2000/XP can read FAT32 disks larger than 32GB just fine. *(Related Articles*- `Limitations of FAT32 File System (184006)` *and* `Limitations of the FAT32 File System in Windows XP (314463)`)

Passwords

Eventually you will come to the GUI-phase of setup. The only important piece that I will be talking about here is how to set up your Administrator account. It is very important to make this password fairly strong. No password like "doggie" or "090774" (birth date) etc. Come up with something exotic and at least 7 characters long. If you make it 15 characters, you'll have a very strong password (cannot be converted into a LanManager hash (a weak encryption system)). Using something on the order of "%2sfQ8bt" is a very good idea. Also, using escape characters is a good idea (ALT-<4 digit character code>).

OS Updates

Service Packs are cumulative. There is no need to apply a previous Service Pack before applying the most current Service Pack.

Windows 2000 Rilex no longer offers support for Windows 2000/NT, as they are both dated, and no longer officially supported. For further information and / or specific enquires, one may wish to contact Rilex at his stie.

Windows XP Service Pack 2 is available at English 32-bit Network Install (266MB). Like Windows 2000, slipstreaming Service Packs is supported. Slipstreaming hotfixes is not supported. Windows XP updates are available from Microsoft Update. Install all of the Critical Updates as there are a few vital security fixes even after applying the Service Pack.
Variables to the same directory, if you choose to do so. Note that the user must have permission to write, read, and delete from that directory. Click OK twice.


Night Vision Goggles

Page File Setup

There are two optimum setups for a page file. Part A applies if you have more than one physical disk. Part B applies if you only have one physical disk (but perhaps multiple partitions).

A) Put the page file on a non-OS disk (i.e. Windows on C:, page file goes on D:). Typically, the default size Windows provides is good enough (which comes out to 1.5 * RAM on systems with less than 1GB installed, or 1 * RAM on systems with equal to or greater than 1GB installed).

The reason for not making a static page file would be that if one fills the page file, Windows will automatically expand it to a larger size to a maximum of 3 * the amount of physical memory. Doing so will interrupt Falcon (and other games). Falcon often crashes at this point. Creating such a large page file will not slow down your system, it will just use up disk space. If one is into conserving disk space, you can use the Performance monitoring tool to track page file usage over the course of a few days. When there is enough data, set your page file size appropriately.

B) Put the page file on the same partition as the OS. When you put the page file on a separate partition, but the same physical disk, it will slow page file operations down (if you're paging, this may result in reduced performance). The reason behind this is the artificial distance created when using partitions. The heads on the drive must now travel farther to access the page file than if they were on the same partition as Windows.

Page file position on the disk isn't terribly important. The reason being is that page files (and this also applies to Windows 9x) are not typically accessed sequentially. Data is read from the beginning of the file, then perhaps near the end, then the middle, and so on. Changing the position of the page file is not going to yield a huge performance gain.

Defragmenting the page file is also unnecessary. Page files are accessed in 4KB chunks of data. Since the data is scattered around the page file, it isn't accessed sequentially. The initial page file (the "minimum" size specified) is created sequentially on the physical disk. The page file size is reset after a reboot in case it has grown beyond the initial size.

Do not eliminate the page file! Doing so will increase the amount of memory needed to run any program. The Virtual Memory Manager can allocate the same 4KB chunk of memory to code that is common between two or more programs. It is a common myth that if no page file is created, paging does not occur. Paging *always* occurs in the Windows NT family. Another form of paging is called the backing store. A backing store might be the program executable, or required DLLs, and so forth. The Virtual Memory Manager may have a program page back to one of these components.

How to Setup a page file in Windows XP:

1. *Start -> Settings -> Control Panel -> System Properties*
2. *Advanced -> "Performance" Settings -> Advanced -> Change*
3. *Select the appropriate drive letter. Click the System Managed size radio button.*
4. *Hit the Set button.*

MEMORY MANAGER REGISTRY SETTINGS

The key registry entries here all relate to the Virtual Memory Manager within the Windows NT family.

DisablePagingExecutive

With this registry entry, Executive files will be allowed to page out (hard page; to disk). You can use regedit (or regedt32) and browse to the HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Session Manager\Memory Management and modify "DisablePagingExecutive" to 1.

This enables the ability for the system to page (hard page; out to disk) pagable drivers and other system files. There are drivers and system files that do not have the ability to hard page, thus this setting does not affect them. Enabling this will allow both user-mode and kernel-mode drivers and system files to be paged to disk.

LargeSystemCache

This allows Windows to allocate up to 80% of physical memory to file cache (but is dynamic if needed). Again, use regedit (or regedt32) to browse to the HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Session Manager\Memory Management key and modify "LargeSystemCache" to 1.

IOPageLockLimit

What this does is help with large amounts of IO (Input/Output) by modifying the amount of locked pages that can be requested on DMA devices only. It allows processes to use a larger buffer and more than one DMA IO at a time. You'll need to add this key, again, at HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Session Manager\Memory Management. Add a DWORD value "IOPageLockLimit" and set its value in bytes. The default value is 524288 bytes (512KB). Do not modify this setting unless you have more than 128MB RAM.

It isn't recommended that this setting be changed as a higher limit can decrease performance. This setting relates to how much memory is used in I/O operations (i.e. moving files on disk, network, etc.). This setting is ignored and has no affect on Windows 2000 SP1, SP2, SP3, or Windows XP. This setting only affects Windows NT (3.5, 3.51, 4.0) and Windows 2000 RTM (no service pack level).

NonPagedPool

Changing the NonPagedPool setting is not often recommended, though it can be done. The value is in bytes; do not set it to -1. The default setting is 0.

F.A.Q.

Falcon & Dual CPUs

Yes, Falcon 4 does support multiple CPUs, Hyperthreading, and Dual Core CPUs. However, it is not optimized for any of these technologies. Falcon runs roughly 20 to 30 threads and the thread balancing is not optimized by the programmers. Thread balancing is done by the OS.

Expect anywhere from a 10 - 20% performance increase and stabilization of frame rates around FLOT.

To set the affinity of Falcon, first start the program. Then bring up the Task Manager (using CTRL-ALT-DEL), go to the Processes tab, right click on Falcon.exe or Falcon4_RP5.exe (or the appropriate Falcon 4.0 exe file), go to Set Affinity. In the box that opens up ("Processor Affinity"), check which CPU(s) you'd like the Falcon executable to function on. Then click OK. Lastly, restore Falcon to full screen.

Windows 2000 and XP with Hyper Threading processors

In Windows 2000, Microsoft did not differentiate between a physical and "logical" processor. Because of this, one Hyper Threading processor will appear to be two physical processors in Windows 2000. In Windows 2000 Professional, this will prevent you from using two SMT processors at the same time (Xeon line). In order to have two physical SMT processors, you would have to upgrade to Windows 2000 Server, which would see all "four" processors (two physical, two logical). Windows XP Home and Pro, on the other hand, can differentiate between both physical and logical processors. In Windows XP Home you can use one SMT processor and it will work, while if you wanted to do a dual Xeon SMT processor system, you could use that in Windows XP Pro. Note that in either Windows 2000 or Windows XP, a logical processor will show up under the Task Manager as a second CPU graph.

Clearmem and other "defragmentation" memory optimizers

(http://forums.frugalsworld.com/vbb/showthread.php?s=&threadid=3579)

Clearmem and other such programs are, for the most part, bogus. Typically what they'll do is use up a lot of RAM and then free that same RAM they've just used. Another thing they'll do is clear out the file cache. Why is that useless? Because the system will need to reload the same files into RAM (or page file) which will increase I/O on the hard drive. Files that are in the file cache and aren't used will be either hard paged (put out onto the page file) or dumped from memory completely. Windows knows what programs are requesting and how to properly allocate memory. A great article on this topic can be found at: http://www.radsoft.net/resources/software/reviews/redux/

Blue Screen of Death

We all fear it; it comes like Death clothed in blue. The Falconeer's nemesis: B.S.O.D.…!! Follow the link below for Rilex's Guide on the BSOD.

The L2 Cache Myth

Not too long ago there was a myth about needing to set the amount of L2 cache you have on your CPU in the registry. This is not true as Windows will automatically detect the size and use the available L2 cache. There were certain CPUs, such as Pentium Pro upgrades, which required this "hack", but for any other Pentium (or AMD) system, this is not necessary.

RAMDrives

RAMDrives defeat the purpose of the advanced memory management in Windows 2000/XP. While they have more of a use in Windows 9x, they are still not recommended. Using a RAMDrive cuts down on the available file cache as well as memory available to programs. RAMDrives, since they are considered a "real" drive in Windows, will still require that their contents, when in use, be in file cache (which is typically physical memory). Thus you effectively double your memory usage. The one single benefit that RAMDrives have is an extremely fast loading time. Loading time, I feel, is not as important as having an overall smooth flight.

Converting from FAT16/32 to NTFS 3.0/3.1

Microsoft provided a nifty utility to convert from FAT to NTFS. Simply open a Command Prompt by typing "cmd" (without quotes) in the Run dialog box. When the Command Prompt opens up, type in "convert". This program is very easy to use. For instance, if to convert the C: drive from FAT to NTFS, type in the following:

convert C: /FS:NTFS

It will request a to reboot and during the loading of Windows, it will convert the volume to NTFS. As always, back up data before converting! Be aware that by converting instead of deleting the partition and formatting as NTFS, it will be using 512 byte clusters which are very space efficient but very slow. Starting from a new partition will yield 4KB clusters.

Hard disk Defragmentation

Disk fragmentation is always a reoccuring topic. In general, it is not needed.

File and folder fragmentation occurs when a file, or part of a file, cannot be contigiously allocated in blocks on the disk.

For example, say you had MyFile.doc. MyFile.doc was 1MB and was allocated 512KB at the beginning of the disk, then 20MB of other data was on the disk, and finally the remaining 512KB of MyFile.doc was written to disk. If an application was to read the entirety of MyFile.doc, it would need to read the first 512KB, skip 20MB (causing a delay in loading), then finish the remaining 512KB. This file would have a single fragmentation in it since it is broken up into only two pieces.

Depending on the application, lots of fragmentation can lead to performance issues, but when is too much?

You can't tell from a pretty picture laid out by the built-in Windows defragmentation tool (now removed with Vista since the display is useless) or other tools. The way to tell if fragmentation is affecting disk performance is with the Performance Monitor. Perfmon can be found in the Administrative Tools folder of the Control Panel.

Once you're in Perfmon, hit the plus symbol near the top of the right hand pane. You will want to choose one of two groups of performance counters based on where your application is.

If you have a single physical disk with a single partition, choose the group of counters named PhysicalDisk. If you have a single disk with more than one partition, choose the counters named LogicalDisk.

Next, find the following two counters in one of those two groups:

Disk Transfers/sec

Split IO/sec

Highlight each one on the left hand pane, then choose the appropriate physical disk or logical partition on the right hand pane. Click on Add. You'll need to do this for each counter.

Run your application and exit it, coming back to Perfmon. Take a look at both counters in the right pane in the lower hand section and record each Average.

If the Average of Split I/Os is within 15 to 30% of the Average number in the Disk Transfers/sec counter, then as a general rule of thumb, defragment your disk.

Remember that defragmenting frequently on NTFS drives can cause a performance <i>loss</i>. NTFS pads each file written with 4KB of blank space (where possible) on either side of the file. By doing so, it allows the file to grow without fragmenting.

I would recommend just using the built-in defragmentor. While 3rd party products can "do more", the "more" generally is not worth the cost for the performance gain, if in reality, there actually is any.

Resource Kit

The Resource Kit has many different tools to quickly do different operations within Windows. Some are useful, some not so useful. Resource Kits can be found at http://www.microsoft.com/reskit. Resource Kits for Windows 2003 can be used and installed on Windows XP, but may have some limitations.

NTFS and FAT32

FAT32 Advantages: The primary advantage of FAT32 is compatibility. Formatting your Windows 2000/XP partition in FAT32 will allow Windows 9x to read and write to the drive without any special drivers.

FAT32 Disadvantages: FAT32 is insecure. It contains no ACLs (Access Control Lists) to limit what certain users can and cannot modify. This can also be extended to viruses. Viruses will have free reign on a system formatted in FAT32 because of the lack of ACLs. FAT32 also remains a less stable file system. Improperly powering off the system (power loss, hard locks, etc.) can lead to FAT32 corruption.

NTFS Advantages: NTFS has many enhancements over a variety of other file systems. NTFS has security permissions (ACLs) which allow an Administrator to limit what users can and cannot modify. This also prevents viruses from modifying or damaging key system files as long as the virus is not run under an Administrator-level account. NTFS is also highly regarded for its additional stability and being a journaled file system. It keeps a "journal" of changes, which in the advent of an improper shutdown, will compare and correct errors within the file system upon restart. NTFS also supports software stripping and mirroring (RAID arrays).

NTFS Disadvantages: Security is a double-edged sword. If using a non-Administrator level account, many times one will be forced to change and add users to the Access Control Lists for programs' files and folders. Please see the section "Running Falcon as a non-Administrator" for how to go about this. NTFS also has a higher overhead (because of its additional features) than FAT32. This overhead on modern systems is not typically felt as a performance loss.

General notes

Both file systems are within a few milliseconds of file read/write performance of each other. Performance should not be a consideration when comparing the two file systems. If using Linux as primary/secondary OS and it is needed to both read and write to the Windows partition, it is not recommended that NTFS is used on the Windows partition. Since NTFS is a journaled file system, it can be corrupted by writing to it outside of Windows. The reason being is the change log (journal) will see the write as a difference and may not properly handle that. Currently, Linux NTFS write is marked as "Experimental". Reading from an NTFS drive, however, is fine.

Falcon 3.0 ™

Falcon 3.0 will run under Windows XP with some advanced utilities. Along with your Falcon 3.0 CD, DOSBox is required. These directions apply to DOSBox version 0.60.
http://dosbox.sourceforge.net/news.php?show_news=1

Once DOSBox is installed, run DOSBox. In order to mount and install Falcon 3.0, type:

mount X: X:\

Where X: is the CDROM drive letter. Then mount the destination (installation) drive using the same syntax. Once both drives are mounted, change directories to the CDROM drive. Type INSTALL and hit enter. Select the full install to the hard drive, and install Falcon 3.0. After Falcon is installed, change directory to the Falcon directory and type in FALCONCD, HORNETCD, or MIGCD if using Falcon 3.0 Gold.

Once Falcon is running, click on the Config screen. Click on System Setup. For Radio Messages and Sound and Music, select Sndblaster. A USB joystick will work in Falcon, however you will only have a two button setup. Detail levels can be set to maximum.

Start a game in Instant Action to set up performance within DOSBox. Gauge the sound and stutter of the graphics to modify DOSBox settings. For a PIII 850, set up CPU Cycles at 7080 and Frameskip at 7. To modify Frameskip, use CTRL-F7 to decrease and CTRL-F8 to increase. To modify CPU Cycles use CTRL-F11 to reduce and CTRL-F12 to increase. When modifying CPU Cycles, leave Task Manager open and watch the CPU column for dosbox.exe. It should be at or near 100 during play. If it starts at 100, try reducing CPU Cycles until it is just under 100. Exit DOSBox and Falcon when the appropriate settings have been identified.

Open DOSBox.conf in the DOSBox Start menu programs folder. Settings that might need to modify include "sensitivity", "memsize", "frameskip", "scaler", and "cycles". Here is the configuration used with a PIII 850:

```
[sdl]
fullscreen=false
autolock=true
sensitivity=100
waitonerror=false

[dosbox]
language=
memsize=256

[render]
frameskip=7
snapdir=snaps
scaler=advmame2x

[cpu]
cycles=7080
```

[mixer]
nosound=false
rate=22050
blocksize=2048
wavedir=waves

[midi]
mpu401=true
device=default
config=

[sblaster]
sblaster=true
base=220
irq=7
dma=1
sbrate=22050
adlib=true
adlibrate=22050
cms=false
cmsrate=22050

[speaker]
pcspeaker=true
pcrate=22050
tandy=false
tandyrate=22050
disney=false

[bios]

[dos]
xms=true
ems=true
dpmi=true

[modem]
modem=false
comport=2
listenport=23

[autoexec]

Change the settings as desired…!

Note that Art of the Kill *will fail with "Unable to Display Type"*

Appendix #4

Then & Now...

F-100 Super Sabre

The North American Aviation F-100 Super Sabre was a sleek, swept-back-wing fighter that gave the United States a supersonic Air Force. Although the first version was produced prior to 1950, various improved versions served as trainers and as active military craft at many U.S. and foreign bases.

Since May 1953, when the first prototype model, the YF-100, bettered the speed of sound on its first flight, the versatile fighter set numerous records for speed, endurance, range and maintenance.

Late production models of the F-100D and F-100F had the capability of being launched from remote areas in the manner of manned missiles. An F-100D Super Sabre became the first supersonic aircraft to be "boosted" airborne without use of a runway in successful Zero Length Launch (ZEL) tests at Edwards Air Force Base, Calif., in 1958.

In addition to its nuclear bomb armament and four 20 mm cannons, the Super Sabre could be equipped to fire rockets and missiles, including the heat-seeking GAR-8 Sidewinder.

While the later models of the F-100 had a speed in excess of 1,000 mph, two earlier models of the "A" and "C" established the world's first supersonic speed records. Colonel F.K. (Pete) Everest reached 755.149 mph in October 1953, and Colonel Horace Hanes topped 822 mph in August 1955.

To demonstrate the ability of its pilot and aircraft, the Air Force chose F-100 Super Sabres to perform throughout the world in aerial precision demonstration flights. The famed "Thunderbirds," a four-man aircraft team, were viewed by over 19 million people as the storied pilots performed intricate precision maneuvers at low altitude. In Europe the "Skyblazers" flew similar demonstrations.

The jet fighter was originally powered by a Pratt & Whitney J57-P-7 axial-flow engine. Later models of the F-100 were powered by a Pratt & Whitney J57-P-21A engine. Both were two-stage turbojet engines with afterburner, rated in the 10,000-pound thrust class.

The F-100 had a service ceiling above 50,000 feet and a range of more than 1,000 statute miles.

In addition to the thin, highly swept wing and tail, the F-100 design incorporated other features that reflect an answer to the problem of supersonic flight. Heat-resisting titanium was used extensively throughout the plane. A low-drag, ultra-streamlined fuselage and canopy with but one thin-lipped air intake duct helped make supersonic speed possible. The canopy line matched the rear fuselage in a smoothly curving line so that from the side, the Super Sabre appeared to be slightly arched. Other features included automatic leading-edge slats and a low-positioned one-piece horizontal stabilizer. The F-100 was the first USAF airplane to utilize the low tail.

The plane had an automatically regulated air conditioning and pressurizing system and automatic fuel system.

Particular attention was given to placement of all controls, equipment and instruments in the cockpit for ease of operation.

FROM: http://www.boeing.com/history/

F-16 FIGHTING FALCON

Mission: The F-16 Fighting Falcon is a compact, multi-role fighter aircraft. It is highly maneuverable and has proven itself in air-to-air combat and air-to-surface attack. It provides a relatively low-cost, high-performance weapon system for the United States and allied nations.

Features: In an air combat role, the F-16's maneuverability and combat radius *(distance it can fly to enter air combat, stay, fight and return)* exceed that of all potential threat fighter aircraft. It can locate targets in all weather conditions and detect low flying aircraft in radar ground clutter. In an air-to-surface role, the F-16 can fly more than 500 miles (860 kilometers), deliver its weapons with superior accuracy, defend itself against enemy aircraft, and return to its starting point. An all-weather capability allows it to accurately deliver ordnance during non-visual bombing conditions.

In designing the F-16, advanced aerospace science and proven reliable systems from other aircraft such as the F-15 and F-111 were selected. These were combined to simplify the airplane and reduce its size, purchase price, maintenance costs and weight. The light weight of the fuselage is achieved without reducing its strength. With a full load of internal fuel, the F-16 can withstand up to nine G's - nine times the force of gravity - which exceeds the capability of other current fighter aircraft.

The cockpit and its bubble canopy give the pilot unobstructed forward and upward vision, and greatly improved vision over the side and to the rear. The seat-back angle was expanded from the usual 13 degrees to 30 degrees, increasing pilot comfort and gravity force tolerance. The pilot has excellent flight control of the F-16 through its "fly-by-wire" system. Electrical wires relay commands, replacing the usual cables and linkage controls. For easy and accurate control of the aircraft during high G-force combat maneuvers, a side stick controller is used instead of the conventional center-mounted stick. Hand pressure on the side stick controller sends electrical signals to actuators of flight control surfaces such as ailerons and rudder.

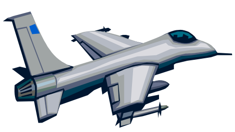
Avionics systems include a highly accurate inertial navigation system in which a computer provides steering information to the pilot. The plane has UHF and VHF radios plus an instrument landing system. It also has a warning system and modular countermeasure pods to be used against airborne or surface electronic threats. The fuselage has space for additional avionics systems.

USAF F-16 multi-role fighters were deployed to the Persian Gulf in 1991 in support of Operation Desert Storm, where more sorties were flown than with any other aircraft. These fighters were used to attack airfields, military production facilities, Scud missiles sites and a variety of other targets.

During Operation Allied Force, USAF F-16 multi-role fighters flew a variety of missions to include suppression of enemy air defense, offensive counter air, defensive counter air, close air support and forward air controller missions. Mission results were outstanding as these fighters destroyed radar sites, vehicles, tanks, MiGs and buildings.

Since Sept. 11, 2001, the F-16 has been a major component of the combat forces committed to the Global War on Terrorism flying thousands of sorties in support of operations Noble Eagle (Homeland Defense), Enduring Freedom in Afghanistan, and Iraqi Freedom

FROM: http://www.af.mil/



Appendix #5

The JDAM

By J.Dunnigan

What JDAM Hath Wrought

©2006 James Dunnigan

Military commanders the world over are struggling to figure out how to deal with the massive changes created by the arrival of GPS guided bombs. The United States has most of them, and the ability to stop others from using them *(America controls the GPS satellites)*. The impact of JDAM has been enormous. It has made air power much more effective, reduced casualties for the force using them, and sped up combat operations.

Few people, however, seem aware of how much JDAM has changed the way wars are fought.

The appearance, and impact, of JDAM has been sudden. While guided bombs first appeared towards the end of World War II, they did not really become a factor until laser guided bombs were developed in the 1960s. A decade later, TV guided bombs came into service. But these guided bombs were expensive, costing over $100,000 per bomb. Even as late as the 1991 Gulf war, only 16 percent of the 250,000 bombs dropped were guided. Analysis of the battlefield later revealed that the guided bombs had done 75 percent of the actual damage. But the guided bombs were still too expensive, and lasers were blocked by many weather conditions (rain, mist, sand storms). Something new was needed to replace dumb bombs completely. The solution was GPS guided bombs.

In 1991, the GPS system was just coming into service. There were already plans for something like JDAM, but no one was sure that it would work. Once the engineers got onto it, it was discovered that JDAM not only worked, but cost less than half as much to build *($18,000 per bomb)* as the air force had expected *($40,000 per bomb)*. So in 1996, production of JDAM began.

The bombs got their first workout in the 1999 Kosovo campaign. To everyone's surprise, **98 percen**t of the 652 JDAMs used, hit their targets. In 2001, JDAM proved the ideal weapon for supporting the few hundred Special Forces and CIA personnel the U.S. had on the ground in Afghanistan. The JDAM was more accurate, and effective, than anticipated. By January, 2002, the U.S. had dropped about half their inventory, of 10,000 JDAMs, in Afghanistan. In 2003, 6,500 JDAMs were used in the three week Iraq invasion. Since 1999, American aircraft have used about 20,000. New versions have added more capabilities.

The latest versions are even more accurate, putting half the bombs within **ten meters** of the aiming point. A new 250 pound version is entering service this year. Another new version, with wings, is on the way, which will enable a bomber to drop the bomb up to **100 kilometers** from the target.

JDAMs are pretty rugged. F-22s have dropped half ton JDAMs, from 50,000 feet, while flying at over 1,500 kilometers an hour.

Even American war planners are not completely sure what the overall impact of JDAM is going to be. That's because the army has introduced GPS guided rockets and artillery shells as well…! Sorting out all the impacts on military operations is complicated by what the enemy will do. So far, JDAM has only been used against tribal warriors and urban guerillas. These foes have been resourceful, but have not been able to do much to degrade the impact of JDAM. Against professional troops, the situation may be different. This uncertainty has generals planning for places like China, Iran and North Korea worried.

The U.S. is currently producing 3,000 JDAMs per month, and is planning to build an inventory of about 200,000. China, Russia and the European Union are building their own GPS systems which - among other things - will enable them to build JDAM type bombs that the U.S. cannot shut down. Even then, using satellite guided bombs against U.S. forces will still be complicated by the need to get your aircraft into the air. No enemy air force has been able to do that for over half a century. So, for the moment, JDAM is an American advantage, and enormous one at that, and one that has changed the way wars are fought in more ways than most people realize.

Appendix #6

Carrier Ops

By Chewbakka

CARRIER OPERATIONS in Falcon 4.0™

Contents

Intro:

Inspired by BeachAV8R's Training AARs (http://www.mudspike.com/falcon.htm) I decided to make a little manual for carrier operations in Falcon 4.0™.

This is mainly to explain things to myself and to n00bs who don't want to search thousands of threads in the forums. It is also intended to collect and summarize all bugs and issues that still remain to be patched or worked upon in this corner of F4.

There are some instructions on carrier operations in the **RedVIPER Operations Guide**, but this Article builds upon that with far more information. It has taken a lot of "tweaking" and a few dozen aircraft and aircraft carriers until I've gotten to the point where I get 80% of my landings right.

I know *"...this is an F-16 sim so quit bitching about the carriers..."*, but FreeFalcon has always made an effort to offer multiple flyable aircraft, so - while the carriers are there - we might as well try to have fun with them.

I have no intention of describing real carrier operations, as there's plenty of material around. I want to point out what can or cannot be done in Falcon 4.0™. Carrier ops in F4 are one of the most unrealistic features of F4. Procedures that work in F4 do not at all resemble procedures on a real carrier.

DO NOT TRY THIS ON YOUR CARRIER AT HOME!

I also want to point out the many bugs that are connected to carrier ops in F4, hoping they'll be fixed in future versions. However, some of them can be worked around (see *BUGS Section*).

Thanks to *Wolfhound_32* for contributing his procedures for the F-14D and for pointing out a few things about RL operations.

Available aircraft:

Sorry to disappoint the reality-freaks, but it seems that in Falcon 4.0™ you can actually land **every flyable plane on a carrier**. Even a C-130. ☺ If they don't have a hook in RL you can still simulate the hook in F4 (Ctrl-k). If you cannot see the hook in the outside view, use the standard F-16 cockpit and check the position of the hook switch to make sure it is down. **Be advised** → You'll be having to make your own TEs to fully enjoy Carrier Ops in F4.0™

This is a list of aircraft that are known to be carrier capable in RL. *Choppers are not flyable in F4.*

A-1 Skyraider: not flyable in F4

A-4 Skyhawk*: is very easy to land, flaps out and you can get her down to 130KIAS landing speed, makes pretty good trainer, just pretend it's a T-45 Goshawk*

A-6 Intruder: *has manual LEFs and TEFs - so figure out the key-combos first*.

A-7 Corsair: *I wouldn't think you could land with the speedbrake open in RL? In F4 you can.*

AV-8B / GRMk3 Harrier: *This one is fun - You don't get true STOVL, but you get good STOL. Page 113 of* The **RedVIPER Operations Guide** *further describes the handling of the Harrier. The flaps simulate the thrust nozzle vector so full flaps will give you max lift, also pop out the speedbrakes and deploy the hook (there is none, I know, but you can actually hear it extend ?? and it is needed to come to a full stop on the deck - see screenshots). I got her down to 45 knots and since the carrier is going 27 knots itself I touched down almost vertically. For takeoff just pull up the virtual hook, set full flaps, leave the speedbrake out and hit the throttle and you'll pop up like Tigger.*

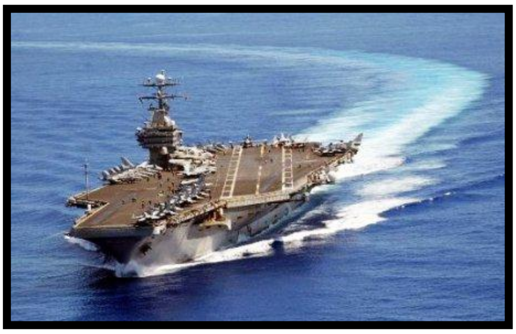
C-2A Greyhound COD: not included in FF4.0/RV1

E-2C Hawkeye: *this one is easy*

EA-6B Prowler: *see Intruder*

F-4 Phantom

F-8 Crusader: *she's a beauty.* Flap keys *tilt the wing*



F/A-18A-D Hornet

F/A-18E/F Super Hornet

F-14A-D Tomcat

F-35 JSF: *we're still waiting for this one…* ☺

KA-6D Intruder-Tanker: *not included in FF4.0/RV1*

MiG-29K: *not included in FF4.0/RV1*

MV-22 Osprey: *not flyable in FF4.0/RV1*

Rafale M

S-3 Viking: *not included in FF4.0/RV1*

Su-27K*: not included in FF4.0/RV1*

Su-33 Naval Flanker: *seems to be more stable in the air than the F/A-18C, takes off like a missile, took off from Cat 1 and was airborne before the end of the deck*

Super-Etendard: *not included in FF4.0/RV1*

T-1 Buckeye: *not included in FF4.0/RV1*

T-45 Goshawk: *not included in FF4.0/RV1* - use the A-4 instead

GAME OPTIONS → How to set up the sim for carrier ops:

Landable carriers can be found using different methods:

Use one of the 'carrier landing....' TEs.

Make your own TE.

This is rather difficult, so you should use the Mission Builder Guide in this Manual.

To find out which carriers you can take off from, display battalions or assign flights of the different F-14 and F-18 variants and they'll be placed on the carriers automatically.

To take off from the Kuznetzov, change to red side and assign a flight of Su-33 Naval Flankers.

If you want AWACS to vector you to the carrier group **-** don't forget to include an AWACS flight in your TE or uncheck "*AWACS Required*" in your **RV Config Editor**

Naval TEs sometimes cause CTDs for reasons unknown, but it seems to help if you delete all the ships you do not need.

Don't forget to study the "Mission Builder Guide" .

Click on a carrier in a campaign and join one of its F-14 or F/A-18 squadrons.

Use one of the TEs I have put for download **here** *(active link)* and add your own planes *(these are my test TEs and have the Truman and the Kuznetzov spaced about 100 miles apart so you can practice hops between them. I made the Kuznetzov friendly so they do not shoot at you. She is actually easier landable than the American carriers although the darker deck is harder to make out against the dark sea. Unfortunately the jump-ramp does not work - you take off right through it.)*

Note: Want eye-candy…? Make a TE and pick one of the fully textured carriers (use TacRef to check).

LANDING ON A CARRIER

Since landings are the hardest part I'll try to explain those first:
This is a general description that is meant to fit a variety of planes, and allows you some time and safety margin for your preparations.

For more 'aggressive' and refined procedures see ***Wolfhound's section***.

The factor that makes the biggest difference for the different planes is the landing speed. Try to find the best landing speed for your plane before you attempt to land at a safe altitude: pop out the flaps, the speedbrakes and the gear (below 300KIAS) and then slow down and try to find the slowest speed you can hold an AOA of about 3-5 degrees while maintaining level flight. Some recommendations:

- (min Speed in *KIAS*):
  - F/A-18: **142**
  - F-14: **125** / **135** *(w/tanks)*
  - E-2C: **118**
  - S-3: **117**

Preparations

Send your wingmen to RTB as soon as you're feet wet and clear of enemy fighters. AI pilots don't land on carriers (since the term AI implies at least some intelligence these guys probably know better than to try a 'controlled' crash of a million dollar plane on a billion dollar ship). They will go for the alternate and it makes no sense to have them burn their fuel just to watch you land.

If you have just accomplished the best mission you've ever flown, killed 117 ground movers and six bandits and you are sure you're in for at least a DFC - head for the alternate. There is a good chance you'll have to discard the mission when you mess up your landing on the carrier *(see Bugs).*

You can get rid of unused bombs now.

This is not strictly necessary in F4, but the lighter your jet is the easier it can be controlled on final. If you decide to keep unused your ordnance it is OK too - it does not make the explosion any bigger whey you crash. RL pilots tend to bring unused ammo back on deck nowadays, since the ordnance has become more expensive and procedures have become safer.

Call AWACS for vectors to the carrier group (QQ7). AWACS will give you vectors and, what is more important, the TACAN channel of the carrier.

Hit T-ILS on the ICP, enter the channel, push ENTR, push the DCS up once to get back to the scratchpad and push 0 on the ICP to change the TACAN band from X to Y (for dynamic TACAN) then push ENTR again.   You can do all this on the backup panel as per F4 manual if you want, but by using the ICP you can keep your eyes on the instruments.

Switch the ILS/NAV switch to NAV and if you are in range for the TACAN you should be getting bearing and DME to the carrier on the HIS

You can also head for the waypoint that is supposed to be over the carrier, but the carrier will have moved and is usually between 5-15 miles away from this waypoint.

Switch the ILS/NAV switch to NAV and if you are in range for the TACAN you should be getting bearing and DME to the carrier on the HIS

You can also head for the waypoint that is supposed to be over the carrier, but the carrier will have moved and is usually between 5-15 miles away from this waypoint.

Switch your radar to SEA-Mode and SP - if you see a lot of returns in an area of about 2 miles around that will be your carrier group

Now that you have found the carrier you need to find which way to land.

- ***DO NOT CALL INBOUND*** - well you can - but do not push ***T1*** - you will more than likely get an immediate CTD *(see BUGS section)*
- Do a low pass over the carrier *(you've all seen TOP GUN - just like that)*. Since AI pilots don't like to land on carriers the airspace should be clear.
  Try to fly parallel or straight over the carrier's landing deck (on US carriers this is the one that is at a left offset angle to the direction the carrier travels) and note the heading it is pointing at. It should be pointing into the wind, but since the carrier has no way of knowing you are inbound (see previous) she wouldn't have time to turn into the wind (and I'm not sure this is modeled in F4 anyway).
- The number on the "runway" does not indicate a heading.
  It is the number of the ship…!
- Click on the CRS button of the HSI and enter the heading.
- Now head the opposite way the carrier is going and keep going for some miles (the further out you go the more time you'll have to get set up for approach.

Approach

- Now use your HSI to do an instrument approach as described in the F4 manual.

- You have not read that? Well, turn about 90 degrees to intercept the radial that you have just entered for CRS (190 in the example below), when the middle part of the needle starts to come closer to the center turn to the heading that you noted in the Top Gun scene.

7 miles out, needle is coming down to the center, time to turn right 190

That was by no means a precision approach like ILS would be, but at least you are coming in from the right direction now. ***Note:*** *When you need less time to make your preparations for landing, skip the part above. Just stay in visual range and line up visually.*

Start preparing your aircraft now:

- Get down to about 1000ft MSL and level out
- Turn Radar Altitude on and set your ALOW to 100 ft. The carrier's deck is 97ft *(Nimitz-Class)* above MSL so if set at 100 ft and your ALOW is flashing you'll be already below the ramp and likely hit the stern.
- Slow down, pop the speedbrakes all the way out
- When you're below 300KIAS drop your gear. When you are flying the F/A-18C/D your speedbrakes will automatically retract when you drop the gear. So if you need to lose some more speed in an F/A-18, wait a little longer before you drop your gear
- Unlike RL your weight (well your A/Cs weight) does not matter for the landing on the carrier except that your plane handles easier when it is lighter. So if you'll feel more comfortable you can dump some fuel, but keep at least 2000lbs *(depending on your A/C)* in case you have to go around.
- If you are flying an aircraft with manual flaps or have your F/A-18 set on manual flaps - start deploying the flaps when your airspeed approaches 200KIAS. If you put the flaps out above 225KIAS you may get a flashing 'RDC SPEED' on the HUD - so slow down first.

Be familiar with the modeling of flaps and speedbrakes for the various aircraft you are flying. Flaps should be fully deployed, and speedbrakes will sometimes retract automatically when certain criteria are met.

- The key to getting arrested (trapped, stopped, kept aboard) on a carrier in RL and F4 is to have the arrestor HOOK DOWN.
- Do this now *(unlike in MS FlightSim you're not going to fall out of the sky when you do this).*
- Make sure you have DriftC/O turned off and be prepared for a crosswind landing
→ push SEQ on the ICP DCS to display wind info in the DED.
- The contrast between the dark sea and a bright blue sky can make it difficult to see everything in your HUD with the standard green symbols. Switch to red - this can be seen equally well against bright and dark background.
- The usual stuff: Master Arm OFF, Laser Off, landing light on, position lights on (to flash), be polite to the ATC, and turn your radar off (not RadAlt), etc…

You should be in level flight at 1000ft and about 200KIAS by now - keep it that way until you are about 1 mile out. **NOW:**

There's a bunch of ships in view - aim for the biggest

- As soon as you can make out the carrier's deck start lining up. If you want more realism go for the offset landing deck that would be used on a real carrier. In this case you aim your nose a little to the right of the carrier first....
- .... and turn left as soon as you intercept the runway heading.

*You need to Call the Ball now, and **do it loud**.*
There is no ball on the carriers in F4, but your family will have some fun when you do so…!

If you like it a little easier, line up parallel and to the left of the carrier's sail.
The deck is longer there, and - since the AI pilots don't like it - the deck will be empty.

Touchdown:

- You'll have to do a lot of things real quick now so be prepared:
- Depending on the weight and type of your A/C keep your AOA as low as possible i.e. keep your airspeed up. 200KIAS would kill you in RL, but are fine in F4. You should be able to bring the most planes in at 150-180 knots.
- Come in low, keep your glideslope low - as if you wanted to make a real low and slow flyby
- Watch your altitude - the deck is at 97 feet MSL if you're lower - you are not going to make it. Be careful when you have to come back up. If you throttle up too much you'll go up too high and your glideslope is going to be too steep
- Aim your FPM slightly behind the ramp
- Some carriers have wires painted on the deck - ignore them.

(For reality's sake you can try to catch the number three wire and make sure you have ACMI running when you hit it.) All that matters in F4 to get trapped is to have all three wheels on the deck. Your airspeed and your throttle setting do not matter, as long as you get all three wheels on the deck you'll get arrested. *

*[*Editor's Note: I've been arrested for a lot less than this…]*

• DO NOT FLARE - you'd pop right back up and overshoot. The landing gear of naval A/C is build to take abuse - so slam it down.

• As soon as you cross the ramp pull back your throttle to drop the few remaining feet and at the same time push your stick all the way forward. You need your nose down before the deck ends.

• When you hear your main gear touch down and your nose drops, put your throttle in afterburner (if your plane has one). That way you'll have enough energy to take off again if you fail to get your nose down in time.

• If you see the opposite end of the deck disappear under your nose (you can't see it in the HUD anymore) pull up 15 degrees, make sure to hit AB, retract the gear and hope for the best.

• If you got all wheels on the deck before you fall off at the other end you'll be stopped - no not slowed down to a stop, but STOPPED.

It's a bit disappointing - no deceleration at all. You don't even get the 1.2 seconds it takes in RL. As if somebody had cut out some frames of the film, you'll just sit on the deck, happy to still have your simulated life.

"OK son, we got ya'. You can throttle back now, you're not going to make the ship go any faster."

WOLFHOUND'S LANDING GUIDE FOR THE F-14

In the F-14 I usually dump fuel to about 3000 lbs, so I can fly a more realistic landing speed
Enter the case 1 landing pattern from behind the ship. Fly at 800 ft and ~400 kts in the upwind leg.
Put the hook down (better be early than too late).
Remember if you forget the hook and you bolter or the LSO has to remember for you, you owe the LSO's a beer!)
Fly over the ship and count to 5 potatoes.
Then bank the plane 80 degrees and make a 4G turn and turn to the downwind leg.
If you're cool, don't count to 5 and enter the break right above the ship.

In the downwind leg go to 600 ft and dirty up the plane.
Brakes out, gear down @ 250 kts and @ 200 kts flaps down.
Make the turn to final and at three-quarters of a mile → call the ball.
In the F-14 keep your airspeed between 140 and 150 kts *(depending on your weight)*.
Keep your flight path marker between the 2,5 °and 5° line on your HUD and aim for the 1 wire.
This is a steeper approach than real life and goes against every rule of a real carrier landing, but this is Falcon…☺
We need to ignore the real life rules of carrier ops.

Set your throttle at about 75%. Try not to go to idle thrust. Keep this attitude until touchdown.

Once you hit the deck, pull back the throttle to idle and push the stick forward.
(This goes against the rules of carrier aviation, but in Falcon it gets the nosewheel on deck).
Don't worry about the bolter. You'll find out soon enough if you can't get the nosewheel down, and still have plenty of time to go to back full MIL power if that happens.
Once your nosewheel is on *deck (or if you do bolter)*, go back to full MIL power (if in the F-14B/D).
This way you can take off again… If necessary → Retract the airbrake and go around.

In older versions of F4.0™ the landing procedure was a bit different. You could fly a normal approach to the ship, in a normal attitude and try to aim for the 3 wire. Recently, you can't push the nose forward very easily anymore and you have to aim for the 1 wire and fly the steep approach to be able to stop in time.

Note: RL carriers are hard to sink - F4 carriers are not.

If you hit the stern of the carrier *(came in too low)* or the sail - the carrier will sink.
It will not sink when you fall off the other end of the deck.

This will not matter to you since you'll be resurrected for the next mission, but if you are in a campaign and want to use the carrier for the rest of it, you'll have to DISCARD (Esc-D) the mission after you crashed.

If the carrier is sunk and you exit your mission Esc-E - it will be gone for the rest of the campaign.

You can still be tasked for missions from the carrier in 2D, but you will not be able to land on it or take off from it in 3D - it'll be gone. *(see* BUGS Section *for important details).*

TAKEOFF FROM A CARRIER (Here's the easy part...)

Preparations: You can take off either right after you've landed *(if you still have fuel)* or... ...after picking a mission in campaign that was still in 'Briefing' status .

In this case choose 'Taxi' or 'Takeoff' *(see section BUGS first).*
Do not choose 'Ramp' since it is likely that your plane will be positioned on the edge of the deck with your nose pointed out to the sea. If you are real good at turning in place you can give it a try, but there is no way to get pushed back in F4.

If you choose 'Taxi' you'll be positioned right behind two blueish or dark-grey lines on the deck - these are the catapults. For the sake of reality you can now taxi onto one of them *(but you don't have to in F4).* With a full load of weapons you might need a few feet more for takeoff so stay where you are or turn around and position yourself even further back on the deck.
The deck should be empty - your AI wingmen will start the mission in the air *(see section BUGS)*.

Don't worry about blast deflectors - there are none…! ☺

Be careful with your throttle when you taxi around, the acceleration needed for the takeoff is somehow coded into the surface of the carrier's deck and you'll accelerate much faster here even when you taxi. So keep your feet on the brakes.

Lower your hook - *this is contrary to RL, but the only way to simulate a cat launch in F4*.

Set flaps when necessary and do your usual pre-take-off routine. Make sure NWS is off.

Release brakes and push your throttle all the way to AB. If your hook is down you will not move.

When your engines have spooled up to max power:

retract your hook → you should now accelerate like a rocket.

As soon as you see the edge of the deck disappear below your nose *(but not a second sooner)* pull back on your stick and get your nose up 10-15 degrees. Don't pull too hard or you'll stall.

You can simulate a RL takeoff by trimming your A/C nose high before takeoff. This way you can take your hands off the controls the way RL pilots do it. Make sure you attach a pair of handles to the top of your monitor and be careful not to hit yourself in the face when you accelerate to 150+knots in less than 3 seconds.

Retract your gear before you reach 300KIAS.

Retract your flaps (if necessary), reset your trim, call your wingmen to rejoin and off you go.

The F-14 is a pretty heavy bird and you may have trouble taking off from the #1 and #2 cats *(the two short ones on the starboard side)*.

Here 's what works:

Wolfhound's takeoff guide for the F-14:

Taxi back to Cat 3/4. *This one is longer than Cats 1 and 2 in Falcon.*

Once in position, drop the hook and do pre take off checks.

Go to full military power *(I fly the F-14D, so afterburner not allowed!).*
From cat 3/4 you CAN take off in mil power, even with a heavy loadout.
Don't try it from cat 1/2 with a heavy loadout, because you will end up in the drink.

Once you clear the ship you can hit the burner with a heavy loadout, but you don't have to.

BUGS SECTION:

1. CTD when calling tower: This one does not seem to have a solution yet, it appears that since the carriers do not have an ATC modeled, something goes wrong when you try to call them and you get a CTD - this happens very often, but not always.

Workaround: do not use any of the Tower calls *(the "T" key)*.

2. Wingmen get stuck in the air above the carrier:

Sometimes you wonder where your wingmen are, or your entire package has refused to join you on your journey into enemy territory. Check your HSD screen and you'll see their Symbols still in the vicinity of your carrier.

Go back to the carrier (or kick in the autopilot and use Friendlies-View) and you find them circling above the carrier, or climbing like mad into the stratosphere right above the carrier, or just pinned to the sky - AB blasting, but not moving…! And most of the times they still have their gear down.

This seems to happen very frequently when you assign an AI flight lead and you are in #2 or #4 position. There seems to be no way to get them to do what they're supposed to do.

Wingmen gone mad ...

Workarounds:

- Fly as Lead.
- wait in 2D for the package to take off and join them later .
- if you're flight lead call Rejoin to get them going

- Wolfhound: *"If I do fly as wingman I usually start the mission and take off from the carrier. Once I'm airborne I end/discard the mission and advance the timer in 2D world. When the timer is after take off time I rejoin the mission. Another workaround is starting the mission as flight lead and give your wingman the take lead command after take off."*

3. Aircraft sinks into carrier deck:

Workarounds:

- This does not hamper the performance of your jet.
- Do not use "external views" whilst on the deck You won't even notice.
- **Make sure that your vehicle magnification slider is set to "1"** .

4a. Carrier has disappeared: You come back from your mission *(that you have joined in flight)* , find the carrier group on the radar, there is a bunch of ships, but no carrier.

Well, it has been sunk - probably by yourself on your last landing attempt…!

While carriers can take a lot of beating from other units *(see #7)* they do not react well to pilots without 'artificial' intelligence crashing into their stern or sail. They SINK…
If you ended your last mission *Esc-E* after a crash, then your carrier will be gone for the rest of the campaign.

Workaround: When you have crashed trying to land on the carrier. always DISCARD the mission (Esc-D) *(Note: if you fall off the other end of the deck it will* **not** *hurt the carrier).*

4b. When your mission starts, you find yourself UNDERWATER and drowning:
This is linked to the BUG just mentioned. IF you sink your carrier (and – perhaps – are unaware due to an "Esc-E" *), there will be Consequences for the campaign:* The mission planning ignores the carrier's mishap and keeps assigning missions to take off from and land on the carrier. If you watch the 2D map you'll find lots of A/C on missions that originated on the carrier. You simply CANNOT use it anymore in the 3D World. *If you join a mission before take off you'll be dropped in the water as soon as the 3D loading is finished.*

Workaround: Wait for your flight to take off in the 2D UI before you join, and plan on landing on the alternate.

5. ATC gives no vectors for landing: If you've survived a call to tower while on a carrier mission and did not CTD, you'll find that ATC will not give you vectors to the carrier.

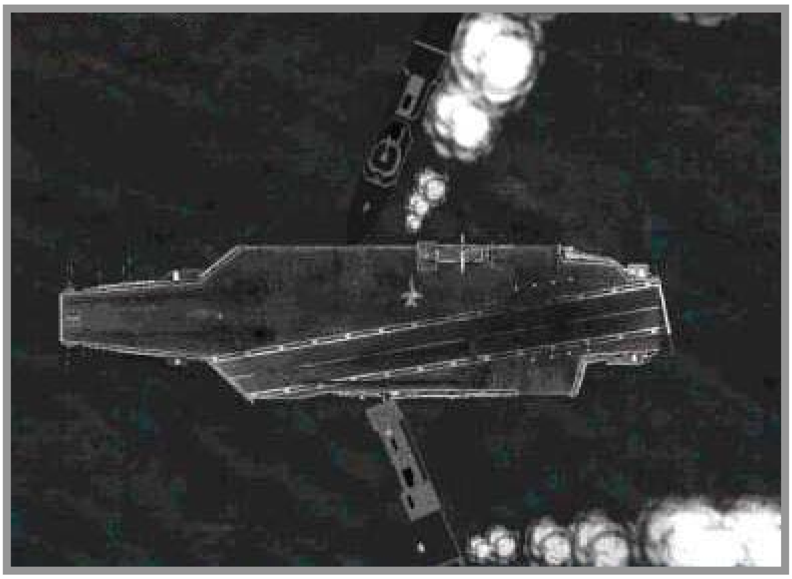
Workaround: Follow the "*Preparation Section*" earlier in this guide.

6. AWACS gives no vectors to carrier

Workaround:

- See #4 (Your carrier has been sunk),
- You forgot to put an AWACS flight in your TE.

7. Battlegroup moves erratcially:



For some reasons the ships of the carrier battlegroup sometimes start to move around erratically, changing course without coordination, driving into each other - apparently without damaging each other.

Workaround: Not required. This does not have ANY influence on your Carrier Ops.

Just watch and enjoy the show.

8. Some Carriers have no or only few textures

Workaround: TacRef is your friend.
(Carriers of the Nimitz-class and the Russian Kuznetzov do have decent textures.)

9. There are no other planes on the deck

- √ Your wingmen will start their missions in the air (see #2).
- √ F4 does not model AI takeoffs or landings.
- √ There are no static A/C on he deck either (see #8).
- √ Glass Half-Full: You have plenty of room to taxi around.

10. There is no Ball ... and no LSO
Correct. I guess that would be too much to ask for… ☺

11. When you enter 3D you do not get a full-screen picture but a little one in the upper right corner that shows an explosion

Well - you just sunk your carrier and your virtual self… ☹
You've been in the wrong place *(in the carrier's hitbox)* at the wrong time, and the carrier is very sensitive to this. This is not your fault - the game placed you at the wrong place at the wrong time and the carrier blew up even before the picture could go full screen…!

Discard your mission (**Esc+D**) or you'll loose the carrier for good.

Workarounds*:* *(There are a few you can try)*

- √ *S*ave your campaign, close Falcon, start Falcon and try again
- √ Pick a different mission and try again
- √ Do NOT not takeoff from the carrier.
  Wait in *2D* until your flight has taken off, and THEN join (this is the safest way).
- √ Do NOT use the *-NoLoader* option.
  A/C placed on the deck before this has been fully loaded will fall through.
- √ Try entering 3D using *Taxi* instead of *Takeoff*
- √ IF you have changed the hitbox values - set them back to the original values.

12. If I slew around in Orbit-View I can see through the deck:

Workaround: Don't screw around in Orbit-View.

http://www.biemiller.com/fstrap.htm

http://home19.inet.tele.dk/airwing/ships/kuznetso.htm

Appendix #7

Flight Model Work

An example of some of the Flight Models submitted for inclusion into FF4.0/RV1 by the European Development Team.

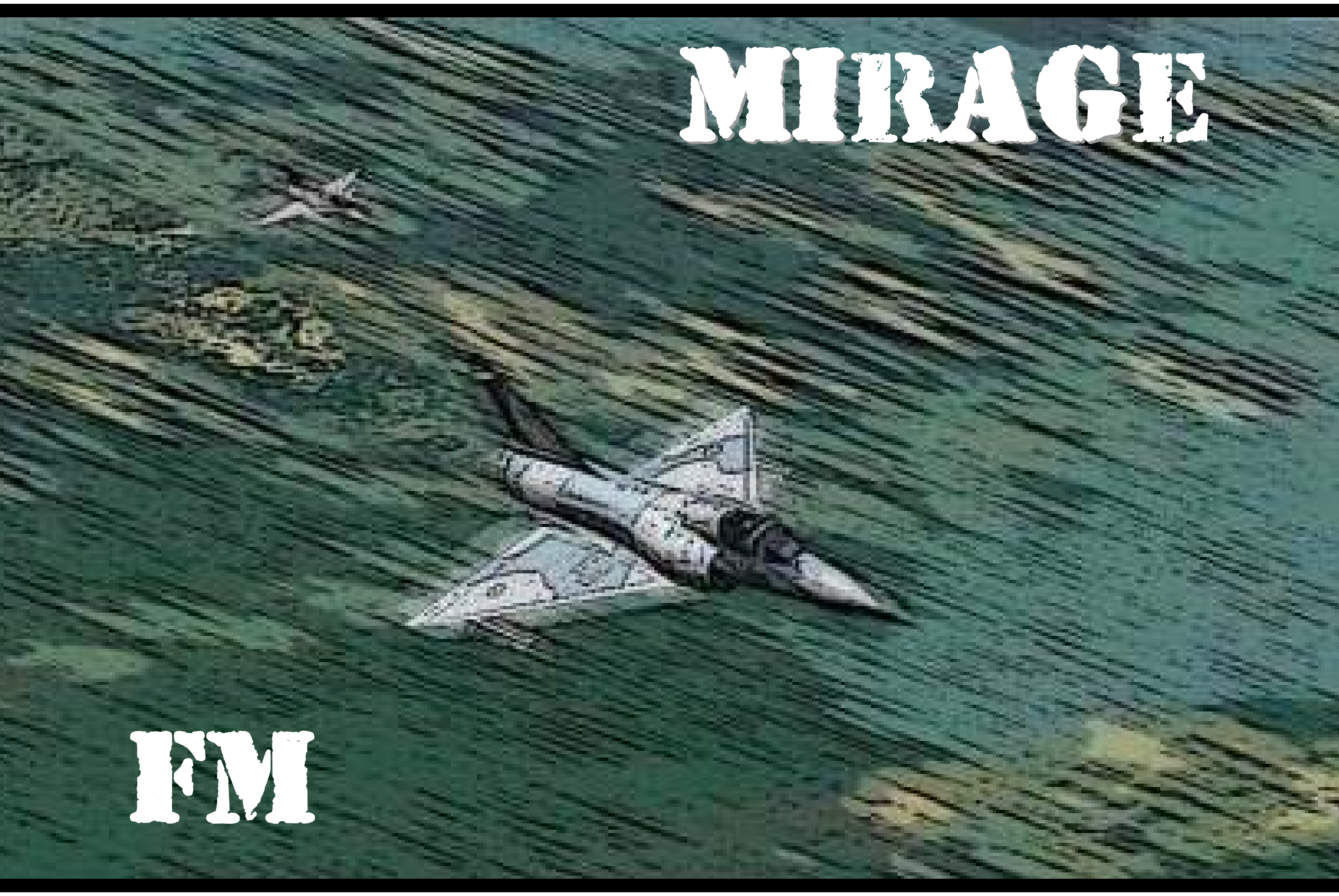
These charts will help give the virtual pilot insight and understanding of the attention to fidelity with regards the FF4.0/RV1 Flight Models.

Although all aircraft have such attention to detail, this Manual will present you with the Mirage, the Rafale and the Mig-29 as representative examples of the Flight Modelling in FF4.0/RV1.

By studying these charts, one may easily appreciate how closely the RV1 FMs approximate Real Life values and performance.

Special Thanks to Topolo for these presentations.

THE



Drag Index of Standard Weapons

- MATRA R550 Magic-II (with its pylon) : 4.5
- MICA (EM or IR) (with its pylon) : 5
- MATRA Super 530D (with its pylon) : 7
- RPL-541/542 : 12
- RPL-522 : 12
- AS-30 L (with its pylon) : 8
- Targeting Laser Pod : 7
- GBU-12 (GP) : 8

Standard Configurations

Mirage 2000-C

Configuration Name: Fox = 1xRPL-522 + 2xSuper-530D + 2xMagic-II

Configuration Name: Bravo = 2xRPL-541/542 + 2xMagic-II

Configuration Name: Kilo = 1xRPL-522 + 2xRPL-541/542 + 2xMagic-II

Mirage 2000-5

Configuration Name: Fox = 1xRPL-522 + 4xMICA-EM + 2xMagic-II

Configuration Name: Bravo = 2xRPL-541/542 + 4xMICA-EM + 2xMagic-II

Configuration Name: Kilo = 1xRPL-522 + 2xRPL-541/542 + 4xMICA-EM + 2xMagic-II

Mirage 2000-D

Loads: 2xRPL-541/542 + 2xMagic-II, 3,300lbs internal fuel

With flaps and gear down, minimum speed: 115Kts (CAS)

Rotation speed (Take-Off): 145Kts

Approach speed: 155Kts with AoA of 12-14 deg

Flaps and Gear up: 80% RPM give 350Kts (CAS) at sea level.

VNE (Velocity Never Exceed): 600 Kts / M=0.98 (Ultimate M=1.05)

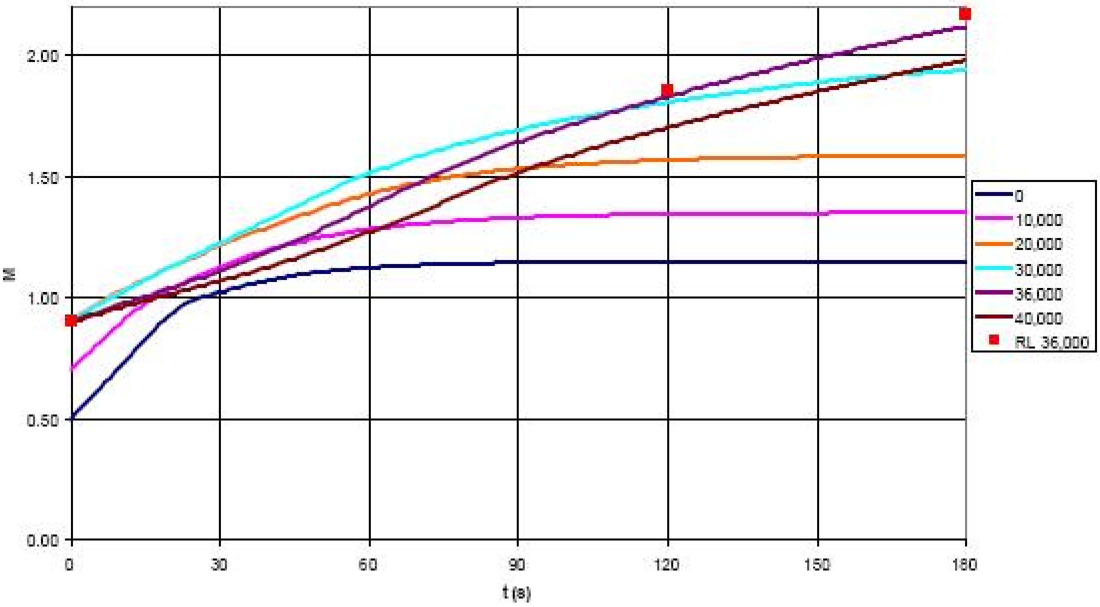
All configurations involving RPL-541/542 are limited to M=0.98 (ultimate M=1.05),

PL-522 seems to be limited to M=1.6

Flight Model - *1G Acceleration table*

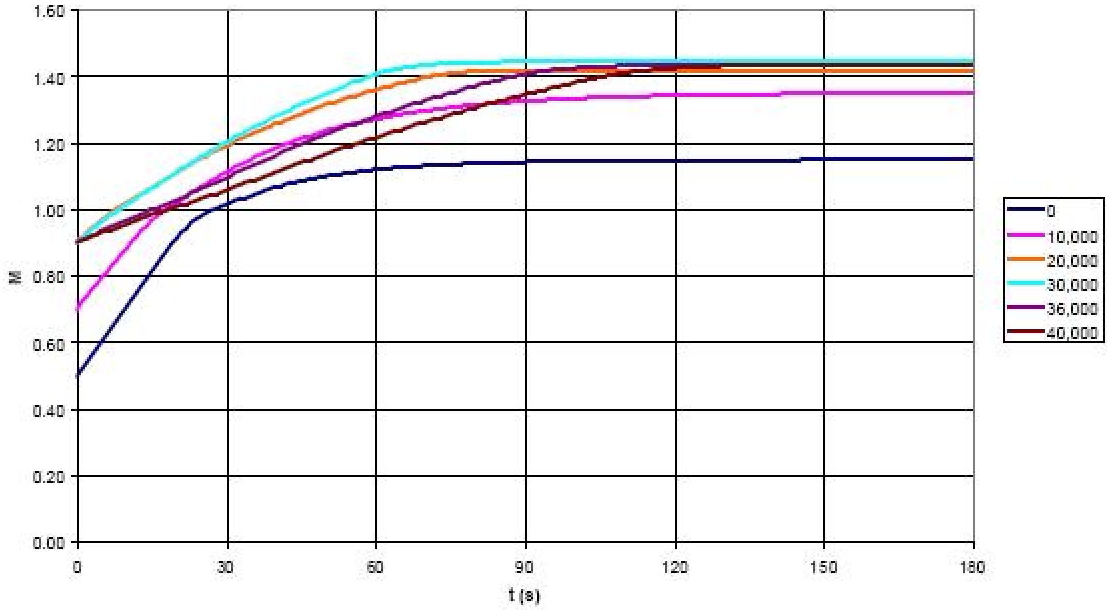
Mach (t)
Drag Index : 10 / 50% Internal Fuel
Full AB

Mirage 2000-C, 5F or -9



Mach (t)
Drag Index : 10 / 50% Internal Fuel
Full AB

Mirage 2000-D or N



Available public data:

Acceleration from Mach 0.9 @ 36,000 ft. → 2x Infrared Missiles/50% Int. Fuel/Full AB Power:
After 2 minutes = Mach 1.85 After 3 minutes : Mach 2.17

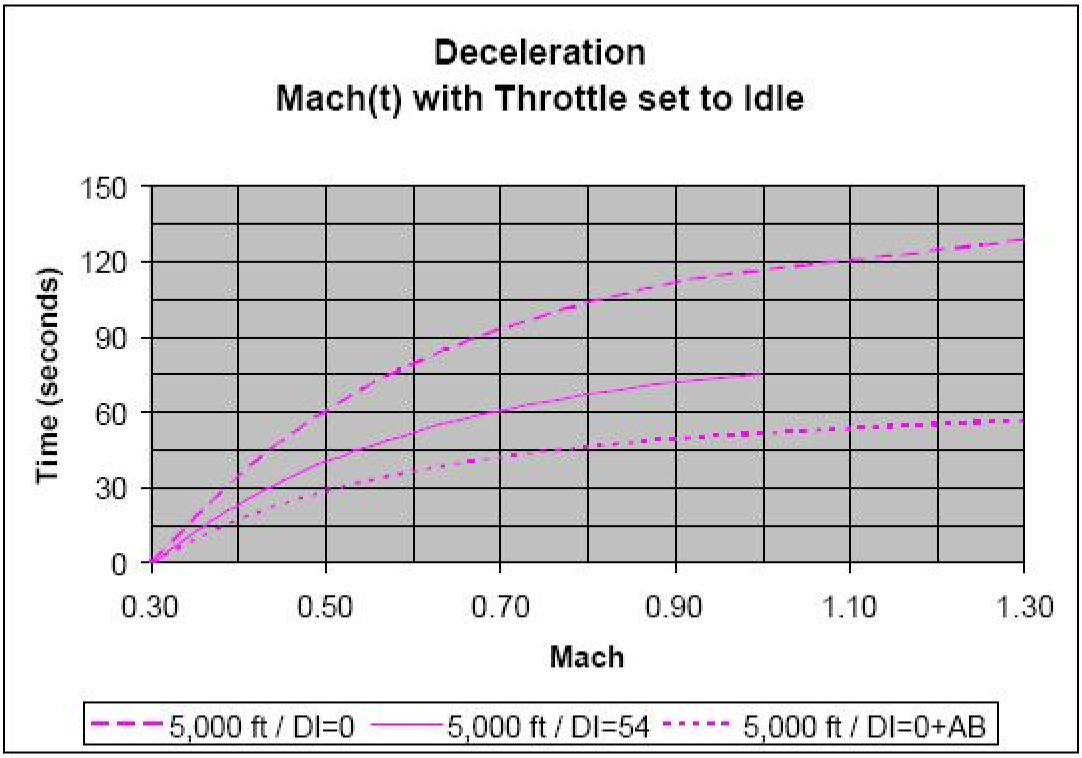
Flight Model - *1G Deceleration table*

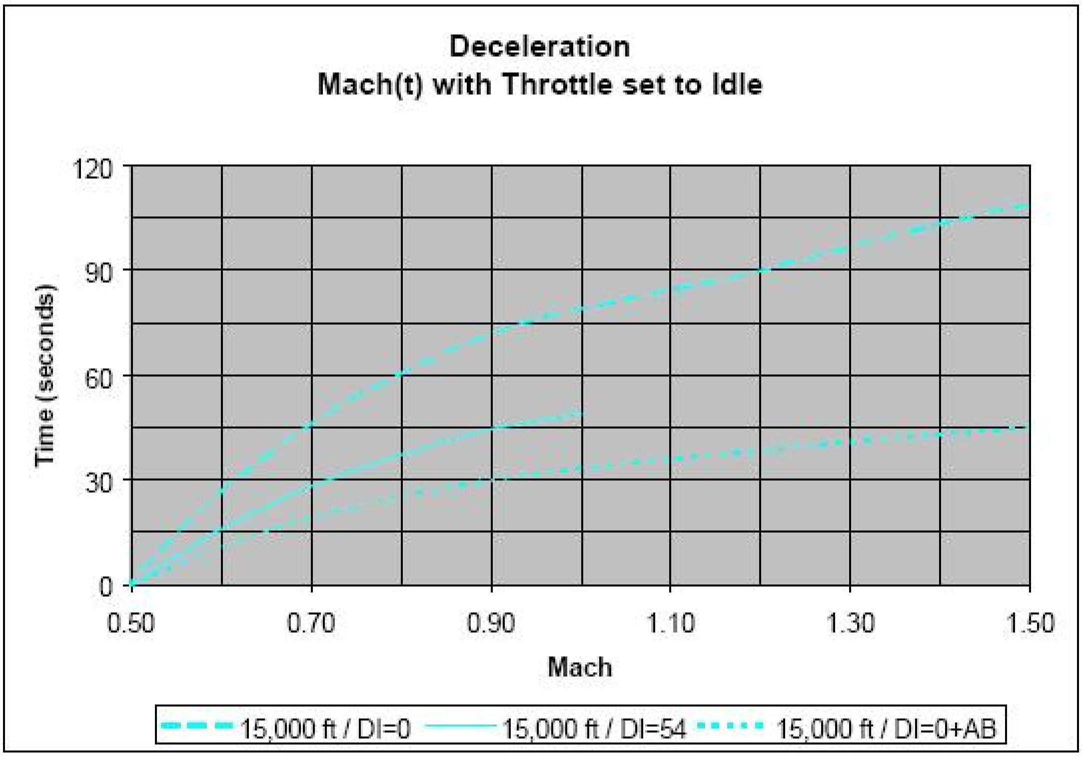
Data related to Mirage 2000-C:

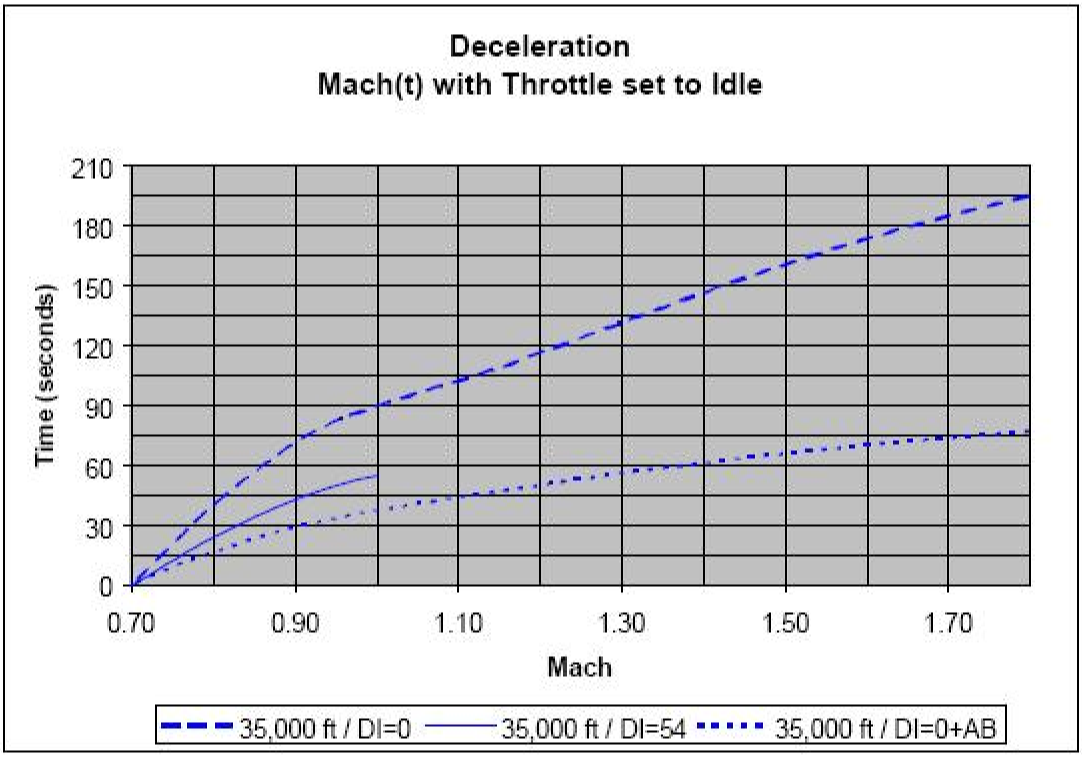
`Configuration` **DI=0** → `Non external load, 50% internal fuel,GW=20,000lbs`

`Configuration` **DI=54** → `2 RPL-541/542, 2 Magig-II and 4 MICA, 50% fuel, GW=25,500lbs`

Time (seconds)



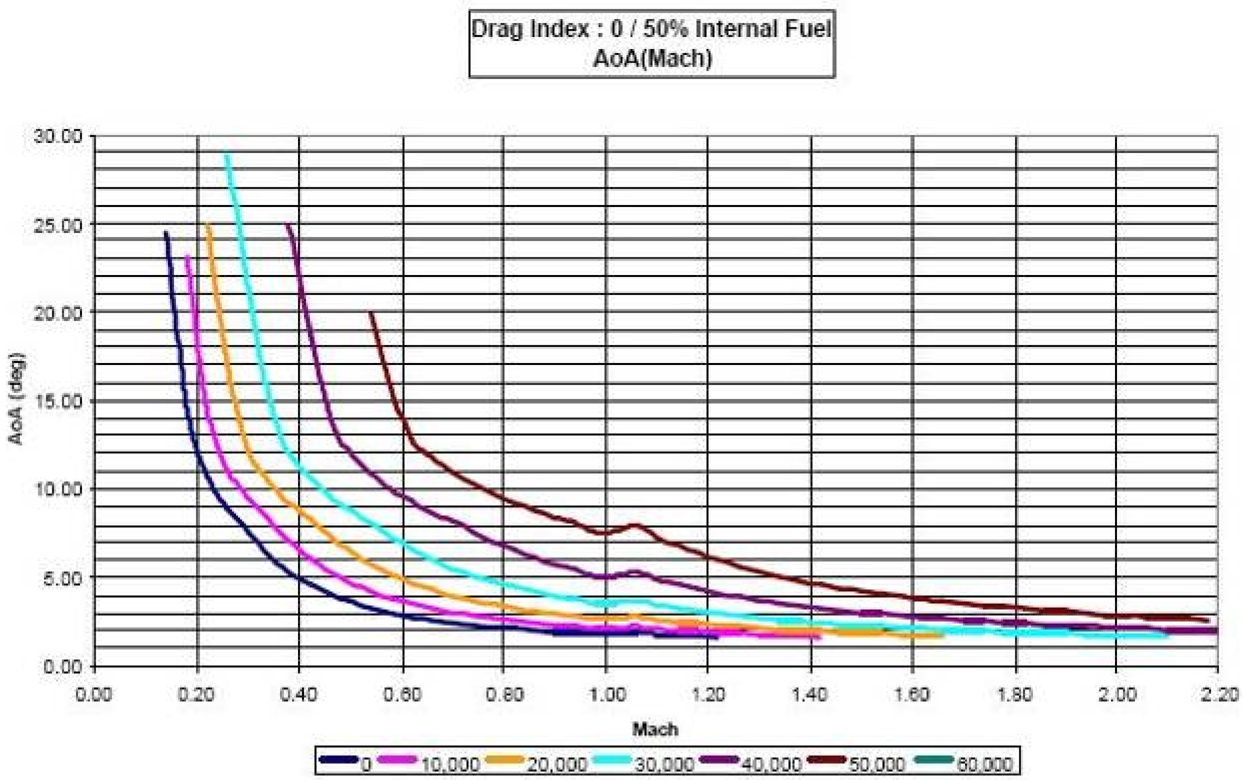

Deceleration
Mach(t) with Throttle set to Idle
120
90
60
30
0
Time (seconds)
0.50
0.70
0.90
1.10
1.30
1.50
Mach
15,000 ft / DI=0
15,000 ft / DI=54
15,000 ft / DI=0+AB


Deceleration
Mach(t) with Throttle set to Idle
210
180
150
120
90
60
30
0
Time (seconds)
0.70
0.90
1.10
1.30
1.50
1.70
Mach
35,000 ft / DI=0
35,000 ft / DI=54
35,000 ft / DI=0+AB

Mach number versus Angle of Attack

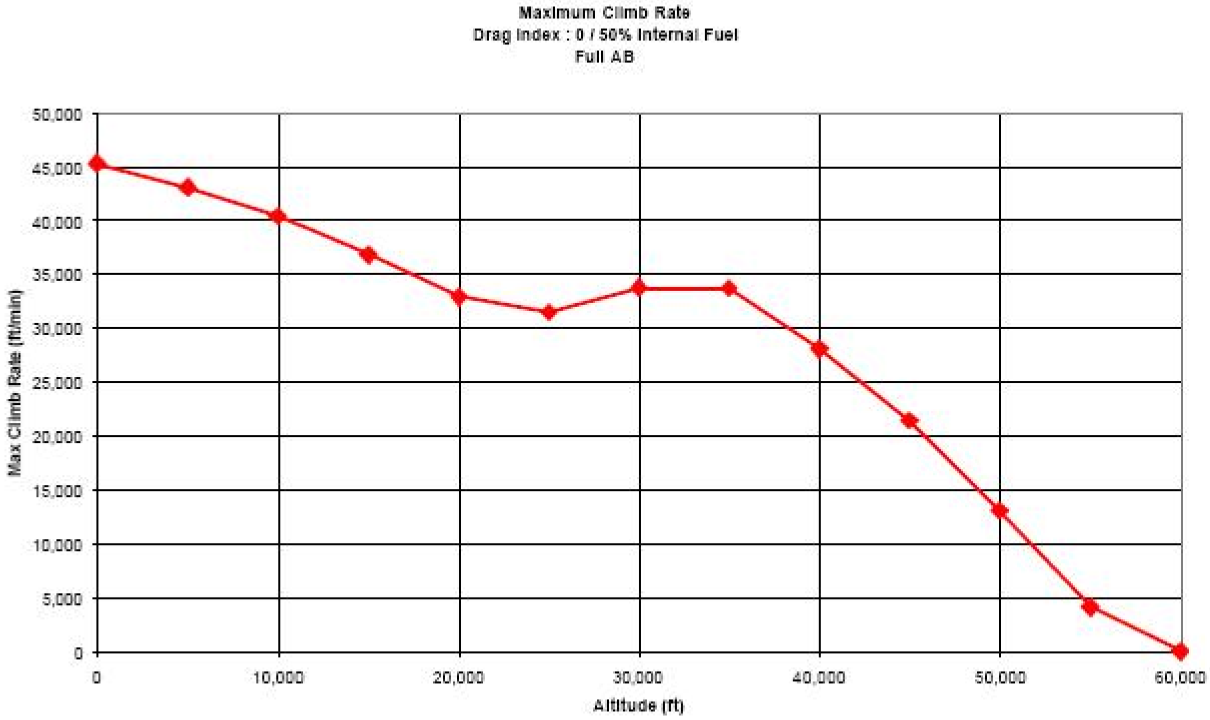
Set of curves giving Mach number versus Angle Of Attack, at stabilized flight level (1G), for a given altitude (from 0 to 50,000 ft, step 10,000 ft)

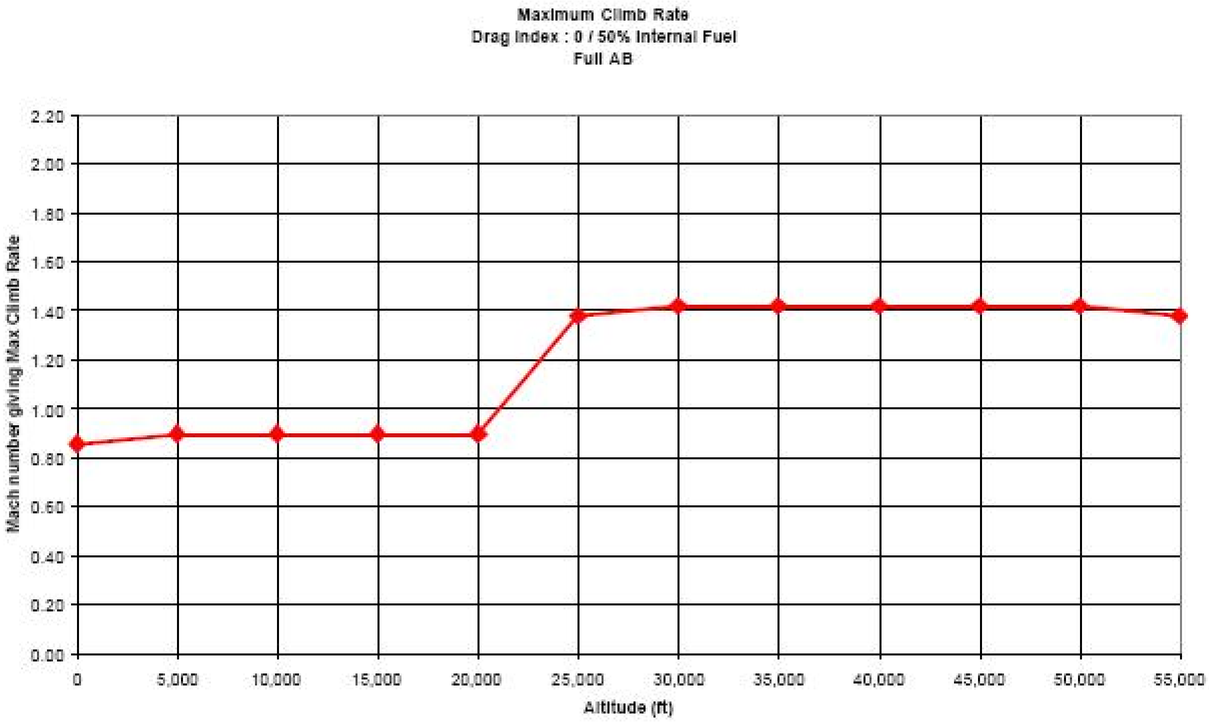
a) 2000-C, No external loads, 50% internal fuel: 20,000 lbs



Climb Rate

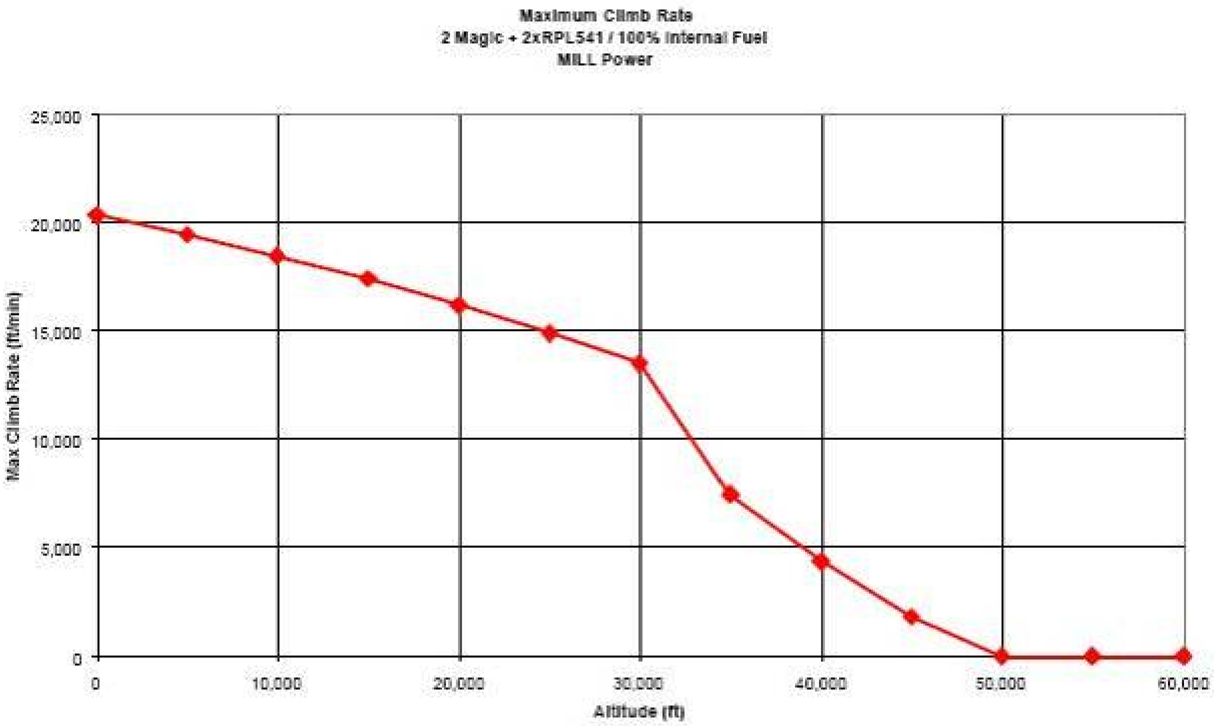
Maximum climb rate for Mirage 2000-C, 50% internal fuel, no external load (20,000lbs):





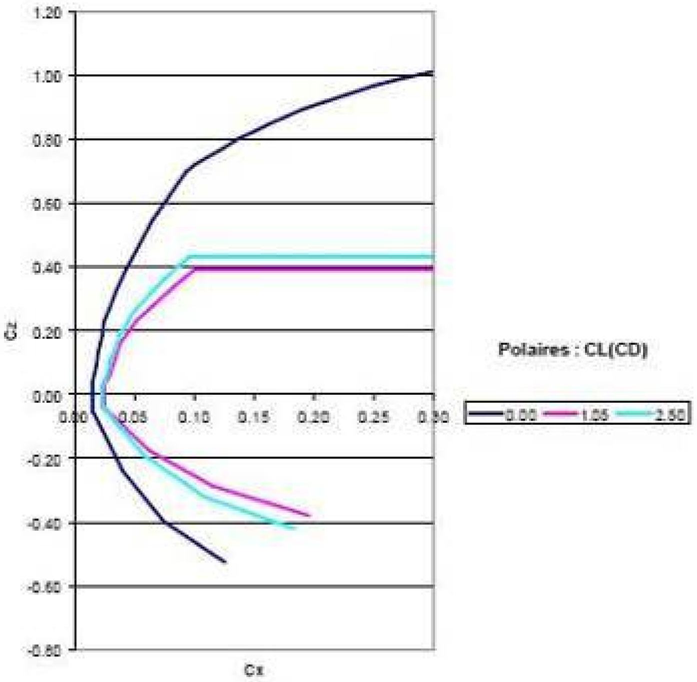
Maximum subsonic climb rate, for Mirage 2000-D:

100% internal fuel, 2 Magic and 2 RPL-541/542 (GW=32,500lbs):

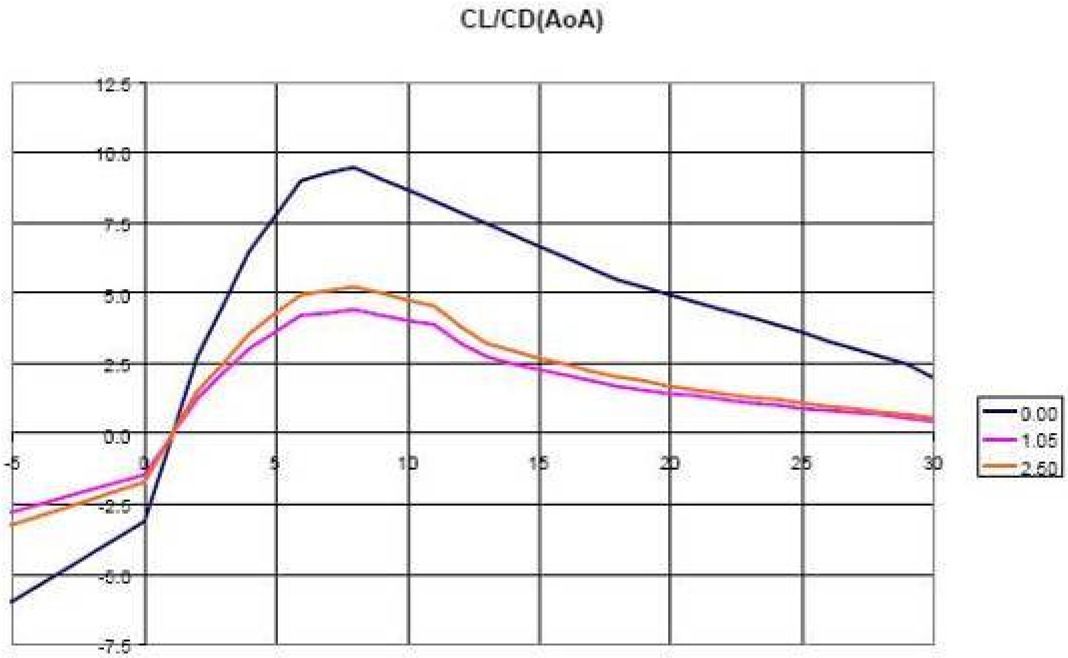


Aerodynamics Coefficients:

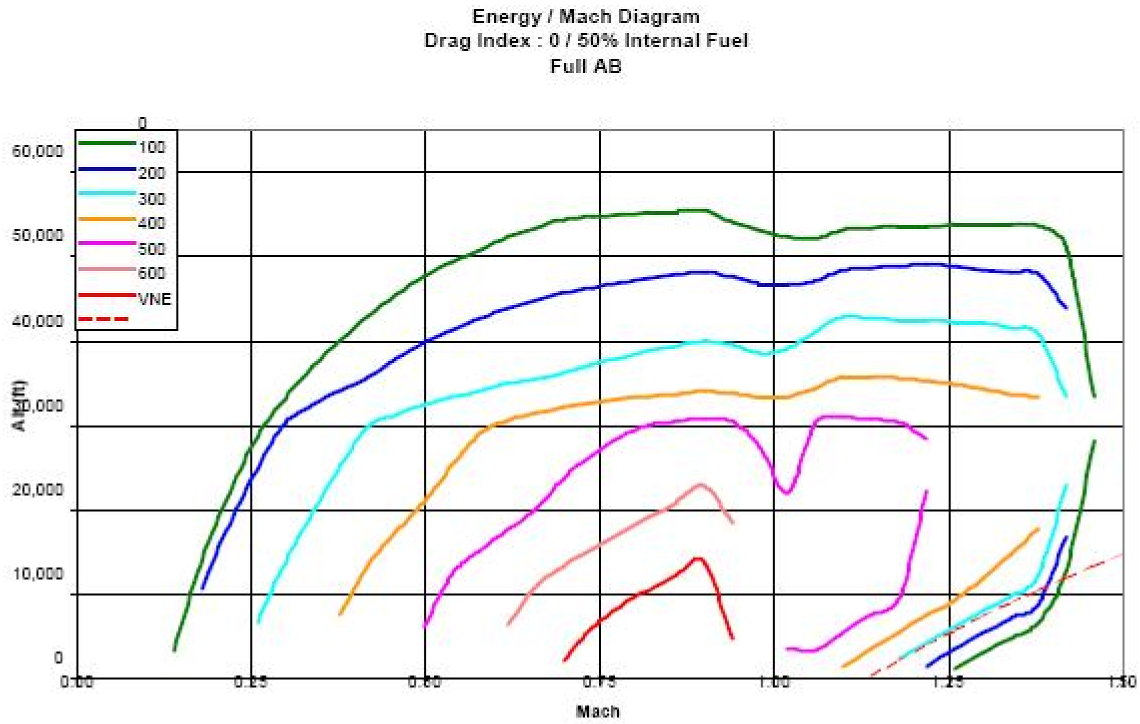
Data (Cl and Cd) used in F4.
CL(CD)



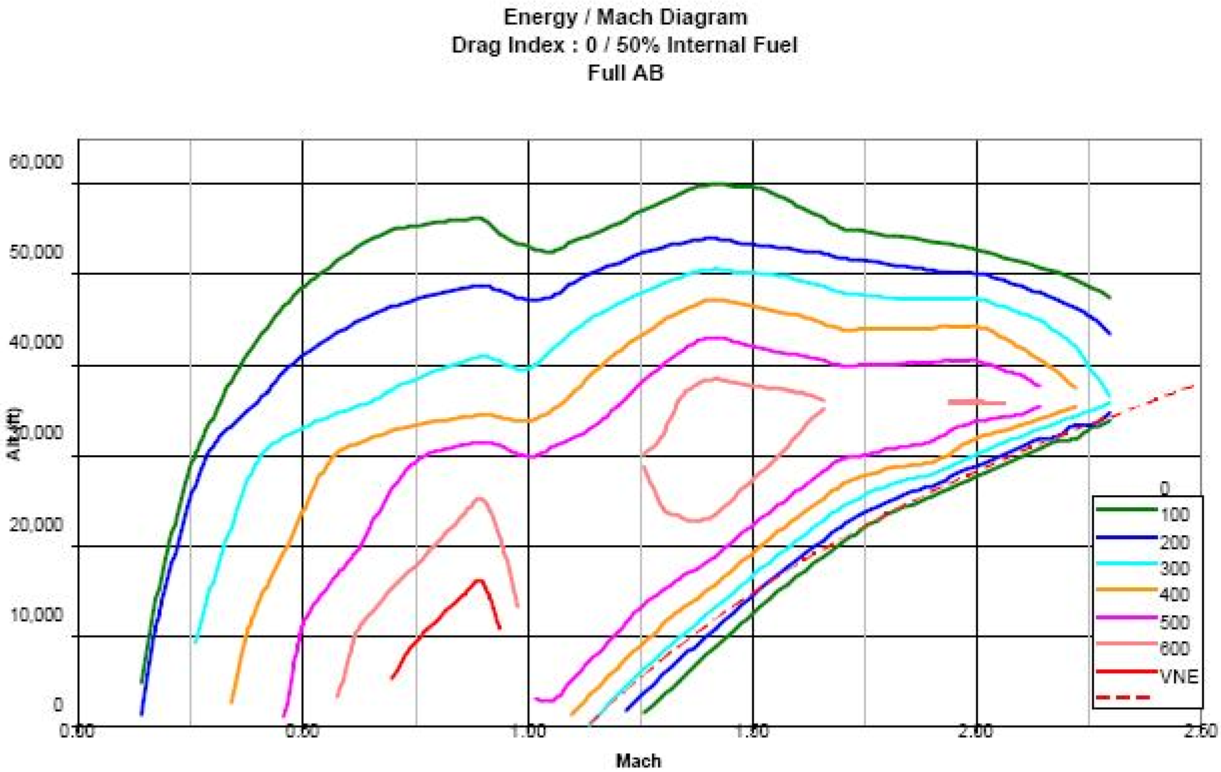
CL/CD(AoA)



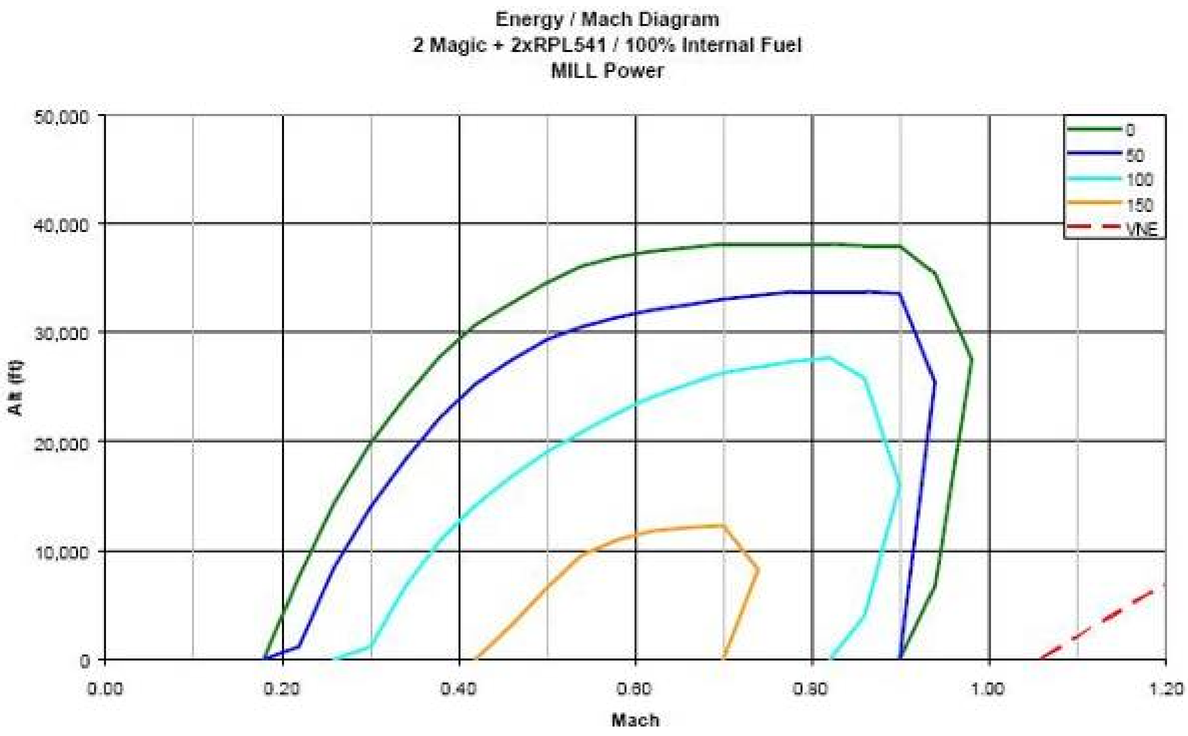
Energy / Mach Diagrams (flight envelope)



2000 D



2000 C



Turn Rate versus Mach number Diagram

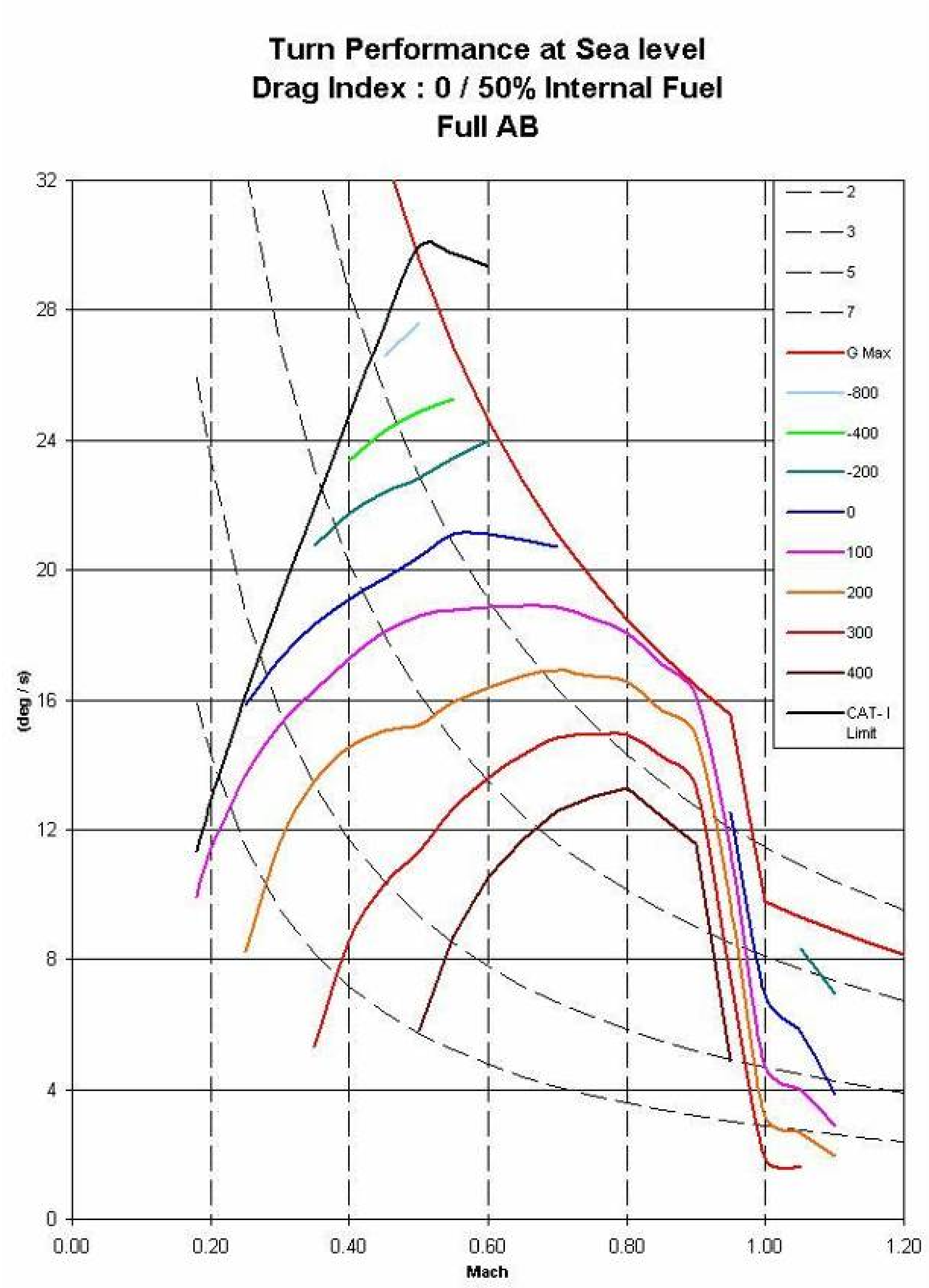
Set a of curves giving Maximum Turn rate (deg/sec) for alt / Mach number, keeping energy level (PS=0), decreasing energy (PS < 0), or increasing energy (PS > 0)

- Available public data:

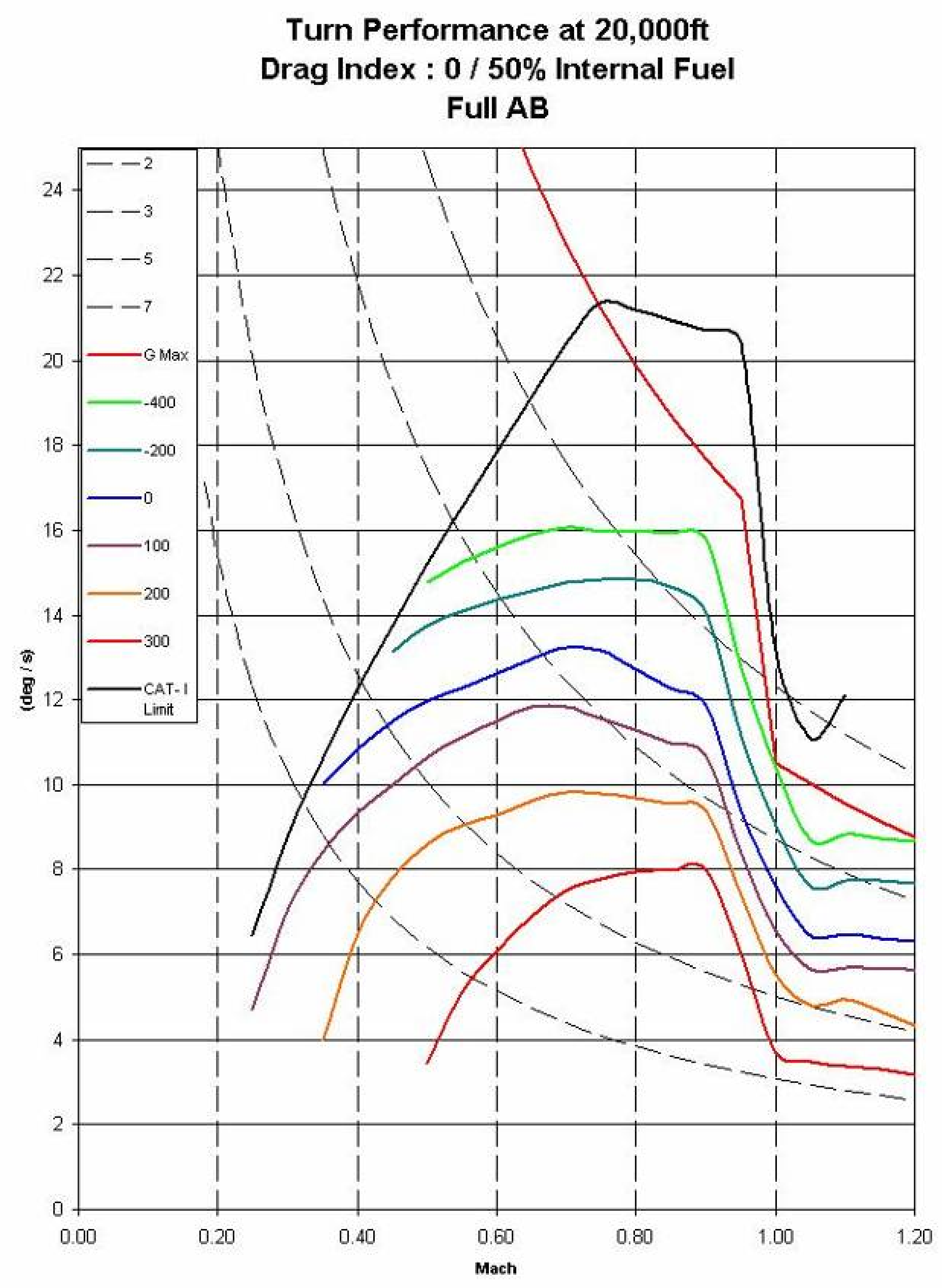
Combat Maneuverability (9G)
Turn rate at Corner Speed @ 15,000 ft. (4,572m) - Two IR Missiles - 50% Int. Fuel
Mach 0.7 : 22 °/s, Mach 0.9: 17.5 °/s Mach 1.2: 13 °/s Mach 1.5: 10.5 °/s

Data used to calibrate flight model:

Maximum turn rate (50% internal fuel, no external load) is 30 degree per second, reached with 9G at sea level for Mach = 0.49, IAS=325Kts
Limit load factor and incidence are +9G / +29.0 AoA



Turn Performance at Sea level
Drag Index : 0 / 50% Internal Fuel
Full AB
(deg / s)
Mach
0
4
8
12
16
20
24
28
32
0.00
0.20
0.40
0.60
0.80
1.00
1.20
2
3
5
7
G Max
-800
-400
-200
0
100
200
300
400
CAT- I Limit

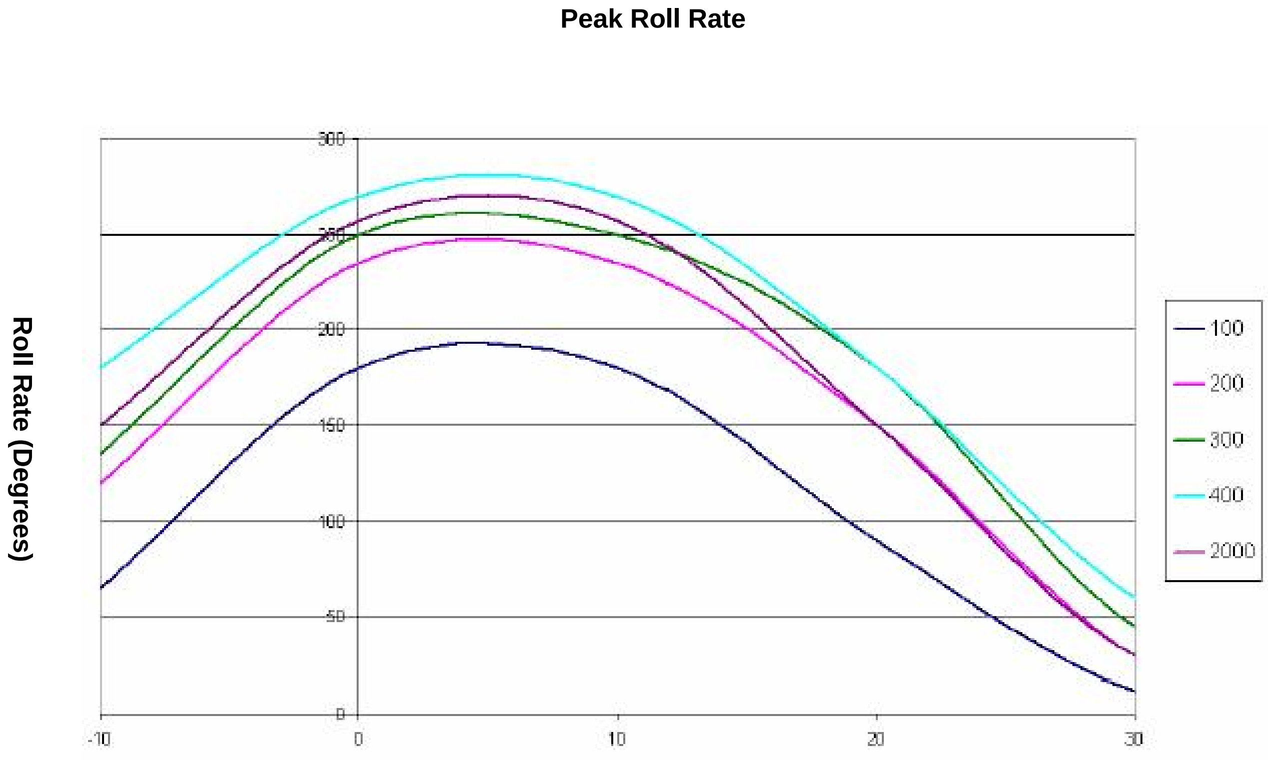


Turn Performance at 20,000ft
Drag Index : 0 / 50% Internal Fuel
Full AB
2
3
5
7
G Max
-400
-200
0
100
200
300
CAT-I Limit
(deg / s)
24
22
20
18
16
14
12
10
8
6
4
2
0
0.00
0.20
0.40
0.60
0.80
1.00
1.20
Mach

Roll Rate versus AoA

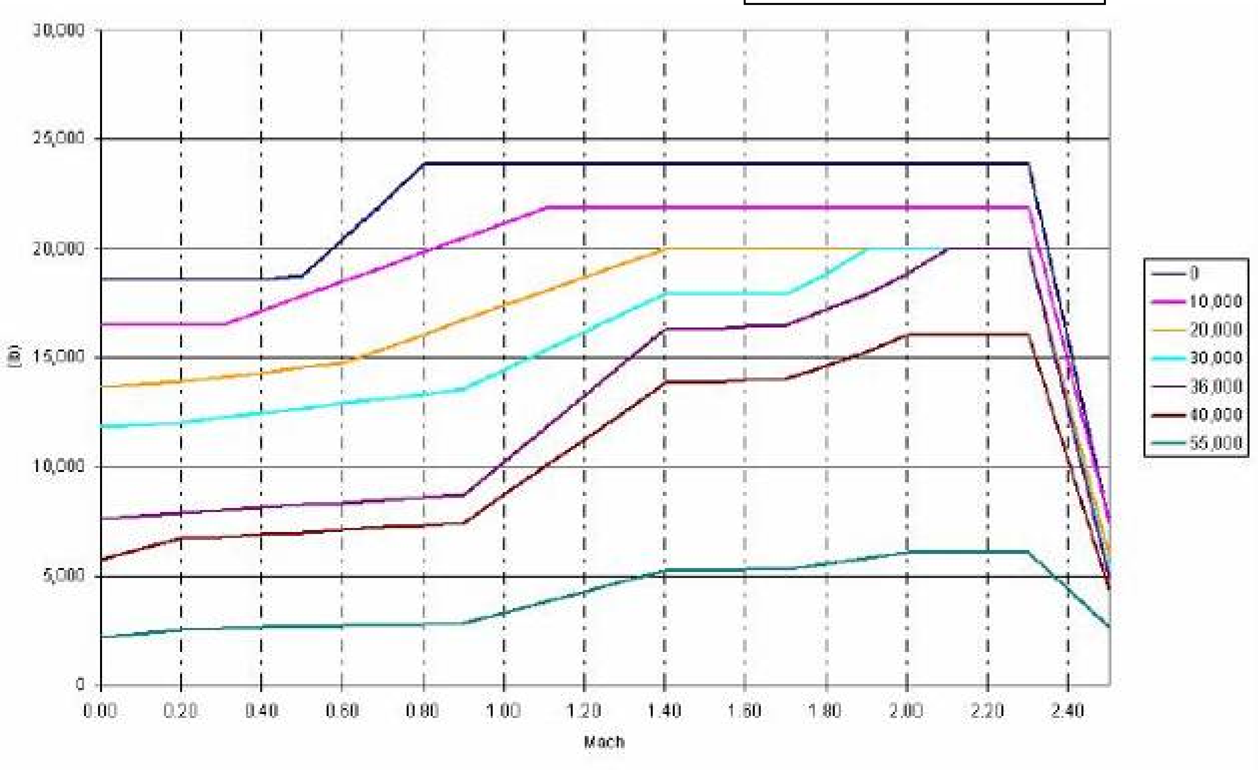
Set of curves giving Maximum roll rate (deg/sec) and time to roll 90deg at constant speed versus Angle of Attack

Peak Roll rate function of Angle of attack (for a given Dynamic pressure in QBar), Clean configuration, 50% internal fuel



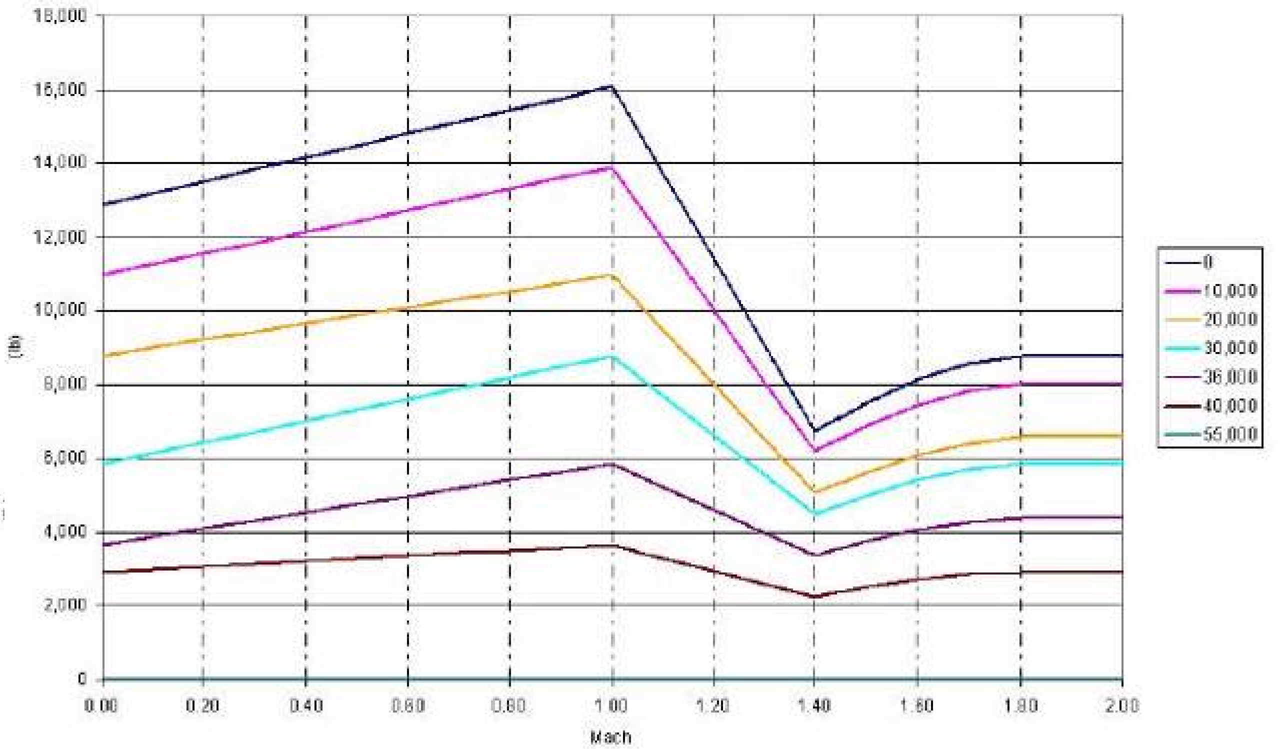
M53P2 Full AB Thrust

Mirage 2000-C, 5F or -9

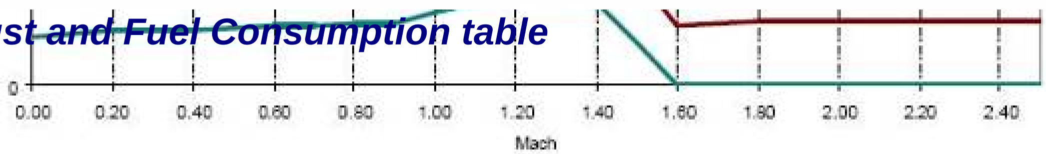


M53P2 Full MIL Thrust

Mirage 2000-C, 5F or -9



Thrust and Fuel Consumption table



M53P2 Full AB Thrust

Mirage 2000 D, 2000 N

Fuel flow *(Real Life Data, not F4)*

Configuration: *Mirage 2000-C, Full AB*

- FL0, M=0.5 : 47,500 lbs/h (360 Kg/min)
- FL150, M=0.8 : 36,500 lbs/h (275 Kg/min)
- FL360, M=1.4 : 30,500 lbs/h (230 Kg/min)

Configuration: *Mirage 2000-D, 2x2000L + 2xBGL-250 + 2xMagic, 100% internal Fuel*

- Taxiway : 2,400 lbs/h (23 l/min, 18 Kg/min)
- FL400, M=0.8 : 3,950 lbs/h (38 l/min, 30 Kg/min)
- FL0, 450 Kts (RPM=86%) : 9,500 lbs/h (90 l/min, 72 Kg/min)

THE

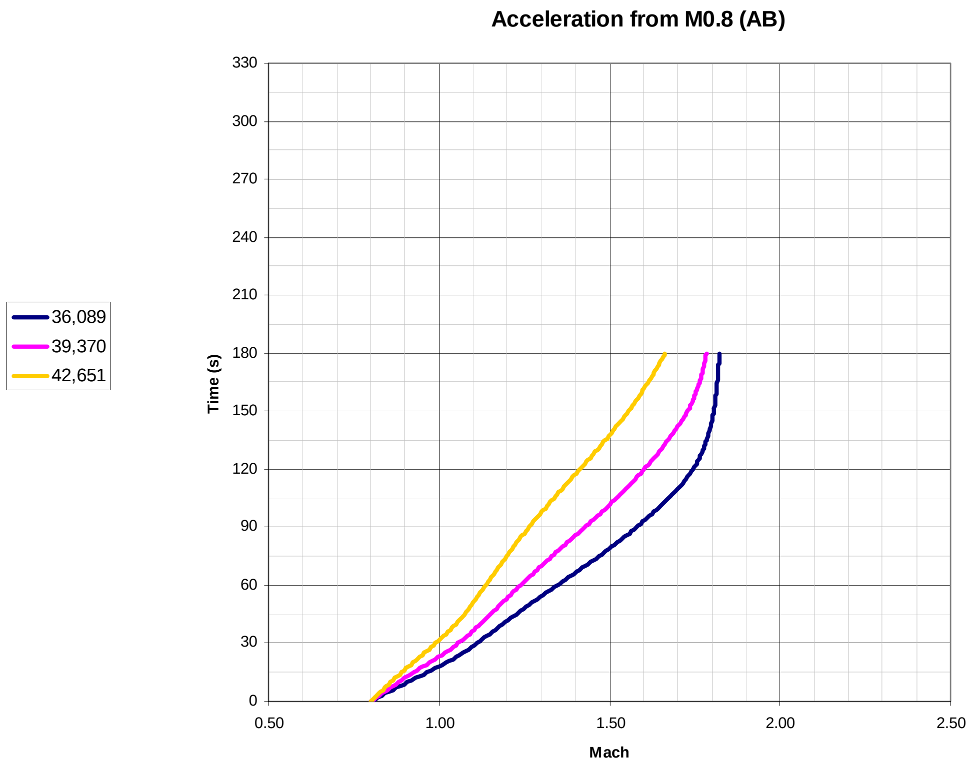
Flight Model

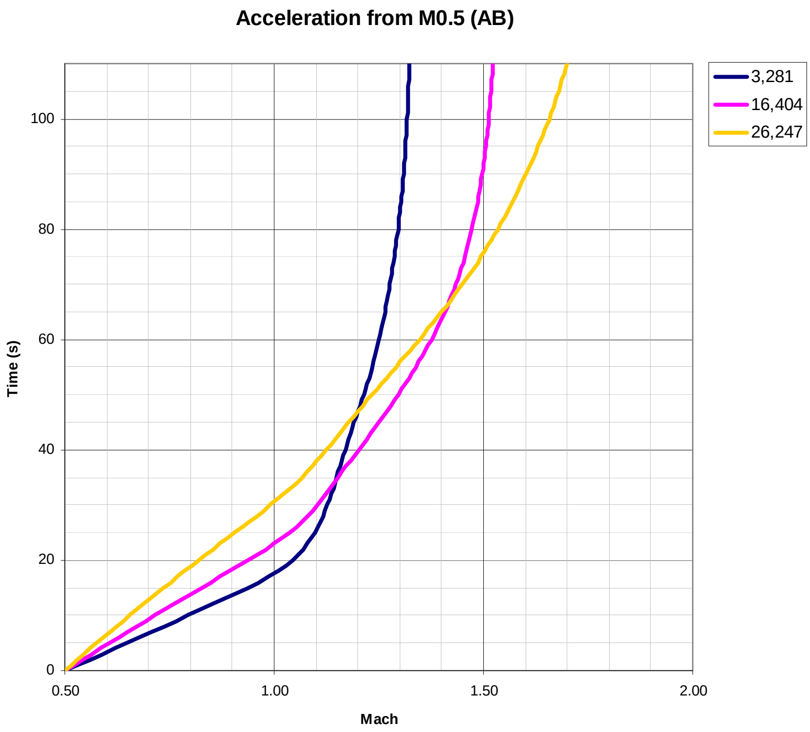
Speed Limitations for specific configurations

- Rafale B, 2 Magic-II + 2 Mica-EM + 1 RPL-711: Total mass 16,400kg (36,203 lbs), Fuel Capacity 6550 liters ,
- Maximum Mach number : 1.6
- Take off speed (rotation) 130 Keas

1G Acceleration table

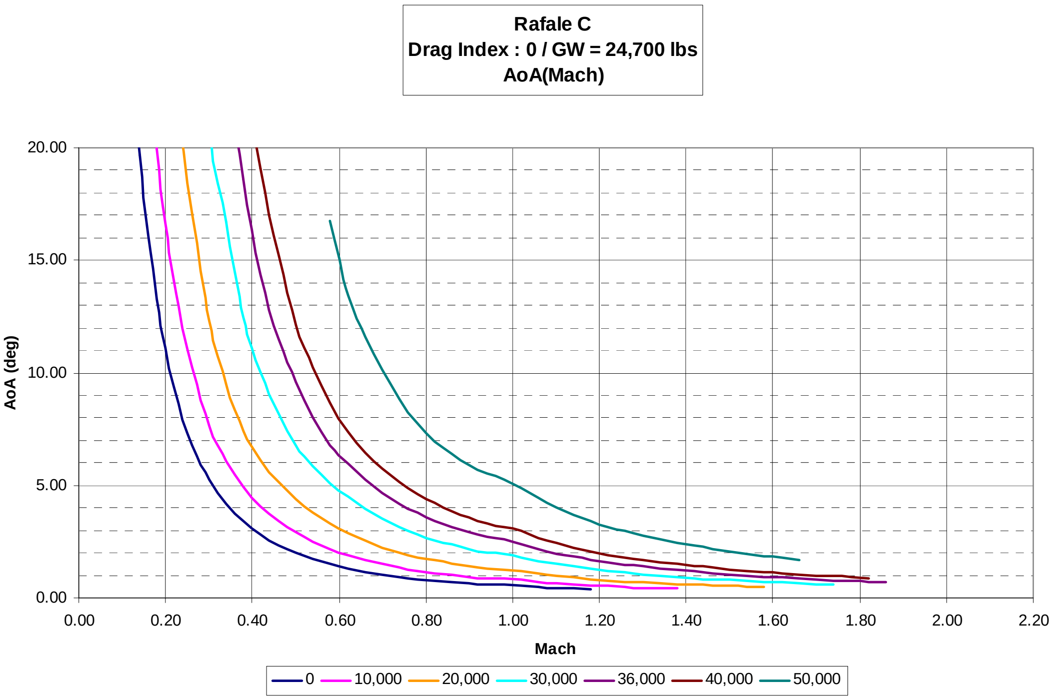
Set of curves giving Indicated speed or Mach number along time for Mil power and full AB (2 tables) at stabilized flight level (1G)
Rafale-C, 50% Internal Fuel, no external Load, 25,200lbs, Full AB.





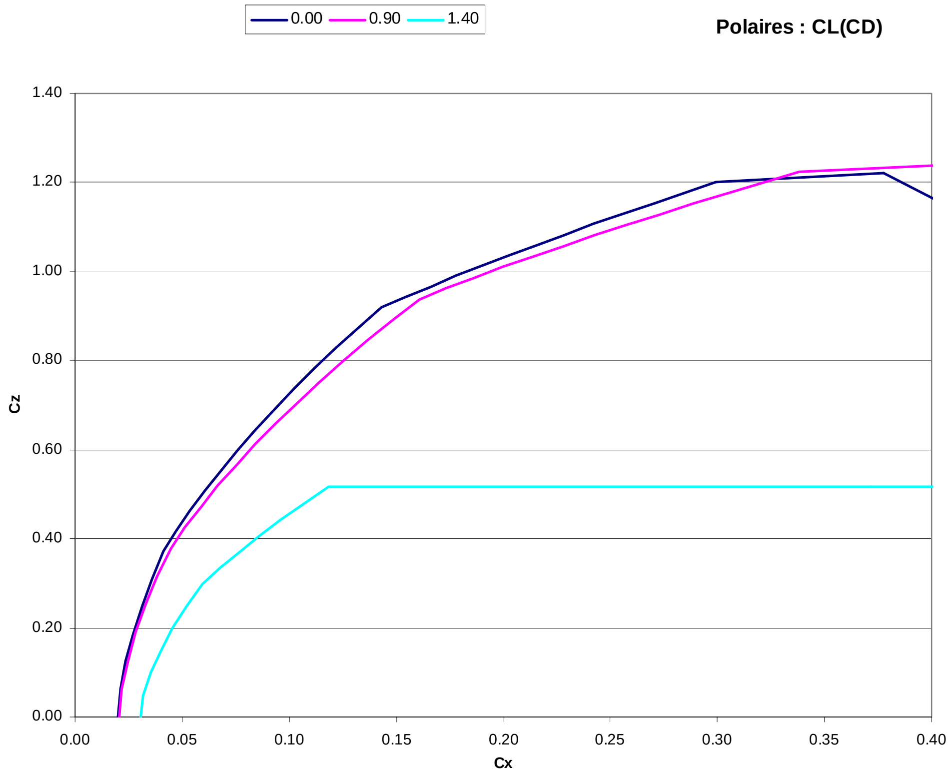
Mach number versus Angle of Attack

Set of curves giving Mach number versus Angle Of Attack, at stabilized flight level (1G), 50% internal fuel, no external load, for a given altitude (from 0 to 50,000 ft, step 10,000 ft)

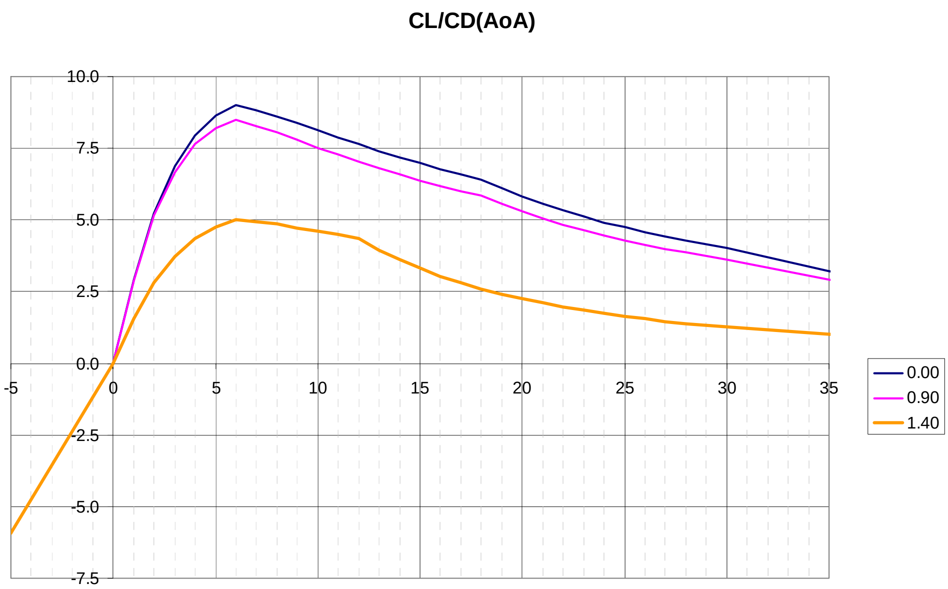


Aerodynamics coefficients

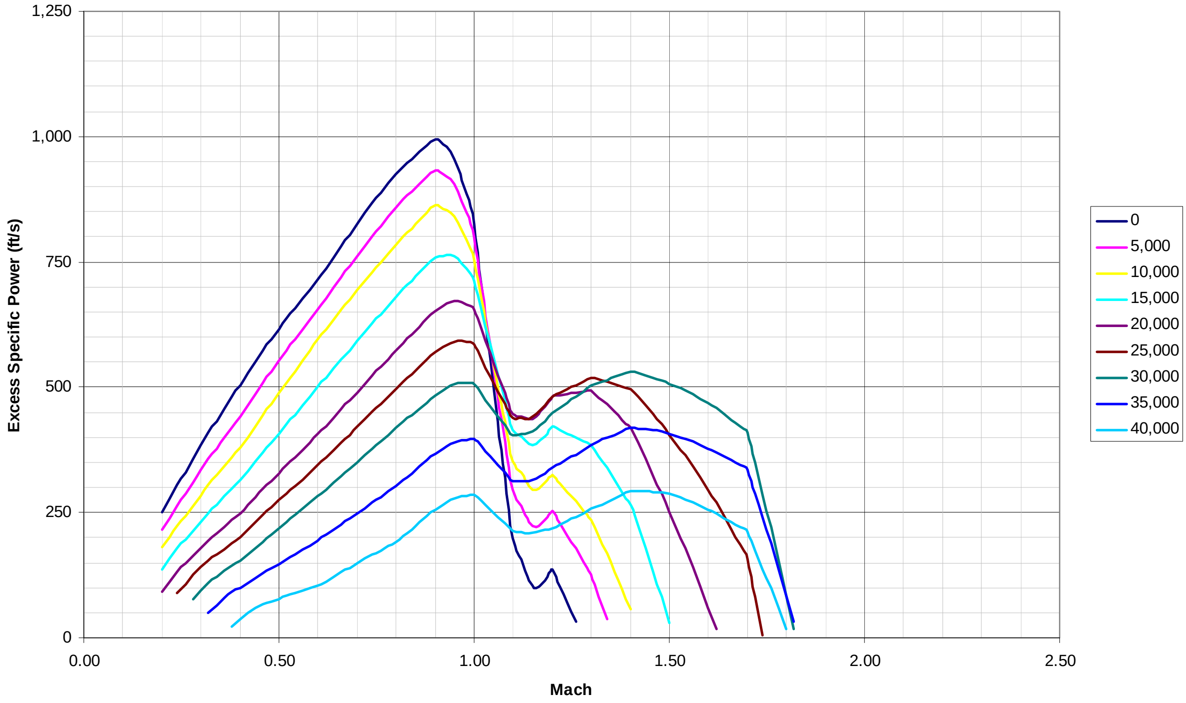
Cz(Cx)



Cz/Cx(AoA)



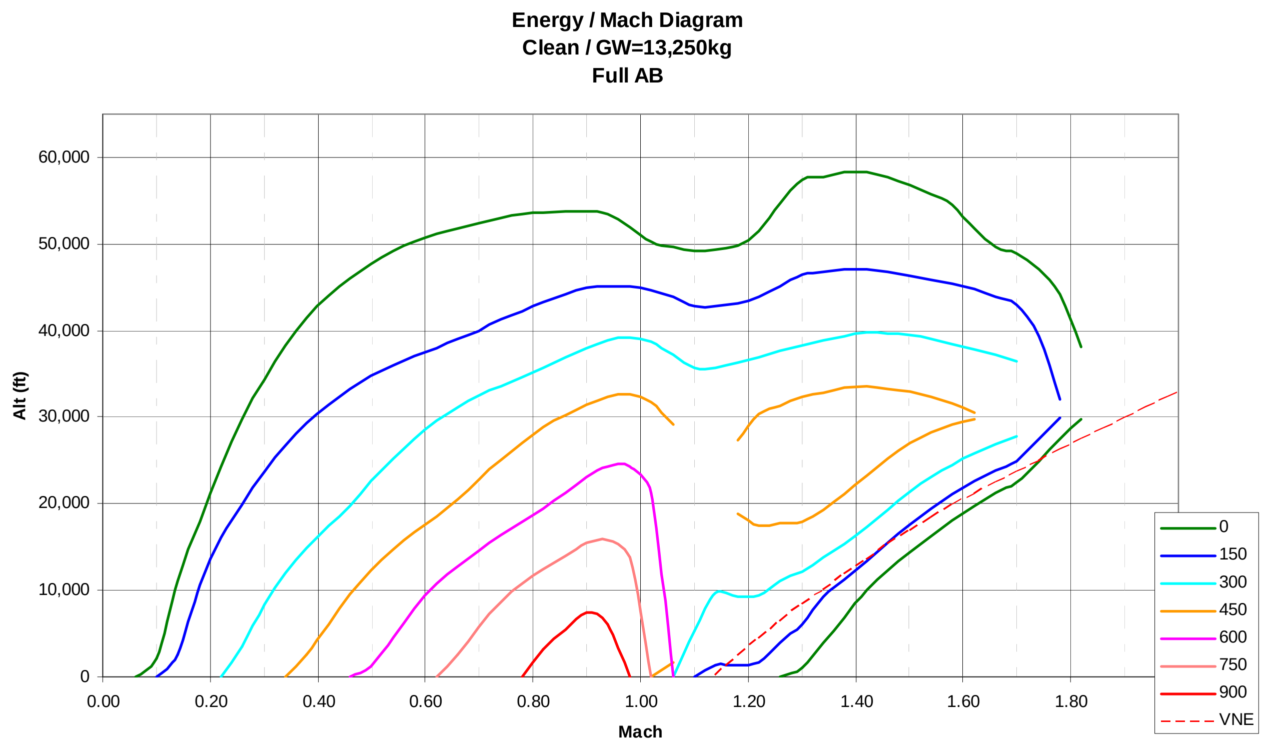
Climb Rate



1,250
1,000
750
500
250
0
Excess Specific Power (ft/s)
0.00
0.50
1.00
1.50
2.00
2.50
Mach
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000

Energy / Mach Diagram

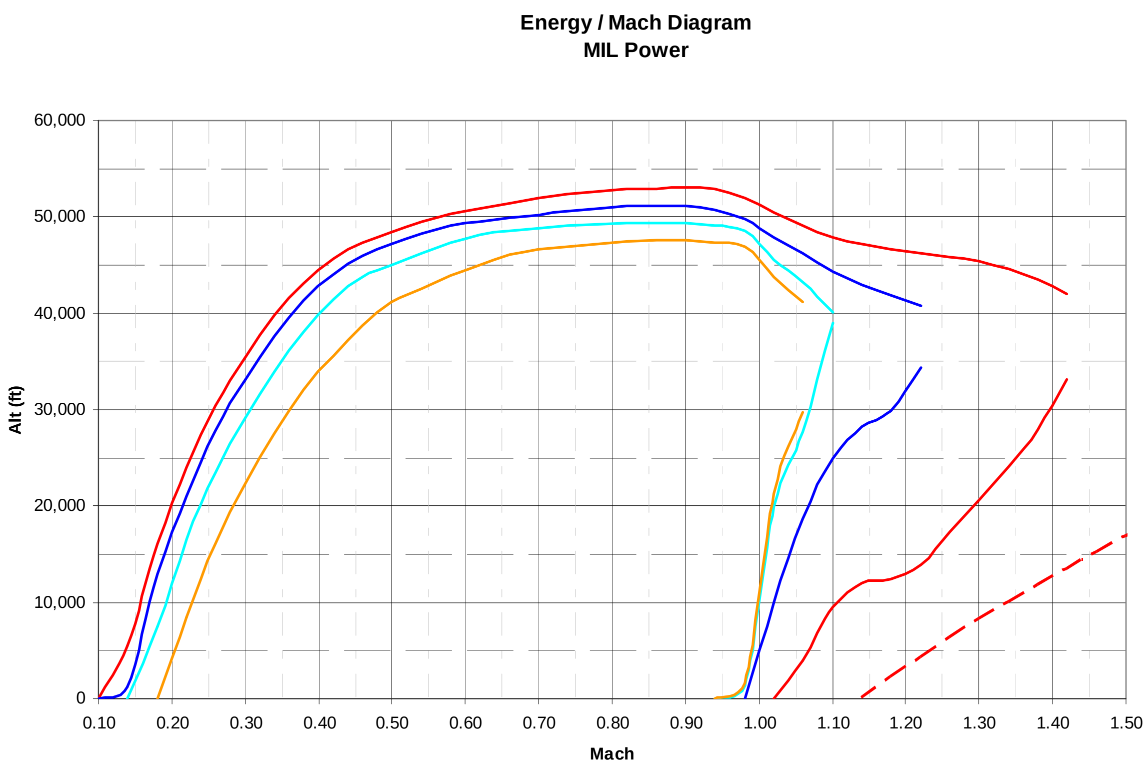
Full after burner (curves are iso-Ps)



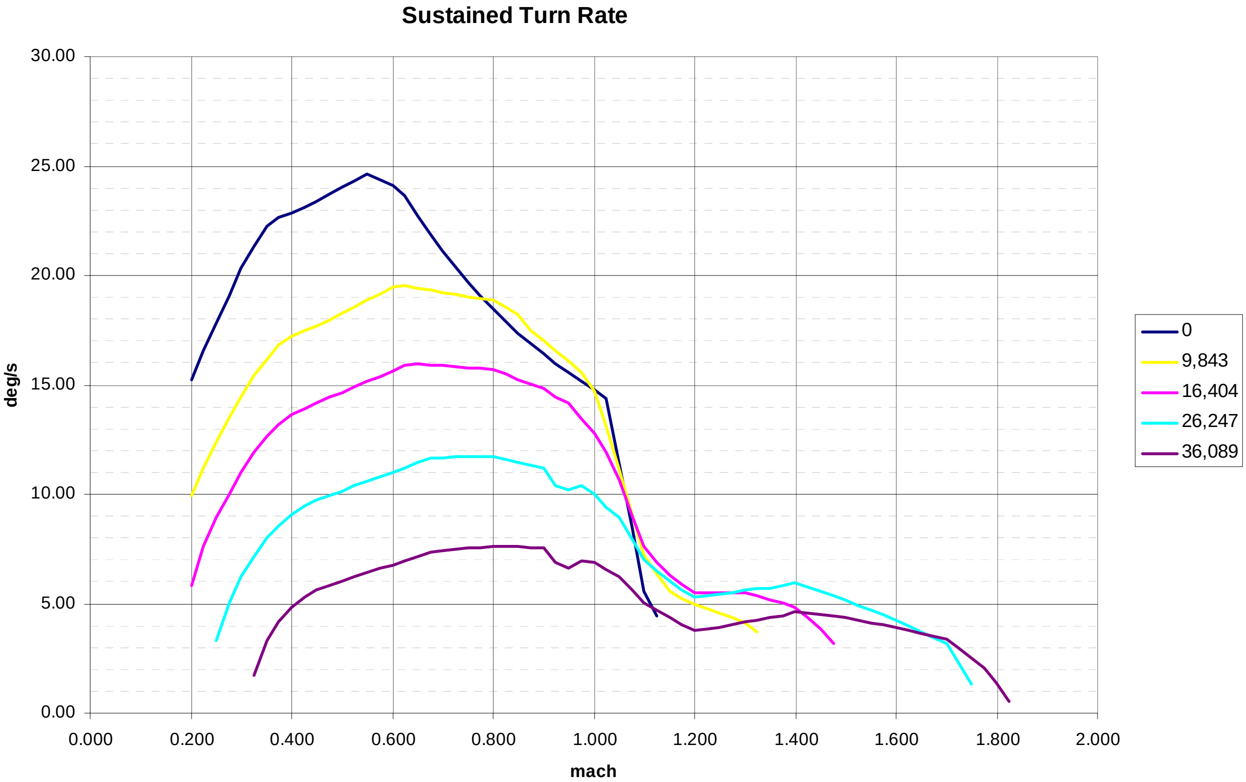
MIL Power, one curve per Drag Index Configuration :

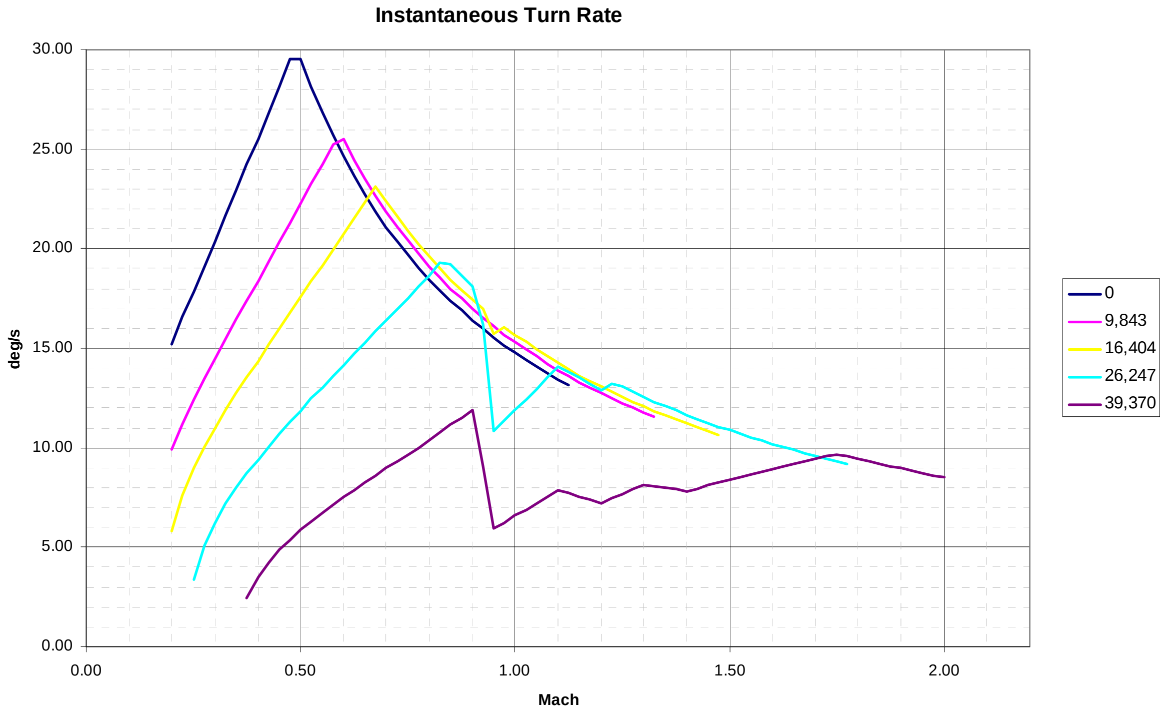
Red = Clean

Dark blue = 4 MICA + 2 Magic + RPL-711 (1250l)



Maximum Turn Rate versus Mach number Diagram





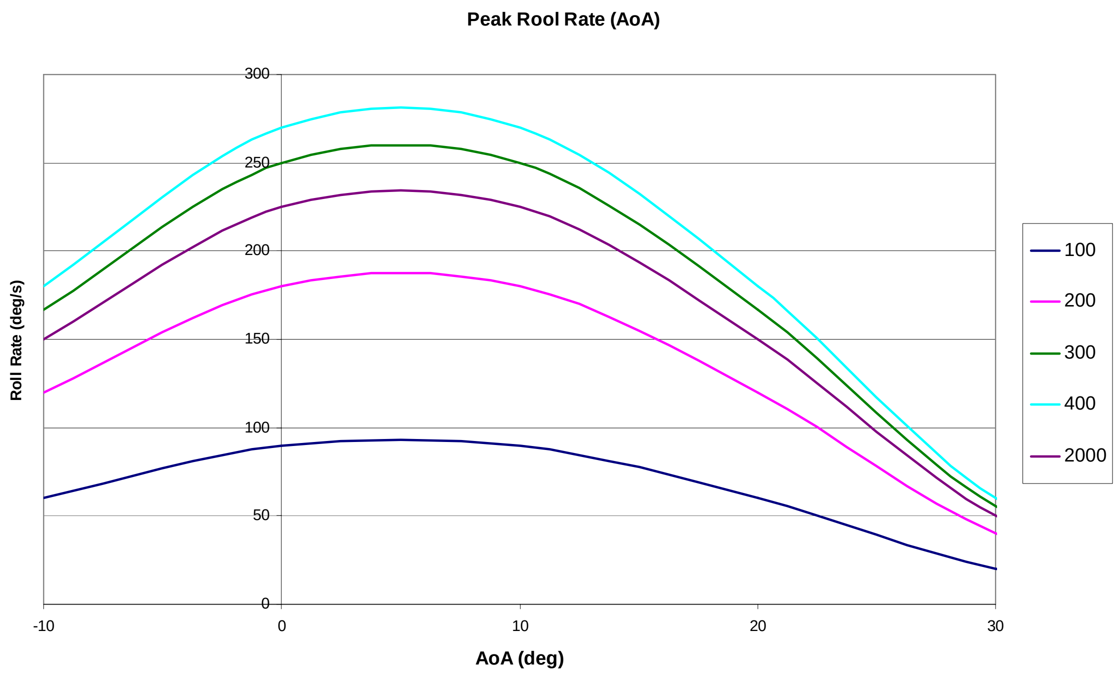
Roll Rate versus AoA

Set of curves giving Maximum roll rate (deg/seg) and time to roll 90deg at constant speed versus Angle of Attack

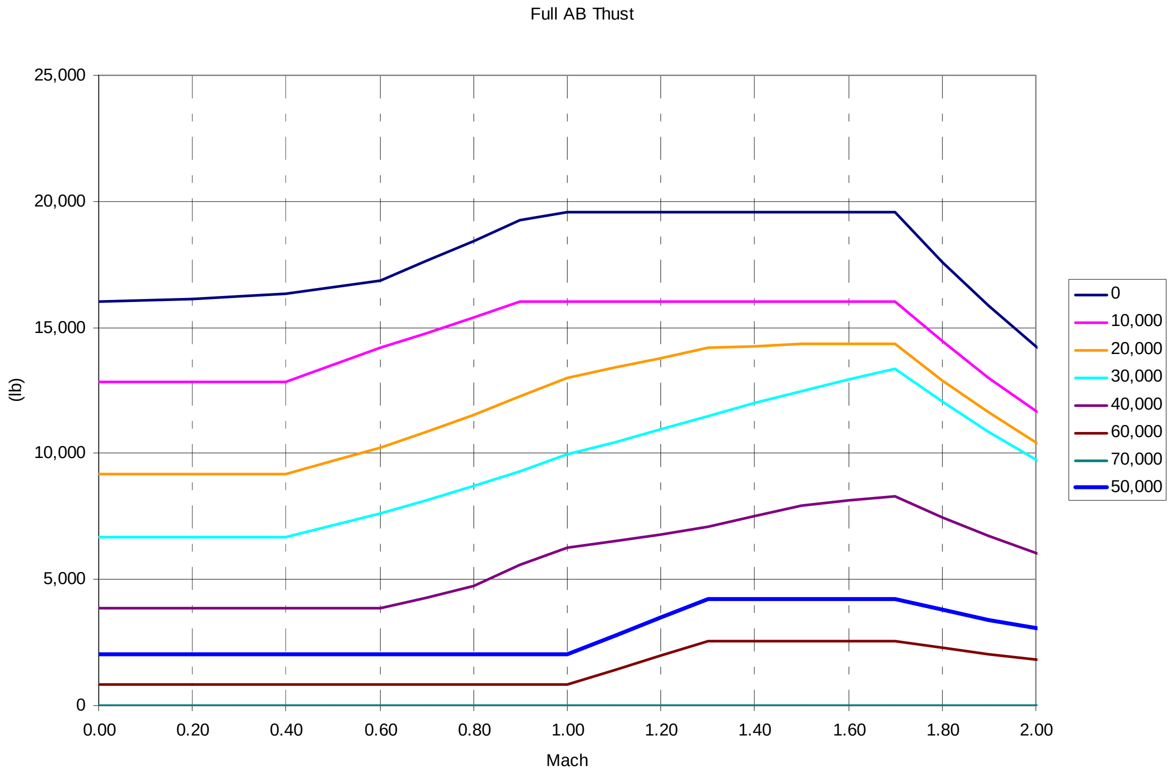
Maximum Roll Rate:

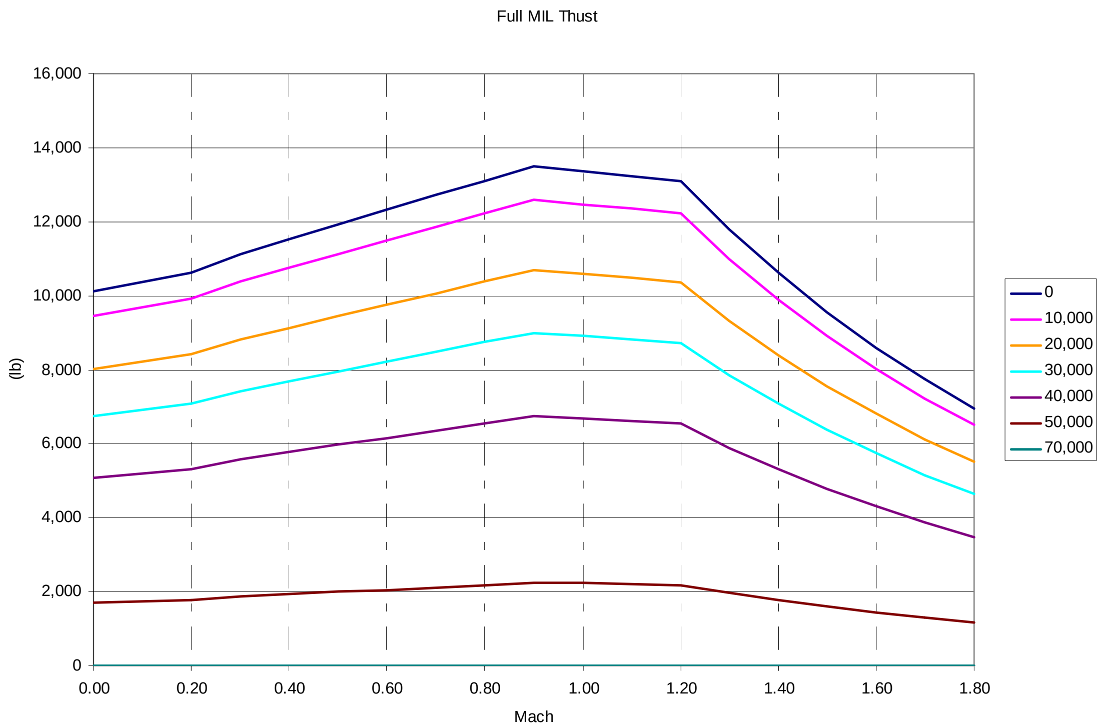
- CAT I : 280 deg/s
- CAT III : 160 deg/s

Peak Roll rate function of Angle of attack (for a given Dynamic pressure in Qbar), Clean configuration, 50% internal fuel



Thrust and Fuel Consumption table



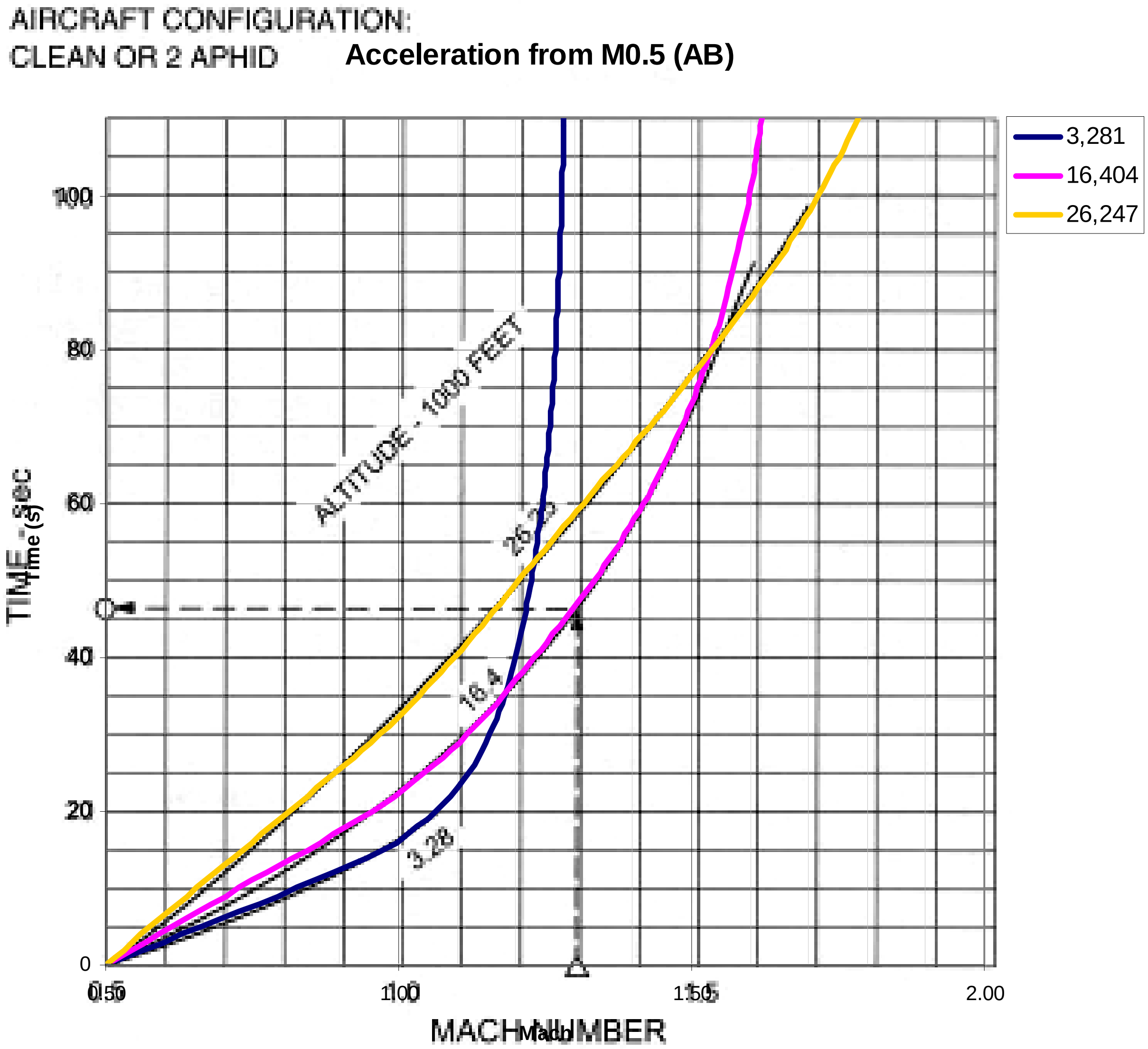


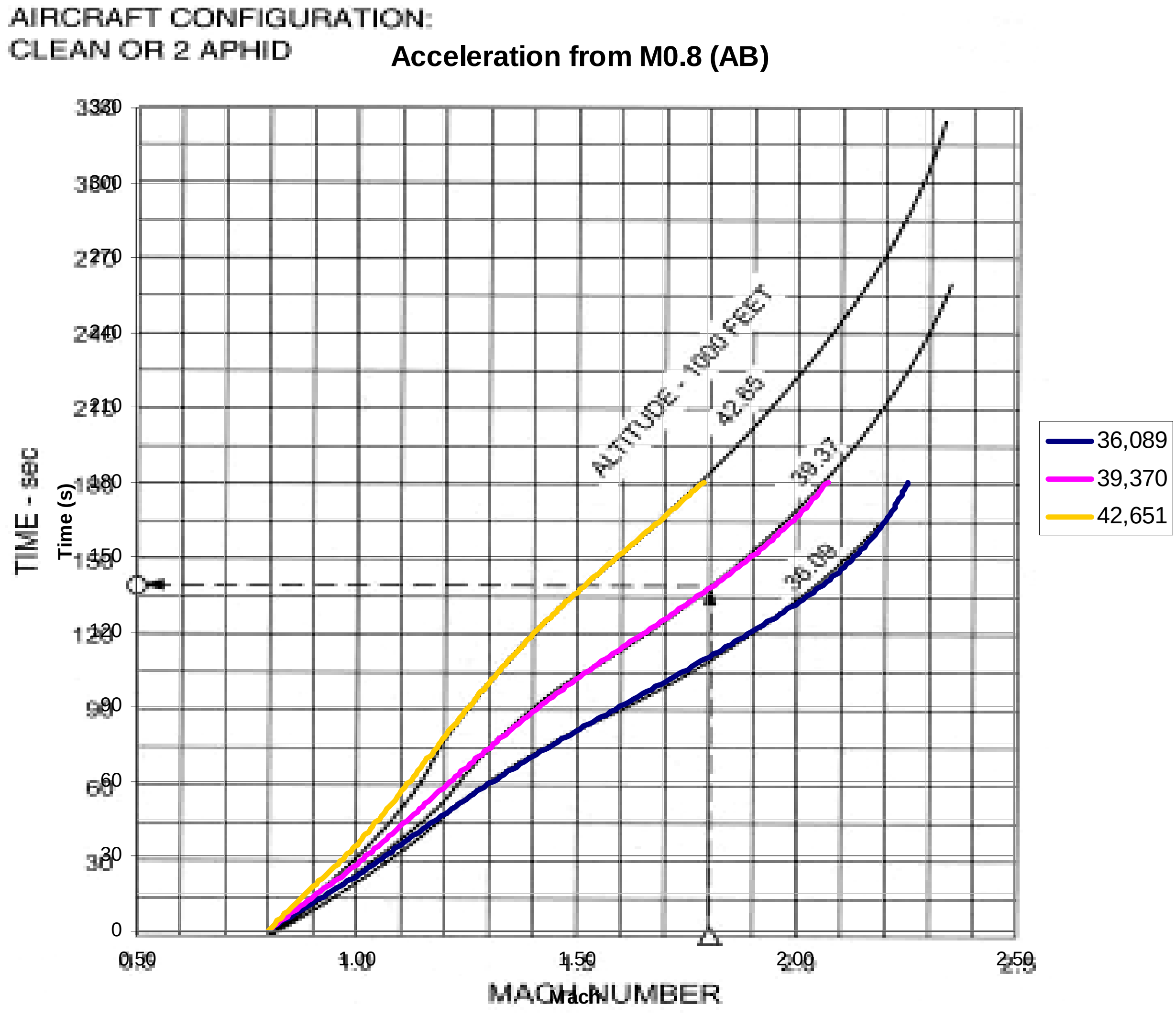
THE

Flight Model

1G Acceleration table

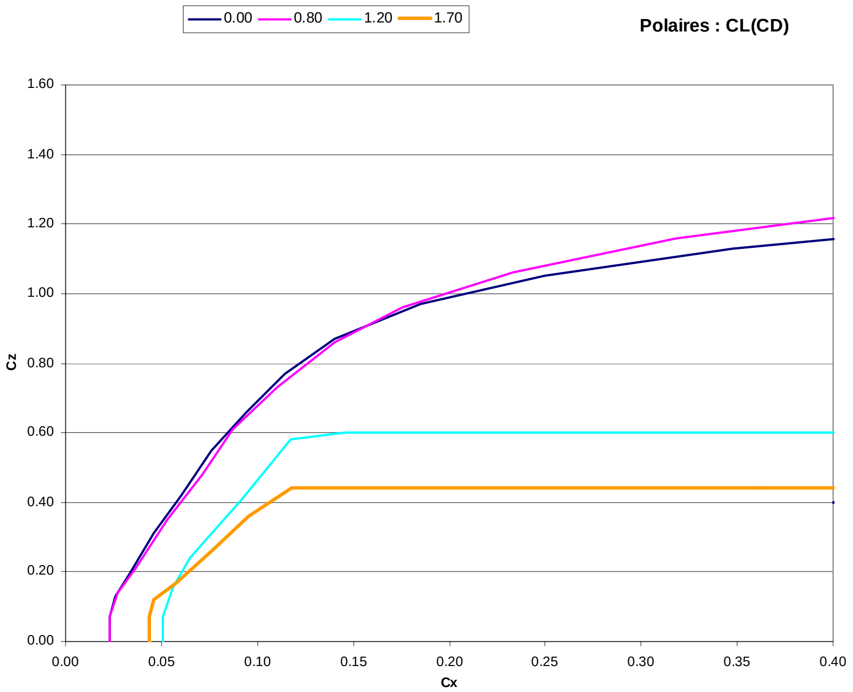
Set of curves giving Indicated Mach number along time for full AB
Black and with figures are extracted from “Real Life” MIG-29G Flight Manual, colored one are those computed from Flacon Flight Model.



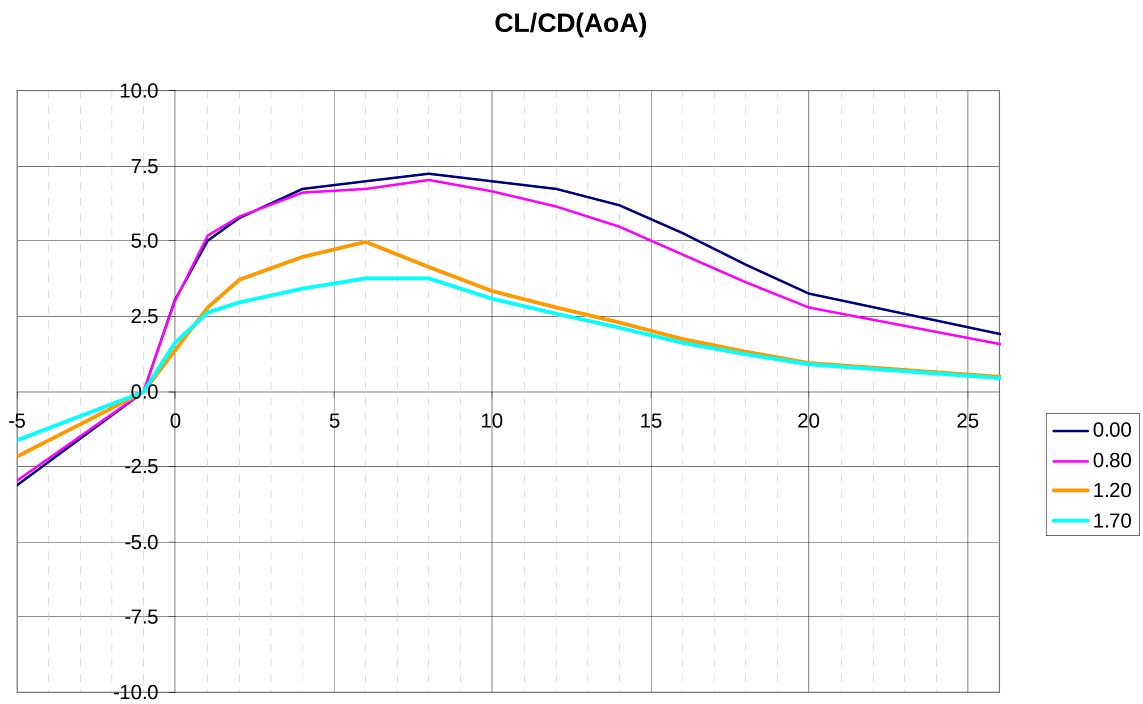

AIRCRAFT CONFIGURATION:
CLEAN OR 2 APHID
Acceleration from M0.8 (AB)
TIME - sec
Time (s)
MACH NUMBER
Mach
ALTITUDE - 1000 FEET
42.65
39.37
36.09
36,089
39,370
42,651
0
30
60
90
120
150
180
210
240
270
300
330
0.50
1.00
1.50
2.00
2.50

Aerodynamics coefficients

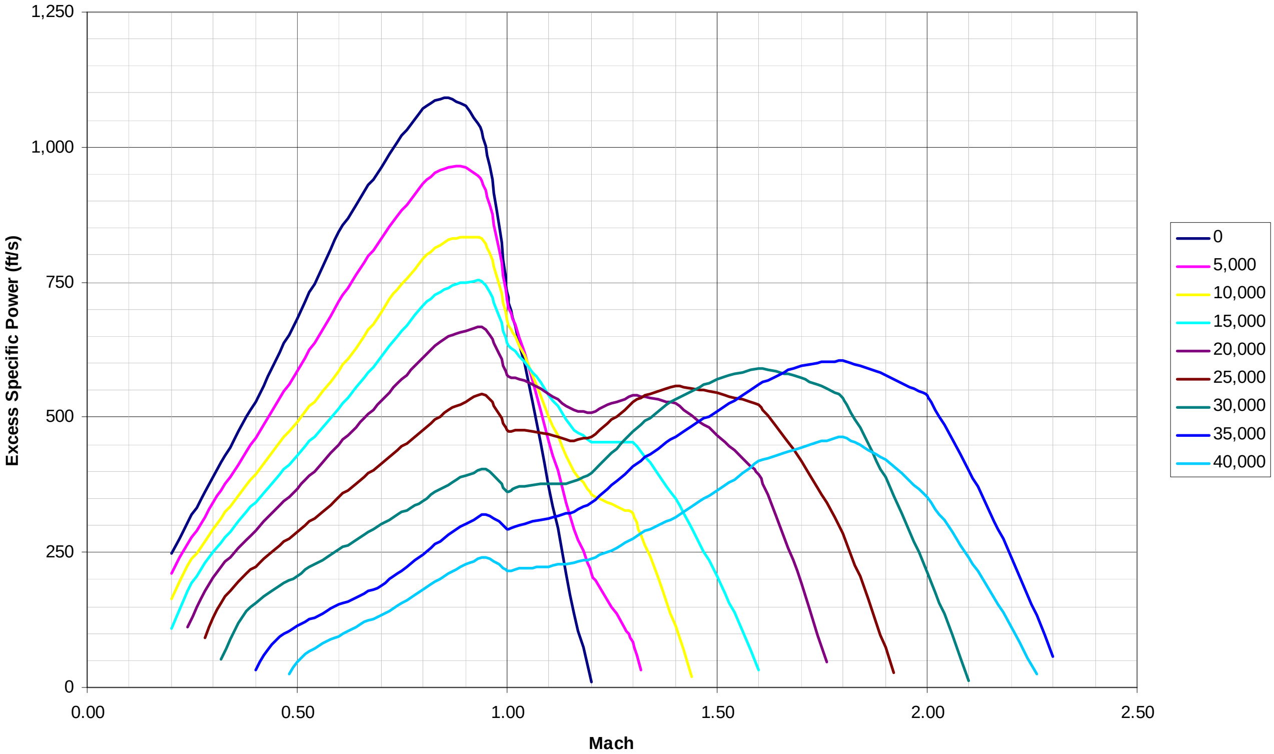
Cz(Cx)



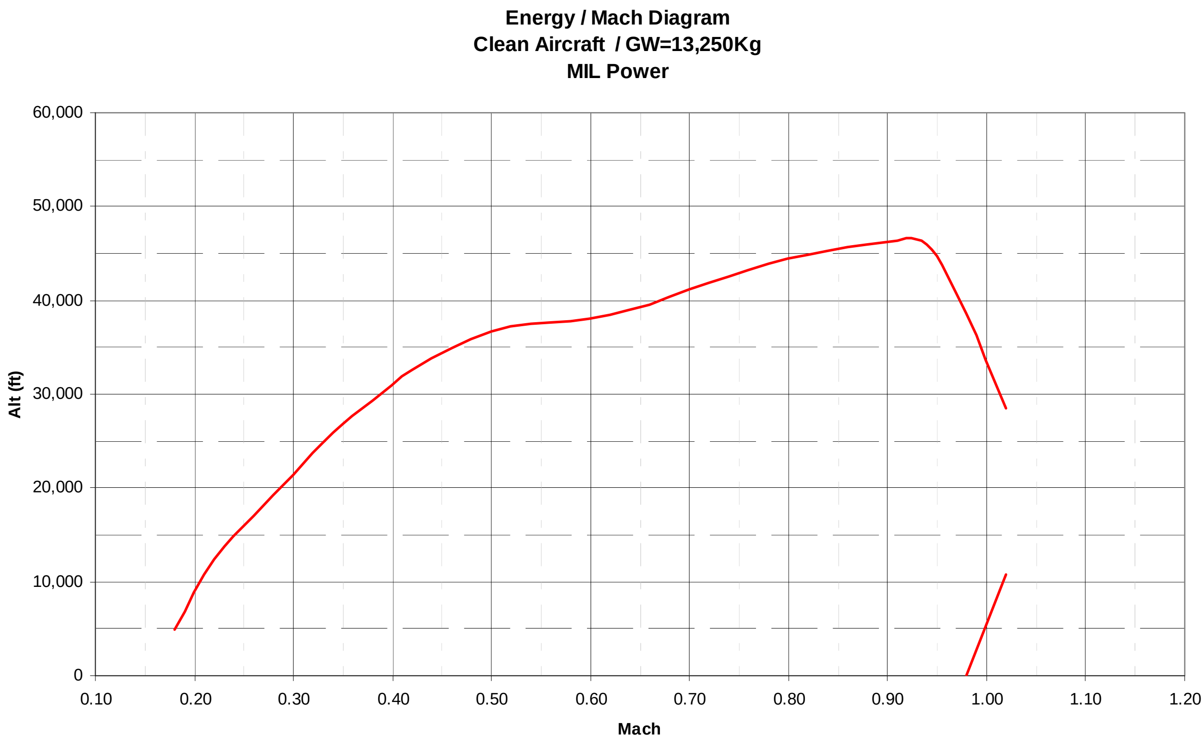
Cz/Cx(AoA)

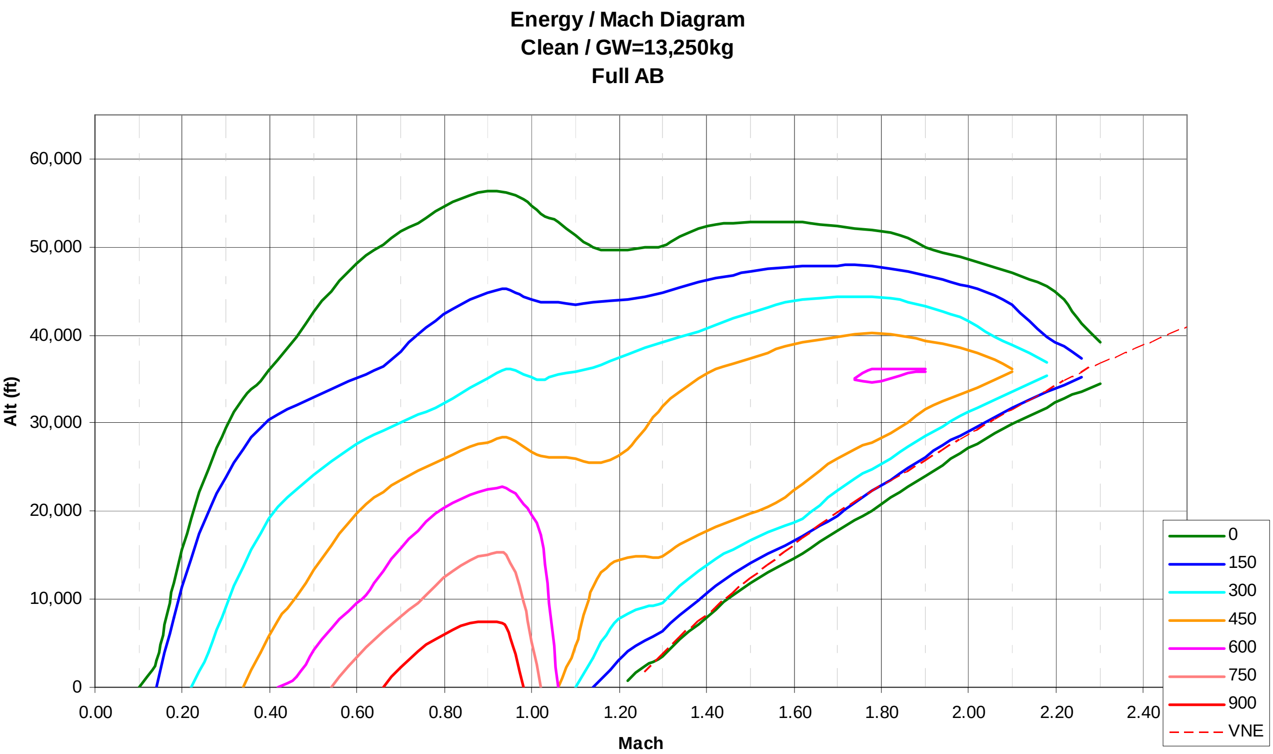


Instantaneous Climb Rate



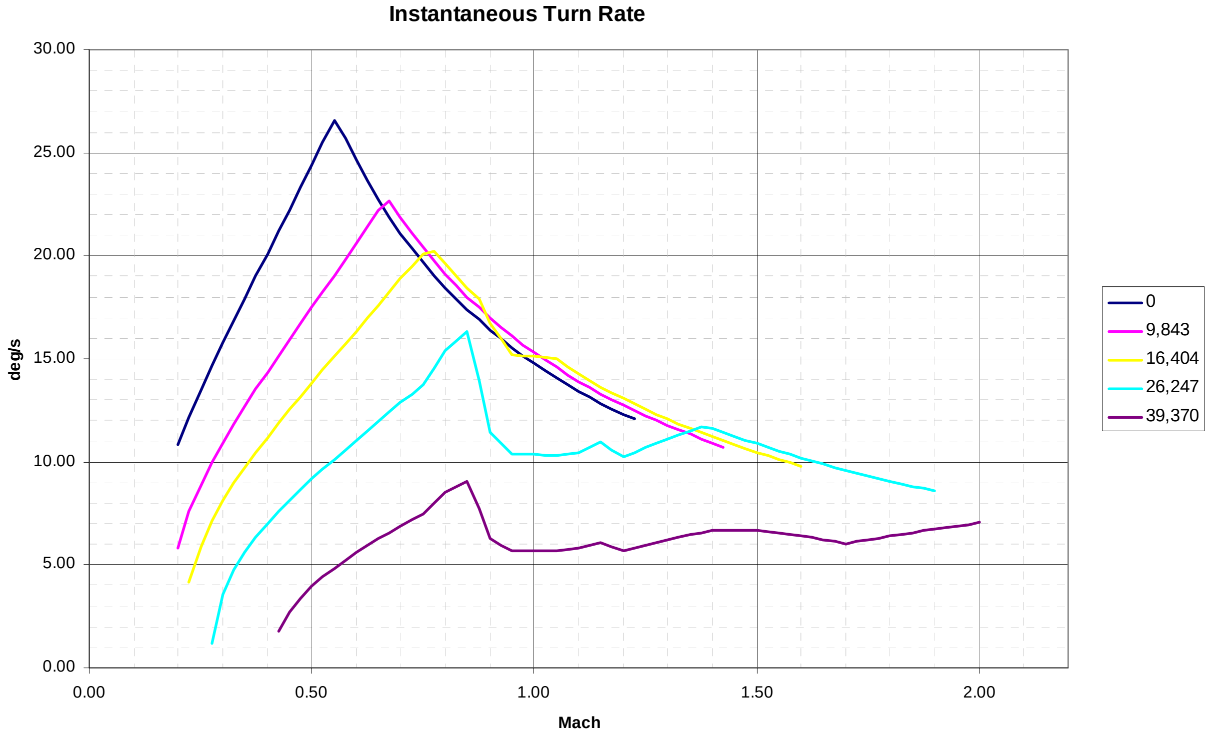
Energy / Mach Diagram

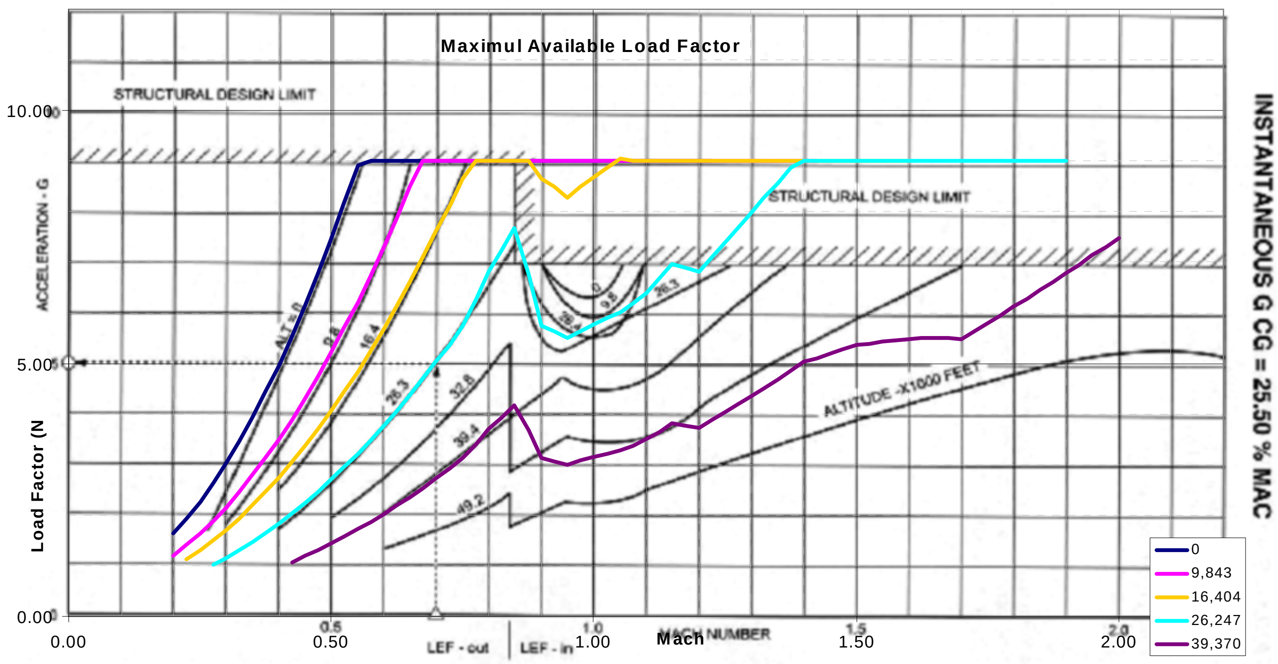


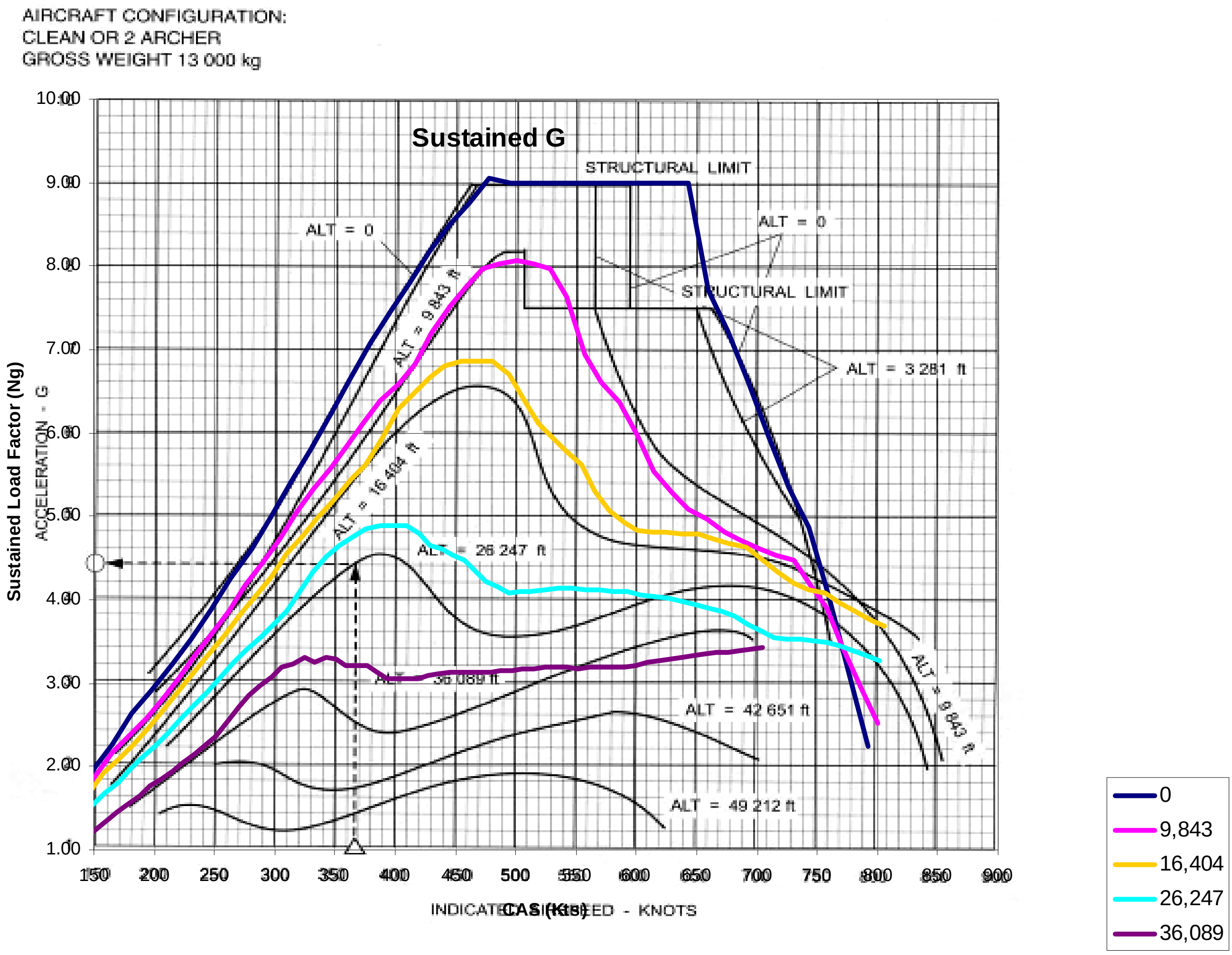


Maximum Turn Rate versus Mach number Diagram.

Black and with figures are extracted from "Real Life" MIG-29G Flight Manual, colored one are those computed from Flacon Flight Model.

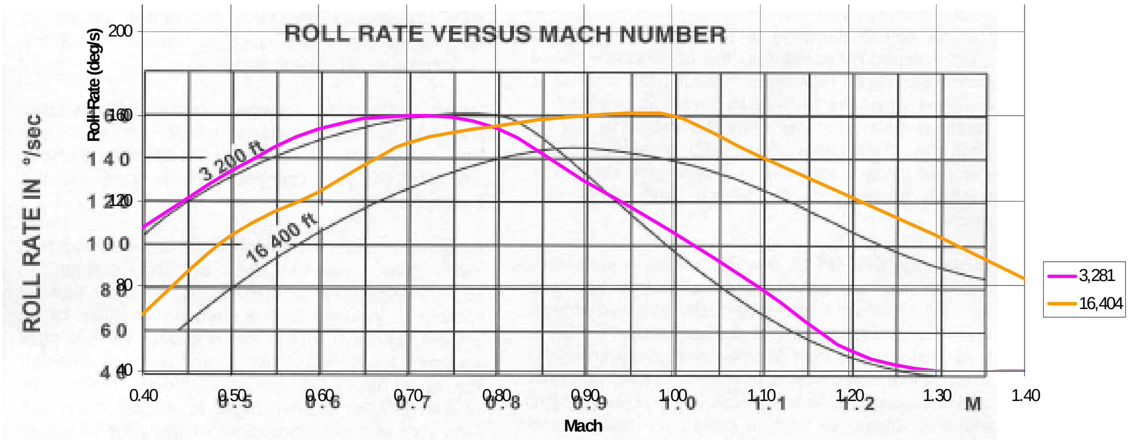




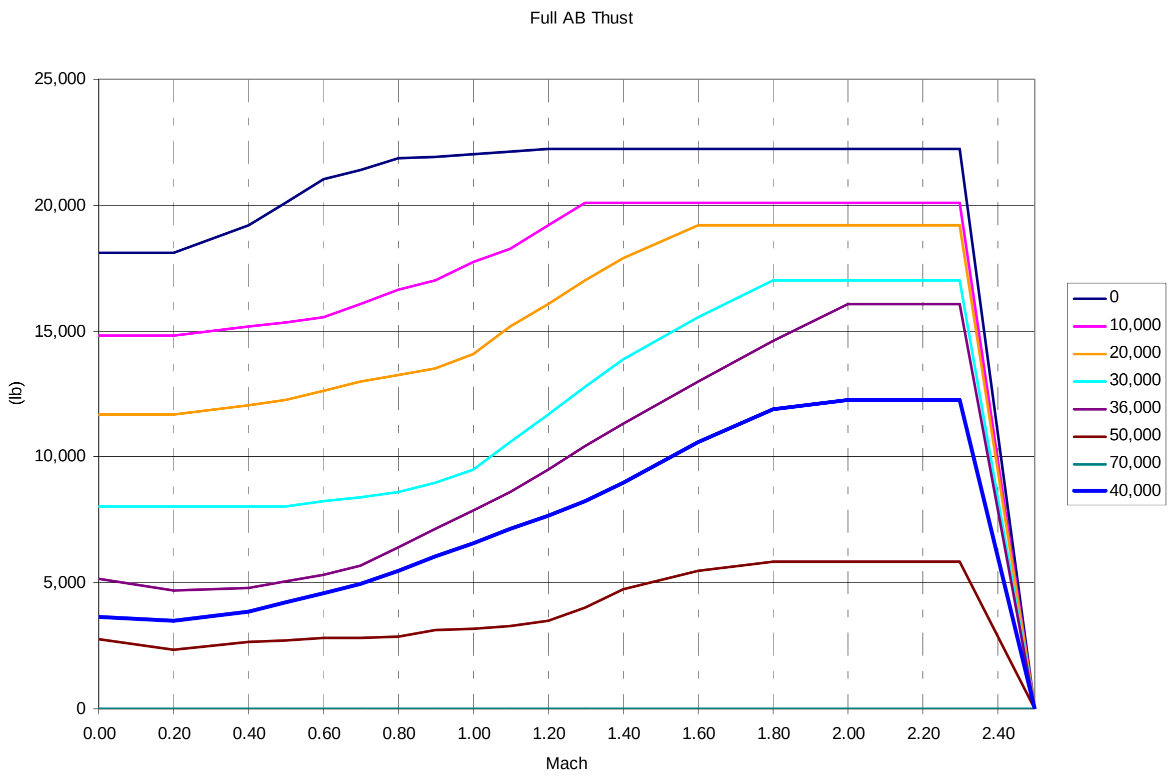

AIRCRAFT CONFIGURATION:
CLEAN OR 2 ARCHER
GROSS WEIGHT 13 000 kg
Sustained G
STRUCTURAL LIMIT
ALT = 0
ALT = 9 843 ft
ALT = 3 281 ft
ALT = 16 404 ft
ALT = 26 247 ft
ALT = 36 089 ft
ALT = 42 651 ft
ALT = 49 212 ft
Sustained Load Factor (Ng)
ACCELERATION - G
CAS (Kts)
INDICATED AIRSPEED - KNOTS
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
0
9,843
16,404
26,247
36,089

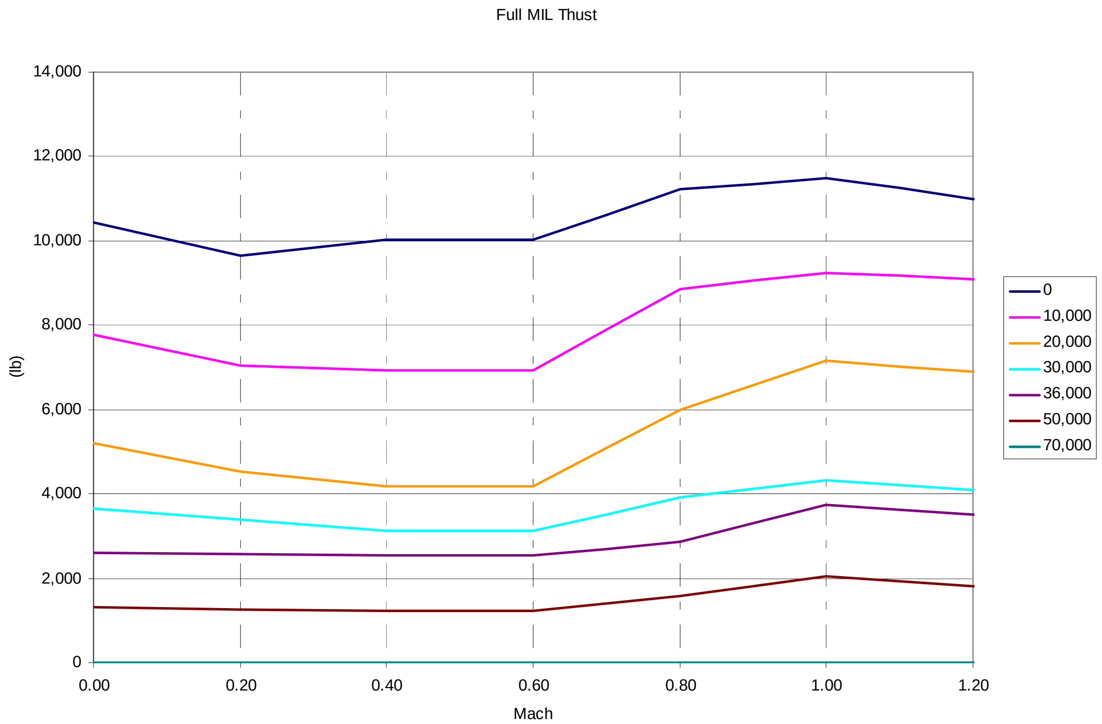
Roll Rate versus AoA

Set of curves giving Maximum roll rate (deg/seg) and time to roll 90deg at constant speed versus Angle of Attack



Thrust and Fuel Consumption table





Contributors Disclaimer:

None of the **CONTRIBUTORS** to his manual in ANY way endorse FreeFalcon, RedVIPER or any product, association, philosophy or action thereof.

The Contributors to this manual are in no way (necessarily) associated with FreeFalcon, it's members or any group thereof.

The Contributors to this manual have not (necessarily) ever downloaded, installed or used a FF/RV product, or any derivative thereof.

The Contributors to this Manual had but one desire → to share their knowledge of Falcon4.0™, that it may help and assist the members of our community in getting the most out of this incredible sim.

The FF/RV Team is very grateful to all the contributors to this Manual.
As is – I believe - the entire Falcon community.

ROLL OF HONOUR

Aaron Ross

Chewbakka

Col Ter Beek

DewDog

Doc

Doctor X

GRMCLE

I-Hawk

James Dunnigan

John "Triton" Waller

Kyong H Lee

MVS-Viper

Red Dog

Rilex

Shatterer Of Worlds

Snake_____________122

BOOK 2

REDVIPER OPERATIONS

GUIDE

Book #2

Skratch's

RedVIPER Operations Guide

Rationale:

This Manual is a compilation of the SP3, BMS, Cobra & RV1 manuals. This manual is not intended to be a stand-alone guide. It should be used in tandem with the Falcon 4.0™ manual. The purpose of creating this manual is to combine all of the updates to Falcon 4.0™ into one integrated work for pilots to use whlst flying the most current verions of Falcon.

Consider it a "Pilot's Handbook Of Operations" for RedVIPER

RED VIPER OPERATIONS GUIDE

ABOUT THIS MANUAL:

This manual should be used in conjunction with the original Falcon 4.0 manual. The purpose of creating this manual is to combine all of the updates to Falcon 4.0 into one complete work for pilots to use while flying Falcon 4.0.
Merging all of the relevant changes in Falcon 4.0 from the last 5+ years is not an easy task and there may be omissions or errors in this text. Portions of this manual is a combined works of other previous manuals and due credit should be given to those who contributed to the SP3, BMS 2.0 and FreeFalcon manuals for their documentation of updates to Falcon 4.0. Without the past efforts of these individuals, this manual would not be possible.

RED VIPER OPERATIONS GUIDE:

ABOUT THE RED VIPER ONE PATCH:

Red Viper One (RV1) is an evolution of multiple patches made for Falcon 4.0 over the last few years. The makers of this patch want to thank all involved with the evolution of Falcon 4.0 since the beginning and especially those coders who have worked on the source code over the years. You will note specific references to SP2, SP3, BMS or Cobra while viewing certain sections of this manual. These notes are indication of some of the teams that worked on Falcon 4.0 since its initial release in 1998. Many contributors have worked on this code since the original 1.08 patch released by Microprose and giving full credit to all those involved is a formidable task. However, the following groups and their respective members should be thanked for all of their hard work that has contributed to the RV patch:

- ***Realism Patch Group (RPG)***
- ***eFalcon Team (eTeam)***
- ***Falcon 4.0 Unified Team (F4UT)***
- ***Bench Mark Sims (BMS)***
- ***FreeFalcon Team (FF)***
- ***Cobra Team***

WHAT'S NEW?

RV1 includes many new and exciting features that should enhance your simming experience while flying Falcon 4.0. For more details on these new features, please take time to read all of the details and usage of the new features. A sampling of what's new is as follows:

- New Graphics engine enhancements featuring improved frame rates, gameplay stability and graphics effects
- Improved multi-player updates
- Fully functional 3D cockpit with 6 DOF TIR support.
- Updates to multiple types of AI
- Implementation of GPS type weapons
- Additional bug fixes, updates and data edits designed to improve game play and realism.

TABLE OF CONTENTS *(Red text denotes clickable links)*

THE RED VIPER ONE PATCH

THE RED VIPER ONE PATCH

FAQ - FREQUENTLY ASKED QUESTIONS

Can I install my favorite cockpit and terrain tiles after I install this patch?
No. Unfortunately, at this time most add-ons will not work with RV until the makers can update their installers and files. For more information on this, please refer to:
APPENDIX A: COCKPITS & OTHER ADD-ONs.

Can I add missions or create packages to campaigns?
No, but you can modify existing missions quite a bit. Here are some tips.

- To check and change weapons loads of different planes, just expand the list of packages in the ATO menu and then click on the flight. You will see that the weapons load screen now shows the plane you have clicked on.
- To edit other flights: Find the flights you want to edit in the ATO screen, exit the campaign and then reenter the campaign in the squadron that has the flight you want to edit.
- To change the mission of an existing flight: Click on the waypoints and select a different waypoint for the mission (SEAD/Strike/BAI/etc), by accessing the drop down menu in the Flight plan screen. You will be able to assign different missions to each waypoint if desired.
  NOTE: If you want the flight to attack a target, you will need to assign the target in the waypoint setting. This includes SEAD or any CAS mission since you are assigning a different target or role to that flight. This will make sure the flight knows what you want it to do.
- To delete a flight: Delete all of the waypoints (except the first one), move the start time to a time earlier than the current time, and when the flight comes up for take-off it will be deleted.

How do I use Scan Mode AIFF?
Hit Cntl, then left arrow key. Confirmed friendlies are shown as green circles in your FCR MFD and non-confirmed contacts are shown as regular contacts. Remember to refresh you AIFF in order to get updates.

I press the "pickle button to fire an AMRAAM and nothing happens?
For all radar A-A missiles as well as some A-G missiles, you now have to hold the pickle button down until the FCC updates the target information. Then the missile will launch.

During take-off, my cockpit starts shaking as I roll down the runway!
It's called "ShakeBabe!" and you'll notice additional sounds and cockpit shaking under certain conditions like roll out on take-offs.

How do I perform hotpit refueling?
You need to land your plane and then taxi to one of the ramp areas and stop. Access your ATC menu and request hotpit refuel. You will notice the plane starts to refuel and will be done in a few minutes.

Are JDAMs and JSOW's correctly modeled?
JDAMs and standard Mk series free fall bombs with GPS guidance kits attached, while JSOWs are gliding bombs that have GPS guidance internally. Both weapons will have more realistic characteristics than in earlier versions of Falcon, but still are lacking some of the proper avionics functioning and symbology as in real life.

My JDAMs fly off the rail and jump back behind my plane!
Yes, this is a problem with JDAMs if you release them beyond the normal release point of other bombs. The best advice is to don't look at them when you release them.

SECTION ONE: NEW FEATURES IN RED VIPER

NEW GRAPHICS ENGINE

Red Viper features an updated DX7 graphics engine that adds multiple enhancements to the simulation. While the work on the graphics engine is a work in progress, pilots will immediately notice some improvements in the simulation as follows:

- FPS
- Stability
- Lighting capabilities and effects
- HUD visual effects
- NVG realism
- Special effects

Note: Additionally, users who have been used to modifying their installs by ***importing and exporting 3D models*** *(LODs) will* ***no longer*** *be able to do this. RV1 uses a new 3D model format called DXMs and modding of this format will require new tools and techniques. The ability to modify DXMs by end users is unknown at this time.*

NEW TURBULENCE (ShakeBabe!)

Red Viper features some new turbulence and shaking simulations that designed to enhance realism. Pilots will notice turbulence and shaking effects in the cockpit as well as additional sound effects.

G-Force Turbulence:
RV simulates turbulence that is applied to an aircraft during high G maneuvering. Pilots will now notice shaking in both cockpits that is designed to simulate the additional forces and shaking that occurs as the effects of high G forces buffet the aircraft.

Mach Transition Turbulence:
RV also simulates turbulence that is applied to an aircraft as it enters and exits high sub-sonic speed envelopes. Pilots will now notice shaking in both cockpits that is designed to simulate the additional forces and shaking that occurs as the aircraft moves in and out of the high subsonic envelope. Pilots will notice that after the aircraft passes through the Mach barrier, the turbulence will subside as in real life.

Take-off and Landing Turbulence:
Pilots will now experience turbulence and vibration effects while performing take-off and landing operations as follows:

- Runway turbulence and vibration during roll outs
- Additional turbulence from airbrakes

NEW 3D COCKPITS

RV1 has several fully functional 3D cockpits that will add a new experience to your F-16 simulation. Some of the features of these cockpits are:

- 6 DOF TIR support
- Functional cockpit buttons, displays, and gages
- Featured 3D pits include: F-16CJ, F-16CG & Mirage 2000-C (Topolo)

Cockpit Switches:
Each of these switches has discrete “hotspots” which are click points that control the switch. The WX Button in the ICP will toggle the display of the button hotspots as see in the image below. Each of the small red dots shown are click points for the buttons and switches. As you can see in this picture, the ICP and MFD buttons are all clickable.

SECTION TWO: MULTI-PLAYER

MP IN RV1

What's new?

RV1 features some improvements to MP over previous SP3/BMS versions. Virtual pilots will need to take time and study the changes and how they affect setting up MP devices such as routers and other forms of connectivity.

MP Updates:
- It's now possible to have multiple clients inside the same Virtual Private Network (VPN).
- Multiple bug and stability fixes have been implemented.

What's different?
The RV MP ID system was updated to allow for multiple clients behind the same router. This has the following effects:
- Network card detection is no longer necessary
- The -ip switch in command line is no longer necessary
- A new -port switch was added to command line.

Connection settings:
- At the comms window, select Internet.
- Choose the bandwidth setting most appropriate to your system (and be conservative). For example, if you have a 256kbps upload/1024kbps download connection, you should choose 128kbps (always lower than your upload).

When Connecting as Server:
- Enter the 0.0.0.0 ip and hit connect.

When Connecting as a Client:
- Enter server IP and hit connect.

If you are inside a VPN:
- RV uses UDP ports 2934 and 2935.
- If voice comms are used, 2936 and 2937 are also used.
- If you are the last client to join game, you don't need port forwards. Otherwise, forward those ports to you machine.

Note: Server MUST always forward ports to its machine if behind a router.

If you have more than one client behind the same VPN:
It is possible to have multiple clients behind the same router. For this, it's necessary to use different ports for each client and also to use a different connecting scheme.
- First client connects normally to server.
- Subsequent clients will need to use -port switch at command line. For example, a second client could use -port 5000, meaning falcon will use port 5000, 5001 (and also 5002 and 5003 if voice comms s are used).
- All these ports need to be forwarded to the client using them.
- Also, these clients **MUST** connect to the first client and not to server.

For example, suppose you have a host H and 2 client machines (A and B) inside a VPN (V), connecting to H.

- The V router needs to be configured to forward UDP ports 2934-2937 to A and UDP ports 5000-5003 to B.
- Machine A connects to H IP.
- Machine B connects to A local IP (inside VPN).
- If a third client (C) at the same VPN wants to join, router needs to forward 4 more ports (based on C -port switch) to machine C.
- And C connects to A IP (like B).

Configuring Falcon 4 (SP3 Notes)

Make sure that EVERYONE has consistent Falcon 4 configurations (and RV Config editor settings, if applicable). It is especially useful to ensure that everyone has built-in voice comms either ON or OFF. Lots of other options are also significant and need to be kept consistent between all online MP users.
Very important: All online players must have the same setting in the tree display option!

Voice COMMS

RV uses DirectX 8 Directplay Voice. Therefore, DirectX 8 or later must be installed on your system. Check out www.microsoft.com/directx). In addition, you must once initialize your microphone by running Voicesetup.exe (in the main Falcon folder).
Real-time voice communication between players does greatly enhance the online gameplay experience in Falcon 4. You can now use "real" radio to communicate with other players! If you want to use voice comms, go into the RedViper configuration editor and enable it (Go to *// use voicecom* and *set g_bvoicecom 1* if editing manually).

Communicating in the User Interface

In the User Interface, use the keys "F1" and "F2" to activate radio comms on two different channels (hold the appropriate key while talking - it acts like a transmit button on a radio):

- Channel 1: Guard (Other team members in the UI or the 3D world)
- Channel 2: Everybody who is in UI

Communicating in the 3D World

Once flying in the 3D world, the keys used to transmit are the ones defined in the keystrokes.key file and will radio on whatever channel COM1 or COM2 is set to on the UFC. The audio volume of each channel can be adjusted by using the knobs on the audio panel in the cockpit. The available frequencies in the 3D world are similar to those in the original Falcon 4.0:

- Flight: Other flight members who have at least one radio set to flight
- Package: Other package members who have at least one channel set to package
- Guard: Other team members will hear (even though there is no radio set on guard)
- Broadcast: Everybody connected to the server (doesn't matter if in 3D or User Interface)
- Tower: Others who have the same takeoff base and at least one radio set to tower.

To change frequency, select COM1 or COM2 from the ICP. Then use [Alt-z] to switch channels.

Fly-Any-Plane in MP Dogfight
The Dogfight module now allows for every online player to fly whatever aircraft is available. If four online players want to fly 2 F-15s vs. 2 MIG-29s (or any combination), this is now possible. In order for this to work correctly the following procedure must be followed.
Note: The host alone must make all the changes listed below. If any client does this, it will not work and the client or host may CTD. The host is the person who started the Dogfight module from the COMMS lobby.
To fly any aircraft in Dogfight, the host must:

1. Follow the normal procedures for connection setup and entering Dogfight module.
2. When in the Dogfight lobby with each player on the proper team, right click on a player's aircraft. This displays this player's dogfight menu.
3. On the player's dogfight menu, navigate down Change Aircraft to the desired aircraft.
4. When the cursor is over the desired aircraft, left click the aircraft. The dogfight menu will close and the aircraft icon will change to the selected aircraft.
5. Repeat this for each aircraft as necessary.
6. After all changes are made and each player is ready to fly, the host must be the first one to select "Fly." The other players are to follow only after the host has clicked Fly.

**** Note 1: Changes do not always appear immediately for the clients****. Though the host sees thechanges properly on his computer screen, the clients may take several minutes to update. Everything will still work correctly though the clients do not see their aircraft icon change to the new aircraft selected.*
**** Note 2: The following step is mandatory to avoid CTDs for clients!***

Setting up a Campaign
When a host starts a new campaign, the clock stops and the priorities setup screen appears. This allows the host to configure the campaign as desired from the beginning on.
The important thing is that clients must wait with joining until the host has set the campaign priorities!

Dedicated Server mode

- Using the option "MP Server mode" in the RV Config Editor, you can put RV into a dedicated Multiplayer Server mode. Clicking the box in the editor next to "MP Server Mode" does enables this.
- ***Using the sub-option "MP Host all units", the server will have the full CPU load of all aggregated and deaggregated units and the network traffic they afford. This option is designed to be useful for a fast CPU server with a high bandwidth hosting many players with low bandwidth connections.***

Dedicated Voice Server
If you want to host large multiplayer games with more than a few players, it is a good idea to set up a separate voice server (Use the voiceserver.exe to setup a dedicated voice host). This host will use mixing techniques to reduce bandwidth load to the clients to max 3.2 kb no matter how many players.
To use a voiceserver, the clients need to point to the host's IP address by setting the *g_stvoicehostip* variable in the config file (i.e. *set g_stvoicehostip "130.123.33.23"*)
A mixing server requires some CPU power so it's not recommended to run the voiceserver.exe while playing Falcon on the same computer. In this case, just run Falcon normally - the Falcon built-in host will act as a forwarding server which doesn't require that much CPU power.

Choosing the server

Now decide amongst all your online MP buddies who has the best online MP connection to be the server and then calculate how many clients will be possible.

- For the server, you need both high bandwidth and stability/consistency.
- To determine how many clients a server can support, do a rule of thumb calculation and figure 33 kb for each client. Therefore, divide the Server bandwidth by 33 to get approximately how many clients can be supported by that server. Do not try to support more clients than the bandwidth can sustain: Major warping and players getting dropped are usually indications that you need to try again with fewer clients, smaller "-bandwidth" settings or both.

Note that the Server host is the person who *HOSTS* the Dogfight or TE or Campaign mission. The Server is *NOT* the person who puts their IP address (or the popular 0.0.0.0 IP) in the UI and has others connect to him. So, the person with the fastest online connection that you want to be the Server must also host the mission. It doesn't really matter much who hosts the connection, since the person hosting the mission will automatically be the Server and all others will be Clients.

About voice-comms

If you use the built-in voice comms in RV, note that (due to MS DirectX features) the voice server host is the connection host person who puts in their own IP address (in the UI) and NOT the person hosting the mission (This does not apply if you use Roger Wilco or other voicecomms and have disabled the built-in comms). Also note that the voice comm server does NOT work from behind routers and NAT. This is a limitation of MS DirectX Direct Voice, so the voice comm. server must be directly on the Internet and cannot be a client behind a router.

Starting a flight

When committing from the UI into the flight to start the mission, one player at a time should enter instead of everyone at once (Note that sometimes this can still create chaos on taxiways). When a player clicks his "Fly" button, the other players will automatically receive the message "(is committing now)" from him.
Be prepared to stop your aircraft from rolling and be alert for other moving aircraft. If possible, it's a good idea to stagger flight times so they won't occur too close together.

Router / Firewall Issues

If you have an external router or firewall, you most likely need to open up UDP protocols on some ports to allow Falcon to work through it (See your router or firewall documentation on how to open up or forward ports).

- For Online Multiplay: UDP on ports 2935 and 2934
- For internal Voice Comms: UDP on 2936 and 2937

If you're behind a firewall or a router, you may also need to use the "-ip" flag in your command line. Using this will explicitly tell Falcon to use a specific IP address. If you know you need this, right-click on your Falcon icon and go to Properties. In the target box put "-ip xxx.xxx.xxx.xxx" (where xxx.xxx.xxx.xxx is your external IP address) in the field and hit apply.
Example: "C:\Falcon4\RedViper.exe -nomovie -noUIcomms -ip xxx.xxx.xxx.xxx"

SECTION THREE: UPDATED AI

AI IN RV1: UPDATED ARTIFICIAL INTELLIGENCE (AI)

RV1 features numerous improvements, reworking and bug fixes of many types of AI. While some changes are subtle, others are significant. Take time to read through the lists of changes and be aware that not all of the improvements are likely listed.

- **New Sensor AI in RV1**
- **Air-to-Air & Targeting AI Updates**
- **Air-to-Ground AI Updates**
- **Additional Fixes and Updates**

New AI A-A Sensor Capabilities:
In previous versions of F4, the AI would respond to A-A threats using "cheats" in the code that gave it some unrealistic sensor abilities. This area of the AI code has been revised considerably along with multiple enhancements as well:

New Sensor AI in RV1:

- The AI will have the same sensors as human pilots: RWR, visual and IR sensors.
- AI will now respond to RWR spikes and will use RWR spikes as a form of sensor.
- AI has more realistic visual sensor abilities. This includes the AI's ability to see incoming missiles that do not trigger launch warnings (IR). In most cases, AI pilots cannot detect IR missile launches that are fired behind or below their visual sensor ranges. Pilots should be able to sneak up behind enemy aircraft with their radars off, providing they are not inside the AI's visual sensor range or have been detected by other means. You may also notice more blind spots in the AI's visual detection abilities due to this work. This also includes sensor enhancements for things like size of target, time of day, use of afterburner, lights, flares, contrails and even damage smoke.
- AI will no longer respond to radar "bugging" by human pilots. If you "bug" an AI aircraft with your FCR, it no longer is used as a way to tell the AI of your presence. Additionally, wingmen will not call out "buddy spike" if you just bug them with your radar.
- The AI can no longer detect incoming IR or ARH missiles at long ranges unless the missile is within a certain distance of their aircraft or if the missile goes active (ARH). This should make BVR missile shots with ARH missiles more realistic.
- AI will now be aware of SAM spikes and will respond by calling out "Mud Spike" and turning on jammers if available.
- AI missile evasion code is now improved. AI will attempt to perform different maneuvers in an attempt to defeat an incoming missile. In some cases, this may mean the AI is able to defeat some missile shots when fired at longer ranges.

Air-to-Air & Targeting AI Updates:
The A-A action in Falcon 4.0 has always been its main feature. Since the Viper has been one of the premier dogfighters in the world for the last 25 years, it has always been one of the strengths of this legacy fighter. Add in the BVR capabilities of the AMRAAM missile, and the F-16 now has become a complete fighter. RV1 features improved BVR and WVR AI. Some of the updates to the A-A AI are as follows:

- A-A flights will now take advantage of the new sensor and targeting updates. This includes responding to radar spikes.
- AI now uses a new scoring system to determine and analyze threats. AI tactics will also change as the threat situation changes.
- AI will react to aircraft using improved tactics. This includes the ability to fire and then beam, which before the AI might simply fly straight towards its intended target. Pilots should also see some improvements in AI intercept tactics when encountering 4 ship flights.
- AI flights may engage targets at longer ranges, depending on the conditions and use missile shots to put opposing flights on the defensive.

- The AI will no longer lock up a target when firing an ARH missile. Pilots will need to be more cautious when going against planes like the Su-27 series, which carry the AA-12 missile. The only way you may know you have been fired on is the RWR warning once the missile goes active.
- AI aircraft now have the ability to target more than one aircraft during combat depending on the conditions. This is best seen when using ARH missiles (AIM-120/AA-12). Once the AI ARH missile goes active, the AI shooter may move onto another target and fire on that one. In some situations, certain aircraft have the ability to ripple multiple ARH missile shots at different targets in a short amount of time if the targets are within the active range of the missile. This is generally where you would have multiple targets that are less then 10 NM away.
- AI will now sort targets according to threat potential and will attack those that are highest threats first. This means that if flights of F-15s are escorting some B-52s, the F-15s will be targeted first and if destroyed, then the bombers will then be targeted.
- AI fighters on strike flights are now more responsive to A-A threats. If threatened within a certain distance while on a strike mission, the AI fighter flight will turn and engage the threat with A-A missiles. They may also jettison their stores, depending on the level of threat. If the AI flight is not capable of shooting A-A missiles (attack/bomber), they will perform defensive maneuvers and may jettison their stores
- AI Strike mission CAP and SEAD escorts will not likely target non-threat aircraft (attack/helos/bombers) if passing nearby when escorting Strike aircraft. This should eliminate the problem of escorts chasing non-threat aircraft while on a strike mission. However if Escort/SEAD/Strike aircraft encounter enemy fighter types, they will break formation and engage the bandits. This may include all the planes in the strike package if all are fighters.
- Some improvements were made to the AI IR missile targeting as well.

Air-to-Ground AI Updates

- The “Weapons Free” command now really is weapons free. If you give your wingmen the weapons free command, the AI will search the area for a target (A/G) and kill it. You don't have to wait until they ask for "permission".
- AI is now aware of A/G spikes. They will call out “MUD spike” and turn on jammers as listed below. This is helpful when AI flights are near SAMs. This also changes the dynamic of jammers v. SAMs in the game. Note the changes to SAMs and their firing ranges as a result of this AI change.
- AI will now drop bombs in single, pair or ripple, depending on the bomb type. In general, 2,000lb bombs will be dropped as singles 1,000lb bombs as pairs and 500lb bombs will be all at one time. Additionally, CBUs will be dropped only in pairs permitting the AI to make multiple passes on targets using CBUs.
- AI is now better at sorting targets when on strike missions.
- AI targeting and bombing with CBUs has been improved.
- AI flights now will show improvements when using HARMs. They will fire at longer distances depending on the SAM and will normally space their firings so they do not waste HARM shots as before.

Additional Fixes and Updates:

- Fixed DATALINK HSD bug where flight members disappeared after others in the flight were killed
- Allow AI to keep speed when returning back to base (no more 300 knots) Before this fix, the AI would switch to landing waypoint after their target and then fly home at 300 knots. Now they will maintain correct waypoint speed until 15 miles from the airbase
- Wingman, Element, and Flight command menus will now update real time. A player may keep a menu open and make selections with the FCR or HTS and the appropriate commands will activate. Player no longer needs to cycle the menu for updates.
- Dropping stores or firing missiles/AGMs will now cause airframe buffet.
- ALOW now defaults to 10 feet.

Pickle Button Changes

RV1 has modified the weapon release profiles for A-A and A-G missiles. In all previous versions, the release of all missiles was instant as soon as you hit the pickle button. Now with some weapons, you will have to depress the pickle button and hold it for a certain time in order for the FCC to update the weapon and fire it. A general rule is if the weapon has an IR seeker (e.g. Sidewinder/Maverick); there is no delay in firing since the missile seeker has already acquired the target. Pilots should note the changes to this operation for the following types of missiles:

- FCC update delay (depress the pickle button until the weapon fires): Radar guided missiles & HARMs.
- Instant weapon release upon depress of pickle button: IR A-A missiles and IR seeker A-G missiles.

Wingman Command Tips

With some of the updates to the AI in RV, a review of wingman commands and their usage is needed. Remember: PB=Pre-briefed and TOO=Targets of opportunity.

- First pilots need to understand that the AI uses the combat waypoints to determine their actions. If you are leading a flight with AI pilots, then you need to make sure you are changing your waypoints to the combat waypoints so the AI is on the same page with you. These are waypoints like “CAP”, “Strike”, “CAS” or “SEAD” as shown in the briefing during mission planning. Otherwise if you give a command such as “weapons free”, the AI does not have any targets to attack and will likely do nothing.
- Pilots also need to understand that AI needs targets in order to take actions. If you are on an A-G mission and have pre-planned targets, then the AI has these on its target lists. In most cases, as the AI acquires their targets and you have switched to your combat waypoints, the AI will call out “permission to engage”. This is indication that the AI has targets to attack and is ready to engage.
- The “weapons free” command should be a standard for use unless you want have a need for more control over your AI wingmen. While you can use the “attack targets” or “attack my target” commands, pilots should remember that the AI in RV already has sorted PB targets if on a Strike mission and micro managing their actions is not necessary. Normally during PB A-G missions, the AI sorted target list is set according to importance and the targets are good ones.
- When on a TOO mission with either A-A or A-G stores, the “weapons free” command should be used first if the AI has targets (CAP/BAI/SAD). If the AI is unable to comply, then you’ll have to target something for them and may have to use the “attack targets” or “attack my target” commands instead of “weapons free”.
- In some cases of A-G sorties, the AI will perform poorly when given “attack targets” command. This is usually due to the commands given when the AI is not able to set up a proper attack profile. Pilots need to remember to assign TOO targets to the AI early enough in the engagement to allow the AI to set up their assigned attack profiles and be able to deliver their weapons.
- In the case of A-A missions, the AI also sorts targets according to combat type so micro managing A-A missions should not be necessary either.
- Additionally, sometimes the AI still does stupid things when you give them commands. In this case it is good to command them to rejoin formation and try and start all over again. This generally will reset the bad AI situation and enable you to try again with your engagement commands.

SECTION FOUR: GPS WEAPONS

The RV patch features some significant changes to the use of GPS type weapons. While these changes are exciting and should add life to Falcon 4.0, they are considered a WIP and still need more work. Pilots are asked to use these with this understanding and accept the limitations of development in this area for now. And as always, if pilots feel the implementation of these weapons is not “realistic” enough for their tastes, they can elect to not use them.

The following tutorial is designed to show you how to properly target and deploy JDAMs and JSOWs in RV. Both JDAMs and JSOWs are GPS guided munitions and are able to only target stationary targets and not moving targets.

JDAMs & JSOWs in RV1:
Both weapons operate in 2 basic modes:
1. **PB** (Pre-briefed targets)
2. **TOO** (Targets of opportunity).

While the delivery methods of each weapon differ in some aspects, the targeting functions are the same. As long as pilots remember some of the basic rules of deployment, they will be able to enjoy this upgrade to Falcon 4.0 and integrate these weapons into their ROE for missions.

Quick Start-Basic rules:
1. For PB targets (TGTs), both weapons can be delivered in CCRP, CCIP or MAN delivery modes for PB targets (although CCRP & CCIP are not desired delivery modes for JSOWs). In PB mode, the scrolling list of targets is used to select targets that have their GPS coordinates pre-programmed. These are the only targets available in this mode and if you release the weapons away from the target area, the bombs will attempt to “fly” towards the GPS coordinates.
2. For TOO modes, currently only MAN delivery mode can be used to deliver weapons to updated GPS coordinates. CCRP and CCIP modes are switched to normal delivery as in regular dumb bombs.
3. DTOS mode is not affected by GPS in either mode and can only be delivered the normal DTOS delivery method.
4. In order to successfully set new GPS coordinates in TOO mode, the TGTs must be locked up using GM radar in CCRP mode first using SP mode. If not in CCRP mode, the weapon will attempt to fly to the previous PB target or waypoint if no PB target. You will need to switch to SP mode in your GM radar and click the lock button one time in order to move your radar cursors over the target area.
5. Once the TGT is locked up in CCRP, pilots can switch to MAN modes to deliver the weapons. Remember, MAN is the only delivery mode that currently works as GPS weapons in TOO mode.
6. Since there are no targeting cues for MAN delivery mode, pilots should use CCRP mode until the TGTs are within range of the weapons then switch to MAN mode for delivery.
7. Using MAN delivery mode is useful for the following:
    a. When pilots want to deliver multiple bombs on one pass at PB TGTs. Each time you release a bomb, you’ll see the scrolling list switch to the next target.
    b. When using JSOWs. MAN delivery mode is the only mode that allows launching of JSOWs from long range.

GPS Weapon MFD Symbology:
The following images show the different functions for operating GPS weapons.

Image 1:

Image 1:
Note that in this image, all of the OSB functions are circled as follows:
1. PB/TOO selector
2. TGT Selector for scrolling list of targets. Pilots and scroll up or down through the list by clicking on the corresponding OSB.
3. On/Off button used to initialize the weapons. This takes about 4-5 seconds for the GPS system to completely initialize.
   *Note the weapon has been initialized and is now “RDY” for use.
4. The TGT list shows the applicable PB Objective as selected in the mission planning map.
5. The OBJ field shows the current TGT selected (Generator)
6. The RNG field indicates the slant RNG to the target in NM.

Image 2: JDAM MFD in TOO mode.

Image 3: JSOW showing that TGT is a unit (97th Air Defense Battalion).

Image 4: JSOW without any PB targets.
TGTs will have to be acquired via CCRP & GM->SP radar functions

Image 5: Shows full HUD and MFD views.

1. WPN is JSOW-A
2. TGT was not a PB, so TOO was required.
3. TGT was acquired using GM radar-SP (snowplow) in CCRP mode.
4. Targeting cues are shown only in the HUD and not MFD.
5. At this altitude and distance, the JSOW should easily glide to the TGT.

JDAMS (GBU-31/32/34/35/38):
JDAMs are regular Mk series dumb bombs with GPS/INS guidance kits attached. They do not have any type of propulsion systems are limited in range due to being free fall weapons. Just like regular dumb bombs, JDAMs dropped at lower altitudes will have lower ranges that those dropped at higher altitudes. The maximum range of any JDAM when dropped in level flight at cruise altitude should be around 6 NM from the target. Under some conditions and altitudes, ranges can be extended, especially if the bomb is lofted during release.

JDAMs work in 2 different modes: PB (Pre-briefed) and **TOO** (Target of Opportunity).
In the PB mode, the JDAM will be pre-programmed to attack any of the targets listed in the scrolling list in the MFD.
This allows the pilot to attack multiple targets in just one pass by selecting different targets after the previous one has had a bomb released towards it. While you can only select and target one target at a time, you can sequentially move through the list in a short amount of time and target several items on one pass, releasing bombs each time you re-target. You can also drop more than one JDAM on an individual target.

JDAMs in PB (Pre-briefed) Delivery Method: This method is used when the primary and secondary targets have been pre-briefed and the target data has been loaded into the INS/GPS systems. The PB target will show up in the MFD as "Runway 22" or "Factory 07". You can also step through the PB target list and select another target by depressing the OSB button next to the TGT STEP listing in the MFD. You will see the different targets listed as you depress the button.

Note: Ground units such as air defense units will not allow you to target step if you have chosen to use JDAMs for strikes against ground units.

JDAM Basic Operations:
If target is PB and is an objective:
1. Make sure you are set to the target waypoint and the >AGG text is not showing in the MFD. If you see >AGG in your MFD, it means you are beyond the target's bubble and the weapon will miss if you fire since it cannot target something outside of the target bubble. In order to get into your target's bubble, you have to either select the target waypoint or move your GM radar cursors over the area where your target is. Once the >AGG disappears, the GPS weapons will be able to target their targets.
2. Turn on weapon.
3. Select PB target from target list.
4. Select delivery mode (CCRP/CCIP/MAN) for weapon release.
    a. CCRP requires you to fly the standard CCRP flight profile in order to release the weapons.
    b. CCIP allows you to point your pipper on or near the target area and release while generally in a dive. In this mode you can make multiple releases of bombs as your FCC steps through the target list.

    MAN allows you to perform similar actions as CCIP, but you can do this in level flight.
    *Note: MAN bombing gives no targeting cues in the HUD. Since there are no targeting cues for MAN, use CCRP mode to get within the normal range of the target(s), then switch to MAN for final release.
5. Once you release the weapon, you will automatically be switched to the next target. If you want to launch another weapon at the first target, you will have to manually switch the target selector to the previous target.

The following delivery modes are recommended for this type of mission using JDAMs.
CCRP: Using CCRP gives the pilot the necessary bombing range and delivery cues need to tell if the target is within range of the JDAM. Since JDAMs are free fall bombs, they will have similar ranges as LGBs or regular dumb bombs. You will still have to fly the standard CCRP delivery profile in order to get the JDAMs to release.

CCIP: Using CCIP gives the pilot a view of the target below and will allow the pilot to release the bomb within the correct range so it can guide itself to the target. The pipper does not have to be on the target since the target has been pre-programmed into the targeting system.
DTOS: JDAMs can be delivered using the DTOS mode the same way they are for regular dumb bombs.
MAN: The Manual bombing mode is useful when bombing multiple targets in one pass. Pilots can fly level at cruise altitude and use CCRP mode to make sure they are within range of the targets. Once in range, switch to MAN and then begin delivery. This is best accomplished while flying in level flight at cruise altitude. In general, if at cruise altitude weapons can be delivered from 6 NM and can successfully reach their targets.

JDAMS in TOO (Target of Opportunity) Delivery Method: This method is used when targets of opportunity are available that are not a part of the Pre-briefed mission. The following delivery modes are recommended for this type of mission using JDAMs.
CCRP: TOO re-targeting GPS does not work in this mode so JDAMs should be delivered the same way as regular dumb bombs. Using the A-G radar, lock up your intended target. The JDAM will now be programmed with the coordinates of that target. Once you are within range in CCRP mode, you can pickle the bomb(s). You will still have to fly the standard CCRP delivery profile.
CCIP: TOO re-targeting GPS does not work in this mode so JDAMs should be delivered the same way as regular dumb bombs. You can use your CCIP pipper as target designator just like regular dumb bombs. The delivery method is the same as normal CCIP methods.
DTOS: TOO re-targeting GPS does not work in this mode so JDAMs should be delivered the same way as regular dumb bombs.
MAN: The Manual bombing mode can be used **only** after you have designated a target using your GM radar in CCRP mode. Otherwise, the bomb will default to the previous target since it has not been reprogrammed. If you target something using CCRP, you can switch to MAN and then pickle the bombs. You should stay in CCRP mode until you are sure you are within range of the target. Otherwise, you bombs are likely to fall short of the target and miss.
* Note: Make sure when re-targeting in TOO, you target using SP mode in the GM radar. Otherwise you may just re-target the pre-planned waypoint and not your new intended target.

- LADD mode is not operational for all types of bombs.

JSOW (AGM-154):
JSOWs currently come in 2 different types: CBU dispensers and Penetration type bombs. The AGM-154 JSOW is a gliding bomb munitions dispenser is designed to allow the launching aircraft to strike from long distances against PB targets or TOO in high threat areas.

- The AGM-154A is a CBU type gliding bomb cluster munitions dispenser, designed to primarily provide an economical way to strike air defenses beyond their threat ranges. The F-16CJ was the first operational and primary user of this weapon, although several other types of aircraft are able to carry it as well. JSOW-As are not recommended for use against hard targets and will likely produce only minimal damage to non-vehicle targets.
- The AGM-154C is a penetration type version designed to allow the launching aircraft to strike from long distances against PB targets or TOO in high threat areas. The USN F/A-18 fleet is the primary user of this variant.
- The AFDS, which is used by several European aircraft and the Bombkapsel m/90 (Mjolner) used by SAAB aircraft, are similar to the JSOW-A. They are gliding bomblet dispensers with GPS guidance for use against soft targets like vehicles and air defense sites. They also will likely have a shorter range than JSOWs.

Developer's notes on JSOWs:
The operations and deployment of JSOWs in this patch are considered a "work in progress" and still need more work. While the weapons basically function in a way similar to the real weapon, realistic HUD and MFD symbology is missing partly to the lack availability of real information at the time of development. Additionally, the flight profiles of JSOWs leave a lot to be desired. In order to get the bombs to glide at realistic distances, pilots will likely see some odd behaviors of the bombs should they chose to view the bomb during it's flight path. Much of this will depend on altitude, release angle, speed of aircraft and range to target. In most cases, the JSOW will tend fly up to the target at high altitude, then make a slow turn down for its final descent.

For best results, it is recommended that pilots release JSOWs in **level** flight while at 25k' AGL. Tipping the nose down or up may cause the bomb to fall short or loft into an unwanted flight profile since the AoA of the aircraft basically is used to aim the JSOW during its flight.

As always, should the virtual pilot find the realism attributes of the JSOW to not be up to their standard, they can elect to not use the weapon and substitute something else for it.

Using JSOWs:
JSOWs work just like JDAMs and operate in 2 different modes: PB (Pre-briefed) and TOO (Target of Opportunity).

If target is PB and is an objective:
1. Make sure you are set to the target waypoint and the >AGG text is not showing in the MFD. If you see >AGG in your MFD, it means you are beyond the target's bubble and the weapon will miss if you fire since it cannot target something outside of the target bubble. In order to get into your target's bubble, you have to either select the target waypoint or move your GM radar cursors over the area where your target is. Once the >AGG disappears, the GPS weapons will be able to target their targets.
2. Turn on weapon.
3. Select PB target from target list.
4. Select delivery mode (CCRP/CCIP/MAN) for weapon release. CCRP & CCIP are not recommended release modes for JSOWs due to the range limits of FCC release mechanisms. Pilots should use the CCRP mode first to get the targeting cues to determine the range of the target, and then switch to MAN delivery for release of the bombs.
   ***Note:** MAN bombing gives no targeting cues in the HUD. Since there are no targeting cues for MAN, level release is suggested when the target is within 30 NM and a loft release of 10-15 degrees is suggested when within 30-50 NM of the target.
5. Once you release the weapon, you will automatically be switched to the next target. If you want to launch another weapon at the first target, you will have to manually switch the target selector to the previous target.

If target is PB and is an air defense unit or other non-objective target:
Non-objective targets are always vehicles, which are part of a unit. This will primarily be an air defense unit, but other types may be targeted as well. Units do not appear on the target list and the PB target coordinates may not be the desired target if a JSOW is launched at the coordinates. There are several options for pilots to use in this scenario.

The first is to recon the target(s) in the recon map during mission planning and determine the location of the main targets before the flight. For a PB target, you can change the waypoint to "Strike" and then select your intended target from the target list. In the case of air defense units, this will not likely place your JSOW on the exact desired target, but will cause it to be close enough to likely destroy several of the vehicles in the unit if the bomb is delivered correctly.

A second option is to use the TOO method as listed below and target specific points where the vehicle(s) you want to destroy are located. In most cases, your SEAD/DEAD target will be the unit's FCR radar vehicle. The location of this vehicle can be found in the recon screen. Once you know the location of this vehicle, you can use this information when acquiring the target using DSB-2 sub-mode of GM radar.

PB (Pre-briefed) Delivery Method: This method is used when targets are in the PB TGT list. If the TGT is an objective, then the only difference between JSOWs and JDAMs is the release distance. In order to release at longer distances, JSOWs will have to be released in MAN mode.

TOO (Target of Opportunity) Delivery Method: This method is used when targets of opportunity are available that are not a part of the Pre-briefed mission. The following delivery modes are recommended for this type of mission using JSOWs.

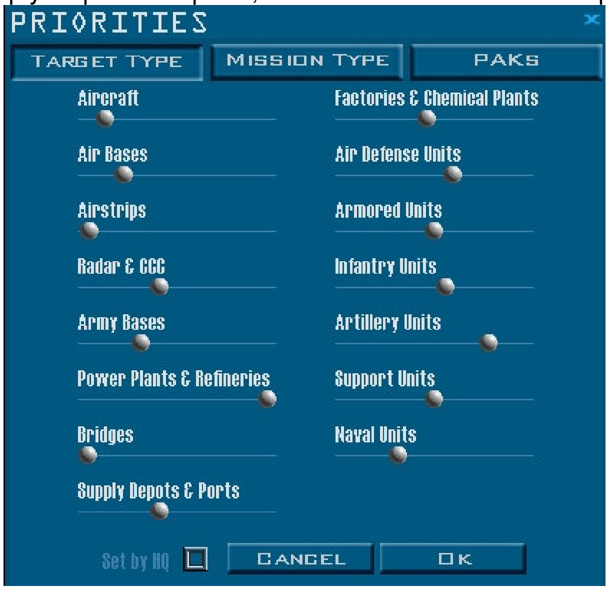
As with JDAMs, TOO mode is used when the pilot wants to retarget while in flight as follows:

1. Switch to TOO mode
2. Stay in CCRP mode
3. Using your GM radar, find you target in SP mode. If you have the waypoints set over your target, you can slew the cursors over the target where your waypoint is.
4. Once you slew your cursors, you can use DBS-1 or DBS-2 to provide enhanced definition of the target area and can target an area on or near the objective or feature you want to destroy. This is where a sketch or map of your targets will come in handy.
5. Lock up the target and the GPS coordinates will now be set for your weapons.
   * Note: Unless you use TOO and CCRP to reset your GPS targets your weapons will fly towards your previous targets. You must use CCRP to retarget in order for your GPS to update the target coordinates to the weapons.

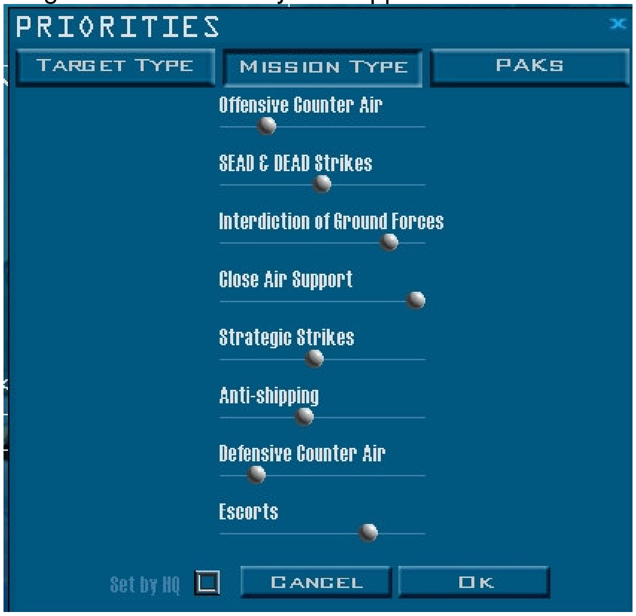
SECTION FIVE: CAMPAIGN ENHANCEMENTS

Campaign Priorities Sliders:
The two sets of sliders used to adjust the ATO in campaigns have been revised to be more logical and intuitive. The sliders will now give the pilot a better understanding and control over the types of targets and missions the ATO works with as follows:

Target type: Changes include; Airbase, Airstrips, Radar & CCC, Army Bases, Power plants & refineries, Supply Depots and ports, and Factories and chemical plants.



Mission type: Three sliders in this screen will have the greatest effect on the ATO. They are OCA Strikes, Interdiction and Strategic strikes. The SEAD/DEAD & Escort sliders will be linked to OCA and Strategic strikes since they are support missions for Strikes.



Addition of Army Bases, Depots and Ports to campaign production-supply system:
These objectives have now been added to the production system of both sides in a campaign. This was done for several reasons. Ports and depots are generally used as storage sites for supplies & replacements. In some cases, ports and depots may be very large and would be high value targets in a real war. Their destruction would likely have significant impact on the enemy's ability to re-supply his war effort. Additionally, army bases would be of similar significance due their supply, replacement and repair capabilities. Adding these three objective types to the campaign supply system now not only makes them legitimate strategic targets but their destruction will have a greater impact on the overall war. While these objectives are now part of the supply system of each team, pilots should know their contributions have been scaled down so they would be considered lower priority targets compared to power plants and factories. This is especially true of army bases, where their re-supply values are minimal.

Code fixes:
Several fixes were made to basic campaign operations code that should result in greater stability in game play.

SECTION SIX: ARTWORK & DATA EDITS

ART WORK:

RV1 features new artwork to go along with the new GE enhancements as follows:

3D Models and Textures:

- Many models now feature moving pilot head to enhance realism.
- Model updates and skins: F-16, A-10, MiG-29, MiG-21, F-4, Tu-22M, J-8, J-10, Su-15, and more.
- Several texture and model enhancements around air bases.

Special Effects:
RV1 features improved special effects as follows:

- Explosions
- Smoke trails

DATA EDITS:

The RV database is a continuation of the data edits started with the RPG, F4UT and FF Teams; and is based upon the FF3.1 DB. With years of work and development behind it, the RV database is now a mature fixture in the RV1 patch. RV1 includes updates and previous work that has improved the realism and game play of Falcon 4.0.

Some key features of the RV1 Data Edits include:

- Flight models
- New additions & Updates
- SAM and IADS Updates
- ATO Updates
- Terrain Elevation
- Campaign & Theatre Update
- DPRK Asymmetrical Warfare in RV1 campaigns:
- 2D Scoring Study and edits
- F4 Reserves Test

Flight models:
The stock F-16 flight models in RV1 are the popular High Fidelity Flight Models, produced by “Mav-jp” and “Raptor One”. The RV1 database has been modified so that any one 3 different sets of F-16 flight models can be selected just by renaming the below listed folders to just “**sim**”. These will be found in your C:\MicroProse\Falcon4 or other applicable root directory. If you want to just fly the HFFMs, then you do not need to do anything. Otherwise, just rename the folder of your choice to “**sim**”. The 3 sets of F-16 flight models are as follows:

- **HFFM sim** -HFFMs by Mav-jp and Raptor One (not necessary, but provided anyway)
- **FF3-1 sim** -SP4 & FF3-1 Flight models by Raptor One
- **FF2 sim** -FF2 Flight models by Saint

NOTE: Users should NOT install the High Fidelity Flight Model patch since it not necessary and will likely cause RV1 to be unplayable.

Additional flight models:
The following aircraft have updated flight models by Topolo:

- Dassault Mirage (all variants)
- Dassault Rafale
- Super Etendard
- MiG-21, 23 & 29

New additions & Updates:
Several updates and additions are now a part of the RV1 DB. For more details, pilots should take time to review the updated Tactical Reference DataBase (Tacref).
Below is a sample of what is new:

- Aircraft updated with newer weapons or capabilities: Luftwaffe F-4F, KF-16 Block 52, & F-4ESK.
- AIM-120C: RV1 has several new variants of the AIM-120C missile. Several of these variants feature long ranges and some improved capabilities.
- PL-12: The Chinese PL-12 MRAAM has now entered service with the PLAAF. It has similar capabilities to the AIM-120B or AA-12 ARH missiles.
- Several new vehicles are now operational, including the ROK K1A1 MBT & the Chinese DK-9 SAM system. Additionally, several vehicles like the Chinese Type-69 MBT were updated or changed to increase realism.
- Most of the ground units of the ROK, PRC and DPRK have been updated to reflect current force levels and unit structures.
- Weapon 2D damage scores were modified as a result of the 2D Scoring study.

SAM & IADS Updates:
SAMs are the single greatest threat to F-16s when flying combat. The SAM simulation in Falcon 4.0 still operates much as it did with the SP3 Patch, although a few improvements have been made for RV1. In the real world, SAM systems can be quite complicated and when integrated into an IADS, they will likely perform differently than what is seen in Falcon 4.0. But for RV1, a study was conducted of SAM operations and how they work in Falcon 4.0. A few new things were discovered that has resulted in changes and updates that are now included into RV1:

- **Addition of Search Radar to SAM units:** It was noted that most SAM systems only have one radar in the unit while in real life they usually have at least 2 types: Search radars and track/guide (fire control) radars. Some SAM systems may have 2-3 different radars in the unit depending on the way the type of unit and the way it is organized. After hours of testing and development, most SAM systems in RV1 now have 2 radars operating in the unit, as follows:
  - **Search/acquisition radar:** Used by most SAM units to provide to provide initial range, bearing and altitude information that is passed on to the Fire Control Radar (FCR).
  - **Fire Control Radar (FCR:** Provides final track & guidance for SAMs (e.g. Fan Song, Low Blow). Pilots now will see a different type of symbology in their TWS/RWR scopes when encountering SAMs. Initially they will see an S or other symbol that indicates search radar is targeting them. As they come closer to the unit, they will see the search radar step through the search, track and guide modes as in earlier versions. When they get within the firing distance of the SAMs, they will see the FCR activate and begin tracking them. In some instances this shows just as the SAM is being launched and is usually a number in the TWS like “2” for the Fan Song radar of a SA-2.

- **Revision of SAM ranges when AI uses jammers:** SAM systems did not react well when the updated AI in RV1 approached them with jammers turned on. In all instances, the SAM radars turned on too early in the engagement. This exposed them to SEAD attacks for extended periods before the SAMs were able to burn through the jammers and fire back. This was considered poor AI, since in real life SAMs are likely to stay turned off until the targets are close enough that their jammers are not effective anymore. As a result of this study, SAM radar ranges and engagement distances have been lowered considerably to accommodate the shorter range they have when the target is jamming them. While SAMs in RV1 will now engage at lower ranges than in previous patches, the effects of ECM will be lesser as well since targets are now more likely to be within the radar burn-through ranges of the SAM units.

*Note: Please refer to the **FF3 SAM Range Chart** for estimates of SAM threat ranges.*

- **Placement of SAMs /IADS:** Comprehensive testing was done to evaluate the effects of the IADS in Falcon 4.0. While SAMs in Falcon 4.0 generally act independently of one another, they do have the ability to use the search radar of longer range radars to minimize search times required for engagements. While the way this currently works might be a bug or at least be buggy, it is known that Falcon 4.0 uses SAMs that overlap one another is a form of IADS. This is where the search radar of one SAM supports the search timing of other SAMs within a certain range and placement on the map.
- **Early warning radar units:** A new unit was added to RV1 and it supports other SAMs by providing search radar functions as listed in the IADS notes above.
- **Alternative guidance methods for SAMs:** Several SAM systems that have optical guidance capabilities now have this feature in Falcon 4.0. Additionally, some SAM systems may continue to fire unguided missiles after their radars are destroyed.

ATO Updates: Changes to the RV1 ATO are as follows:

- SEAD strikes are now called SEAD/DEAD and feature 2 - 2 ship flights of SEAD aircraft with the 2nd flight carrying CBU type munitions. This was designed to emulate the "Hunter-Killer" flights that are common SEAD/DEAD tactics.
- Pilots should see some improvements in escorts for certain types of missions.
- Transport flights now will generate sorties on a normal schedule.
- Low-altitude strike is now a mission feature for certain aircraft assigned these scores.
- SEAD sweep is now a mission available only in TEs for SEAD type aircraft.

Terrain Elevation:
The stock KTO in RV1 now has an increased elevation to the terrain. Pilots will see higher mountain peaks, which add to the immersion and realism of flying.
Note: Modifying the terrain elevations with other resources may cause the radar LOS calculations to be incorrect.

Campaign & Theatre Update:
RV1 features 9 campaigns that are designed for the Korean theatre. These are aligned into 3 different theatres as follows: Korea Standard, Korea-2005 and Eurowar.
All campaigns feature several flyable F-16 variants as well as a wide variety of aircraft, units and scenarios. Additionally, full use of all of the new features in RV1 was taken advantage of. All campaigns in RV1 have the following features and updates:

- The "Rolling Fire" campaign was designed to feature all of the updates in the RV1 DB as well as placement of units based upon real life force levels. This should be considered as the "most realistic" campaign in the patch.
- Campaigns come with default ATO settings designed to improve play and realism. Pilots need to make sure the "Set by HQ" light is turned **off** when starting a campaign. This will activate the pre-set settings. Pilots need to monitor their ATO slider and PAK priorities settings as the campaign progresses.
- Pilots need to take advantage of the new Mission and Priority sliders feature in RV1. This will allow them greater control over their sortie types. Also note that the slider for bridge strikes is turned off by default.
- The IADS in all campaigns has been updated to make use of all of the updated SAM and search radar functions featured in RV1. SAMs have been strategically placed so they form an improved IADS. This includes use of Early Warning radars placed in strategic locations.
- All campaigns and the stock TE template have had their radar Line-of-sight calculations updated to accommodate the increased terrain elevations in the KTO terrain. This will result in improved NOE flying, especially near mountainous areas.
- All campaigns that feature the ROK have updates to the KF-16 and F-4ESK aircraft.
- Pilots will now notice a larger amount of OPFOR aircraft flying CAPs deeper in their own territory. This will require a greater emphasis placed on achieving air superiority before

attempting strike missions deeper into enemy territory, since any strike flight is likely to be engaged multiple times by enemy fighters to and from the target area.

- The Standard Korean theatre features updates of the original Tiger Spirit, Rolling Fire and Iron Fortress campaigns. Starting with Tiger Spirit, the campaigns are aligned in difficulty from easy to hard in descending order.
- The Iron Fortress campaign now features the Allies going on the offensive depending on the conditions.
- The Eurowar theatre is designed to feature European aircraft in 3 different scenarios. All campaigns feature Allies v. OPFOR scenarios and have a wide variety of aircraft and other forces in them.
- The Korea 2005 theatre provides a few more interesting campaigns like Korea 1983 & Korea 2005.

DPRK Asymmetrical Warfare Tactics in RV1 Campaigns:
RV1 has attempted to improve realism in Korean campaigns by making modifications designed to create more asymmetrical warfare for the North Korean side. Additionally, some of these modifications are a result of recent articles on tactics the DPRK has planned in the event of war. This includes the following contrasts of Red v. Blue:

- The Allied ATO will generally follow standard USAF doctrines of attempting to achieve air superiority by use of SEAD/DEAD strikes, sweeps, and use of escorted strike packages for strike missions. Additionally, Allied ATO will schedule all missions to be flow at medium and high altitudes to avoid enemy AAA and MANPADs.
- The DRPK will use its fighter force to stay home and defend the homeland while generating strike flights that fly at very low altitudes, are normally unescorted, and are considered “expendable” aircraft. These strike flights are designed to fly under Allied radars and cause air defenses to have more difficulty in stopping their attacks.
- Some of the DPRK fighter squadrons have been made smaller so they can be dispersed to more locations while still preserving a realistic amount of planes as the DPRK has in real life.
- The Allied side will generally have most of their resources above the ground; the DPRK will have a certain amount of strategic resources located in underground areas, which require more intense bombing to destroy.
- The DPRK will use some airstrips that have been converted to small airbases for staging flights by certain aircraft that are able to use shorter runways.

Campaign Tips:
Pilots who enjoy the dynamic campaigns of Falcon should review the following campaign tips.

Settings upon starting a campaign:

- Use the pre-set RV config editor settings.
- Only use airbase relocation if you need to, otherwise leave it turned off.
- Only use “large strike packages” if you have enough planes on your side to handle the extra flights.
- For the challenge rating, always select “rookie” settings as you start a campaign. This will set the proper amounts of forces for both sides as dictated by the campaign designer as well as the unit data editors. Using “ace” settings for both “pilot skill” and “ADA skill” is advised for maximum realism.
- Before you start the campaign, make sure you adjust the priority and PAK sliders settings. These are found on the right hand side of the screen and are opened by hitting the “P” button. Note that you have 3 different pages. The last page is called the PAK page. Always make sure the “set by HQ” button green light is turned **off** so that the pre-set priorities will be used and not the ones generated by the game.

Strategies as the campaign progresses:

- Note the new slider settings and use this to control the flow of sorties for you side. Also remember the PAK settings and use them to your advantage. If you are in the early going of a campaign and have not acquired air superiority, then you may want to scale back the amount of strike flights into enemy territory. The same for some of the harder campaigns where the enemy is on the offensive and you need to focus on defensive missions.
- Use SEAD/DEAD flights to not only clean out SAM sites, but to destroy enemy aircraft in the air as well.
- Remember that with the “any waypoint tasking” feature; you can take any flight and turn it into something else by changing the combat waypoints and weapon loads. If your ATO has lots of Strike missions and you are getting your airfields destroyed by enemy flights, then you might want to turn your strike missions into BARCAPs and concentrate on protecting your vital assets.
- If you allow the campaign ATO to plan numerous OCA strikes against air bases, you may find that you campaign will begin to get stale since most of the opposing side’s airfields will be destroyed. You might want to lower the sliders so that the amount of the OCA strikes is lowered, resulting in more A-A action for both sides. In some cases, it may be more advantageous to destroy enemy aircraft in the air than to have the airbase destroyed, since this will give your side points and will increase the initiative for your side.
- Remember, the campaigns in RV are not perfect, but they can be challenging and fun. While you can just enjoy the flights that the campaign ATO assigns you, you can also take charge and affect the outcome of the war by using some of the above-mentioned strategies.

2D Scoring Study and Edits:

A detailed study was conducted to review the effects of data edits and how they affect the 2D scoring in Falcon 4.0. While the 2D world in Falcon 4.0 has long been known to suffer from realism problems, the results of this study enabled us to adjust the 2D effects of weapons and aircraft so that there is more balance in the entire database. Some findings and adjustments are as follows:

- Some aircraft due to larger weapons loads and some unbalanced scoring values were able to achieve highly unrealistic damage results in the 2D world. This included a combination of scores from the aircraft files and the weapons file. Once some basic parameters were determined, adjustments were made for all aircraft and weapons so that all no aircraft was given unrealistic scores.
- Some weapons were found to have the wrong amount of hard point divisors, which gave them scores higher than normal. These were corrected in RV1.
- It was noted that the 2D world does not take into account the blast radius of weapons when scoring, but only the damage amounts. Along with this finding, it was noted that CBU type weapons with high blast radiuses were getting very low 2D scores. These were corrected as well.
- With these edits, AI weapons selections in campaigns should be improved as well.
- Unfortunately, there were some other outcomes noted from the 2D study that were not editable and as a result continue to give unrealistic results. Particularly is the scoring of SAMs and the effects on flights in 2D. While this is an area for future consideration, it will require code edits to improve this.

F4 Reserves Test:
The “Percentage of available aircraft” and “Minimum available aircraft” settings in your configuration utility are commonly known as F4Reserves. These settings affect the amounts of flights generated by the ATO during campaigns. A test was conducted to see the exact results of the different settings available in the available aircraft fields listed in the F4Patch utility. After reviewing the tests of multiple aircraft in the campaign mode using the different settings, the best settings for these fields were determined and are preset in RV1. It is recommended that users leave the stock settings as they are as set in the RV config editor. These are:

- set g_npercentage_available_aircraft 40
- set g_nminimum_available_aircraft 4

Updated RWR/TWS Symbols:
Pilots should note the updated radar symbols listed below. All aircraft radars will have a chevron over top of the number.
They are as follows:

- Mirage 2000: 20
- Mirage III/5/Kfir: M
- Rafale: R
- EF-2000: E
- Super Etendard: S
- Mirage F1: 1
- Su-9: 9
- JA-37: 37
- JAS-39: 39
- J-10: 10
- F/A-18E/F: 18
- F-4F ICE: 18
- AV-8B: 18
- K-SAM: K
- SA-11: 11
- SA-12: 12
- SA-17: 17
- Crotale/HQ-7:C
- Crotale-NG: C
- Roland-Marder: R
- All Ship Radars -ship silhouette

SECTION SEVEN: GETTING STARTED

CONFIGURATION AND SET-UP:

Game Settings and the RedViper Configuration Editor:

1. Once you have installed this update, it is good to go ahead and start the simulation and perform the initial set-up functions. Make sure your desktop Icon is pointing to the RedViper.exe and not another Falcon 4.exe.
2. If you want to use the external RedViper Configuration Editor, you will have to exit the simulation and click on the RV Config Editor desktop icon. This should already start upon install.
3. Start your RV Config Editor and go through the configurable options if you wish. If you have not used this utility before, take time to view **Appendix E: RedViper Configuration Editor** so you have a basic understanding of how to use this utility. The configuration editor allows the pilot to have access to a wide variety of options that give more control over their simulation. If you are familiar with F4Patch from use with previous patches, then you likely know what options you want to adjust. If you are a new to this editor, then it is recommended that you leave the default settings as they are until you can spend more time experimenting with the different options. Most of the default options are recommended anyway.
4. Once the RV Config Editor is open, make sure the executable task bar at the top is pointed to Red Viper. C:\MicroProse\Falcon4\RV1.exe. You may then make changes to the RV Config Editor.
   - Note the new RV settings in the menu.

Set-Up Tab:

The set-up tab has 4 buttons at the top as follows: Simulation, Graphics, Sound and Controllers. Depending on the version of Falcon you have been flying, you may find some significant changes to some of these sections.

Simulation Tab:

Pilots should note these two items, which may be a change from their previous version of Falcon:
Display Radio Subtitles: Enables radio chatter to be shown in text form in upper right hand corner.
Display Infobar: Adds a infobar to the bottom of most external views that gives additional information about what you are viewing.

Avionics/Simulation Tab:

Most pilots use realistic avionics since it takes advantage of all the latest features available. However, if you choose to use some of the other avionics settings, you should use the original Falcon 4.0 manual for details on these settings. Additionally, there have been some stability problems in the past with non-realistic avionics settings. Although work has been done to improve this problem, pilots may still experience some problems since minimal testing has been done while using non-realistic settings.

Graphics Tab & Advanced Graphics Tab

By now most people are familiar with the basic graphics settings tab. Pilots need to be sure to select their video cards from the video driver box. Also note that Direct 3D T&L HAL is now default. Pilots also should select their resolution as desired.
The following settings are considered standard for this patch:

- The Object Density, Terrain Texture and Object Detail sliders should all be set to their maximum settings or all the way to the right.
- Player Bubble should be set to at least 3. Higher bubble settings are permissible, but depending on your CPU and GPU capabilities, this may result in lower FPS during some missions. Otherwise higher bubble settings should have limited effect on game play and likely have no detrimental effect at all.
- Vehicle magnification should always be set to 1.

- You will also notice the boxes for haze, advanced lighting and cloud shadows. Unless you have problems or preferences with any of these, it is recommended that you leave these on.

Weather Condition:
RV1 features the same physically based weather engine as found in BMS 1.03.
There are 4 different weather options for you to select. These settings are always controlled from the set-up menu and once you move to a campaign or TE, you have to re-enter the set-up menu and unlock this setting in order to change your weather.
Upon starting the game, whichever weather setting is the default, that weather setting will be the default weather setting for all TEs and campaigns. You can select Sunny, Fair, Poor or Inclement weather as the weather type in your graphics set-up menu.
If you have a saved TE or Campaign file, you will have to click on the “unlock” window in the weather graphics set-up menu in order to change the weather type. You will have to you’re your TE or Campaign file in order to keep these changes. Cloud heights and weather types can be edited using the weather page in Tacedit v2.46. You can edit Weather Conditions, including Cloud Base, Thickness, Contrail Level, Wind Speed and Direction plus type of Weather. See **Appendix D** for more details.

Advanced Graphics Tab:
The Advanced graphics tab is located just above the canopy cues text. As you click on the advanced graphics tab it is recommended that all of these settings be left turned on for RV:

- **Anisotropic Filtering:** This enables anisotropic texture filtering. Falcon 4 does **NOT** support forcing anisotropic filtering through video card drivers. Doing this will cause visual anomalies, such as blue outlines around cockpit parts. Therefore, your video card anisotropic settings **MUST** be set to "Application Preference."
- **Mipmapping:** This option enables mipmapping of object textures. Enabling this will reduce texture shimmering and swimming.
- **Linear Mipmap Filtering:** When used in conjunction with mipmapping, this option enables tri-linear filtering.
- **Render GM To Texture:** With this option enabled, the GM radar will be rendered to a texture, providing a significant performance gain on most video cards.
- **Rendered 2D Cockpit:** Enabling this will force the 2D cockpit to be rendered as polygons, instead of being "blitted" to the back-buffer, resulting in substantial performance gains.
- **Texel Bias Fix:** Enabling this option fixes text corruption and 2D cockpit "cracking" on most modern video cards. Older video cards may need this disabled.
- **Textured TV/IR:** Enabling this option will force all TV/IR displays to display fully textured objects and terrain.

Sound Tab/Sound Engine (BMS)
The Falcon 4 sound engine features multiple improvements over the original. This includes Doppler and distance effects, improved engine effects, and general positional sound improvements.
Users may now customize their sounds more than ever via the f4sndtable.txt file, and control the properties of all sounds in any way they so choose.

Enable Doppler Effect:
This enables a new method of playing engine sounds. The biggest difference between this method and the old, is that the doppler effect changes the pitch of sounds depending on the movements of the listener and the object creating the sound.

Enable Distance Effect:
This attempts to simulate distance between the listener and the object emitting sound. Sounds will have to travel to the listener to be heard. This is characterized by a

"pause" between when an event, such as an explosion occurs, and when it is actually heard. For fast moving objects such as aircraft, sound will appear to come from a distance behind, depending on the speed of the object, and the distance between the object and listener.

Internal Sounds Outside Cockpit:
This enables or disables playing Betty sounds while in external views.

External Sound Slider:
While in-cockpit, and with the canopy closed, this slider will lower or boost the volume of external sounds. This adjustment is added to the aircrafts default value for lowering external sounds Slider ranges:

- Full Left: Practically silences all external sounds
- Center: No extra effect
- Full Right: Boosts (when possible) external sounds

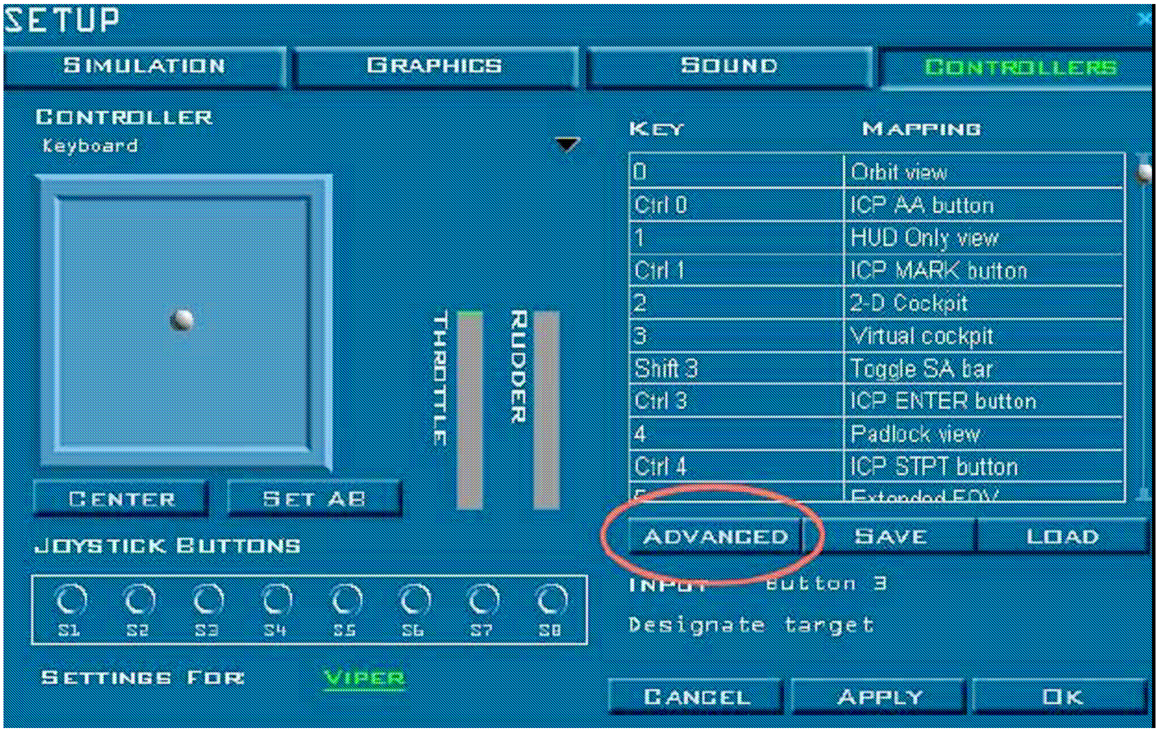
Controllers Tab
Depending on the version of Falcon you have been flying, this section may have some huge changes to it. The following section has some lengthy details that include use of controllers, cockpits and TIR devices.

- Note separate sections are provided below for understanding the BMS advanced controller screen and Track IR details.

- Along with the extensive notes on handling of input devices, pilots may want to review the following Appendices:
    - **Appendix B: HOTAS Setup**
    - **Appendix C: Key Mapping (SP3 Keyboard Commands)**

Controller & Mapping your Joysticks
Click on the 'Controller' drop down box in the setup-controller tab in order to select your flight control device, which is the joystick were your pitch and bank (x/y) axis are located. Please note that this will be the only device that plays any force feedback (FFB) effects!
Falcon will try to auto-detect pitch, bank, yaw (rudder) and throttle axis located on that device; if it succeeds, the respective bars will turn colored and will start representing the current value of this axis. Do not worry if no axes are detected, or if Falcon picks up the wrong ones, you can configure this in the advanced controller screen.
Falcon will pick up the first 32 buttons on each controller, but will only light the buttons in this screen in response to the first eight buttons pressed on the primary flight control device. However the text-readout below the keymappings should work for each button.
If the mapped device supports FFB it will be enabled by default, and you should get immediate feedback (the 'gunfire' effect) on button presses.

Advanced Tab (BMS)
The advanced tab is located below the key mapping box. Once you click onto this button, it will bring up another menu titled “Advanced Options”. This menu has 3 different clickable tabs for view control, flight control and avionics control.



View Control Tab:
The View Control Tab has multiple view control options as follows:

Field Of View (FOV) Axis
This axis moves the field of view inside its specified minimum and maximum values. You can set these ranges in the RedViper.cfg file. Should this axis be mapped to the mousewheel, then you will be able to reset it to its default value by pressing the 3rd mouse button (usually the wheel itself). This axis works both inside and outside of the cockpit.

You can adjust the field of view in game using the GUI. This has multiple uses. Increasing the FOV can dramatically increase perception of speed, and can be used in the virtual cockpit to see more of the cockpit. Decreasing the FOV allows closer inspection of far away objects, and allows closeup views of the MFD's in the virtual cockpit.

The following keystrokes can be added to your keystrokes.key file:

- FOVIncrease: Increases the field of view by the number of degrees set by FOVIncrement
- FOVDecrease: Decreases the field of view by the number of degrees set by FOVIncrement.
- FOVDefault: Sets the field of view to the default of 60 degrees.
- FOV is retained when switching from external to internal views. Stick input will remain constant, regardless of FOV.

View Zoom Axis
This axis controls the zoom range when viewing an object. Naturally, it only works while in outside views. If this axis is mapped to the mousewheel, you will be able to reset the zoom range to a default value (specified by the 3d model currently in focus) by pressing the 3rd mouse button (which is usually the mousewheel).

Mousewheel Sensitivity Slider
This slider lets you set the sensitivity of your mousewheel axis if you have one.

Mouselook Sensitivity Slider
By manipulating this slider you can configure the sensitivity of the mouseview, both inside and outside of the cockpit. The more left the slider is, the less sensitive the view wil be.

Keyboard / Pov Panning Sensitivity Slider
This slider lets you configure the panning speed when keyboard or POV inputs are used. The SP3 (and default) sensitivity value is almost on the extreme left.

3DClickable Cockpit Default
This checkbox sets the default mode of the 3d clickable cockpit.
The 3d cockpit can be in one of two modes: clickable or pannable.. in clickable mode, the mousepointer is always visible, the left mouse button is active and can be used to activate buttons etc.. you can still pan by pressing (and holding) the right mouse button. In pannable mode, no mouse pointer is visible, and the left mouse button has no function. You are still able to act on buttons etc by pressing the right mouse button, moving the (now visible) cursor over the button of interest and clicking the left mouse button.
You can toggle between these modes by pressing the mouse button #4 (provided your mouse features one), or by mapping and pressing the ToggleClickablePitMode command.
An additional note about the mouse... if it is NOT mapped to any analogue in-game axis, the mousewheel (if available) will send FOV-increase/decrease commands, and the middle mouse button (in most cases, the depressed mouse wheel acts as an additional button) will reset the FOV to its default value. Once the mousewheel is mapped to an analogue axis, the middle mouse button will either reset an axis to its default value, or just recenter it.

Enable 3D Cockpit Track IR
This checkbox enables Track IR for the 3D pit.
**You will have to activate the naturalpoint software before starting up Falcon! If you fail to do so, theTrackIR related buttons will never light up, and you will be unable to change TrackIR related options! You can enable 2D and 3D TrackIR support independently of each other, so it is no more required to activate 3d TrackIR for 2d TrackIR to work. Should initialization fail, then the button will not light up but stay dark instead.*

Enable Custom Axis Shaping
This button allows Falcon to load custom axis 'response curves' from a file generated by an external program. These response curves allow the user to change an axis' input characteristics to a nonlinear mode. This operation is sometimes also referred to as 'axis shaping'. The external program needed will be released at a latter date.

Enable Mouselook
Using this button you can enable the mouselook mode introduced with the BMS releases. Please note that it is not possible to inverse mouse axis direction.

Enable 2D Cockpit Track IR
This checkbox enables Track IR for the 2D pit.

Enable Force Feedback
This button allows you to enable or disable force feedback effects on your flight controller. This button will only light up if Falcon has detected a force feedback joystick as your flight controller, otherwise it will stay dark all the time. If you disable force feedback, the joystick should enable auto centering, that is, it should emulate springs using its actuators, but it should not play any additional effects. The playback of the "stall" Force Feedback effect is deactivated while the combat autopilot is active.

Flight Control Tab:
This tab gives multiple options for advanced flight controls. Take time to review the screen and adjust your settings as desired. Note that you can not assign pitch and bank axis in this tab, as this selection has to be done in the 'original' controller screen. You can, however, edit the deadzones of the pitch and bank axis.

Avionics Control Tab:
This tab gives multiple options for avionics controls. Take time to review the screen and adjust your settings as desired.

Padlock View
Mastermode-independent padlocking is now possible by working with the Padlock prev/next AA [Shift-Num- -/+] and Padlock prev/next AG [Alt-Num- -/+] keyboard shortcuts. You can also use the new Padlock AA [Shift-4] and Padlock AG [Alt-4] keys.

SECTION EIGHT: ADVANCED CONTROLLER SCREEN

THE ADVANCED CONTROLLER SCREEN (BMS):

This screen has multiple options that are explained in detail below.

The Flight Control & Avionics Control Tabs
These tabs are going to be described together as the controls located on them are exactly the same, the only thing that changes are the axis the controls operate on. These tabs provide a list of all available in-game axis, where, depending of the nature of the axis, each of these axis may have one of the following controls:
The Flight Control tab shows mapped axes and axis value bars:

- A drop down box where you can select the physical axis you want to map it to.
- A 'value bar' (located to the right of the axis name) that shows the current value of the analogue axis.
- A deadzone drop down box presents you 4 options: 'Small' 'Medium' 'Large' and 'Huge'. 'None' means exactly that, no deadzone is applied to the physical axis. 'Small' applies a deadzone of 1% the size of the physical travel to either side of the '0' point, while 'Medium' enlargens that size of 5%. 'Large' applies a 10% deadzone, and 'Huge' makes it a whopping 50% !
- And a saturation drop down box that contains 4 options: 'None' 'Small' 'Medium' and 'Large', where 'Small' specifies a saturation zone size of 1% of the physical travel, 'Medium' sets 5% and 'Large' applies 10%.

Please note that, as a consequence of the "One physical axis per in-game axis" rule, the selection of axis in the list boxes get smaller the more axis you map. If you want to exchange the mappings of two axes you will have to temporarily map one of them to the keyboard. in order to select it in the other list box.

Additional Notes
The changes done in the advanced controller screen are saved partly in the playeroptions save file (has the extension .pop) and a new file called "axismappings.dat", which both are located in the /config subfolder of your Falcon4 install. If you want to clear all your mappings, either simply delete this file or select the keyboard as primary flight controller in the 'original' controller screen. In addition, the optional axis response curve information is stored in a file called 'axiscurves.cal'.

Custom Axis Shaping
There exists an external program that lets the user configure the response curve of any in-game axis directly via directX. Because of this, all deadzone and saturation settings done for this axis in the controller UI will be disregarded. To enable custom axis shaping, activate the checkbox in the 'View control' tab. If it does not light up it means that an error occurred while reading in the axiscurve file.

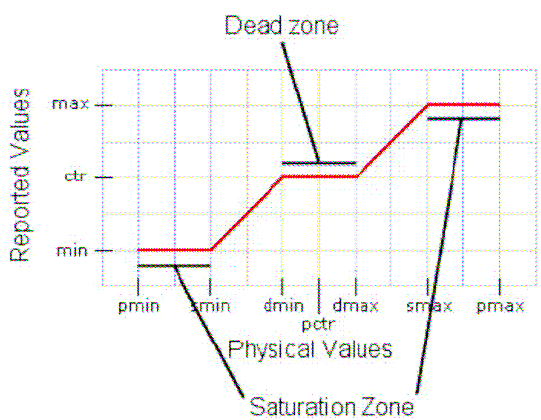
Analogue Axes in Falcon
The following section was written to assist the pilot in understanding some basics of input devices axes, deadzones and saturation points. Maybe the most important fact first: you will only be able to map one in-game axis to one 'physical' analogue axis. So if you, for example, already have mapped the mousewheel axis to the viewzoom axis, you will not be able to use it to control FOV too.
Axis properties
Axis in Falcon have three properties that may be configured in the UI by the user:

Deadzones
A deadzone is a region around the center position of the axis in which motion is ignored. Hence, the axis always reports '0' while in a deadzone. Deadzones are always symmetrical to the '0' point of an axis.

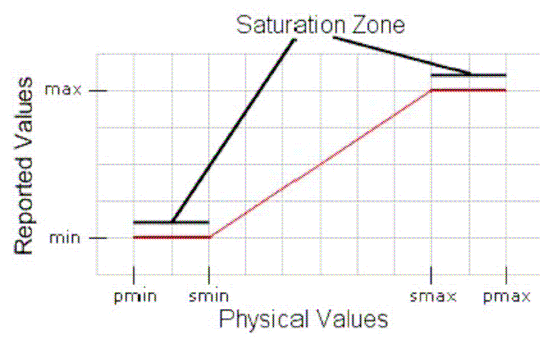
Saturation
A saturation zone is a zone of tolerance at the minimum and maximum of an axis. An axis value within this zone is reported as the minimum or maximum value. The purpose of this is to allow for axis (usually of the cheaper ilk) that report values less (or greater) than their maximum (or minumum) value even if their physical 'throw' is already at the maximum (or minimum). An example might be a throttle slider that just can not report 100% thrust even if it is already at its maximum positive travel. Saturation zones are always symmetrical, that is, the zones at the maximum and minumum ends of an axis are of the same size.

Reversal
By activating this option you can reverse an axis, that is, it then reports its minimum value while at its maximum physical travel, and vice versa.

Axis Types
Axis in Falcon can be of two types: 'unipolar' or 'bipolar'. The difference between the two is that unipolar axis report value in a non-negative range only, while bipolar axis report value symmetric to the '0' value. Because of this, some axis (bipolar ones) may be configured to have deadzone and saturation zones, while others (unipolar ones) may have a saturation zone only.



A bipolar axis can feature saturation and deadzone



A unipolar axis does not feature a deadzone

An example for an unipolar axis is the throttle, while a classical bipolar usecase is any of the flight control axis, like pitch.
Of course there exists an exception to all this: the mousewheel axis. As the mouse is per definitonem a relative device (it is not physically bound to a certain point - desktop-size/mouselength-cable/radio-range does not count) the absolute coordinates have to be gathered 'in software', without using DirectX. So neither deadzone nor saturation settings will apply to any axis mapped to the mousewheel.

SECTION NINE: TRACK IR DETAILS (BMS)

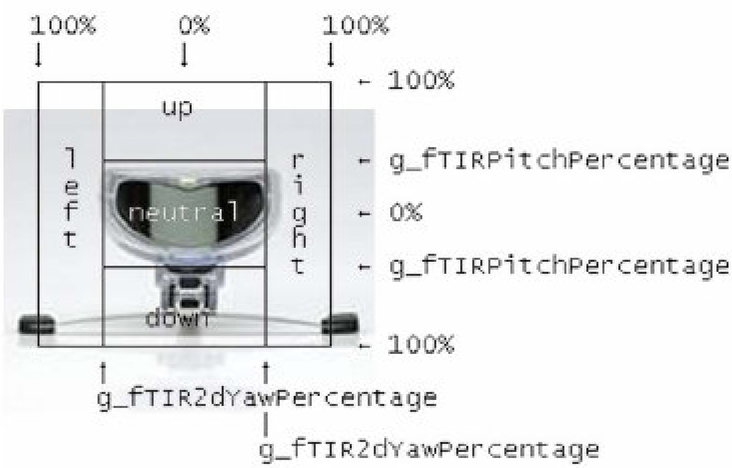
TRACK IR DETAILS (BMS):

The RV1 patch supports the “TrackIR" head tracking device via its remote interface, which enables much easier panning. You have to start the Naturalpoint application prior to running Falcon. Once in the game, you may activate the TrackIR support for 2D and 3D cockpit seperately in the 'View Control" config settings (please refer to the relevant chapter in this manual).

You are able to deactivate TrackIR at any time by using the Naturalpoint hotkeys (F9 by default), or by just breaking the LOS between the TrackIR emitter/receiver and the,,dot" which is tracked by it. After about 1 second, view control should migrate to the POV keys/keyboard. Once you enable TrackIR again (or restore LOS between tracker and dot) control should switch immediately to the TrackIR.

While in the 3d cockpit, panning will work just as with the TIRF4 application

There is also support for the 2d cockpit. In this mode, the headtracker behaves a bit like a POV hat, which means that if you look up, the program will emulate an 'up' press on the POV hat. If you look left, the program will emulate a 'left' POV hat press etc. The repetition rate of these emulated keypresses can be configured by the adjusting the settings in the Config Editor called “TIR Sample Frequency”. The units of this variable are in milliseconds, it defaults to 512 milliseconds (about 2 emulated keypresses per second). The area where the TIR input will be interpreted as 'POV-press' can be configured as follows:



This is a view of the TIR receiver. As long as the dot stays in the 'neutral' zone (if you look directly at the receiver) no change in the 2d cockpit will happen.

The two configuration variables in your RV Config Editor allow you to adjust these settings are:

- TIR Pitch Percentage
- TIR Yaw Percentage

SECTION TEN: AVIONICS

AVIONICS:

This section covers the upgrades to Falcon's avionics that have been done since the original Falcon 4.0. If you have been flying newer versions of F4, you might want to scan through this section and make sure there are not any changes or updates that you are not used to.
Most of the changes only function if the Avionics variable in the Falcon Settings screen is set to ` ***Realistic*** '. Using Realistic Avionics adds tremendous functionality and means that the cockpit workload is much closer to a real F-16CJ.
If you are a beginner in Falcon 4.0 and find yourself overwhelmed by the complexity of the realistic avionics, switch to "simple" avionics for your first steps.

Overview
The updated avionics of the SP3/BMS code, offers a number of significant improvements to the Falcon 4.0 original avionics. The changes to the different subsystems are documented on the following pages. They include:

1. The Integrated Control Panel (ICP) with its Data Entry Display (DED). This is the primary interface to configure the Fire Control Computer (FCC).

2. The Multi-Function Displays (MFD) are two small monitor screens positioned on the front panel of the cockpit. They display information about various avionics and aircraft systems.

3. The Heads-Up Display (HUD), projecting vital information directly onto the windshield.

4. The APG-68 Radar System, the "eyes and ears" of the F-16.

5. The Autopilot, an important navigation aid.

6. The Electronic Warfare System, supporting and automating countermeasure operations such as jammer activation or chaff and flare deployment.

7. The Fault and Warning System, giving the pilot a quick overview of the current jet status.

8. Various switches around the cockpit, supporting special functions and additional features.

Integrated Control Panel (ICP)

The Integrated Control Panel (ICP) is the primary interface to the aircraft's systems. The Data Entry Display (DED) tracks system status, Fire Control Computer (FCC) settings, and facilitates data entry. The side-consoles are back up systems in the event the ICP fails.

Backup Switch

In the event of a primary system failure, the BACKUP switch on the AUX COMM panel is used to divert control from the ICP to backup controls. When switched to backup, the TACAN channels and other systems are accessed through the AUX COMM panel. When the BACKUP switch is restored to the UFC position, the settings from the ICP override any entries made using the AUX COMM panel. See your original Falcon 4 manual for more information.

Master Modes

The master modes simultaneously set several functions and configure the cockpit and it's display devices for a particular mission activity. There are two types of master modes. The first set is for weapon delivery:

- Air-to-Air (A-A) 

- Air-to-Ground (A-G) 

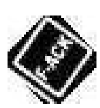
- Dogfight (DGFT)
- Missile Override (MSL OVRD)

Air-to-Air [Shift-Num-0] and Air-to-Ground [Shift-Num-.] master modes are selected using the appropriately labeled buttons on the ICP. The DGFT [d] and MSL OVRD [m] override master modes are selected from switches on the throttle grip or via the keyboard. They can only be exited by pressing the cancel button [c]!

The other master modes are:

- Navigation (NAV) is the default mode and is automatically selected when no other MASTER
mode is selected.
- Selective Jettison (S-J) may be accessed from either MFD using the Stores Management System (SMS) page.
- Emergency Jettison (E-J) is shown while the Emergency Jettison button is pressed.

Override Modes



COMM1, COMM2, IFF, LIST and F-ACK buttons are *Override* modes. Pressing any of these buttons usually provides immediate access to the functions of the corresponding button. *Override* modes are a toggle function. Return to the previous mode by pressing the same *Override* button a second time.

The RESET function is a special *Override* mode that brings up the Communication, Navigation, and Identification (CNI) page from any mode or display combination. It is accessed using the Data
Command Switch (DCS).

ICP Functions And Usage

The numbered keypad (numbers 0-9) are the *Secondary* buttons. They are labeled with a four-letter abbreviation if they directly access a subpage. They are used as a normal numeric keypad for data entry on subpages with data entry options.

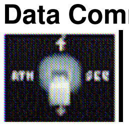
DED "presets" (BMS)

New DED “preset”	Falcon 4 Channel Function
1	Flight1
2	Flight2
3	Flight3
4	Flight4
5	Flight5
6	Package1
7	Package2
8	Package3
9	Package4
10	Package5
11	From Package
12	Proximity
13	Guard
14	Broadcast
15	Tower

Scratchpad

Two asterisks surround the data entry section of the DED known as the *Scratchpad*. Wherever you see two asterisks, you're allowed to make manual input using the *Secondary* buttons (there are a few exceptions).
To change a value, such as the TACAN channel for example, access the appropriate page (such as the T-ILS page) and type in your new channel. You'll notice that the text between the asterisks will be drawn with light text on a dark background when starting to input data. After pushing the Enter button (ENTR), the input is checked for validity. If valid, the system will use the new settings and clear the *Scratchpad*. If the input is not valid (entering a nonexistent TACAN channel), the DED will flash. Your input is not set until ENTR is pressed.

Data Command Switch (DCS)



The Data Command Switch (DCS) is the four-way switch below the ICP. Its four labeled positions and corresponding functions are:

Label	*Direction*	*Function*
RTN	Left	Reset
UP	Up	Cycle through the editable options forward
SEQ	Right	Cycle through subpages and options
DOWN	Down	Cycle through the editable options backwards

CLEAR button
This button will clear the last two data entries. If pushed twice, the entire input is cleared.

DED Pages:

The next 9 pages show the various DED pages as well as the different functions.

Communication, Navigation, and Identification (CNI) Page

The Communication, Navigation, and Identification (CNI) page is the default page displayed on the DED after powering up the Up Front Control panel (UFC). The CNI page displays information about your communications channel, steerpoint, IFF response, and TACAN channel settings. The active communications channel is written on the 1st row of the DED. To change from UHF to VHF, push the COMM2 button, return to the CNI page, and VHF will be displayed on the first line. The UP/DOWN function of the switch will cycle the symbol between the communications channels and the steerpoint. Then use the PREV or NEXT button to change your channel or steerpoint.

Wherever you see that small up/down arrow symbol, you can change the data using your PREV/NEXT buttons.

- Toggling the DCS into the SEQ position will show wind information.
- The HACK clock (see below) is displayed on the CNI page when it is running.
- Observe that there is a small up/down arrow symbol beside your steerpoint. This indicates the steerpoint can be changed using the PREV and NEXT buttons on the ICP. If you've selected AUTO steerpoint (see below), you'll see an "A" next to your steerpoint number.

IMPORTANT NOTE: You must RETURN to the CNI page after accessing any page using a *Secondary* button. For example, after pressing MARK to access the Mark page, the sequence to change to the Steerpoint page would be:

- Press RTN [Ctrl-Insert]
- Press STPT [Ctrl-Num-4]

Pushing the "3" Button while at the CNI page will bring you to the DLINK page (which can also be accessed through the LIST page).

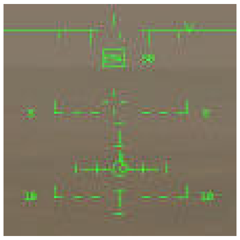
Instrument Landing System page (ILS or 1 button)

The T-ILS Button makes the FCC enter into one of the two following modes:

1. Instrument Landing System (ILS) mode is entered if the nstrument mode (INSTR MODE) switch (beside the HSI) is n the appropriate position (TCN/ILS or NAV/ILS).

2. The FCC defaults to NAV mode when the INSTR MODE is set to NAV or TCN.

- Input any new TACAN channel using the *Secondary* buttons. A valid channel must be between 1 and 126. To cycle through the TACAN BAND, input 0 into your *Scratchpad* and push ENTR. The DED readout shows your active TACAN channel. The FREQ readout shows a bogus ILS frequency if your TACAN channel is set to an airbase.
- Use the SEQ button to toggle the TACAN domain.
- The CRS readout shows your selected HSI course.
- To activate the reception of the ILS signal, you must first call the Tower using the "Inbound"radio command.
- For a perfect ILS approach, work with the Command Steering mode: While receiving an ILS signal, use the DCS to get to the CMD STRG section, then press Mode-Select (M-SEL 0) to activate Command Steering. This will put your ILS in CMD STRG mode, with the tadpole in the HUD indicating an 45° intercept path to the ILS approach path. Just put the FPM onto the tadpole and follow this direction. Then, as soon as you are within 3° of the approach path, the ILS will switch to the usual approach mode.



Two things to keep in mind: The 45° intercept doesn't consider your relative position to the runway (so if you are outside of +/-45° horizontal cone extending from the runway threshold, the intercept will falsely lead you to a position which is actually behind runway). In addition, if you overfly the runway, command steering will not lead you back towards ILS approach.

Altitude Low page (ALOW or 2 button)

Increment or decrement the low altitude alarm using the *Secondary* buttons. By default, your Minimum Safe Level (MSL) floor is set to 10,000ft. Should the aircraft enter that area during a descent "Bitchin' Betty" will call out "Altitude" twice.
NOTE:

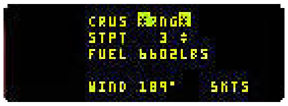
- The MSL floor setting is RALT independent!
- Terrain Following Advisory (TF ADV) is not implemented at this time.

Steerpoint page (STPT or 4 button)

Provides the GPS coordinates of the selected steerpoint. Choose the steerpoint to be displayed on the DED with the PREV/NEXT buttons. Pushing any of the *Secondary* buttons will change to the Destination (DEST) page (see below). Press RTN

to return to CNI page (required before accessing any other page).
Use the SEQ function to cycle between AUTO and MANUAL options. If you've selected AUTO, your steerpoint will cycle automatically to the next when you're within 2 miles of the currently selected steerpoint. AutoSteerpoint only works when the FCC is not in A-G mode.

Cruise page (CRUS or 5 button)
There are 4 sub pages:
RNG

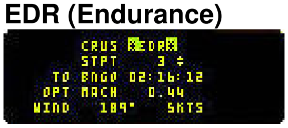


Shows the current waypoint, how much fuel you will approximately have when you reach it, and wind information.

HOME

Shows the same info as the RNG page plus the optimum cruise altitude for your HOME waypoint.

EDR (Endurance)



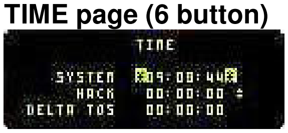
Shows your current waypoint, how much time left until you reach your bingo level (see below) plus optimum cruise altitude, and wind information.

TOS

Shows your current waypoint, system (or, if running, HACK) time (see below), time left until reaching the current waypoint, estimated waypoint arrival time, and the required (approximate) ground speed to reach the waypoint on time.

Push either the SEQ button, or a *Secondary* button (1-9 only) to cycle through the pages.
Press RTN to return to CNI page (required before accessing any other page).

TIME page (6 button)

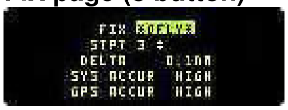


Shows the current system time. Also contains a stopwatch that can be started/stopped using the PREV/NEXT buttons. Push NEXT once to start it, a second time to freeze it (while the timer is still running in the background), and a third time to update the display again. Use the PREV button to clear the HACK clock. If the HACK time is running, it will show up on the CNI and the CRUS TOS pages. For example, there is a given station time on a BARCAP mission. When arriving at the first BARCAP steerpoint, start the HACK time. This will give an indication of time on station as it runs. Then wait until the HACK time has almost exceeded the station time, then cross reference destination time on station with your ETA. As an example, by Falcon4 default a full 15 minutes is required in the BARCAP area, so a safe bet is to let HACK time run a minute or two over, then apply a little more power to meet the speed/time requirements to get to the next NAV steerpoint.

MARK page (7 button)

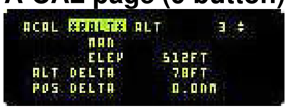
Shows info on the MARK points. Press RTN to return to CNI page (required before accessing any other page).

FIX page (8 button)



Permits selection of sensors to update INS position (N/I).

A-CAL page (9 button)



Used to update system altitude and/or INS position (N/I).

Identify Friend or Foe (IFF)

Displays some info about your IFF settings. IFF is not implemented in the ICP.

LIST page

Used to access various additional subpages:

Destination page (DEST)

Displays the GPS coordinates of the selected steerpoint (see STPT page above). Use the *PREV* or *NEXT* button to change the selected steerpoint. The waypoint coordinates may be changed using the *Secondary* buttons. Enter the GPS coordinates of the new waypoint destination and press *ENTR* to implement the change.

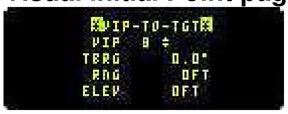
There will always be an error shown for the coordinates you are entering. This is not a bug of SP, but the way F4 calculates coordinates in game.

For the target waypoint (needs to be the currently selected waypoint), up to two Offset Aimpoints (OA) may be entered: Use the sequence button to cycle between the two OA and DEST, then input an OA by entering it's bearing and distance relative to the target waypoint.

BINGO page

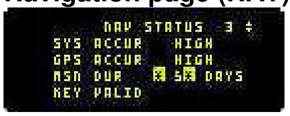
Sets the BINGO Fuel warning level. It can be set using the *Secondary* buttons. Push the ENTR button to implement the changed warning level.

Visual Initial Point page (VIP)



Set location information for the Visual Initial Point (VIP). Enter a Visual Initial Waypoint for the target waypoint (the target waypoint needs to be the active waypoint).

Navigation page (NAV)

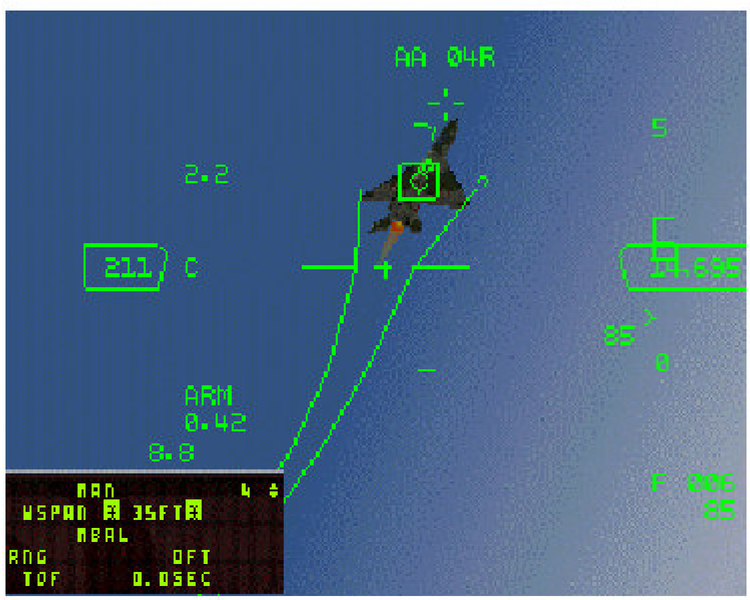


Displays and controls FCC NAV Filter operation and some GPS functions. Not implemented.

Manual Gun Funnel Adjustment page (MAN)

Set the manual ballistics for the gun using the DED scratchpad. Valid data entries change the size of the gun funnel to match the wingspan of known threats. The default is 35 feet, an effective setting for small to medium fighters (e.g. MiG-29).

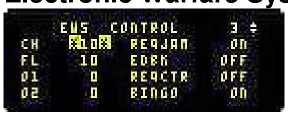
Aircraft	Span (ft)
A-10	58
F-111	48
F-14	51
F-15	43
F-16	31
F-18	38
F-4	39
F-5	27
MiG-21	24
MiG-23	37
MiG-25	46
MiG-29	36
MiG-31	46
Su-24	44
Su-25	51
Su-27	42



Inertial Navigation System page (INS)

The first line displays the align time/status, RDY mnemonic, and steerpoint. The other lines display your current GPS coordinates, heading and groundspeed. Use this page to set your current reference coordinates before aligning the INS.
This isn't needed on normal ramp start (as the coordinates are already programmed into the system), but may come in handy to manually reprogram the coordinates after a full system shutdown and restart on another base.

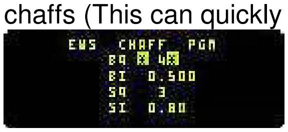
Electronic Warfare System page (EWS)



Control page for the Electronic Warfare System. Toggling the REQJAM option to ON automatically turns the radar jammer on when the RWR system detects a radar spike. Set the warning level for expendables by toggling BINGO to ON, then manually set chaff and flare low warning levels. When BINGO is ON, Bitchin' Betty will call out "Low" when your chaff/flare level reaches the alarm level set. REQJAM and BINGO options are toggled with any of the *Secondary* buttons.

To create your own chaff/flare programs, use the SEQ button to access the programming mode (*you need to set the EWS mode switch to STBY before*).The PREV/NEXT button then switches between four different default programs.

The following example program releases 4 chaffs after a missile launch is detected (this is called one iteration), using a 0.5 second interval between the individual chaff releases. 1.5 seconds later, the program is repeated. This loop will be called 3 times all in all; spending a total of 12 chaffs (This can quickly empty your expendables!).



EWS	CHAFF PGM
Burst Quantity (BQ)	4
Burst Interval (BI)	0.500
Salvo Quantity (SQ)	3
Salvo Interval (SI)	1.5

Don't forget to switch EWS mode to STBY to enable access to the program mode! Your programs are saved in your cockpit settings by pressing [ALT-c], then [s].
NOTE: The chaff and flare programs are only initiated when the MODE switch on the EWS panel is set to SEMI or AUTO.

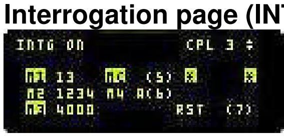
Master Mode page (MODE)

The current master mode may be changed through this page should the master mode buttons on the ICP become inoperative. Use the SEQ button to choose the mode you want to change to, then press the 0 button to select it (You can only choose between A-A and A-G master modes). The active mode is drawn color inverted. Pushing 0 on a selected mode will change the FCC into NAV mode.

Visual Reference Point page (VRP)

Set location information for Visual Reference Point (VRP). Enter a VRP for the target waypoint (Target waypoint needs to be the active waypoint).

Interrogation page (INTG)

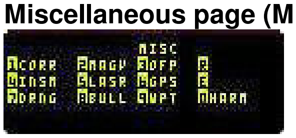


Check or set AIFF modes and code for interrogation (N/I).

Data Link page (DLNK)

Display data link target information (N/I).

Miscellaneous page (MISC)



Gives you access to miscellaneous subpages:

Correction page (CORR)

Allows checking/input of the correction coefficient for the HUD, CTVS, CAMERA and left and right hardpoints (N/I).

Magnetic Variation page (MAGV)

Displays the actual magnetic variation of the aircraft's location. This value is displayed on the DED. This info would be used to correct the INS for positional errors in the real aircraft (N/I).

Operational Flight Program page (OFP)

The Operational Flight Program (OFP) page shows the program numbers for the UFC, FCR, MFDs, FCC, SMS and DTE (N/I).

Inertial Navigation System Memory page (INSM)

This is the place where INS parameters like drift errors, maintenance data and manufacturer codes are stored (N/I).

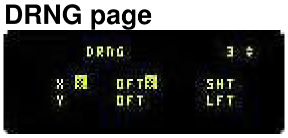
Laser page (LASR)

Page for setting the targeting pod laser pulse code (N/I) and lasing timer (default setting: lasing begins 8 seconds before impact).

Global Positioning System page (GPS)

Displays information about the GPS system (N/I).

DRNG page



Set manual correction to a consistent A-G miss distance (N/I).

BULL page

Select Bullseye mode.
Toggle with ICP button 0 while inside this subpage.
If selected, Bullseye information is displayed. If the aircraft is further than 99 miles away from Bullseye, the Bullseye circle is empty. Otherwise the actual distance is displayed. When the target is in STT, the Cursor- Bullseye readout changes to Target-Bullseye distance/bearing.

If not selected (default), an aircraft reference symbol is displayed in the FCR and HSD screens. It's bearing/distance readout depends on current master mode:

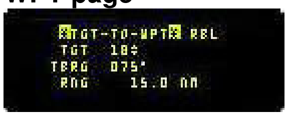
A-A: Bearing to the collision point (with a locked target only)

A-G: Air-to-Ground bearing

NAV: Bearing to current system waypoint

In this screenshot (below), the current system waypoint is the one fully right. Therefore, the vertical line in the aircraft reference symbol is also shifted to the right, displaying the bearing to this current waypoint.

WPT page



Info and settings for Harpoon missile operation (N/I).

HARM page

Verify/modify HARM threat table data (N/I).

TACAN Radio Horizon (BMS)

In previous versions of Falcon4, you could receive the TACAN no matter what altitude you were at. A radio horizon has been added that takes your altitude into account when determining if you can receive the TACAN or not. If you are 75 miles out and are receiving the TACAN, if you start to descend, you will reach an area of intermittent reception followed by no reception. The altitude that you loose the TACAN will depend on your distance from the TACAN site.

SECTION ELEVEN: MULTI-FUNCTION DISPLAY (MFD)

MFD:

MFD Basics

The Multi-Function Displays (MFD) are two small monitor screens positioned on the front panel of the cockpit. They display information about various avionics and aircraft systems. As their name implies, they can have different functions set by the pilot according to his or her requirements. Twenty Option Selection Buttons (OSBs) surround each MFD. Each button on the MFD may have a label (shown on the display next to it) to indicate its current function. The type of function assigned to each button position is generally consistent across all displays and falls into one of the following categories:

Buttons 1 to 5

Usually control the format of the display or its sub-modes. For example, changing the radar mode (which changes the appropriate display), or changing the position of the HSD are typically controlled by these buttons.

Buttons 6 to 10 and 16 to 20

Normally concerned with options for a specific mode or sub-mode. Changing the radar range, scan beam width or controlling some aspect of a sub-mode (such as boresight versus slave targeting mode).

Buttons 11 and 15

Regardless of mode, these special buttons usually are assigned the same function. Button 15 is labeled [SWAP] and exchanges the displays of the two MFDs. Button 11 is labeled [DCLT] and de-clutters the display if that function is supported by the current mode. The Stores Management System (SMS) page is unique with button 11 labeled as S-J to give quick access to the Selective Jettison function.

Buttons 12, 13, and 14

These are three quick access modes. The primary selection is highlighted to indicate the current display mode. The other two are optional secondary selections. Change modes by pressing the appropriate OSB. In the real F-16 a joystick button can be programmed to cycle between primary and secondary selections. This enables a pilot to set-up his/ her three favorite modes on each MFD for each master mode and quickly cycle between them.

Selecting Display Modes

Pressing the currently selected primary mode button brings up the MENU page showing all major modes. Selecting one of the other modes will load that mode into this position (It is advisable to set up the MFDs for each master mode on mission start). You can use the DMS keyboard shortcuts [Shift-Num-4/6] to cycle through the preset MFD pages on the MFD being SOI (switch SOI using [Shift-Num-2]).

Example 1 : Primary and secondary displays are set as follows: With OSB 12 selected (FCR), BLANK on OSB 13 and TEST on OSB 14 (as SEEN RIGHT), we can directly access the MENU page by pressing

OSB 12 because FCR already is the primary ("currently selected") mode.

We can also get the menu page by pressing button 13 or 14 twice: The first press promotes a page from secondary to primary mode, changing the display to that mode (here: BLANK or TEST). The second press is just like the case mentioned before, except that the mode selected from the MODE menu will be assigned to the selected page (OSB 13 or 14).

Example 2 : We have FCR (OSB 12 primary), BLANK (OSB 13) and TEST (OSB 14), but need to change to FCR (OSB 12), HSD (OBS 13 primary) and TEST (OSB 14):
Press OSB 13 (BLANK) once to select it as primary (display changes to BLANK display), then press OSB 13 again to bring up the MENU page for OSB 13. When we now select HSD (using OSB 7), it will be loaded into the display format option at button 13. The MFD now looks as desired.

Configuring Master Modes
The settings of the OSB 12, OSB 13, and OSB 14 buttons are master mode specific, meaning that different OSB display configurations can be assigned to each of the five master modes (NAV, A-A, A-G, MSL, DGFT). These configurations will be remembered when you switch back to that master mode. For instance, if you press the A-A button on the ICP to enter the Air-to-Air master mode, the MFDs reconfigure to the last set modes for that master mode. So if you make a change in range, scan width, radar mode, etc. while in A-A mode, switch back to NAV for a moment and then switch back to A-A mode, the MFDs will show the same settings as before.
The current cockpit configuration can be saved by pressing [Alt-c], then [S]. This will save ALL settings in your HUD, DED and MFDs. Use [Alt-c], then [L] to reload.
The two extra MFDs available in the upper half of HUD-only view [1] do not offer these features.

Menu
The MENU page is the top-level page. All other MFD pages are be accessed from this page. Pressing the highlighted OSB 12, 13, or 14 (the one in primary mode) will switch to this page. The OSBs on this page access other primary MFD pages or apply a function.

OSB 1 BLANK	Access blank MFD page
OSB 2 HUD	Mirror HUD display
OSB 3 RWR	Mirror RWR display
OSB 4 RCCE	Access Reconnaissance Pod page when loaded on a hardpoint
OSB 5 RESET MENU	Access the Reset page
OSB 6 SMS	Access Stores Management page
OSB 7 HSD	Access the Horizontal Situation Display page
OSB 8 DTE	Access Data Loading page (N/I)
OSB 9 TEST	Access Test pages
OSB 10 FLCS	Access the FLCS page
OSB 11 DCLT	Declutter display (if in supported mode)
OSB 12 <mode 1>	Direct access mode (FCR on this screen)
OSB 13 <mode 2>	Direct access mode (HSD on this screen)
OSB 14 <mode 3>	Direct access mode (TEST on this screen)
OSB 15 SWAP	Swap left and right MFD displays
OSB 16 FLIR	Access FLIR display
OSB 17 TFR	Access TFR on the MFD
OSB 18 WPN	Access Weapon Display page
OSB 19 TGP	Access Targeting Pod page
OSB 20 FCR	Access Fire Control Radar page

NOTE: It is not possible for both MFDs to display the same data simultaneously and therefore some MFD combinations are not possible. When attempting to display something currently displayed on the other MFD in either primary or secondary buttons, the item will be `stolen' from the MFD and replaced with a blank setting.

Horizontal Situation Display (HSD)

The Horizontal Situation Display is a `God's eye' view of the airspace and relevant ground based objects where the aircraft is currently located. It shows your current position together with a collection of other relevant features, such as Bullseye, waypoints, SEAD threats, wingmen location, and radar information.

SEAD threats are shown based on the known data that is available at take-off time. If a JSTAR aircraft is active, you will receive updates on this information every 30 seconds for the immediate surrounding area.

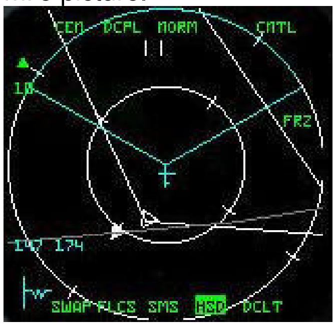
Wingman positional data may be shown on the HSD. This requires both data links (ownship's and wingman's) to be powered up and working. All wingmen will be displayed on the HSD with

their number and altitude. If they bug a target, it will be indicated together with a number and the bugged target altitude. These displays may be suppressed (see below).
The HSD has three modes, two of which are implemented in SuperPAK:

HSD Mode 1: Base Page
The Base page is the default view.

OSB 1 - CEN/DEP
In Depressed (DEP) mode, the display view shows your aircraft (ownship) offset from the center. Your aircraft's position is depressed two-thirds down the display to dedicate a larger percentage of the display to your forward quadrants. The display covers a minimum viewable range of 15 miles and a maximum of 240 miles. Three range rings appear in this view and divide the display into four quarters of viewable range (rings at 5 miles, 10 miles, and 15 miles at minimum range). DEP is the default mode.

In Centered (CEN) mode, the display view centers the ownship on the MFD. Two range rings appear in this view and divide the display into equal thirds distance (rings at 5 miles and 10 miles at minimum range). The minimum range is 10 miles and the maximum range is 160 miles in this view. This mode can be used as a means to zoom the display slightly since you can get a 10-mile picture.



OSB 2 - DCPL/CPL
In the default decoupled (DCPL) mode, OSBs 19 and 20 adjust the range displays on the HSD. When in Coupled (CPL) mode, the range is not adjustable, but follows the range of the radar display.
For example: if the radar range is set to 40 miles, the HSD will be set to 40 miles when in CEN mode, and 60 miles in DEP mode.

OSB 3 - NORM/EXP
Toggles expanded view modes (only if HSD is SOI)
OSB 5 - CNTL
When pressed once, this button takes the MFD display to the control (configuration) page. In this mode various display options may be set (see next page). Pressing the CNTL button again returns you to the base page.

OSB 7 - FRZ
This button freezes the HSD at the current world position and orientation of the ownship (see picture below). The aircraft now moves with the world position fixed on the MFD (ownship is free to fly around and off the HSD) instead of the world moving with reference to the aircraft. Pressing the FRZ button again unfreezes the HSD's world position.

OSB 19 - (Down symbol)
Pressing this button decreases the current HSD view range. No symbol is drawn if the mode does not allow range modification, or if the range is already at minimum.

OSB 20 - (Up symbol)
This button increases the current HSD range view. No symbol is drawn if the mode does not allow range modification, or if the range is already at maximum.

HSD Mode 2: Control Page
The Control page accesses the configuration of the HSD. Thebuttons are highlighted when their function is available or active (RINGS toggled on OSB 10 is shown below right).

OSB 1 FCR -Displays the ghost radar cursors and the radar scan volume of the Fire Control Radar (FCR).

OSB 2 PRE -Displays preplanned targets. SEAD targets include range rings.

OSB 3 AIFF - (not used in lieu of other AIFF deployment method) Display IFF responses from other aircraft, showing friendly and unknown targets.

OSB 5 CNTL - Exits Control mode

OSB 6-9 / LINE1-4 - Toggles line drawings 1-4 on the display (currently FLOT/FEBA (Line 1) is the only line drawing)

OSB 10 RINGS - Toggles the display of the range rings

OSB 11 DCLT - Declutter display (if in supported mode)

OSB 12 <mode 1> - Direct access mode (FCR on this screen)

OSB 13 <mode 2> - Direct access mode (BLANK on this screen)

OSB 14 <mode 3> -Direct access mode (TEST on this screen)

OSB 15 SWAP Swap left and right MFD displays

OSB 16 ADLNK -Toggles the display of data link air information, including wingman position and wingman bugged targets.

OSB 17 GDLNK Toggles display of data link ground information. This includes data link mark points and data link SEAD threats.

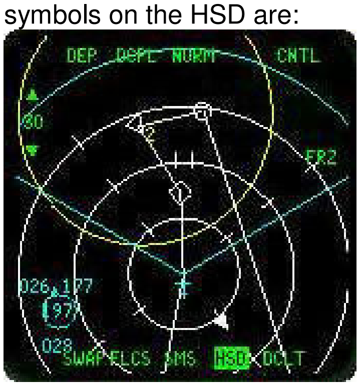
OSB 18-20 NAV1-3 -Toggles the display of NAV routes 1 through 3. Only NAV1, the default route, has any information.

HSD Cursor
If the HSD is SOI, you can move the cursor and designate items:

- Designating a waypoint selects it as the currently active waypoint.
- Designating a pre-planned threat will show it's range ring (if not yet visible).
- Undesignating a pre-planned threat will remove the range ring from the display

Moving the cursor to the top or bottom of the display will cause the HSD range to bump. If coupled with the Radar, it will decouple.

Symbols
As in the F-16C Block 50/52 MLU upgrade, Falcon features color MFDs. The colors of the symbols on the HSD are:



CYAN
- Own ship, representing your aircraft
- Radar search volume
- Bullseye location and data
- Wingmen positional information (including wingman number and current altitude in thousands of feet)

YELLOW :
- Your own bugged target
- Wingmen bugged targets
- Pre-planned SEAD threat ranges (when you are outside lethal range)

WHITE :
- Navigation routes
- Range rings
- Cursors
- North pointer

RED :
- Pre planned SEAD threat range (when you are inside lethal range)

Color MFDs can be de-selected in the Configuration Editor.

Test (Test) Pages

These pages show various Built-In Tests (BIT). Page one and two display the master list of faults encountered during a flight. Each fault encounter logs the following:

1. Fault type. This is the first mnemonic that's appears on the F-ACK list.
2. Test number that failed.
3. Number of failures.
4. Time of the first fault. The time is relative in minutes and seconds since startup.

Two pseudo-faults are recorded; the take-off time (TOF), and landing time (LAND). Pressing the CLR button will clear the fault list. A maximum of 17 faults (including the two pseudo-faults) may be recorded. Subsequent faults are not recorded, unless they are duplicates.

PAGE 1

OSB 1 BIT1	Indicates BIT 1 tests. Pressing this button changes to the BIT 2 page.
OSB 3 CLR	Clears the Maintenance Fault List (MFL) if displayed
OSB 6 MFDS	MFD Self Test (N/I)
OSB 7 RALT	Radar Altimeter test (N/I)
OSB 8 TGP	Targeting Pod test (N/I)
OSB 9 FINS	Fixed Imaging Navigation Set (N/I)
OSB 10 TFR	Terrain Following Radar Test (N/I)
OSB 16 RSU	Rate Sensor Unit (N/I)
OSB 17 INS	Inertial Navigation System test (N/I)
OSB 18 SMS	Store Management System test (N/I)
OSB 19 FCR	Fire Control Radar test (N/I)
OSB 20 DTE	Data Test Loading (N/I)

PAGE 2

This page contains additional built-in tests.

OSB 1 BIT2	Indicates that these are the BIT 2 tests. Pressing this button will change to the BIT 1 page.
OSB 3 CLR	Clear fault list (N/I)
OSB 6 IFF1	IFF1 Self Test (N/I)
OSB 7 IFF2	IFF2 test (N/I)
OSB 8 IFF3	IFF3 test (N/I)
OSB 9 IFFC	IFF Mode C test (N/I)
OSB 10 TCN	TACAN Test (N/I)
OSB 19 TISL	Target Identification Set, Laser (N/I)
OSB 20 UFC	Up-Front Controls (N/I)

RESET PAGE

The reset page allows various symbology and lighting levels to be reset.

OSB 1 BLANK	Switches off the MFD display
OSB 5 RESET MENU	Return to main menu page
OSB 6 SBC DAY RESET	Reset day symbology to default value (N/I)
OSB 7 SBC NIGHT RESET	Reset night visibility symbol data (N/I)
OSB 8 SBC DFLT RESET	Reset default symbology visibility settings (N/I)
OSB 9 SBC DAY SET	Set the SBC daylight settings (N/I)
OSB 10 SBC NIGHT SET	Set the SBC nighttime settings (N/I)
OSB 18 NVIS OVRD	Night visibility override mode (N/I)
OSB 19 PROG DCLT RESET	Programmed declutter reset (N/I)
OSB 20 MSMD RESET	Master mode initialization data reset (N/I)

Fire Control Radar (FCR) Page

The FCR page displays all the radar modes. There are eight main radar modes, each with sub modes. OSB buttons 1-5 select the current radar sub mode. The currently selected major mode is shown at OSB 1.

The radar will start up in OFF mode. In this mode the screen displays limited information and no radar specific selections are possible. Only the generic OSBs 11-15 are active. To turn the radar ON, power must be applied to the radar system, using the avionics power switches (This can not be done through the MFD). When power is applied, the radar goes through a self-test, then enters the Stand-By (STBY) mode. In this mode, the radar is inactive and the radar dish is stowed. Pressing OSB 1 (STBY) will take you to the radar sub-mode menu page. This will continue to display the current radar picture if any, but allow selection of a different sub mode. The ground radar options are displayed down the right side, and the air radar modes down the left side. The options are:

OSB 1	Menu page (select a different mode)
OSB 2	Shows the current sub-mode
OSB 3 NRM	Toggle expansion of the area of interest
OSB 4 OVRD	Override will stop the radar emitting in any of the modes. It will become highlighted when selected, and pressing it again will allow the radar to start scanning again.
OSB 5 CTRL	Control page (displays the radar parameters to be modified)
OSB 6 GM	Ground Map radar
OSB 7 GMT	Ground Moving Target radar
OSB 8 SEA	Sea Mode radar
OSB 9 BCN	Beacon mode (N/I)
OSB 10 STBY	STBY mode
OSB 11 DCLT	Declutter display (if in supported mode)
OSB 12 <mode 1>	Direct access mode (FCR on this screen)
OSB 13 <mode 2>	Direct access mode (BLANK on this screen)
OSB 14 <mode 3>	Direct access mode (TEST on this screen)
OSB 15 SWAP	Swap left and right MFD displays
OSB 17	Set radar bar scans
OSB 18	Set radar scan azimuth
OSB 19	Decrease range scale
OSB 20	Increase range scale

The Declutter (DCLT) button works in both A-A and A-G modes. Decluttering removes much of the text and some of the less critical symbols to allow concentration on the main picture. Many OSB button labels are removed in this mode (but the buttons still function). Pressing DCLT again restores the display. The A-A and A-G modes have individual decluttered states that are retained in computer memory as long as the FCC is powered. The real F-16 has a menu to select symbols and labels to be removed when declutter is toggled. This functionality is not present.

Control (CTRL) Page

Pressing OSB 5 on the FCR MFD pages accesses the FCR Control page. This allows fine-tuning of the radar parameters. The current radar display is overlaid with the control options, in positions 6-10 and 16-20. They are:

OSB 6 CHAN	Radar channel in use (cycle four possible channels).
OSB 18 TGT HIS	Number of target histories shown, selecting a lower number of target histories will show fewer low intensity returns in A-A radar modes (cycle 1 to 4 histories).
OSB 20 MTR HIGH	Moving target recognition. Toggles target minimum speed processed and recognized by the system. Low and High speeds may be chosen (N/I).

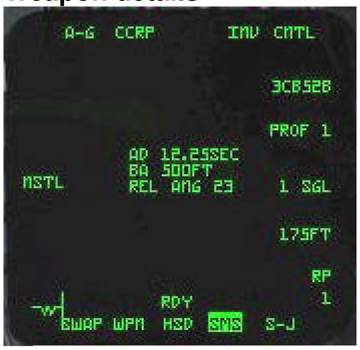
Note: Only TGT HIS is functional. Other OSBs display labels change when pressed but have no other effect.

Stores Management System (SMS) Page
The SMS page shows the details of the stores management system. There are several possible modes of display on this, of which only some are implemented in this version.

Inventory (INV)

This is the default view when in NAV master mode and displays an overview of the currently loaded stores.
In the real jet, you can manipulate the stores from this page, changing the number and types of munitions. This is not implemented (N/I) in SuperPAK.

Weapon details



OSB 1	Display current master mode (A-A, A-G, MSL, DGFT or GUN). Pressing this button in A-A or A-G will toggle the GUN mode.
OSB 2	Display current submode (when applicable). Only applies to GUN, A-G and DGFT. The sub-mode options are: A-G: CCIP, CCRP, DTOS, LADD, MAN • DGFT/A-A (in any of the A-A Gun modes) • GUN: STRF (if in A-G mode)
OSB 4 INV	Access the inventory page
OSB 5 CNTL	Access the control page
OSB 6	Select hardpoint
OSB 7 PROF	Switch preplanned bombing profile
OSB 8	Single / Pair weapon release [Alt-; / ´]
OSB 9	Modify release spacing [Ctrl-; / ´]
OSB 10	Modify ripple count [Shift-; / ´]
OSB 18 NSTL	Select Nose, Tail or NSTL (NoSeTaiL) bombing profile (as set in CNTL page)

Weapons Control page

Used to edit the details of the bombing profile that was selected in OSB 7 (PROF) on the main SMS view. Allows adjusting of weapon delivery parameters like arming delay, burst height and release angle for different weapon types:

OSB 5 CNTL	Return to the previous page (weapon detail)
OSB 10 REL ANG	Set the release angle for tossing deliveries. This value is used by the FCC to calculate the bomb loft and bomb release cues.
OSB 15-20	Modify the selected bombing profile (Arming delay and Burst Altitude), according to weapon category:
OSB 20 CAT1	Arming delay for impact-fused weapons
OSB 19 CAT2	Arming delay and burst altitude (CBU) for altitude-fused weapons*
OSB 18 CAT3	Fuse time and desired burst altitude for time-fused weapons (N/I)
OSB 17 CAT4	Two fuss times and desired burst altitude for Rockeye weapons (N/I)

The two bombing profiles store FCC Submode, Pair or Single, Ripple spacing, Release Pulses and Nose/Tail/NSTL profiles.

Selective Jettison

Toggle Selective Jettison by selecting OSB 11 when in SMS mode. This brings up a display that allows you to select which hardpoint weapons to jettison. You may move back to normal mode by pressing OSB 11 again. Once selected, the hardpoints to be jettisoned are saved. This allows pre-selection of what is to be jettisoned.
To selectively jettison your stores, press the "pickle" button while in the S-J page.

Selective Jettison (S-J) (BMS)

The first thing the pilot will notice is some graphical differences. The line box drawn around the store/pylon(s) are gone, and now replaced by inverse labels, upon when a station's store/rack is selected for jettison. The S-J page and the S-J mastermode are selected by depressing OSB 11 adjacent to the S-J label on any SMS page. This will allow the pilot to jettison weapons and racks unarmed or unguided from selected aircraft stations. Only jettisonable stores will be displayed for selection. The pilot presses the OSB adjacent to the station displayed on the S-J page. The selected station's bottom-most store is highlighted on the S-J page, indicating that it is selected. If a jettisonable rack is also loaded, it may also be selected on the second depression of the OSB. A third depression will then deselect all stores on that station. The pilot can preselect a selective jettison configuration while in S-J mastermode, which will be remembered during mastermode transitions. The stores are jettisoned using the pickle button when the Master Arm switch is in ARM. After the stores are released, the highlighted stations are removed from the S-J page and the associated weapon quantity reads zero. The S-J mode also bypasses any other weapons settings.

Emergency Jettison

This page looks similar to Selective Jettison. It is only displayed while the Emergency Jettison button is pressed down.

Pressing the Emergency Jettison button for about a second will jettison all Air-to-Ground weapons.

Terrain Following Radar (TFR) Page

To engage the TFR, switch to this page, level the aircraft and fly the desired heading. Then select the wanted altitude (OSB 6-10) and ride type (OSB 2), change TFR mode from STBY to NORM (OSB 1) and finally press OSB 4 [Ctrl-Shift-A] to engage TFR.

If anytime during the ride you desire to change heading, or temporarily take control, hold autopilot override [Ctrl-3]. After releasing AP override, TFR will resume control and maintain the new heading. To switch TFR off, press OSB4 again.

The OSB buttons have the following functions:

OSB 1 -Current mode

OSB 2 -Ride type (Hard/Soft/Smooth) determines how aggressively the terrain is followed and how many G's the Autopilot is allowed to pull to avoid terrain

OSB 4 ON -Toggle On/Off to enable or disable the TFR system

OSB 5 CHN1 -Current radar channel (N/I)

OSB 6 1000 -Set 1000' terrain clearance

OSB 7 500 -Set 500' terrain clearance

OSB 8 300 -Set 300' terrain clearance

OSB 9 200 -Set 200' terrain clearance

OSB 10 VLC -Set very low clearance (only over sea, or extremely flat land)

OSB 11 DCLT -Declutter display (if in supported mode)

OSB 12 <mode 1> Direct access mode (TFR on this screen)

OSB 13 <mode 2> Direct access mode (HSD on this screen)

OSB 14 <mode 3> Direct access mode (TEST on this screen)

OSB 15 SWAP -Swap left and right MFD displays

OSB 16 ECCM -Emission Control Mode (N/I)

OSB 17 WX -Weather mode settings (rainy or clear conditions) (N/I)

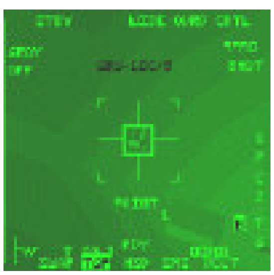
OSB 18 STBY -Standby mode

OSB 19 LPI -Low probability of intercept mode (TFR only scans forward and less often)

OSB 20 NORM -Selects normal mode

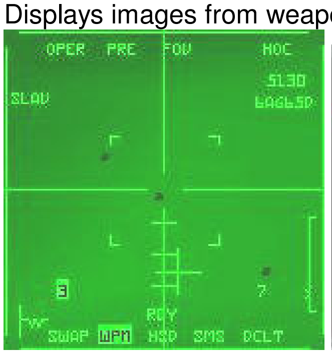
If you are flying another plane than the F-16 and the TFR won't engage, it may be because the selected airplane doesn't feature TFR. Due to code limitations, it was unfortunately not possible to remove the TFR page from these aircraft.

Targeting Pod (TGP) Page
This page shows the FLIR image from the targeting pod.



OSB 3 -Select field of view (FOV)
OSB 6 -Select display polarity (N/I)

Weapon (WPN) Page
Displays images from weapons with a seeker head, such as the AGM-65



"Maverick". When selected, a black screen is shown first. You must then uncage [u] the missile to remove the missile's seeker lens cover and display the image.

OSB 3 -Select field of view (FOV)
OSB 20 -Select SLAVE/BORE mode

Forward Looking Infrared (FLIR) Page
Only partially implemented, it displays the Forward Looking InfraRed sensor parameters. The FLIR page allows some adjustment of the FLIR image so it can be aligned with the real world when the FLIR is switched on. Field of Vision and pitch reference lines may currently be changed. The FLIR image can also be displayed on the HUD [Shift-h].

Flight Control System (FLCS) Page
Displays the status of the Fly-by-Wire system. (N/I)

Data Terminal Entry (DTE) Page
Data cartridge loading page (N/I)

SECTION TWELVE: APG-68 RADAR SYSTEM

THE APG-68 RADAR:

This section includes changes made to the radar MFDs to reflect improved realism and enhancements to the HUD and the Non-Cooperative Target Recognition.

Air-To-Air Radar Modes

Long Range Scan (LRS)
The LRS mode is functionally identical to the RWS mode. It is however designed to operate in the 80-160nm range, and is intended to detect large objects at distant ranges. The LRS mode is also slower than the RWS mode and increases your chances of being detected by enemy radar warning receivers.
The real use of LRS is to detect enemy strategic bombers when flying DCA or BARCAP missions: Using LRS alerts you to their approach at a much longer range, allowing you to plan the intercept early on. As LRS only detects large planes, it can also be used to find and attack enemy early warning aircraft (AWACS), transporters and other support aircraft.

Range While Search (RWS)
When using the AIM-120, some of the major HUD elements are now also displayed in the FCR: This includes the Allowable Steering Error Cue (ASEC), the Dynamic Launch Zone (DLZ) brackets and the LOSE cue.

The above pictures show (from left to right) the display changes upon AIM-120 engagement:

- A bugged target (depicted as a yellow triangle) well inside the DLZ.
- The same target (now in RED), moments after a missile was launched against it.
- The target after estimated impact (based upon FCR missile flight time estimation): yellow triangle marked with red cross.

Non-cooperative Target Recognition (NCTR)

As soon as you lock up a radar contact in TWS or STT mode, the NCTR system will try to identify the target by analyzing radar signature details. During this process, "WAIT" will be displayed in

the top middle of the FCR.
If NCTR is successful (see picture above) , it will then display the actual target ID (e.g. "MG25") in the FCR. If NCTR fails, it will display UNKN ("unknown") instead.

Success for NCTR depends very much on the aspect to target, as it relies heavily on radar returns from the engine compressor blades and air intakes. Therefore, NCTR must be able to "see into" the engines of the target; this means that your plane must point towards the target and be inside a 25° cone in front of it. The NCTR range depends on the radar mode: in TWS, it's only about 70% of what it is in STT.

TRACK WHILE SCAN (TWS) / "TWIZ" (BMS)

How to use TWS (Twiz)
To switch to the CRM-TWS (combined radar mode) sub-mode, the pilot may either hit OSB 2 three times or TMS right to switch from CRM-RWS to CRM-TWS. Upon entering TWS, the radar azimuth will initialize to an "A2" or 50 degree azimuth scan (25 degrees on either side of boresight) and the elevation will initialize to a 3-bar "3B" scan.

Mechanization
As its name implies, TWS tracks multiple targets while searching for others. It is mechanized to begin forming track files (triangles, or hollow squares with a tic if you're using EPAF radar cues) automatically from RWS search hits (solid squares) when the radar receives two hits (meaning the radar detects something twice) in 6.5 seconds. The radar is able to track 10 targets simultaneously. Since the radar does not pause on the track files while scanning, the track's positions are extrapolated in between updates (when the radar detects them again). If a target is not updated, i.e., detected in 13 seconds, the radar will dump the track file until the target is detected again upon which it will rebuild it into a track file. A dump could happen for a number of reasons including a target moving out of the radar's current azimuth scan, elevation scan, or both. Also for example, if the pilot is tracking 10 targets and decides to designate on a search target, the radar will dump the lowest priority track and automatically upgrade the search target into a track file. If the radar has not received a hit on a track on its return scan where the track should be (or rather, where the radar thinks it should be based on the target's last heading and speed), the track file will turn from yellow to red to indicate this. When the track is detected again, it will turn back to yellow. If a track is no longer detected, it will turn red like previously mentioned and extrapolate for 13 seconds total. The last 5 seconds before the radar dumps the track, the track will begin to flash. Tracks are prioritized by range and the order in which they were built. Three scan patterns are available in TWS. They are:

± 60, 2 bar

± 25, 3 bar

± 10, 4 bar

Without a bugged target, the azimuth scan centers on the cursors and elevation is controlled manually. When a target is bugged, the azimuth is biased to keep the bugged target in the scan and the elevation is centered on the bugged target. If the antenna elevation is tilted while the pilot has a bugged target, upon dropping the bug, the elevation scan will move according to what the pilot commanded to reflect the position set by the antenna elevation controls.
There are two ways to bug targets. The pilot may either slew the cursors over to a track file (or a search target) and designate or may TMS-right to bug the closest track file. Further TMS-right's will step the bug to the next highest priority track file. The pilot may enter STT (Single Target Track) by TMS-forward on a bug. This will erase all search targets and tracks from the radar, although the tracks will extrapolate for 13 seconds. If the pilot undesignates (TMS-aft) to return to TWS, the extrapolated tracks will reappear and the target will be bugged. If TMS-aft is commanded again, the pilot will drop the bug and the radar will continue to TWS. If TMS-aft is

commanded a third time, the radar will dump all tracks and begin rebuilding tracks automatically. If TMS-aft is commanded a fourth time, the radar will go back into CRM-RWS.

SP3 Additional TWS Notes:
TWS has an EXP mode, expanding the field of view by 4:1 around a bugged target (or the current cursor position if no target is bugged). With no target bugged, the expansion box can be slewed around the screen with the radar cursor keys.

This EXP function enables you to split out targets flying in close formation (No special radar modes are used here; EXP is simply magnifying the existing display).
To toggle between the Expanded (EXP) and Normal (NRML) views, use OSB3 or the SOI FOV keyboard shortcut [v]. The EXP mnemonic under OSB 3 will flash when the function is enabled.
Also note the following changes to the TWS:

- Track Files are now displayed as hollow polygons.
- Track Files display a tail if an AMRAAM has been fired at it. The tail flashes when the missile goes active.
- At the calculated impact time, an X is imposed over the Track file. This happens regardless of actual impact or not. The X is steady for 5 seconds before it flashes and disappears. If the radar lock is lost due to target disintegration after impact, the Track Files will vanish as usual.
- The radar will not scan while the aircraft is on the ground.

Azimuth Step
The Azimuth scan width step can also be changed between 60 and 30 degrees using the radar cursor: Slewing it to one side of the display toggles an Azimuth step change and moves the radar cursor back in range on the MFD.

ACM modes
ACM submodes are accessible via OSBs on the MFD by cycling through the A-A radar modes. Direct access to individual submodes is possible through keyboard shortcuts [Ctrl-F5/F6/F7] or by switching to dogfight master mode [d] ([c] to cancel).

AIR-TO-GROUND RADAR MODES

Air-to-Ground Ranging (AGR)

The Air-to-Ground Ranging mode is automatically selected during continuously-computed impact point (CCIP) and dive-toss attacks. It is used by the FCC to generate the slant range measurement to a designated surface location. This means that the radar basically "looks" through the CCIP pipper to provide the fire control computer with the range and elevation of the target. The FCC then makes its calculations and releases the bombs as soon as you press the pickle button. If you push the pickle button while the plane is still a bit too far away for the bombs to reach the target, the usual CCRP solution cue comes up in the HUD. Once the solution cue drops and meets the flightpath marker (while you are on the CCRP steering line), the bombs will be released (just as in normal CCRP mode).

Air-to-Ground GM SnowPlow (BMS notes)

Depress OSB 8 next to the SP mnemonic to select the snowplow option. The mnemonic highlights indicating that you are in the SP mode. SP sighting directs each sensor line-of-sight straight ahead in azimuth, disregarding any selected steerpoints. In the GM, GMT, and SEA modes, the ground map cursor will be positioned at half the range selected, i.e., the center of the MFD. The cursors remain at this range while the ground map video moves, or "snowplows," across the MFD. At this point, there is no SOI, and the cursors cannot be slewed. The cursors can be slewed to a target or aimpoint with the CURSOR/ENABLE switch after you ground stabilize them by using TMS forward. TMS forward establishes the radar as the SOI and enables cursor slewing. TMS forward again over a target to command single target track. All cursor slews in SP are zeroed when SP is deselected. After ground stabilizing, the point under the cursors at the time of stabilization effectively becomes your steerpoint. All NAV and weapon delivery steering and symbology, including great circle steering, will be referenced to this "pseudo steerpoint." Displays return to the previously selected sighting point when SP is deselected. For example, SP can be used to accomplish an FCR mark on a point 5 nm in front of your position when the steerpoint selected is 40 nm away. It may often be used with IR Mavericks where target coordinates are not known in advance.

Additionally, the GM range AUTO bumping function is revised in this version. It works more intuitively now with the range bumping up if the cursor is at 95% of the way up the MFD and bumping down if the cursor is at 42.5% of the way up the display or less. Note the bump will only happen if and when the cursor is not being slewed! As a final note, TTG (Time-to-go) has been added to the GM radar scope when you are in STP mode or SP mode with a ground stabilized aim point.

Ground Map (GM) / Ground Moving Target (GMT)

GMT only shows targets that are actually moving (and not all vehicles, regardless of their speed, as it did in all previous versions of Falcon). If a contact is moving slower than 5 kts or faster than 100 kts, it will therefore not show up on the scope.

All targets that are not moving will instead show up on GM (not just buildings as it did before). So if you have a tank column that is speeding towards it's destination, they will show up on GMT. When they arrive in their destination area, they will move slower. Then, as soon as they move at

less than 5 kts, they will disappear from GMT. Finally, once the have stopped completely, they will show up again on the GM scope.
Furthermore, Soldiers will not show up on any radar mode anymore: Since these troops don't really have a radar signature, they simply can't be detected by the APG-66.

If you want your wingman to attack an infantry target that doesn't show up on the radar, just padlock the target visually (you can use the new Padlock AG keys), then issue the "Attack Targets" radio command.
This is also a neat trick when flying the A-10, as the Warthog doesn't feature an AG radar!
Once you designate a target in either GM or GMT, the radar displays a cross and dot symbol over the target location as the radar enters a stabilized ranging and tracking mode similar to A-A STT mode and stops sweeping the entire selected azimuth. The moment you undesignate the target, the A/G radar returns to the usual azimuth sweep display.

Auto/Manual ranging
Auto and Manual ranging has been implemented. This option can be toggled through OSB2. What it does is rather simple: In Auto mode, you can use the cursor to bump the radar range up and down - just move it to the top or bottom of the display. In Manual mode, the bump will not happen and you will have to change the radar range through the OSB keys or by using the appropriate keyboard shortcuts [F3/F4]

Azimuth Step
The other thing added is that the azimuth sweep of the radar can now be set just like it can for the A-A radar. Pushing the OSB that is labeled with "A" and a number will change between 60,30 and 10 degrees sweep.
This is useful if you only need a specific patch of ground map updated (where your target is). When reducing the azimuth scan, you'll get faster target updates.

Radar map gain

In GM and GMT modes, adjusting the radar gain can improve the picture quality of the display, thereby providing more details and better information about the target and it's surroundings (like displaying hills, valleys, rivers and roads. To help you taking advantage of this, the default gain settings have been adjusted. In addition, check out the HOTAS chapter earlier in this manual: proper key shortcuts [Ctrl-F3/F4] have been added to allow the correct simulation of the radar range knob on the TQS, doing range switching in A-A modes and radar gain adjustment in A-G modes.

Scan Mode AIFF (Cobra)
Scan Mode AIFF is featured on the FCR (fire control radar), together with AIFF on the NAV HSD. IFF works by sending a signal to other aircraft and then interrogating the return of the signal in order to determine if the radar contact is friend or foe.

- IFF in Falcon 4.0 is powered On by default, but is limited to F-16 types that have this type of IFF in real life. This includes; F-16CJ, KF-16 Block 52, F-16AM-MLU, F-16C/D HAF, and F-16I. F-16C+ and F-16CG do not have IFF by default.

- To turn power Off/On you will have to add the keystroke listed above to your keystrokes.key file and use Ctrl-I to cycle On and Off. You can also use the switch located on the left side of your cockpit to turn IFF on and off.

- With IFF on and FCR selected on the L-MFD, you can scan Radar targets for friendly v. unknown by selecting Ctrl-LAROW on your keyboard. You will see a green 4-second countdown on the FCR screen as the IFF scans the radar contacts (see Figure 1). When finished, all targets it interrogates as friendly will be shown as small green circles and contacts it interrogates as unknown will remain as yellow squares (See Figure 2). While green circles are friendly aircraft and yellow squares are generally enemy aircraft, pilots need to use AWACS to verify the IFF interrogation authenticity since some of the contacts may have missed the IFF scan.

Figure 1. IFF in scan Mode 4

Figure 2. IFF showing friendly & unknown returns

- It is necessary to refresh this from time to time as radar conditions change. Scan Mode IFF is not fool-proof and if your FCR drops radar track of any contact, then you will have to re-send the IFF signal for re-interrogation. Also, if a new target appears after you perform IFF, you'll have to re-interrogate.

- On the FCR screen there is a CPL and DCPL mode which you access by pressing CNTL (OSB 5) and then OSB 10. CPL interrogates what's showing on the FCR screen. DCPL interrogates the whole 60x60 area in front of the plane and gives the pilot a snapshot of what is in the distant field of view (See Figure 3). DCPL returns stay active for 5 seconds before being wiped.

- On the HSD (normally right MFD in Nav Mode), the AIFF is active as well and will display friendly interrogated returns based on the CPL and DCPL in the FCR (See Figure 4). If you do not want the AIFF to display, on the HSD, press CNTL (OSB 5) and then OSB 3. This turns AIFF On/Off.

To return either or both MFDs then back to normal hit the CNTL (OSB 5) on each again.

Figure 3. IFF shown in DCPL mode on HSD

Figure 4. IFF showing returns

SECTION THIRTEEN: HEADS UP DISPLAY (HUD)

HUD Features

- A roll cue is displayed in normal mode and shows your roll angle up to 45º. This roll indicator is only displayed when the FPM is visible (switched on) and the system is not in AG or DGFT master mode.
- A bank indicator is displayed when FPM is visible (switched on), the system is in AG master mode, the gear is down and the scales switch is set to VV/VAH.
- The AOA indexer lights only work when the gear is down
- When the landing gear is down, a -2.5o ladder bar appears. As well as showing the approximate best descent angle, it is another visual cue that you are in landing mode. in addition, Calibrated Airspeed is displayed (regardless of switch position).
- The heading cue on the heading tape has changed: In ILS master mode, it's a "V"; in NAV mode, it's an inverted triangle
- If the HUD is SOI, a star («) is displayed in the HUD's top left corner.
- *In the HUD-only view [1], all MFDs can now be turned off (g_bNoMFDsIn1View)*

Additional HUD/ Avionics (BMS)
The horizon line in the HUD extends across the entire HUD FOV.
If the FPM is displaced outside the HUD FOV, it stays in the HUD FOV and has an X displaced over the symbol indicating that it is unreliable. Flight conditions such as a strong crosswinds, extreme rudder input and high G maneuvers will cause this.
When the normal horizon line is not in the HUD FOV, it is replaced by a ghost horizon line. The center of the ghost horizon line is on the outer edge of an imaginary circle with an 8° radius centered in the HUD FOV. The ghost horizon rotates around the center of the circle to indicate which direction to pull toward the real horizon.

When the aircraft is in a dive (FPM below the horizon), the dive attitude bars are bent incrementally. The minimum bend is 8.3° and the maximum bend is 45° (at 90° of dive). Also note the pitch ladder lines are different.
When the steer point diamond is out of the HUD FOV, it will be displaced in the HUD side of the shortest turn to get to the STPT and will have an "X" superimposed over it.
Some minor tweaks to the AIM-9 uncaged symbology have been made. The missile diamond flashes when the target is within maximum range and the missile reticle and missile diamond flash when the target is within the maneuver zone (between RMAX2 and RMIN2).

Switches

HUD power switch
Use the SYN dial on the UFC to toggle the HUD on and off [Shift-Ctrl-Alt-b].

Drift C/O switch
The Drift C/O switch [Ctrl-PageDown] on the UFC centers the FPM in the center of the HUD. Without it, the FPM is off to one side depending on the prevailing winds. During take-off and landing, you usually switch to normal mode, which means you see the effect the wind has on your flight path. Once in the air, you no longer need to worry about the wind, so you use that switch to center the HUD ladder and fpm for better visibility.

HUD Control Panel

This panel in the right auxiliary console determines how the HUD displays information:

Scales Switch [Shift-Ctrl-Alt-s]
Off -Digital readouts for velocity and altitude
VAH -All scales except vertical velocity
AH -All scales

Flight path Marker Switch [Shift-Ctrl-Alt-f]
FPM -Flight Path marker
ATT/FPM -Flight Path marker and attitude reference bars

DED Data Switch [Shift-Ctrl-Alt-d]
PFL -Pilot Fault List
DED -Data Entry Display

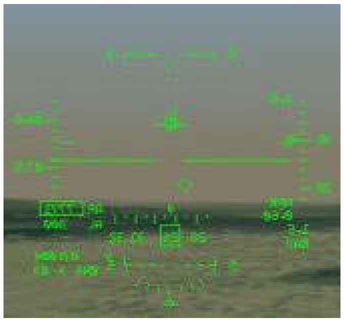
Manual Bombing Switch [Shift-Ctrl-m]
STBY PRI -Backup reticle
DEPR RET -Manual Bombing reticle

Velocity Switch [Shift-Ctrl-Alt-v]
GND SPD -Ground Speed
TAS -True Air Speed
CAS -Calibrated Air speed

Altitude Switch [Shift-Ctrl-Alt-a]
ALT RADAR -adar Altitude Above Ground Level (AGL)
BARO -Mean Altitude Above Sea Level (MSL)
AUTO -Radar altitude while below 1500 fe et AGL / MSL when higher than 1500 feet AGL,

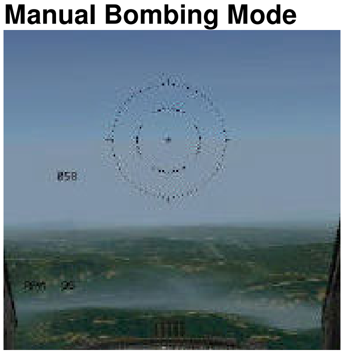
Brightness Control Switch [Shift-Ctrl-Alt-b]
DAY -Full brightness
AUTO -Auto brightness
NIGHT -Half brightness

Radar Altimeter Display



The HUD symbology has been changed to match the RALT changes. The altitude is displayed rounded to the nearest tens of feet (571' becomes 570'). An "AR" or "R" is displayed below the altitude tape depending on the position of the altitude scales switch. This reflects radar altitude when the Radar-Altimeter has been turned on. Below the altitude readout is the low altitude alarm (ALOW) setting. Should the aircraft descend below the ALOW setting the AL readout starts flashing. If the landing gear is retracted Bitchin' Betty will call out "Altitude, Altitude". With the gear extended, the readout still flashes, but without the cockpit voice warning. The RALT readout box will flash if the Radar Altimeter fails.

Manual Bombing Mode



In a situation where the FCC has become inoperable due to damage, switching to the manual bomb delivery reticle may be a viable option to complete an Air-to-Ground attack (The standby reticle is available even when the HUD fails). Similar to a WWII aiming device, the reticle has three modes: Off, Primary (Normal) and Standby (Backup).

- Enable the reticle from the A/G MFD by depressing OSB2 and selecting MAN in the list.
- Toggle modes between OFF, STDBY and PRI using the switch [SHIFT-CTRL-m] on the HUD control panel.
- Move the reticle on the HUD using the DEPR RET wheel found on the ICP [Ctrl-[/]].

HUD Warnings

TRP FUEL

This indication shows that the fuel in the external tanks is not accessible. Check the fuel transfer switch positions or make appropriate adjustments in the flight plan to increase the effective range. The normal cause of this is incorrect setting of the Air Source control. If the external tanks are not pressurized then fuel will not transfer correctly. This cue will appear when all the following conditions are met:

- More than 500 lbs. of fuel in the external tanks
- Internal fuel is 500 lbs. or more below capacity
- The fuel display selector is in NORM position
- Fuel flow is less than 1800 pph
- Air refueling has not happened in the last 90 seconds

ALIGN

While the INS is spinning up, ALIGN is displayed in the HUD. As soon as the INS is ready, the ALIGN flashes for a few seconds before disappearing.

LOSE

A LOSE cue will appear on the HUD when an AIM-120 is in flight, and the FCC calculates that the missile no longer has the ability to intercept the target. At this point LOSE will flash on the HUD, and the timer cue will change from an A (Autonomous) or T (Targeting) prefix to an L (Lose).

HOJ

The HOJ (Home on Jam) symbol will appear if the target of an AIM-120 missile is using ECM. The AIM-120 will switch off its active seeker in favor of a passive home on jam capability.

Autopilot

There are two switches that control the Autopilot (AP) operation, the ROLL [CTRL-1] and the PITCH [CTRL-2] switch. The PITCH switch engages the AP. The PITCH switch must be in the ALT HOLD or ATT position for the AP to be active. The AP system tracks your current altitude in the ALT HOLD position or your current attitude in the ATT position.

Switch: Position	ROLL: HDG SEL	ROLL: ATT HOLD	ROLL: STRG SEL
PITCH: ALT HOLD **AP holds current Altitude**	**Follow HSI heading**	**Hold roll angle and altitude**	**Follow course to next waypoint**
PITCH: OFF	**AP OFF**	**AP OFF**	**AP OFF**
PITCH: ATT HOLD **AP holds current Attitude (pitch)**	**AP OFF**	**Hold roll and pitch angle**	**AP OFF**

To make manual inputs at any time during AP operation, use the paddle switch [CTRL-3]
The Autopilot can only be engaged when the following conditions are met:

- Refueling door is closed
- Landing gear is up
- No FLCS Fault
- Aircraft attitude must be within +/-60 degrees of trim flight
- Altitude < 40,000 feet
- Speed is less than .95 Mach

Attitude Hold

The attitude hold mode is available in either pitch or roll when the pitch and roll mode switches are placed in the ATT HOLD position. Once ATT HOLD is engaged, the aircraft will be held within +/-0.5 degrees in pitch and +/-1 degree in roll. To do a roll and/or pitch correction, use the Autopilot Override. The Autopilot Override (paddle switch [CTRL-3]) will decouple all autopilot inputs while it is depressed. Upon release of the Autopilot Override, the autopilot hold modes capture the reference at release and the heading select guides the aircraft towards the selected HSI heading.

Heading Select

To use this mode, switch to the HDG SEL position on the ROLL switch. The autopilot system uses the heading error signal from the HSI to command the necessary bank angle (up to 30 degrees) to capture the heading that has been set on the HSI. The aircraft will automatically turn through the smallest angle to any heading selected by the pilot, and will maintain that heading within +/-1 degree. To use your current heading, adjust the heading select knob on the HSI to align the heading marker (Captain's bars) to the aircraft heading. Then engage HDG SEL.

Altitude Hold

Upon engagement of the ALT HOLD position on the PITCH switch, the autopilot system receives an altitude error and altitude rate signal referenced to the conditions existing at the time of selection. The autopilot will control to within +/-100' with bank angles less than +/-30 degrees.

Autopilot Updates (BMS)

The BMS AP should meet or exceed the real jet's performance of holding altitude +/- 100 feet either side of the selected reference. In doing so, pitch changes when the jet is close to the selected reference altitude are very much smaller so
you should end up with a rather more "straight and level" experience when selecting this mode.
Roll mode selections are now independent of the pitch mode selection. What this means is that you can select pitch ATT HLD (attitude hold) and any of the three roll modes. Fixed pitch climbing turn to waypoint heading
Pitch ATT HLD mode completely revised. The new function is able to hold selected pitch much more effectively while also implementing stick steering as described below. The pitch reference is now driven from the same reference value used to place the FPM on the HUD pitch ladder. What this means is that when you engage pitch ATT HLD mode, you should get (near enough) the pitch displayed in the HUD as the reference value for the AP to hold.

Stick steering implemented. When you have either pitch ATT HLD or roll ATT HLD selected, you can change the pitch or roll reference angles respectively at any time by merely applying pressure to the control stick (i.e. joystick). When pressure is released again, the AP will attempt to hold the new pitch and roll at the time the pressure was released. Stick steering will work for either axis if it selected, regardless of the selected AP state of the other axis; i.e. if you have pitch ATT HLD and roll in STRG SEL, you will be able to manually change pitch by direct stick inputs but not roll (unless you also depress AP Override of course!).
Self-centering pitch mode AP control switch implementation completed. In the real jet, the right-most AP control switch is a spring loaded self-centering switch. It is held in ALT HLD or ATT HLD positions by a magnetic capture mechanism. Capturing the switch in either one of these two positions is what engages the AP. The AP will operate within limits of plus or minus 60 degrees from straight and level in both pitch and roll axes. If you exceed these limits with the AP operating, the AP function is suspended but the AP pitch switch is not released from its current position. In order to re-engage the AP in this case, you must center the pitch mode switch manually and then reselect the required AP pitch mode to turn on the AP. Also, if certain other conditions arise during AP operation, the AP wil self-disconnect, releasing magnetic hold and springing the switch back to the off/center position. The conditions implemented in the version of the game are:

- Angle of attack exceeds +15 degrees.
- Slow speed warning sounds.
- Gear handle is placed in the down position.
- The AIR REFUEL switch (FUEL panel) is put into the "OPEN" position opening the refueling door.
- There is an FLCS fault detected.
- Power is removed from the AP system
- The Trim AP Disconnect switch (MANUAL TRIM panel) is placed in the "DISC" position.
- The ALT FLAPS control (FLT CONTROL panel) is placed in the "EXTEND" position locking the trailing edges flaps in the down position.
- The manual pitch override control (MANUAL PITCH panel) is placed in the "OVRD" position.

BMS AP Operation Summary

The following charts depicts the main functions of the AP in the BMS executable.

Switch	Position	Remarks
Roll mode (left)	HDG SEL (up)	When the autopilot is on, placing the roll mode switch in this position causes the AP to turn the jet towards the heading currently selected in the HSI gauge (center console).
	ATT HLD (center)	When the autopilot is on, placing the roll mode switch in this position causes the AP to hold the current bank angle at which the aircraft is flying. Stick steering for the roll axis is available with this setting.
	STRG SEL (down)	When the autopilot is on, placing the roll mode switch in this position causes the AP to turn the jet towards the currently selected in the navigation system (note that this may be a steer point, mark point or equivalent).
Pitch mode (right)	ALT HLD (up)	Placing the switch in this position turns on the AP function. The AP will attempt to hold the altitude at which the jet is currently flying. Roll mode is determined by the roll mode switch.
	OFF (center)	Placing the switch in this position turns off the AP. All AP control is terminated.
	ATT HLD (down)	Placing the switch in this position turns on the autopilot. The AP will attempt to hold the pitch attitude at which the jet is currently flying. Stick steering for the pitch axis is available with this setting. Roll mode is determined by the roll mode switch.

Note that the roll mode selection is independent of pitch mode selection. The AP is only on and engaged when the pitch switch is in either the ALT HLD or ATT HLD position. When the AP is on the roll mode is determined only by the position of the roll modes control switch.
Note that movement of the roll mode switch when the AP is off (pitch mode switch in center position) has no effect on aircraft controls.

Guidelines For AP Use

Keep in mind that the AP manages pitch and roll inputs for you but you retain control of the throttle. Particularly with pitch ATT HLD modes, you will quickly see the AP disconnect because it exceeds available angle of attack if too low a power setting is selected via the throttle.
Use caution when engaging the pitch ATT HLD mode AP with a negative pitch angle. The jet will happily fly you into the terrain if you run out of altitude. The VMS system will of course still warn you that this is about to happen.
The AP Override control is always available if you want to take temporary control of the jet while the AP is on and engaged and you have something other than pitch and/or roll attitude hold modes selected. I.e. to change altitude when you have the AP in ALT HLD mode, depress the AP override, dial in the new required altitude with the stick and then release the AP override.
For both pitch and altitude hold modes, the AP will take a little time to "settle" at the requested altitude or pitch; sometimes this can be a minute or more. This time will likely be on the longer side for higher pitch angles and/or lower power (throttle) settings. If you select a high pitch angle with relatively low power and/or a hefty load out, the AP may not be able to settle at the requested pitch reference angle before exceeding AP operating limits and self-disengaging. This may look like the AP is not working but in practice you just requested it to hold a flight condition that is not within the AP's flight envelope.

If it looks like the pitch mode AP switch appears not to move from the center position when you try to turn on the AP, take this as a hint that one of the conditions than causes the self-centering AP switch to self-center applies! With a real switch you'd try to move it and it would spring back. The game graphics do move the switch but it springs back in one frame so it may appear not to have moved at all.

SECTION FOURTEEN: ELECTRONIC WARFARE SYSTEM

The EWS allows for automatic countermeasures upon missile launch detection by the RWR. This includes the release of pre- programmed sequences of Flares and/or Chaff and the ability to turn on the Jammer automatically. The EWS is controlled by a number of switches on the main EWS panel found on the left-hand front panel.

MODE
Select the EWS main mode [SHIFT-z/x]:

- **OFF**: The system is switched off completely. No Flare/Chaff release is possible.
- **STBY**: To manually re-program one of the default programs through the ICP, switch the EWS to standby mode.
- **MAN**: To manually launch the selected Flare/Chaff program.
- **SEMI**: When a radar spike is detected by the RWR, Betty calls out "Jammer" to ask you if you want to turn the Jammer on (*only* if the REQJMR Option in the ICP is set to ON). If so, turn it on manually.

When a missile launch is detected by the RWR, Chaff/Flares are automatically released according to the currently selected program on the PRGM switch.
AUTO: When a radar spike is detected by the RWR, the Jammer is turned on automatically (*only* if the REQJMR Option in the ICP is set to ON).
When a missile launch is detected by the RWR, Chaff/Flares are released automatically according to the currently selected PRGM.
PRGM
The program selector [Shift-q/w] controls which one of four pre-programmed counter-measure programs will be used in SEMI and AUTO mode. The default program is #1, a *chaff-only* sequence for medium and high altitude SAM evasion.
The pilot can choose between 4 different programs, each optimized for a certain task. By default, the 4 programs are defined as follows (*Check the ICP-EWS section on page 54 for a detailed explanation on how the programs work)*:

Program #1 - High-Med Altitude SAM Evasion
This program is optimized to deal with RDR launches from SAMS and SARH missiles. The 3 Chaff drop every 2 seconds gives the pilot a maneuver time between salvos to jink and change

heading.

Chaff	BQ: 3	Flare	BQ: 0
	BI: 0 .5		BI: 0
	SQ: 3		SQ: 0
	SI: 2		SI: 0

Program #2 - Merge program against enemy with IR missiles
This is optimized to deal with the Archer-HMS combo. At the first turn, the Pilot dispenses this program (8 flares in 2.5 seconds per program launch)

Chaff	BQ: 1	Flare	BQ: 4
	BI : 0.5		BI: 0.25
	SQ: 3		SQ: 2
	SI : 3		SI: 1

Program #3 - Popup AG sequence, Chaff only
To confuse enemy radar, as the ingressing fighter begins his pull-up into the SAM envelopes this program dumps 8 bundles of chaff.

Chaff	BQ: 2	Flare	BQ: 0
	BI : 0.5		BI: 0
	SQ: 4		SQ: 0
	SI : 3		SI: 0

Program #4 - Popup AG sequence, Chaff-Flare
With the possibility of SA7 or SA8 over the target area, this sequence adds in the protective measure of 6 flares.

Chaff	BQ: 2	Flare	BQ: 2
	BI : 0.5		BI: 0.5
	SQ: 4		SQ: 3
	SI : 3		SI: 3

The EWS system is closely related to the ICP. The pilot can change each program as he/ she likes. To do so, the pilot accesses the "LIST" page, switches to the "EWS" selection and enters the Chaff and Flare program pages. The pilot can change the various values from there (*see the ICP-EWS section on page 54*). Remember: To manually re-program the default programs the MODE switch of the EWS must be in STBY MODE.

RWR
This switch controls whether or not the EWS system receives RWR data. Switch it to ON to use SEMI and AUTO modes - otherwise the EWS doesn't get launch warnings from the RWR.

JMR
SEMI and AUTO Jammer operations only work if this switch is set to the ON position.

Chaff / Flare
Chaff and Flares are only released in SEMI or AUTO when these switches are in the ON

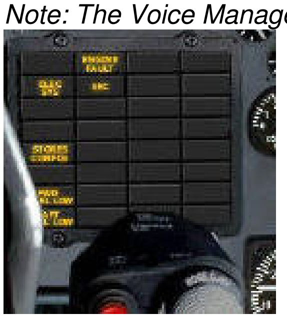
position. Manual Chaff/Flare program release does not depend on the state of these switches.

Chaff / Flare release keys
If the avionics are setup as "Realistic", pressing the keystrokes for manual Chaff or Flare release will instead start the selected program.
Manual release of single Chaffs/Flares is not possible. If you really want to release single chaffs or flares, you must reprogram your EWS programs accordingly.

VMS Calls
New VMS ("Bitchin' Betty") calls are "Chaff/Flare", "Chaff/Flare LOW", and "Chaff/Flare OUT".

Fault and Warning System

There are two types of indications that the pilot can get from this system: warnings and cautions.
Note: The Voice Management System (Bitchin' Betty) is disabled when on the ground.



Warnings And Warning Lights
Warning lights are attached to the glare shield, and are red in color. The "T/O LDG CFG" (Take-Off Landing Configuration) light is a warning light. If the pilot flies slower then 190 kts, descending at more than 250 ft/min, and is below 10,000 ft. with gear up, this warning light illuminates. A typical warning consist of a "WARN" indication on the HUD when a light is illuminated. Five beeps followed by "Warning, warning!" from the VMS (Betty) follows 1.5 seconds after a warning light illuminates.

There are two ways to clear a warning:

- Use the WARN RESET switch located on the ICP. The "WARN" indication in the HUD will be removed, and the VMS will stop. However, the warning light will remain on.
- Change the situation that caused the warning. In the above example, accelerate to a speed above 190 kts, descend slower, or lower the landing gear. The HUD "WARN" indication will be removed, the warning light will extinguish, and Betty will quit shouting. This is the same with all warning lights. Clear by getting out of the condition that caused the warning (if possible), or use the WARN reset switch.

Cautions And Caution Lights
Cautions work basically the same as Warnings, but the Master Caution light illuminates instead of the HUD "WARN" indication. Seven seconds after the caution light illuminates, Betty calls "Caution, caution". Pressing the Master Caution button during the seven-second interval avoids the VMS call. Removing the condition causing the warning will clear the warning.

Example: selecting CAT I when the aircraft is limited to CAT III will generate a Master Caution, a Betty call and a Stores Config caution light. Changing the switch back to CAT III will extinguish the caution lights and there will be no VMS messages. Also after expending all A-G ordnance, the Master Caution and Stores Config lights will be on and Betty calls. This is because CAT III isn't necessary any longer, as no A-G ordnance hangs under the pylons anymore. Simply switch back to CAT I to solve the problem!

Pilot Fault Display

The Pilot Fault Display (PFD) is located just above the caution lights panel on the right auxiliary console. This display is accessed via the F-ACK button on the left side of the glare shield. If the button is pressed and there are no system faults then "No FAULTS, ALL SYS OK" will be displayed. Pushing the F-ACK button a second time will turn the display off.
When the "AVIONICS FAULT" caution light is illuminated the pilot will get a Pilot Fault List (PFL) and Master Caution will illuminate as it does for all cautions. Pushing the F-ACK button will bring up the first fault the system detected. Use the F-ACK button to cycle through all system faults *(You can also click directly on the PFD to switch through the messages)*. When the last fault in the list has been displayed, another push on the F-ACK button will turn the display off. The "AVIONICS FAULT" light will be turned off once the pilot has cycled through all faults.
The PFL can also be accessed through the DED: If the DED Data switch is set to PFL data, the F-ACK button steps through the individual faults, just like the PFD display.

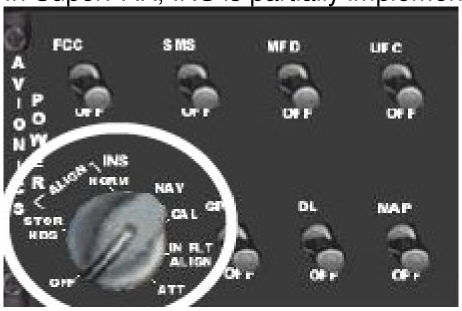
Warn Reset

The Warning Reset switch [SHIFT-CTRL-ALT-w] is located on your UFC and is used to acknowledge warning indications when they appear on your HUD. For example, should a warning indication for Bingo Fuel occur, the Master Caution light illuminates and "WARN" is displayed in your HUD. Pressing the Master Caution button [CTRL-c] will reset the warning system and extinguish the Master Caution light, but will not remove the "WARN" indication on the HUD. Use the Warn Reset switch to reset and remove that indication. The Warn Reset resets the MaxG readout the pilot sees on the HUD to 1.

SECTION FIFTEEN: INERTIAL NAVIGATION SYSTEM

INS:

The INS uses gyroscopes and other electronic tracking systems to detect acceleration and deceleration of the airplane. With this data, the INS computes the aircraft's position in latitude and longitude. As the INS is aligned on the ground before take-off, it's accuracy declines on long flights. In modern jets, the INS is coupled with the GPS to gain additional precision.
In SuperPAK, INS is partially implemented:



- When doing a ramp start, the INS must be aligned. (Full alignment takes 8 minutes, but INS will be useable after 90 seconds of alignment).
- Wrongly entered INS coordinates will result in waypoint offset (coordinates are automatically preset upon start – but can be changed manually through the DED)
- The INS drifts if GPS is turned off (HUD waypoint and HSD stuff drifts). Drift depends on alignment time. The longer aligned, the smaller the drift will be: With full alignment, INS drifts 1 NM per hour, with minimum alignment, INS drifts 10% more.
- The jet may not be moved during alignment, or alignment will stop (it continues once the jet stops again). If the plane moves faster than 60kts on ground and in Align mode, INS has to be shut down before it can be aligned again.
- Pitch ladder and heading tape numbers aren't shown when the INS is powered off or not aligned

How to Use the INS

- To align the INS, the UFC must be turned on. Then, switch the INS knob on the right panel to ALIGN NORM [Ctrl-Alt-F7/F8]. Alignment will now begin.

- The alignment status is shown in the HUD and on the INS DED page: * During alignment, ALIGN is displayed in the HUD and flashes after full alignment.

- On the DED, the 1st line shows RDY as soon as the INS is useable (after 90 seconds). When the INS is fully aligned (after about 8 minutes), this RDY indicator will flash.
- The timer on the INS DED page will count on after 8 minutes, but status won't go below 10.

- If coordinates are entered in the DED after 2 minutes of alignment, alignment starts anew.

- Should you have a total power loss in flight or switch the INS to OFF, turn the INS knob to IN FLT ALIGN. The INS will then use GPS information to re-align itself

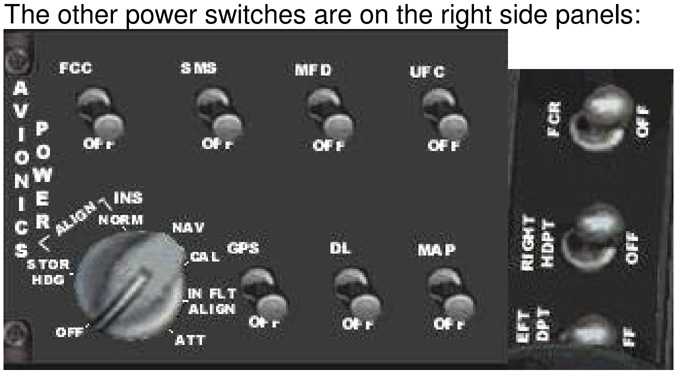
SECTION SIXTEEN: OTHER SWITCHES

OTHER SWITCHES:

Avionics Power

The main power switch on the left console needs to be set to BATT for engine startup and to MAIN PWR when the engine is running [CTRL-ALT-F1/F2]

The other power switches are on the right side panels:



[SHIFT-ALT-F6...F12]
FCC -Fire Control Computer HSD display on the MFD-
SMS -Stores Management System
MFD -Main MFD
UFC -Up Front Controls, DED, and ICP
MAP -Unknown (N/I)
DL -Data link (required to datalink wingman positional data and JSTAR updates)
GPS -GPS power
INS -Inertial Navigation System
- Inflight/Aligned: NAV
- Ramp/Aligning: ALIGN NORM

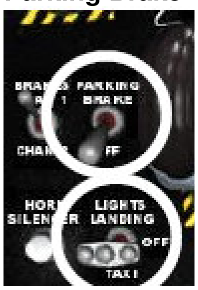
FCR -Fire Control Radar, powers up the radar systems [SHIFT-ALT-F5]
LEFT/RIGHT -Powers the fuselage hardpoints
HDPT -(normally targeting or navigation pods) [SHIFT-ALT-F3/F4]

Radar Altimeter (RALT)

This is a three-position power switch. Positions are OFF, STANDBY, and ON. Only the ON position provides A-LOW warnings. The altimeter takes time to cool down before it functions.
In realistic avionics, the RALT will only work if the aircraft's parameters are within following limits:

Altitude (ft)	Roll (+/-)	Pitch (+/-)
< 3000	60°	30°
> 3000 <= 5000	30°	30°
> 5000 <= 10000	25°	25°
>10000 <= 25000	15°	15°
>25000 <= 50000	10°	10°

Parking Brake



The parking brake switch [ALT-p] applies the brakes permanently. As its name implies, it is used to park the aircraft. The parking brake may be released with the parking brake switch or by applying 83% or greater engine RPM.

Landing Light
Toggles the landing/taxi light on or off [CTRL-ALT-l].

Exterior Lightning

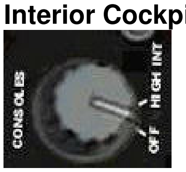
Used to toggle the jet's position and anti-collision lights.

MASTER -Set to NORM [Ctrl-Alt-F9]

ANTI COLLISION -Toggle the anti-collision light (on the tail) [Ctrl-Alt-F10]

POSITION -Switch to BRT to turn on the position lights [Ctrl-Alt-F11] on the wings and choose FLASH or STEADY [Ctrl-Alt-F12].

Interior Cockpit Flood Lighting Rheostat

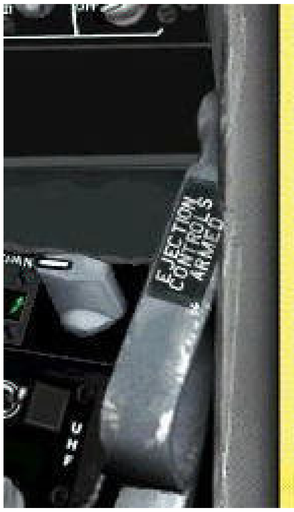


This rheostat on the right console controls the interior flood lighting of the cockpit.
Please note that enabling this causes a framerate hit.

Kneepad

The kneepad has a third page listing the original waypoints fromFalcon's planning page. The pages can be cycled with the command [ALT-k].

Seat Arm Switch



This switch [SHIFT-e] can be found on the left front of the ACES II Ejection seat, just below the pilot's kneepad and the landing gear handle. When the switch is in the UP (SAFE) position, the seat is NOT armed and the SEAT NOT ARMED caution light will illuminate. Ejection is NOT possible. Moving the switch down (ARMED) allows normal operation of the ejection seat. Changing the seat from ARM to SAFE will illuminate the caution light and a Master Caution will be displayed.

Tail Hook Switch

For carrier landings, the aircraft's tailhook must be deployed [CTRL-k]. Upon landing, the hook catches one of several arresting wires stretched across the landing deck of the carrier, bringing the plane to a stop.

Alternate Gear Deploy / Reset

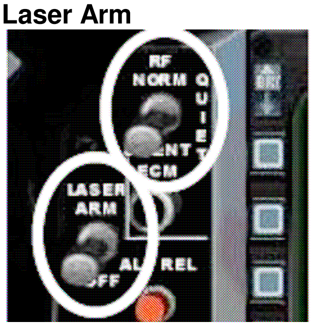
If hydraulics fails, this handle [ALT-g] engages the alternate gear deployment. The center white button [CTRL-SHIFT-g] resets the alt gear deployment and re-enables normal hydraulic gear deployment.

Speed Brakes

In the air and with the gear retracted, the speed brake operates through its full range. However, if the landing gear is lowered, the speed brake opening is limited to 43°. If necessary, the pilot can override this limitation by holding the speed brake actuator in the "open" position [Shift-b].
On the ground, there is no need to hold the key in the open position after the nose wheel is on the ground. The speed brake will remain in the position the pilot set before.

Drag Chute
Some planes like the F-4 or the SU-27 will feature drag chutes to slow the plane after landing. Use a cockpit switch (if available) or [Shift-d] to deploy the chute when you have slowed to about 160 kts (do not deploy while faster - it may get detached!). After slowing down, press the switch a second time to detach the chute (before turning from the runway onto the taxiway).

Laser Arm

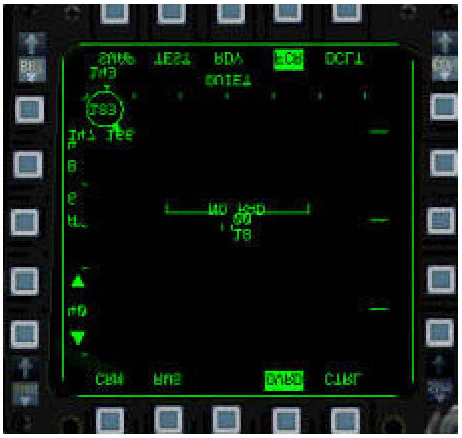


Found just below the RF Switch, the Laser Arm switch [ALT-l] turns on the Forward Looking InfraRed (FLIR) pod's targeting laser. Laser Guided Bombs (LGB) require that the laser illuminates the target until impact. Should the laser stop illuminating the target, or should the lock be broken during the LGB's time of flight (TOF), the weapons will follow a ballistic trajectory. LGBs can be assigned new targets while in flight.

RF Switch
The RF switch [SHIFT-ALT-r] is located on the left side of the cockpit, just above the Laser Arm switch. This switch is used to cut radar emissions quickly and completely. When entering into enemy territory with the desire to be undetected (perhaps using Terrain Following Radar navigation or just NOE ingressing) use this switch. This switch has three positions:

- NORM: Normal operation
- QUIET: Radar emissions reduced, and the AGP-68 radar is put into Standby

- SILENT: ALL radar emissions are silenced (i.e. no RADAR, no CARA (RALT), and no TFR,
  the system will indicate a TF failure and generate a TF FAIL light and WARN indication)




Ground Jettison Enable Switch

Enables [Alt-j] stores jettison while still on the ground (in case of Emergency).

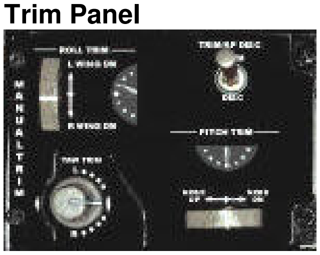
Emergency Jettison Button

Pressing this button [Ctrl-j] for more than one second will jettison all Air-to-Ground weapons (Air-to-Air missiles will stay onboard). *While the Emergency Jettison button is hold, the Emergency Jettison page will be displayed in the MFD.*

Stores Config Switch

This switch [SHIFT-c] toggles the stores configuration. Also known as the CAT switch, it restores maneuverability to the aircraft after the loadout is released or jettisoned.

Trim Panel



Use the manual trim knobs to correct problems with airplane stability (e.g. after being hit by AAA or SAM). The gauges show the level of currently applied trim [Shift-Alt-

NumInsert/Home/PageUp/Delete/ End/PageDown]. TRIM/AP DISC switch: Set to DISC to disable trim through the stick or autopilot [Ctrl-4].

Flight Control

As the F-16's flaps are controlled by the FLCS, no pilot input is needed. However, if the FLCS is damaged, you can manually access the flaps by using the FLT CONTROL panel:

LE FLAPS -AUTO: Leading edge flaps controlled by the FLCS [Ctrl-5]
LOCK: -LEFs locked in current position

Manual Flaps

On aircraft equipped with manual flaps, normal (trailing) flaps and leading edge flaps (LEFs) can be operated by using appropriate cockpit panels (if available) or by using keyboard shortcuts to set the flaps to zero (null), extend them fully or decrease/increase their angle:

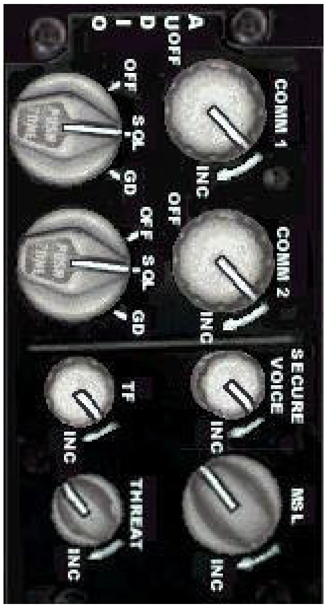
	Set to Zero	Extend Fully	Decrease	Increase
Flaps	[Ctrl-F9]	[Ctrl-F10]	[Ctrl-F11]	[Ctrl-F12]
Leading Edge Flaps	[Alt-F9]	[Alt-F10]	[Alt-F11]	[Alt-F12]

AVTR Switch

The Airborne Videotape Recorder is used to record ACMIs:

- Switching to ON starts recording.
- Switching to AUTO [Alt-f] enables automatic recording. In this mode, the AVTR starts recording whenever the 1st trigger detent or the pickle button is pressed. It then keeps recording for at least 30 seconds or until recording is stopped [f].

Audio Volume



Use the knob on the main AUDIO panel to regulate the sound volume of the missile seeker heads (MSL), the threat warnings (THREAT) and the two (voice) comms channels.

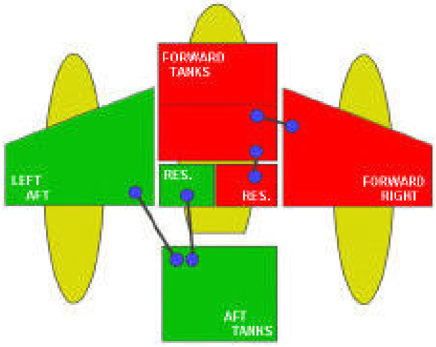
Audio	Vol. -	Vol. +
MSL	Shift-Ctrl-[	Shift-Ctrl-]
THREAT	Shift-Alt-[	Shift-Alt-]
COMM 1	Ctrl-Alt-[	Ctrl-Alt-]
COMM 2	Shift-Ctrl-Alt-[	Shift-Ctrl-Alt-]

Test Panel

Set the Test switch from NORM to TEST to check malfunction and indicator lights [Ctrl-t]. *Left mouse to turn on, right to turn off.*

SECTION SEVENTEEN: AIRFRAME

THE AIRFRAME:



Airframe Overstress
Extreme levels of airframe overstress or overspeed during flight will damage the hardpoints. Damaged stations will not be able to release weapons.
Noise inside the airframe will warn you of increased airframe stress.

Fuel
The F-16 Fuel system is based on the Forward/ Right Left/Aft layout. The fuel is divided into two systems, the F/R and L/A, and is fed from both systems to the
engine. In this way balance is maintained and the aircraft does not become too nose or tail heavy or have a tendency to roll.

The fuel storage system is composed of the following:

- Two Reservoir tanks, these hold 480lbs of fuel each and feed the engine directly. One reservoir is for the F/R and the other L/A system.

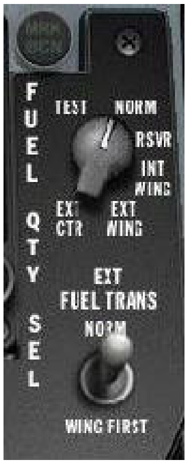
- Forward and aft fuel tanks hold the bulk of the internal fuel. They feed into the appropriate reservoir tanks.

- The wing tanks which feed the forward and aft tanks, the left wing tank feeding the aft main
  tank, and the right feeding the forward tank. These tanks hold 550lbs of fuel each.

- External tanks feed into the wing main tanks. The wing externals feed into the appropriate wing tank, and the centerline feed into both. Capacity is dependent on the tank size loaded.

The fuel is transferred from the reservoirs to the engine. There are fuel pumps that are normally activated to aid the transfer, but the main transfer mechanism is gravity and siphoning between tanks. The fuel then goes through the Fuel Flow Proportioner (FFP). It adjusts flow rates from the two systems to maintain the balance of fuel between F/R and L/A systems to maintain the aircraft's center of gravity. Should the FFP fail (it is part of the `**A'** hydraulic system) then erratic distribution may occur leading to a center of gravity imbalance.
The fuel then goes through the main fuel valve to the engine (where it burns!). The amount of fuel in the F/R and L/A is shown on the fuel gauge. More important is the ratio of the fuel in the tanks. If the difference is too large, a center of gravity imbalance will occur. Attention to the fuel gauge indicators is important beyond just assessing remaining fuel.

The **fuel readout knob** has 6 settings - which alter what is shown on the gauge. In all positions except TEST, the digits in the display show the total fuel [Shift-Ctrl-F1/F2].



The positions have the following functions:

- TEST: Digits should show 6000lbs of fuel, and both dial indicators should point to 2000lbs.
- NORM: One gauge indicates the F/R amount, and the other the L/A quantity of internal fuel (total amount stored in reservoirs, Fwd/Aft tanks and internal wing tanks for each system).
- RESV: Shows the amounts in the Fwd/Aft reservoirs.
- INT WING: Shows the amount of fuel in the Right/Left internal wing tanks.
- EXT WING: Shows the amount of fuel stored in any external wing tanks.
- EXT CENTER: Shows the amount of fuel stored in any centerline tanks.

The normal fuel transfer procedure from external to internal is to transfer fuel from the centerline tank first, then from the external wing tanks. However, this may be overridden by setting the **fuel transfer switch** to WING FIRST.

The left console has the protected **fuel master switch**. This controls the main fuel valve. In the off position, no fuel will get to the engine.

*The next switch, **tank inerting**, is not implemented.*

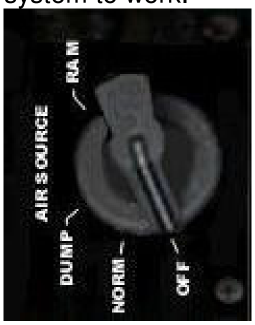
Next to it is the **fuel pumps control switch**. This has 4 positions [Shift-Ctrl-F5/F6]:

- OFF: All fuel pumps are off. Fuel will still transfer using gravity and siphon feeds, but you will encounter problems in negative G maneuvers with the engine being fuel starved.
- NORM: Normal position - all fuel pumps on.

- AFT: Fuel is transferred from the L/A system only.
- FWD: Fuel is transferred from the F/R system only.

These last two positions allow a fuel imbalance to be corrected manually.
The switch for the **aerial refueling door** [SHIFT-r] opens and closes the air-refueling door. The air-refueling door must be opened before attempting in-flight refueling.

Finally, there is the **air source control switch** on the right console. This controls pressurization of the cockpit and the fuel tanks. The external fuel tanks require pressurizing to allow the transfer system to work.



This knob has four settings [Shift-Ctrl-F3/F4]:

- OFF: no air control.
- NORM: normal position for pressurizing the cockpit and the external fuel tanks.
- DUMP: dumps cockpit pressure, but still pressurizes the external fuel tanks.
- RAM: external tanks are not pressurized.

The external tanks are pressurized when switch is in the NORM or DUMP. In other positions the tanks are not pressurized and external fuel flow will not occur. If this happens for too long, you may get a FUEL TRAPPED warning on the HUD indicating fuel flow problems.

To **dump fuel**, use the keyboard shortcut [Alt-d]. On every key press, about 7% of the available fuel is dumped (with a minimum of 100 pounds per key press).
About fuel management, warnings and radio calls:

- "Joker" is called at 50% of internal fuel
- "Bingo" at 20% of internal fuel
- "Fumes" at 7% of internal fuel.

SECTION EIGHTEEN: ENGINE

THE ENGINES:

Definitions and Terminology

The jet engine system in the F-16 consists of several engines actually. There is the main engine, and a small jet engine known as the **Jet Fuel Starter** (JFS) [SHIFT-J]. This engine is used to bootstrap the main engine to life by spinning up the main engine to an adequate RPM where the fuel can be fed and ignited. What spins up the JFS engine to a point where it can light? Hydraulic power, stored in two hydraulic pressure accumulators, is used to accomplish this.

When you start the JFS, hydraulic accumulators discharge through the JFS to spin it up to starting speed. Once running, the JFS can then start the main engine. The JFS accumulators are a one-shot process. Once the accumulators are discharged (one JFS start attempt), they must be recharged before another attempt can be made. Running the engine at greater than 12% RPM about one minute is enough to charge the accumulators.

Power to move the control surfaces and other parts is supplied through the ` **A**' and `**B**' hydraulic systems. These are pressurized from pumps driven by the main engine.

When all other systems fail, and the aircraft is in the air, the **Emergency Power Unit** (EPU) starts up automatically. The EPU has ten (10) minutes of fuel, total. When the engine is offline, the secondary hydraulic system, Hydraulic B, fails. The primary hydraulic system, Hydraulic A, fails when the EPU shuts down. None of the aircraft control surfaces function when both systems are down. This is a good time to leave the cockpit.

If the EPU switch is in the NORMAL position during flight, the EPU will start and run automatically. In the OFF position, the EPU doesn't run. In the ON position, the EPU runs regardless of the main engine status. The EPU can be set manually [ALT-e].

Switching the EPU to ON has no noticeable effect if the engine RPM is above 80%, as it will simply derive power from the main engine. However, as soon as RPM drops below 80%, the EPU will start to burn EPU fuel.

The throttle on the F-16 has various stops where the normal sliding motion stops (called detents). The throttle must either be lifted or an interlock lever pulled to move it further. One of these detent settings stops the throttle before it moves into afterburner position, so the pilot has feedback that he is about to go into afterburner. There is another position at the other end of the throttle travel that stops the throttle from moving below the idle setting to the cut-off setting (which avoids accidental shutdowns). In the F-16, a small lever must be engaged to move the throttle below idle and shut down the engine: Use the **throttle idle detent** [ALT-i] to cut-off the fuel flow to the engine.

One of the preflight checks is to check the throttle travel and confirm that the detents are working correctly.

Functions and Usage
To shut down the engine:

- Set throttle position to idle.
- Engage the idle detent switch [ALT-i]. This is equivalent to pressing the lever that allows the throttle to travel fully back, and then pulling back the throttle.
- Engine will now spool down (to 0% on the ground or between 5%-10% in the air, depending on speed). In flight, the EPU will start and run automatically as soon as the rpm drops below 80% (The EPU has a 10 minute fuel supply to power flight systems, then a total flight control system failure will happen).

The Hydraulic B system will fail as soon as the engine is shut down. The most important effect of this is that the landing gear cannot be lowered normally. Instead you'll have to use the Alternate Gear Extension [ALT-g] to lower the gear. You will not be able to retract it unless the main engine is restarted. To retract after an engine restart, toggle the Alternate Gear Reset switch [SHIFT-CTRL-g] to reset the system.

To start the jet engine

- Set throttle position to idle.
- Start the Jet Fuel Starter [SHIFT-J]. Engine will spool up to a maximum of 25% rpm.
- When the RPMs are greater than 20% advance the throttle above idle.
- Press the idle detent switch [ALT-i].

Engine should now start and spool up to over 70%. The JFS will automatically disengage when the engine RPM gets above 50%.

Details
The JFS will fail to start the main engine if the aircraft is higher than 20,000 ft barometric or moving at greater than 400 Knots. There is an increasing probability of failure at higher altitudes or speed. Unfortunately, the JFS accumulator will still discharge during an attempted restart! Once discharged, the JFS accumulator will not function without recharging the pressure accumulators. If at sufficient altitude, diving the aircraft to get 12% or better RPM on the inlet turbine will recharge the JFS accumulators in about one minute.

When the `**B'** hydraulic system fails the following systems will fail:

- landing gear
- nose wheel steering
- drag chute system

- gun
- air refueling
- wheel brakes
- JFS recharge
- When the `**A**' hydraulic system fails the following systems will fail:
- speed brakes
- fuel flow proportioner

All other systems are served by both A and B.

Start-Up Sequence
When you select to start from the hanger by clicking RAMP start in the mission loader screen, the game will start with the F-16 in its powered off, cold state. The jet therefore needs to have a full preflight sequence before being ready to take off. Currently twelve (12) minutes are allowed to preflight the aircraft, start the engine, and taxi to the runway. The AI aircraft, and players using Combat AP, will do this automatically. Check out Training Mission SP01: Ramp Start / engine startup for a complete walk-through! There is also an appropriate check-list included at the end of the manual.

BMS Engine Code

Two Engines
The Falcon code fully supports two engine operations. When flying a two engine aircraft, the player can control the left, the right, or both engines with his throttle. Each engine has its own thrust, fuel flow, damage modeling, etc. Be advised that adverse yaw and roll are also modeled when there is asymmetric thrust!
When an aircraft has two engines enabled, the upper left corner of the screen will display the current engine selection (BOTH, LEFT, RIGHT) and the rpm of both engines. To cycle between engines, use the CTRL-O key (known as the CycleEngine command when using different key mappings). When LEFT or RIGHT is selected, the throttle will only control the rpm of the engine selected.
For engine startup or shutdown, the procedures are the same as with the single engine operation except that LEFT or RIGHT engine must be selected.

F-16
All F-16s have specific engine code as follows:
** For F-16 aircraft using the PW220 Engine:*
Engine idle increases from Mach 0.84 to Mach 1.4 when it will be at MIL power from 1.4 and above.
The afterburner has 3 schedule zones. Area 3 is Segment 5 no light. Area 2 is Seg 1 light only. Area 1 is no AB available. These are based on various low speed and altitude regimes.
Engine will increase idle speed based on altitude
Engine will increase spool up/down time based on altitude/speed.

** For aircraft using the GE110/PW229/GE129 Engine*
Engine has reduced speed excursion logic modeled. Switches between a higher or lower idle speed based on mach speed (mach 0.55 being the transition point)
Idle spools up from Mach 1.1 to Mach 1.4 where it will be at MIL power

Idle speed increases with altitude
Reduced AB schedule for low speed/high altitude regimes

F/A-18
The F/A-18 series of aircraft have the following aircraft-specific enhancements:

NAV HUD
The HUD layout for the F/A-18 is now modeled. The player will find:
Vertical velocity indicator above altitude.
Alpha, Mach, G, Peak G moved to their correct locations.
AOA bracket set for (6-10 degrees AOA). The alpha display will blank out when the gear is down and FPM is in the bracket range. Also the cockpit AOA indicator lights will now match the correct F18 AOA range Peak Gs will only display if greater than 4 g's are pulled. If less than 4 g's are pulled, the g display will be removed when the gear is lowered.
Mach display is removed when the gear is lowered.
A water line indicator will appear when the FPM is constrained or the gear is lowered.

Flap Modes
The F/A-18 aircraft now have AUTO/HALF/FULL flap modes modeled. To cycle modes use the CTRL-F10 keystroke (or the AFFullFlap key command). A player should only use this keystroke to control flap settings (the other flap keystrokes should be ignored). When the flap mode is cycled the flap display will also indicate the current mode.
AUTO is the standard up and away flying mode. After takeoff, CTRL-F10 to AUTO
HALF will allow flaps to blow down under 250 knots to a maximum of 30 degrees. If speed increases past 250 knots, flaps will raise.
FULL will allow flaps to blow down under 250 knots to a maximum of 45 degrees. If speed increases past 250 knots, flaps will raise.

TEF Scheduling
The F/A-18 aircraft now have the trailing edge flaps scheduled per the -1 manual. The TEFs wil deploy and retract based on both AOA and Mach.

Speedbrakes
The F/A-18 A-D model aircraft will now auto retract the speedbrake when aircraft g is 6 or greater, AOA is greater than 28, or the gear are down and airspeed is below 250 knots.

Engines
The F/A-18 engines will now spool up to full MIL power when at Mach 1.23 or greater.

F-14
The F-14 series of aircraft have the following improvements New NAV HUD.

The HUD layout for the F-14 is now partially modeled. The player will find:
Vertical velocity indicator above altitude. Alpha, Mach, G, Peak G moved to their correct locations. AOA bracket set for (13-17 degrees AOA). The alpha display will blank out when the gear is down and FPM is in bracket range. Furthermore, the cockpit AOA indicator lights will now match the correct F18 AOA range Peak Gs will only display if greater than 4 g's are pulled. If less than 4 g's are pulled, the g display will be removed when the gear are lowered. Mach display is removed when the gear is lowered. Waterline indicator that appears whenever the FPM is constrained or the gear is lowered.

Flap Warning
The F-14 does not have an automatic flap retraction system. If the flaps are extended past 10 degrees and the airspeed is greater than 225 knots, a RDC SPEED warning is flashed on the HUD. This warning will also appear when a maximum airspeed of Mach 2.4 is exceeded.

Speedbrakes
The F-14 A-D aircraft will automatically retract speedbrakes when the throttle is moved to MIL power or the airspeed exceeds 400 knots.

Engines
The F-14 engines will now spool up to full MIL power when at Mach 1.4 or greater. The engines will also increase idle rpm speed if the AOA exceeds 18 degrees. Also modeled is the rich stability cutback. This feature allows only partial afterburner in various low speed/high altitude flight regimes.

F-15
The F-15 series of aircraft have the following improvements

New NAV HUD
The HUD layout for the F-15 is now partially modeled. The player will find:
Vertical velocity indicator below altitude. Alpha, Mach, G, Peak G moved.
True Airspeed (marked with a T symbol) displayed under Calibrated Airspeed.
Peak Gs will only display if greater than 4 g's are pulled. If less than 4 g's are pulled, the g display will be removed when the gear are lowered. Mach display is removed when the gear is lowered.

Flap Retract
The F-15 flaps will retract if a player exceeds 250 knots. If the flaps switch is left down, the flaps will also deploy again when the airspeed decreases below 250 knots.

Speedbrakes
The F-15 speedbrake will retract if extended and 25 AOA is exceeded. If the speedbrake is left deployed, it will extend out again when the aircraft is under 25 AOA.

Engines
See F-16 (PW-220, 229).

F-4
The F-4 series of aircraft have a few improvements.

Engines
The engine operating range is modeled along with the possibility of flameout from various low speed, high altitude, or high AOA regimes (per the -1 manual). The afterburner cutoff range is also modeled.

Electrical Systems
The F-16 has several electrical systems and generators. The main sources of electrical power are in rough preference of use:

- Main Generator
- Standby Generator
- Emergency Power Unit (EPU)
- Battery

The main generator is powered by the engine and is sufficient to power all the aircraft's systems. The standby generator is powered by the main engine and has adequate output to power most of the essential systems. The emergency power unit is an independent system that can provide power in the absence of the main generators. The batteries provide minimal power to certain systems only.

Attached to each generator is a power bus, which is designed to allow degrading of the power systems. These are:

- Battery bus
- Emergency power bus
- Essential power bus
- Non essential power bus

Thus, the main generator provides power to all busses, the standby generator provides power to all but the non-essential power bus, and so on. Without the engine, both the standby and main generators are inoperative, which is why the EPU is an independent system used for power during an engine failure.

Lights

There are numerous lights associated with the electrical system. The main one is the ELEC SYS caution light. This illuminates when there are any electrical problems identified and is a cue to check for other problems. There are two lights on the electrical panel, showing the status of the main and standby generator. These are illuminated when there is a problem with the generators. FLCS RLY and TO FLCS indicate problems with power to the FLCS. This usually indicates that the FLCS is not getting power from all possible power sources (The FLCS gets power from every system as it is the most critical system in flight). The battery light illuminates when there is a problem charging the batteries, or problems with the battery voltage. The EPU has two lights to show that it is working (in addition to the main EPU run light): The first one is an AIR light that indicates that the EPU is running. The other one, labeled HYDRAZINE, indicates that the EPU is consuming Hydrazine fuel (rather than running off engine pressure). This means there are less than ten (10) minutes of reserve power!

SECTION NINETEEN: WEAPON SYSTEMS

WEAPON SYSTEMS:

Gun

The EEGS display levels have been further expanded to reflect increased realism:

- The funnel disappears when firing and reappears shortly after firing stops.
- If the SCOR button on the MFD is enabled, FEDS bullet markers replace the funnel while firing (only if no target is locked and the Master Arm switch is set to either to SIM or ARM).
- If a target is locked, a level V director piper appears, giving a true "death dot" in a stabilized situation against a target on a predictable flight path.

Targeting Pod

The AN/AAQ-14 Targeting Pod contains a high-resolution, forward-looking infrared sensor (which displays an infrared image of the target to the pilot), a laser designator-rangefinder for precise delivery of laser-guided munitions, a missile boresight correlator for automatic lock-on of AGM-65D imaging infrared Maverick missiles, and software for automatic target tracking. These features simplify the functions of target detection, recognition and attack and permit pilots of single-seat fighters to attack targets with precision-guided weapons on a single pass.

- The Targeting Pod image in now shown in the TGP page. Therefore, the SMS page shows only SMS inventory.
- As soon as right hardpoint power is turned on, the pod begins to cool. This will take 7-15 minutes. During cooling, "NOT TIMED OUT" will be displayed on the TGP page.
- FOV adjusted to real world values (6° in Wide View, 1.7° in Narrow View). EXP mode modeled,
  providing 2:1 expansion over narrow view. The box around the crosshair is the narrow FOV indicator. The Pinky switch toggles FOV.
- If the TGP is SOI and not ground stabilized, it will use the Radar slewing speed. If it is ground stabilized, it will use it's own (slower) slewing speed.
- Less jumpy cursors when designating (only jumping to the closest target, not to a random one). Real pod would track based on contrast - In Falcon 4, tracking is based on range. The laser will only fire if armed (LASER ARM switch!). It keeps firinguntil 4 sec. after impact. OVRD (OSB 4) inhibits the laser from firing.
- If the laser hasn't been fired manually (1st trigger detent) and a bomb is in the air, the laser will automatically fire at the target using the LASER ST TIME entered on the UFC (MISC page 5) if the calculated impact time is greater than the entered time. LASER ST TIME can be
  176 seconds at maximum. Using manual lasing overrides this setting - the laser will not lase automatically anymore during this bomb drop!
- Laser status displayed: Steady L means laser armed, flashing L
  means Laser is firing.
- Time to Impact displayed.
- Laser and passive ranging added: The TGP image shows the range to target. When the laser is firing, an L is displayed in front of the readout. Without the laser firing , a T is displayed meaning that the range value is coming from the targeting pod itself.
  * RALT readout is displayed (if enabled).
  * TMS-Left toggles display polarity between BHOT and WHOT

Laser-Guided Bombs

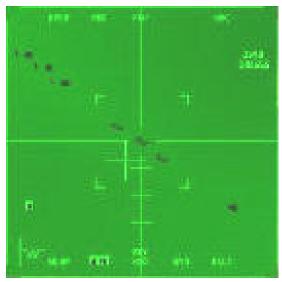
The major changes to the use of Guided-Bomb Units (GBUs) relates to the changes in the TGP usage as described above. In addition, the following features are new in SuperPAK:

- GBUs now have normal parameters just ordinary bombs. They can be rippled or dropped in pairs. They can also have an arming delay.

- When the laser is lasing, GBUs drop where the TGP crosshair points to. Therefore, the target doesn't need to be locked.
- Seeker head gimbal limit adjusted to 18 degrees instead of 45 degrees

AGM-65 "Maverick"
With SuperPAK come various enhancements to the operation of the AGM-65:

- Mavericks need to be powered on before they can display an image. Power is either applied through the PWR Button (OSB 7) on the SMS page, or with STBY (OSB 7) on the WPN page (will then change to OPER). They take about 5 seconds to cool down. During cooling "NOT TIMED OUT" will be displayed.
- To see the image from the Maverick's seeker head on the MFD, change to the WPN page. Then, each time a AGM-65 is selected, it needs to be uncaged [u] in order to receive an image from the seeker head (This simulates removing of the seeker cover).



- The box around the crosshair is the narrow FOV indicator. The pinky switch toggles FOV.
- The gimbal cross indicates if we have a lock or not:
  - ➢ Steady cross: Locked and within gimbal limits
  - ➢ Flashing cross: No lock or approaching gimbal limits
- RALT readout displayed (if enabled)
- TMS-Left toggles display polarity between HOC and COH (N/I)

In addition, Submodes have been modeled (not all complete):

- PRE for preplanned targets: Radar will start in GM, the Maverick is slaved to the radar. Once designated, a steering line is displayed (same as CCRP).
- VIS for visual targeting: Missile starts in Boresight, Radar is in AGR.
  - ➢ Predesignate: the seeker position indicator is a square
  - ➢ Postdesignate: the seeker position indicator is a circle.
- BORE is the same as VIS.

AIM-9
The AIM-9 Sidewinder has 2 basic modes: Caged and Uncaged.

Caged
In Caged Mode, the performance of the missile varies depending on the mode and whether the radar is locked on target or not:

- In Slave mode with Radar Lock: The missile seeker (HUD diamond) is slaved to the radar and will look at the radar locked target. The seeker gimbal limit is approximately 30 degrees.
- No Radar Lock or in Boresight mode: The missile seeker will look directly forward. The seeker diamond will be placed in the middle of the HUD.
- In Scan and Spot modes: Scan mode provides a larger FOV for the seeker head to detect targets. Spot mode requires the pilot to place the diamond on the target.
- Threshold Detection (TD) and By-Pass (BP) modes provide auto-uncage capability. When the IR signature detected by the seeker head (direction is indicated by the

diamond in the HUD) rises above a preset level (potentially a target or a large heat source), in TD mode, the seeker head will uncage automatically.

Uncaged
While uncaged [u], the seeker diamond is displayed twice as large. A new tone is heard when the AIM-9 has obtained a lock while uncaged.
There are two possible conditions in Uncaged Mode dependent on whether the seeker is tracking a target or not (Spot, Scan, TD or BP, Bore or Slave do not affect an uncaged seeker head):

1. **Tracking**: The missile seeker will track (follow) the target. (You will hear a pulsating high pitch tone a.k.a. grumble). The gimbal limit is now approximately 40 degrees horizontal.

2. **Not Tracking**: The missile seeker will tumble randomly around since it's not able to track anything and may fall off the HUD.

Use of Caged/Uncage modes

There are two ways to shoot the "heater", with radar lock and without:

With radar lock (preferred):

- Wait for a good tone (high pitch tracking tone), then uncage the missile [u].
  This is optional, but a good habit to get into as it increases the gimbal limit of the seeker from 30 to 40 degrees. If not manually uncaged, the missile will auto-uncage at launch.
- If the missile is uncaged, check that the diamond tracks the target.
- Check the Dynamic Launch Zone (DLZ) to ensure that the target is in range.
- Shoot!

Without radar lock:

- Maneuver the jet so the missile seeker diamond is directly over the target.
- Uncage the missile (not necessary since missile will auto-uncage, but if the target is lost by the seeker head just before launch it would be a wasted shot).
- Wait for a good tracking tone and confirm the diamond is following the target.
- Judge whether the aspect/range is OK for the missile (since you don't have a DLZ)
- Shoot!
  If you don't hear a tracking tone even although a target is being tracked, check that the MSL Volume isn't turned down (in the AUDIO panel).

AIM-9 L/M cooling
Contrary to the thermoelectically cooled AIM-9P, the AIM-9L/M IR seeker head has to be cooled to even lower temperatures to have an increased sensitivity for acquiring IR targets. Compressed argon is used for that purpose, but the volume of argon available is limited and cooling usually can last only 60-90 minutes (depending on outside temperature and flight profile). After that period, the seeker head efficiency will be greatly reduced (to being almost useless).
AIM-9L/M seeker cooling can be controlled by the pilot: OSB 8 on the AIM-9 SMS page toggles between warm state (WARM) and cooled state (COLD). Transition from WARM state to COLD takes a few seconds and once cooling is stopped, or coolant runs out, the seeker head will be warm again within a minute. Upon selecting Dogfight master mode, the AIM-9L/M cooling process is started automatically. However, remember to manually stop the cooling process after leaving Dogfight mode if early in the flight or you might not have enough coolant left for the remainder of the mission, leaving you with practically useless Sidewinder missiles.

AIM-120
The Dynamic Launch Zone (DLZ) is a feature of the AIM-120 software in the MicroProse release of Falcon 4, displaying minimum and maximum ranges for launching an AARAAM, giving the pilot parameters for an optimal shot. The Allowable Steering Error Cue (ASEC) in Falcon

4.0 (which was displayed rigidly) had been modeled after the Block30 model F-16C. Now the real Block 50 model has an ASEC that breathes between 262mm and 12mm, and is a function of missile kinematics and LINE OF SIGHT to target (LOS). Locking up a target from rear aspect beyond 15 or so miles will therefore give the pilot the smallest ASEC display on the HUD. If that target then turns towards you, the ASEC expands accordingly. As the target nears maximum track rate for the AIM-120 by closing to extremely close quarters, the ASEC will shrink again. When the target is in the maneuver zone and missile LOS limits, the ASEC flashes.

If a missile's time of flight exceeds the calculated impact, LOSE will be displayed in the center of the HUD. LOSE will accordingly disappear if the target returns to range within the time of flight and impact calculations. During the display of the LOSE cue, the time of flight countdown will change from the T to an L.

Non-data-link launching is now modeled the same way as in Jane's F/A-18. Selecting BORE will command the missile to be launched without a data-link from the F-16's FCR. The missile will track the first target it finds in its FOV (indicated in the HUD's center by the AIM-120 diamond). Also modeled is the AIM-120's ability to turn off its own radar in favor of a Home On Jam (HOJ) capability: If a target is jamming your radar, the AIM-120 can home on this signal. HOJ will then be displayed on the HUD.

Five radio calls accompany firing the AMRAAM.

- "MADDOG" -Shooting with no radar target
- "FOX3 CLOSE" -Firing at close quarters [<5miles]
- "FOX3 MEDIUM" -Firing medium range shot [5-15miles]
- "FOX3 LONG" -Firing long range shot [>15miles]
- "PITBULL" -The AIM-120 is now active and autonomous

The AIM-120 may now be selected while in Dogfight override master mode by using OSB 6. The AIM-120 MFD page includes OSBs for activating telemetry (TM) and missile data link channel selection (ID). Telemetry (OSB 18) is a test setting and has no modeled function. The missile data link channel selection (channels 1-4), toggled by OSB 17, is used to deconflict multiple AMRAAM launches. Although channels can be cycled, the full function is not modeled.

SECTION TWENTY: *FLIGHT MODELS*

FLIGHT MODELS:

This section is designed to:

- Familiarize you with the additional features of the flight models added in the SP3 patch.
- Give you the basic knowledge necessary to successfully fly the aircraft in Falcon 4.0.

This QUICK START guide is a concise introduction and does not supersede the necessity of reading the forthcoming complete flight manual upon final release after the bug fixing period.

Introduction

While the original MicroProse F-16 flight model was a good representation of the F-16, the flight models for all other aircraft ranged from adequate to subpar. This was most likely done to allow the AI aircraft to fly and complete their assigned missions. Once human players were allowed to fly other aircraft, these shortcomings became even more obvious. The typical data file problems encountered:
* One low aspect ratio wing type (F-16) for every aircraft (fighter, attack, bomber, cargo)
* F-16 modified turbofan thrust curve for each aircraft
* Improper fuel flow (too high or too low)
* Wrong thrust numbers (too high or too low)
In essence, it was obvious that the data files were generic and intended to get the AI flying only. This is not to fault the original work, but it is necessary to understand the need for improvement.
The flight models in SP2/3 are an incredible leap forward and bring added dimensions of "realism" to flying in the Falcon 4 virtual battlefield. The SP pilot will immediately experience the difference from the F-16 to the B-52. Each aircraft now has a distinct "feel" and the new flight models demand better piloting skills and better tactics.

Features

What the FM team accomplished is simply amazing for a home PC simulation. While graphical changes are often the first thing being noticed, the profound changes to the flight models will be obvious after a few minutes flying in SuperPAK. What the SP pilot enjoys now is the end result of a long process of putting together aircraft piece by piece. This process began by researching wing data:

Wings

The Flight Model team spent hundreds of hours researching and then creating new wings for the SP flight models. The team acquired information on multiple wing types through NASA, NACA, Freedom of Information Act (FOIA), Journals, Libraries, and web sites. The end result is that the FM team found data on the F-16, F-15, F-18, A-10, F-4, MIG-29, F-111, F-5, YF-102, 60 degree Delta, MIG-21, X-5 (45 degree sweep), C-130, Monoplane, Boeing 767, and other wings. These wings were incorporated into the flight models and were matched as best as possible to the aircraft type and wing aspect ratio.
An important feature now present because of the new wing data is the transonic drag rise. For most fighters, both old and new, there are three regions that the pilot flies in: subsonic, transonic, and supersonic. The subsonic region is generally considered to be between Mach 0.0 and Mach 0.6. The transonic region is considered to be between Mach 0.7 and Mach 1.2. The supersonic region is considered to be Mach 1.2+. What the pilot needs to understand is that as an aircraft accelerates from subsonic speed and approaches the Mach 1 barrier, he enters the transonic region where one particular type of drag, wave drag, increases substantially. Once through the transonic region, the drag coefficient begins to decrease, though never back to the lower subsonic values.
Before SP2, this curve was not completely present. The drag coefficient on the F-16 model had a strong increase in the transonic region, but it never decreased once into the supersonic region.

The drag coefficient continued a sharp increase all the way to Mach 2.5. In contrast, the SP2 fighter wings reflect the drag coefficient curve correctly with the drag coefficient decreasing once past the transonic region due to the decrease in wave drag (see fig. 1).
The transonic drag rise is important to note particularly for older fighter aircraft and any fighter that is low on thrust to weight ratio. There are techniques that a pilot can use to get through the transonic region quickly to achieve a better acceleration to top speed. One technique is to best climb (normally maintaining Mach 0.8) to 40, 000 feet and then to do a zero g pushover in afterburner. This zero g pushover should bottom out around 30,000 ft and into a slight climb to the desired altitude and speed (see fig. 2).
The transonic drag increase is also the reason why many fighters cannot break the Mach 1 barrier when carrying multiple bombs and fuel tanks. These additional drag producers combine to create a wall of drag that is nearly impossible to push through. Even high powered fighters like the F-16 experience this problem with high drag index loadouts like six CBU-52's, four missiles, two 370 gallon fuel tanks, and one ECM pod.

Engines
The engines in SP are considerably improved as well in comparison to the 108i2 originals. In the original MPS flight model for the F-16, the thrust for an afterburning turbofan engine was used, but modified in various ways to incorporate RAM drag and to match the F-16 energy curve (Ps curve). This same thrust chart was the basis for all the other flight models as well. Because of all the specific "tweaking" to the original thrust model and the lack of other engine type thrust curves, the FM team went back to the beginning and started from scratch on the engines.

The team assembled data on the various engines types (afterburning turbofan/jet, turbojet, high bypass turbofan, turboprop, etc.). Each type of engine has a specific thrust curve and this curve was duplicated and matched to each aircraft depending on that aircraft's engine type. The team then compiled the published output performance numbers for each engine.
On some engines the FM team had the exact thrust numbers and curves (like the F-18's F404 engine in afterburner). On other engines (particularly OPFOR aircraft) the output thrust numbers were scaled to the appropriate engine thrust curve. Since most published output numbers are for uninstalled "gross" thrust, the FM team used a standard installation loss equation to simulate installation thrust loss as well.
The end results are aircraft with engines that perform in the manner real world aircraft engines perform. The SuperPAK pilot will need to take this information into account as well when flying. Since most pilots will be flying fighters, the example thrust curve below represents an advanced fighter engine similar to the engines used in fighter aircraft:
The top line is the Sea Level thrust curve. Notice how the thrust starts at 30,000 lbs. and then dips slightly through Mach 0.1 Mach 0.4. The thrust then increases through to Mach 2+. SP models this same type of thrust curve for afterburning turbofan engines.

Engine Spool Rate
Each engine has a particular time it takes to spool up and down from idle to full power. SP allows for different engine spool rates. Data was found for the various types of engines and added to each aircraft. Typical spool rates are:

- Afterburning Turbofans (1995 - Present): 2-4 seconds
- Afterburning Turbofans (1970 - 1995): 4-8 seconds
- Afterburning Turbofans (1955 - 1970): 6-10 seconds
- High Bypass Turbofans (1970 -Present): 6-8 seconds
- Turbojets (1950 - 1970): 8-12 seconds

On some of the older turbojet aircraft like the J-5 or Mig-19, these engine spool rates are much

slower than the typical modern turbofan. These new rates are another factor pilots must take into account when flying and fighting.
Each aircraft now contains sound numbers to allow for individual sounds to be set per aircraft.

Fuel Flow (TSFC)
Along with the new thrust curves and matching output numbers the FM team researched and implemented the standard Thrust Specific Fuel Consumption (TSFC) numbers. Each engine has a particular efficiency in how much thrust it provides per how much fuel it consumes. These values vary significantly depending on the type of engine, the age of the design, and the power setting. Modern engines are more efficient per pound of thrust than older ones, while high bypass turbofans are more efficient than regular afterburning turbofans at subsonic to low transonic speeds.
The FM team found TSFC values for nearly every engine in SP. For the few that did not have published TSFC values, the team took a similar engine TSFC values and used those. This particular change will have a profound effect upon mission performance. As one former F-15C pilot commented on flying in real life, "I quickly got fuel religion." In SP, "fuel religion" is a must as well. Let me quote again this former F15C pilot:
"I always had sense of how much gas something was going to cost ... If I turn with this guy, it is going to cost me XXXX pounds of fuel... Can I afford it? Or, would it be better to burn YYYY pounds of fuel running?"
For many, this particular area is going to be the single biggest immersion producing factor with the new flight models.
As a quick tip, knowledge of the thrust curve comes into play again when discussing fuel flow. Notice on the thrust curve chart (fig. 4) that thrust decreases as the aircraft gains altitude. Since fuel consumption is "Thrust Specific" this means that you have a much lower fuel flow at 20,000 feet than at the same speed at Sea Level. This type of knowledge is helpful in determining what type of profile to fly.
As a representative example of what the TSFC changes will mean for the SP pilot, here is a comparison between the 108i2 F-16 and the SP2 F-16 fuel flow for military and afterburner throttle settings at Sea Level:
These fuel flows are the reason why most mission profiles are High/Low/Low/High: You will get the best endurance by performing a best climb to altitude and then cruising the majority of the mission at altitude.
The SuperPAK engines and TSFC values bring added realism to piloting in the simulation. No longer can a pilot ignore the questions of distance and fuel usage. This will also mean that tankers will play a significant role in the SuperPAK campaigns.

Flap Settings
A great new addition in SuperPAK are the various manual and automatic flap settings. Because of the many different lifting devices on modern aircraft, there are many possible combinations of settings. Currently SP models:

Leading Edge Flaps (LEFs) / Slats
These devices are found on the front of the wing and can be set in the following manner:
- No Device (most older aircraft)
- Manual (pilot deploys/retracts)
- AOA related (LEF deploys/retracts automatically according to the angle of attack of the wing)
- Mach related (LEF deploys/retracts automatically at a designated Mach speed)
- TEF related (LEF deploys/retracts automatically when the TEF is deployed)
- Takeoff Setting (LEF default at takeoff)
- Stages (how many stages the LEF deploys through)
- Max Angle (the maximum angle the surface can deflect)
- Rate (the rate in degrees per second the surface can move)

Trailing Edge Flaps (TEFs)
These devices are found on the back of the wing and can be set in the following manner:

- No device (rare)
- Manual (pilot deploys/retracts)
- AOA related (TEF deploys/retracts automatically according to the angle of attack of the wing)
- Mach related (TEF deploys/retracts automatically at a designated Mach speed)
- Takeoff Setting (TEF default at takeoff)
- Stages (how many stages the TEF deploys through)
- Max Angle (the maximum angle the surface can deflect)
- Rate (the rate in degrees per second the surface can move)
- Flapperon (surface is both a flap and aileron, or both are separate)
- Gear Relative (surface deployment linked to landing gear position or separate from it)

Obviously, it is important to note which aircraft have manual settings since these aircraft require the pilot to raise and lower the surfaces. A table showing LEF and TEF settings for each aircraft is available on the following page.

The keystrokes to move the LEFs and TEFs are:

	Set to Zero	Extend Fully	Decrease	Increase
Flaps	[Ctrl-F9]	[Ctrl-F10]	[Ctrl-F11]	[Ctrl-F12]
Leading Edge Flaps	[Alt-F9]	[Alt-F10]	[Alt-F11]	[Alt-F12]

To view the current flap position with manual flaps, find set g_bShowFlaps and set it to "1" instead of "0" in the "falconsp.cfg" file found in the main Falcon4 directory. This will put a flap position display in the upper left corner of the screen that is always on during flight. This is a temporary measure until cockpits and 3D models are designed that take advantage of the SP coding for flap position.
Another feature to help the pilot is an added flap sound that plays when the LEFs/TEFs are manually set. The sound plays when first entering the cockpit as the flaps lower to takeoff position, and when the pilot manually deploys or retracts the surfaces.
All of these models are flyable, but not all of them are in a finalized form. Therefore, please note that some areas of performance may be wrong, or that there might be graphical glitches or loadout errors. But overall, these models should well be enjoyable and add a new dimension of excitement in the Falcon 4 world!

AV-8B Harrier
Of all the available airplanes, the AV-8B is the most unique to Falcon 4 - because the flight model code for Falcon does not include the ability to takeoff or land vertically. This presented a problem for modeling the Harrier. The next best solution was to model short take off and landing by adding a significant amount of lift to the flaps. Therefore, the flaps on the Harrier should be thought of acting like thrust nozzles: As you lower the flaps, think of the thrust nozzles turning toward the ground.
The Harrier has ten flap positions to cycle through. This allows for the lift to be added slowly when coming in to land. When you first join the aircraft for take off, the flaps are set to position five and will allow you to takeoff at 75-80 knots. This simulates a STOL take off. Whether in take off or landing mode, it is best to cycle the flaps up or down instead of using the full up or full down keystrokes: Because there is a large amount of lift tied to the flaps, fast changes between flap positions can cause unpredictable flight behavior and possibly cause you to crash the aircraft.
Here are some instructions for a typical landing scenario:
1. At five miles out, bring the Harrier to 200 kts at 2000 ft.

2. Reduce the throttle and allow the airspeed to drop.
3. Add flaps in one step increments as speed continues to decrease.
4. Hold the nose level and allow speed to reduce.
5. Continue to add flaps until airspeed is 80 kts and aircraft flaps are fully deployed.
6. Allow speed to continue to drop but hold the nose of the aircraft level.
7. Manage descent rate with small uses of the throttle.
8. Touch down with 10-12° AOA at 55-60 kts.

While this may sound hard, with some practice you will have no problems landing virtually anywhere on the airfield!

Roll Rates

The roll rates on many aircraft are revised to reflect the various classes of aircraft. For fighters, there was some roll rate data available on the F-16, F-15 and F-22 aircraft. These values helped define how the roll rate charts should look. The numbers were then made into a template and used to fit other fighter aircraft where no data was present.

Fighters

The average fighter roll rate in SP is 300 dps at Mach 0.6. Some aircraft figures are higher and some are lower, depending on data provided or a good generic figure. The figure is based on a test pilot's recommendation and in agreement with the other pilots in the SP group and the testing community.

Attack/Fighter-Bomber

In the absence of hard data, attack/fighter-bomber type aircraft were given roll rates anywhere between 120-220 dps depending on the aircraft.

Cargo/Heavy Bombers

For the heavy aircraft like the KC-10, KC-135, B-52 and others, the F4UT had access to some real life pilots of heavy aircraft for the military and civilian world. These pilots gave input and helped adjust the roll rates until satisfactory performance was reflected in the simulation. The typical heavy aircraft is set to 60 dps max at Mach 0.6.

It is important to realize that roll rates decrease as angle of attack increases and as speed decreases. When a fighter aircraft starts to pull near 20+ angle of attack, there is a noticeable decrease in roll rate. To get the roll rate back, the pilot must "unload" the aircraft by easing the back pressure on the stick and allowing the AOA to decrease.

Aircraft Momentum (Roll, Pitch, Yaw)

With the F-16 being a fly-by-wire (FBW) aircraft, much of what non-FBW aircraft experience is dampened or removed by the flight control system. With the ability to fly other aircraft came the need to model more of the momentum/inertia of each aircraft along the three axes. SP allows for these changes and each aircraft has some minor changes to the axes. Using roll as an example, a pilot will notice on some aircraft more of a need to give opposite stick to stop the roll at the precise point desired. The momentum of the wing is not countered by the FCS and it is up to the pilot to stop the momentum.

Dynamic Roll Inertia

The inertial effects of stores on the wings are factored into the rolling inertia of aircraft. The effect also takes into account the fuel weight in external tanks. A player will notice that a fully loaded aircraft will react in a more "sluggish" manner. Both starting and stopping of rolling maneuvers will need more attention. As weapons are released and fuel is used, this inertia will decrease.

Turbulence (BMS)

RV includes a sophisticated turbulence model that takes into account a wide variety of conditions. A player will experience different turbulence intensities and durations depending on weather conditions, time of day, altitude, vicinity to clouds, and terrain. Also modeled is tropopause boundary turbulence (35k-36k altitude).

Roll Coupling
Roll coupling is the tendency of an aircraft to roll in the direction of the rudder input. This is normally dampened significantly by FBW systems, but most aircraft have light to moderate roll coupling. Pilots will now experience a slight tendency to roll when the rudder is used.

Drag Chute
There are many aircraft that use a drag chute to assist in slowing down upon landing. SuperPAK gives the pilot this feature as well. The drag chute can be in one of four states: stowed, deployed, trailing, and released. To deploy the drag chute, press [Shift-D]. To detach it after deployment, press [Shift-D] a second time.
* *The drag chute will tear off if deployed above 170 knots!*

Generic Wings.
While every aircraft has a new and better wing, not every aircraft has its proper unique wing. This means that some aircraft, while much better than before, are still not going to perform exactly as they should in every flight region. When faced with a lack of data, the issue became: "How do we improve the wing to give it more realistic flight behavior?". The question which we repeatedly asked ourselves after each wing modification was: "Does this move the aircraft closer to better and more realistic flight behavior?" So for example, when data was lacking for the B-52's high aspect wing, it was better to give it a generic higher aspect wing than a generic lower aspect wing like a fighter. Until the FM team gets the proper data for each unique wing, these were considered necessary concessions.

Generic Engines.
As with the wing data, exact engine thrust data is very hard to find. When specific thrust data was not available, the aircraft was given the proper generic thrust curve for the particular class/type of engine and scaled to the published output numbers. This again is a step toward more realistic behavior since the aircraft engines are now following a proper curve for the engine type. It is better to have the high bypass turbofan on the KC-10 on a generic high bypass turbofan curve than to have it on an afterburning turbofan curve like a fighter. As more data is found, changes will be made to reflect that data.

RAM Drag
Currently, most of the idle thrust values are set to zero. Ideally, the idle thrust table should reflect the proper RAM drag for each engine and aircraft inlet. The amount of work necessary to determine proper RAM drag has pushed its implementation back until a later point. The effect of not having the proper RAM drag values in idle thrust means that aircraft will not decelerate as quickly as they should. The FM team hopes to incorporate RAM drag before the final bug fix period is over. As of this writing, only the F-16 aircraft has the proper RAM drag.

TSFC Values
Thrust Specific Fuel Consumption values do change over airspeed and altitude. To reflect this properly would have required a large amount of code work. It was considered best to use the single published values for MIL and AB power alone. This means that the fuel usage will be a little higher than it should be in some flight regions.

Flaps
The broad range of aircraft simulated in Falcon 4 brings with it a broad range of lifting devices. Some aircraft, like the F-18C, have LEFs and TEFs that deploy over both an AOA and Mach region. This would have required building a table into the data file for the simulation to read for the proper scheduling of these devices. Because of the complexity of this issue and the small amount of time, this was not done. This means that some aircraft will not have their lifting devices deploy as they do in the real world.

Stall Model
One particular glaring omission in Falcon 4.0 from the beginning is the lack of a true stall model. The FM team tried hard to work out a stall model, but complexity and a lack of time prevented this from happening. This means that angle of attack stall and slow speed stall are not modeled correctly. Aircraft will still fly in attitudes and speed ranges that they should not.

SECTION TWENTY-ONE: Radio Commands

RADIO COMMANDS:

Air Traffic Control
Once you call inbound on approach to a field, ATC will call out traffic such as "Cowboy 11, traffic 2 O'Clock 4 miles." The traffic must be a possible traffic conflict to your plane or it will not be called out. Once ATC calls traffic out to you, it will continue to update you with that traffic as long as it remains a possible conflict. If you find the traffic, or just want ATC to shut up about the traffic, select the "Traffic In Sight" under the Tower menu. ATC will stop calling that specific traffic out to you unless it becomes a possible conflict again. ATC will not call out aircraft in your own flight.
Known issues: ATC speaks fairly slow in Falcon4. If there are lots of aircraft, and ATC is giving lots of vectors, the buffer can get backed up. When traffic is called out, it may have already moved from the location the traffic call was calculated for. If you have text display on, you will see the traffic call at the appropriate time, but you may hear it 5 or 10 seconds later. Also, Falcon4 is limited to the distance it can call out. It will only call traffic out in the following distances: 1, 2, 3, 4, 5, and 10 miles.

FAC
If you are on a On Call CAS (or similar mission CAS, BAI, INT), you can use the AWACS menu "Check In" command as to use AWACS as a FAC.
Only AWACS can perform FAC functions in RV1.
If a target is ready, the AWACS will give you vectors and a cleared hot call. If no targets are currently available, you will be instructed to hold at CP Alpha (just hold at one of your target waypoints). In the campaign, as a target is found, you will be vectored to that target. When vectored, you need to respond with "Wilco".
When finished, use Check Out to end your station time. If Check In is used when you are not tasked on an appropriate A/G mission, AWACS will reply "Unable".
Note: Human FAC is not enabled in RV and F-16s will not be assigned FAC missions. If you decide to fly another aircraft (e.g. A-10), you will want to skip over FAC missions.

Wingman Command Updates:

Combat Management 1
Attack Targets…………………………...Attack targets in designated group.
Go Shooter (Wingman only)………..…You attack; I will provide cover.
Go Cover (Wingman only)…………..…..I will attack; you provide cover.

Combat Management 2
Drop Stores…………………………..….Jettison external stores.
Form Wing (Wingman only)…………...Re-form wingman formation
Split Wing (Wingman only)…………..…Split from wingman formation

Mission Management
Take The Lead…………………..………Take over as lead
Say Weapons…………………….……..Report weapon status

Formation Management 1
Switch side………………….…………..Toggle formation side Left/Right
Break Right…………………..……….…Perform 90 degree break to your right.
Break Left………………………………..Perform 90 degree break to your left
Go Higher…………………..……………Increase relative Altitude
Go Lower…………………...……………Decrease relative Altitude

Flex…………………………..…………..Orbit current position

Formation Management 2
Go Fluid……………………………..……Go "Fluid" formation

Formation Management 3
Go Vic……………………………………..Go "Vic" formation
Go Line Astern…………………………...Go "Line Astern" formation
Go Finger Four……………….……..…….Go "Finger Four" formation
Go Echelon Left…………………….……….Go "Echelon Left" formation
Go Echelon Right………………….……..Go "Echelon Right" formation
Go Diamond…………………..…………Go "Diamond" formation

Identification Management
Turn ECM On…………………………..……Turn ECM jammer on
Turn ECM Off…………………….……….Turn ECM jammer

SECTION TWENTY-TWO: Miscellaneous

In-Air Refueling:
The tanker will set up a 60x25nm track pattern for jet aircraft and a 40x20nm pattern for turboprops (each aircraft can be defined to have its own track pattern size, refueling altitude and speed) along the FLOT. Turns will be smooth with a low turn rate, so you can stay connected to the refueling boom while the tanker turns (In fact, AI aircraft will now stay connected to the boom during the turn). In addition, a few miles before the tanker begins a turn, it will warn you accordingly by radio - so be prepared! (The tanker operator will say: "Heads up, tanker is entering turn").
The config variable called Refuel Help will give you 50% AI steering input on your aircraft's maneuvering in Realistic refueling mode and 100% AI input (apart from the throttle) in Easy refuel mode. In Simplified mode you must head to the tanker and get to the boom, but once you are connected, the AI takes over full control.

Hot-Pit Refueling
Anytime you are at a complete stop on any Taxiway or Parking ramp, you can press T-7 (ATC menu) for "Request Hotpit Refuel" and get Hot-pit refueling. Upon your request, you will hear the ATC reply "Cowboy X, copy" and your fuel tanks will begin to be refueled at a reasonable rate. This also works for Guests in Multi-player. Additionally, in the Dogfight arena, all Host and/or Guests have to do is land and come to a full stop on any Runway, Taxiway or Ramp. They do not have to request Hot-pit Refuel, as they will be automatically refueled.

Printing The Briefing
Select the PRINT button on the briefing screen to print the text to the default printer and/or save/append it to the "briefing.txt". Use the Config Editor to select if you want only to print, only to save, or to do both. Also select if you want to append new briefings/debriefings to the existing files or to keep only the latest one. Also choose if you want to save debriefings to "debrief.txt".

Skyfixes
The ability to change, edit or install custom “skyfixes” is enabled when using RV. The tod.lst file can now be edited to affect changes in sky colors and other features affected by this file. The tod.lst file is in the Falcon4\terrdata\korea\weather folder and controls advanced lighting effects and the times of day the various lighting effects are activated. Many star constellations are visible if you fly high at night. Big Dipper can be seen just left of heading 360 degrees for example.

Screenshots
* In-game screenshots will be saved as BMP files in the *falcon4/pictures* subfolder.
* Using [PrintScreen], you can also take screenshots from the User Interface. These will be saved as TGA files.

CARRIER OPERATIONS

Take-Off:
34 Carrier Operations: F/A-18C Hornet
Missions begin with the aircraft located at the center of the aircraft carrier's deck. Depending on fuel and weapons load, you may need to turn your aircraft around and taxi to the end of the carrier. Once at the end of the carrier, point your nose to the front of the aircraft carrier, lock the brakes, push the throttle up to full afterburner, release the brakes, and takeoff. Raise the gear [g] as soon as the aircraft is airborne to gain additional velocity. If the mission includes wingmen, they will start in the air above the carrier. Radio them to "rejoin" the flight once you are airborne.
Navigation
Follow the waypoints back to home plate. The carrier will likely have moved since your take-off, so do some searching to locate it. You can also request "Vector to Carrier Group" from AWACS,

as the carriers now feature dynamically allocated TACAN (like the refueling tankers do).

Landing

For a successful approach, align the aircraft behind the carrier. Lower the landing gear [g] and the tail hook [CTRL-k]. Set the AOA and throttle so the FPM is located on the end of the carrier's deck. Once within several hundred feet of the end of the carrier deck, increase the throttle and/or pull back slightly to move your FPM to the middle of the carrier's deck. Keep in mind that the heavy-duty landing gear typically found on carrier aircraft is not modeled, so set down gently. Mission accomplished!

APPENDIX A: COCKPITS & OTHER ADD-ONs

COCKPITS & OTHER ADD-ONs

In light of the vast amount of work and changes in the RV patch, most of the add-ons that some end-users are accustomed to installing will not work with RV at this time. While changes and updates may be forthcoming that remedies some of these problems, one of the goals of the RV OCI is to eliminate the need for multiple patches commonly known as the “dance”. End-users are encouraged to go enjoy the new features of RV and then consider installing other add-ons as they become usable.

3rd Party Cockpits (2D/3D)
Due to the new GE in RV, 3rd party cockpits will not be usable until the cockpit makers are able to update their files for the new graphics format. The status of this will likely change once the pit makers are able to make the necessary fixes. Pilots who wish to use their old cockpits will have to monitor the normal outlets and internet forums for updates on this.

Theatres
Currently the only theatres that will work with RV are only the ones that do not use modified LOD models, which must be converted before use. This includes the Balkans theatre.
Several new theatres are in development and may be formatted to work with RV. More details about these releases will come from the specific theatre makers.

Terrain Tile Textures
The pay-ware “Hi-tiles” installation cannot be installed using the installer at this time with RV without causing significant problems with the terrain leveling files. Users will have to use some modified install procedures in order to get these tiles to work properly. You are recommended to keep an eye on some of the popular forum sites for updates on this in case a patch is made available.

HFFMs
As stated earlier in this guide, the HFFMs are already included in this patch and attempting to install them will likely cause problems that cannot be fixed without a total re-install.

Baz-T Terrain Elevation Patch
This popular patch should not be installed with RV since it has not been tested and may cause problems with some of the files in RV. Pilots, who choose to install this patch, do so at their own risk and may have to perform a re-install of RV if problems occur.

APPENDIX B: HOTAS SETUP

HOTAS:

To allow for maximum realism in HOTAS programming, a number of additional keystrokes have been added to simulate proper HOTAS button operations.

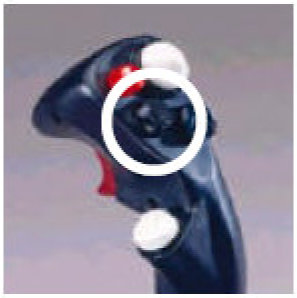
2-Stage Trigger
The original HOTAS trigger is a two-detent switch. Squeezing the trigger to the first detent [Ctrl-/ (the key left of the right shift key)] starts operation of the AVTR (if the AVTR switch is in the AUTO position) and provides consent for laser fire (if selected and armed).
Squeezing the trigger to the second detent [Alt-/] continues operation of the AVTR (and consent for laser fire) and, if the gun is selected, fires the gun.
If the AVTR switch is in the AUTO position, camera operation continues for 30 seconds after the trigger is released.

MSL Step Button (NWS)
This button [SHF-/ (the key left of the right shift key)] is mode dependent:
* On the ground, it enables the Nose Wheel Steering (NWS) used to taxi around.
* In Air-to-Air modes, depressing MSL STEP selects the next available missile of the currently selected type.
* In Air-to-Ground modes, depressing MSL STEP switches through bombing modes (CCRP, CCIP, and DTOS).

Pinky Switch
This key [Alt-v] toggles the FOV (field-of-view) in various radar and weapon views:

SOI / Mode	View
FCR (TWS mode)	NORM, EXP
FCR (GM mode)	NORM, EXP, DBS1, DBS2
FCR (SEA and GMT modes)	NORM, EXP
WPN (AGM-65D)	WIDE / NARROW FOV
TGP (LGB/GBU)	WIDE / NARROW / EXP FOV

Target Management Switch
Special keyboard commands are available to partially simulate the operation of the Target Management Switch (TMS) on the HOTAS: [Ctrl-Up], [Ctrl-Right] and [Ctrl-Down] allow easy target designation and quick Air-to-Air radar submode switching.
Depending on the current radar mode, the TMS works as follows:



RWS: Command SAM (=Designate target)
TWS: Designate target
ACM: Boresight scan

A-G: Designate target

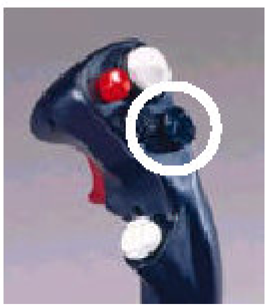
RCR (N/I)

RWS: Command TWS
TWS: Step bug
ACM: 30 x 20 scan

RWS: STT->SAM->Search
TWS: STT->Search->RWS
ACM: 10 x 60 scan

A-G: Drop target tracking

Display Management Switch
After setting up the preferred MFDs on mission start-up using the OSBs, use the Display Management Switch (DMS) to quickly access these pages or to move the SOI between the HUD and the MFDs.
Depending on the current radar mode, the DMS works as follows:



Move SOI to HUD (if possible) [Num-Shift-8]

Cycle through left MFDs [Num-Shift-4]

Cycle through right MFDs [Num-Shift-6]

Switch SOI between MFDs [Num-Shift-2]

Countermeasures Management Switch
CMS information and operation is classified. We can assume that it controls ECM and flare/chaff operations. Therefore, the following setup is suggested:

Run selected EWS program [x]

Decrease EWS program [SHF-q]

Increase EWS program [SHF-w]

Toggle jammer [J]

Cursor/Enable Switch
The Cursor/Enable switch [Shift-n] on the TQS is the Z-axis of the slewing cursors used to move the radar or the weapon video view.

Depressing the Cursor/Enable switch with an AIM-9L/M, AIM-120, or AGM-65 selected will change the BORE/SLAVE option.
For AIM-9L/M and AIM-120, the BORE/SLAVE option is changed only as long as the switch is held depressed. For the AGM-65, a permanent change of BORE/SLAVE (PRE/VIS/BORE) occurs.

Radar Range Knob
In the real jet, the radar range knob on the throttle has a combined, mode-dependent function: It is used to control the radar range in A-A mode and the radar map gain in A-G.
With SP3, this is now properly implemented: press [Ctrl-F3] to simulate turning the radar range knob down (clockwise), and [Ctrl-F4] to turn it up (counter-clockwise).

APPENDIX C: KEY MAPPING (SP3 KEYBOARD COMMANDS)

The key mapping section may include additional key controls or changes depending on the version you have been flying. Pilots should be sure to use the SP3 based pdf documents located in the Falcon\docs folder for assistance with keyboard commands.

Activating the new mapping file
There are quite a few keyboard commands available to the pilot. Nearly all of the new commands are also directly accessible by using the mouse in the default cockpit. The installer will place a keystrokes file called "keystrokes.key" (including all these commands) in your "Falcon4/config" subfolder. To activate it, select the "Controllers" tab in the
Falcon Setup screen, click "Load", select "keystrokes.key" in the resulting file list and click "Load" to activate it.
The " SP3_Keyboard-Map.pdf " found in the Falcon 4 Docs folder is a keyboard layout map of this keyfile, similar to the keyboard chart found in the original Falcon 4.0 retail package.
In addition, there is also a new quick reference included ("SP3_Keyboard-Reference.pdf ").

For ease of use, we strongly suggest using the new keystrokes file "keystrokes.key" in its entirety and re-programming your HOTAS to your needs! If you feel that this will be more time than you care to invest, then you can manually add the new key definitions to your existing .key file:

Modifying The Key Mapping File
If you don't want to use the included keystrokes.key file and choose to apply the new keyboard shortcuts to your existing keyboard mapping file, the following documentation describes how the key file in Falcon 4.0 works and how to reprogram it directly using a text editor.
We still suggest using the new keystrokes file "keystrokes.key" in its entirety and re-programming your HOTAS to your needs!

How to add new keyboard shortcuts to your existing keyboard mapping
You can find all the new commands available in Falcon in the aforementioned "keystrokes.key" file. To add these shortcuts to your existing .key file, copy the shortcuts line per line (each command takes one line) from the new keystrokes.key to your old .key file by using a
text editor.
After pasting the new commands into your .key file, you will need to start Falcon 4.0 and use the key remapper in the controller setup of Falcon to program the keys to the new commands.
There have been reports that sometimes Falcon 4.0 will scramble the keyfile if you try to program the keys in the key programmer. The safest thing to do when making modifications to the keystrokes.key file is to always "save as" and rename the file after modifying it.
The steps are as follows:

1. Make a backup of your current .key file located in the \falcon4\config folder.

2. Open your current .key file with Notepad.

3. Open the SuperPAK keystrokes.key file with Notepad and highlight the first new command line. Copy it to the clipboard [Ctrl-c].

All commands consist of ONE line!
Example: ***SimToggleMissileCage -1 0 0X16 0 0 0 1 "Wpn-Sidewinder-Cage/Uncage"***

4. Switch to your original .key file and, using the names between the "" of the line (NOT the beginning of the line), determine the alphabetical order to insert the command line into. Use your mouse to select the beginning of the line you want to insert at in your .key file. With the cursor at that position, press [Ctrl-v] and the command line will be pasted.

5. Now check if the command is not yet used in your existing keyfile: Search for the hex code associated with the command's shortcut ("***0X16 0"*** *in the example above. The "0X16" stands for the associated key, and the following "0" for the modifier (none here, 1 is SHIFT, 2 is ALT, 3 is CTRL etc.))*.

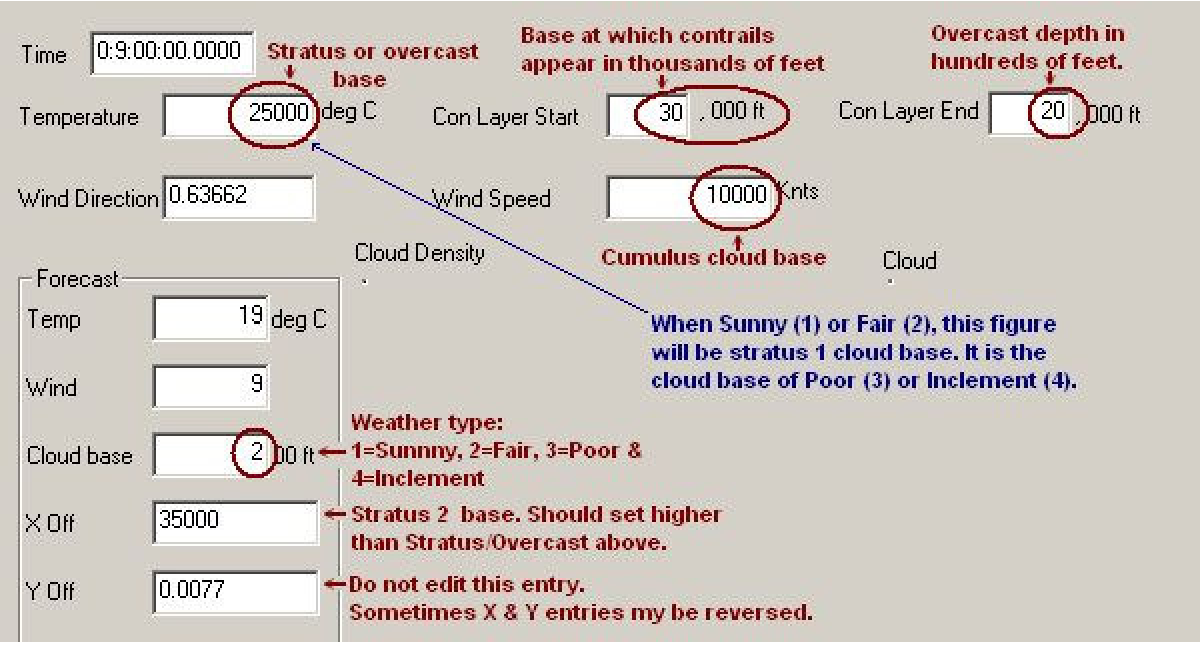
6. If the code is found in another command, the shortcut is already in use. You must therefore replace the code section between the command and it's description (***-1 0 0X16 0 0 0 1*** in our example) with a value of ***-1 0 0XFFFFFFFF 0 0 0 1*** . This will clear the shortcut and you can manually re-program a new shortcut later by using the Falcon Setup > Controllers tab.

7. Repeat these steps until all new commands are in your .key file.

8. Once they are all copied, you will want to save the .key file to the falcon4\config folder, start F4, go to the Controllers Setup screen in F4 Setup and reload your .key file. Program unassociated commands (those where you had to delete the code section) to whatever keystrokes your heart desires.

Appendix D: Editing Weather Using Tacedit

This picture below illustrates how variables in TacEdit v2.46 Weather section are used to edit weather. Load your TE, Training or Campaign Save and in TacEdit select the Weather tab at the bottom left of TacEdit.



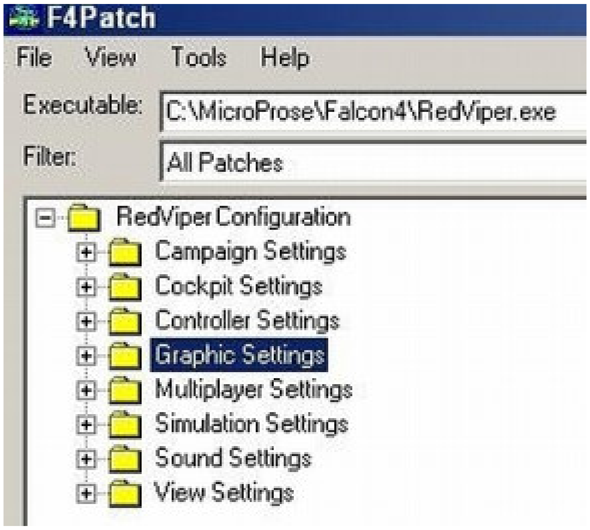
Main box item entries:
- Temperature - Cloud Base level of Stratus 1 clouds in Sunny or Fair weather, or Cloud Base level of Overcast clouds in Poor or Inclement weather
- Con Layer Start - Level that Contrails on planes appear, in 1000's
- Con Layer End - Thickness of Clouds whether Fair, Poor or Inclement, in 100's not 1000's as shown
- Wind Direction - Reverse wind heading in degrees. For example above would be wind 'from' 360
- Wind Speed - Actual level of Cumulus Cloud base if Fair weather is selected

Forecast box entries:
- Temp - Temperature in degrees Celsius
- Wind - in Knots
- Cloud Base - Enter digit for weather type: 1 = Sunny, 2 = Fair, 3 = Poor, 4 = Inclement
- X Off - Do not edit any entry that shows 0.0077

Y Off - Stratus 2 Cloud Base, should be set higher than Stratus 1 Base
(Note: Entries in X Off and Y Off are sometimes reversed and that is ok)
When finished editing click on the Update tab in upper right corner then Save.

Appendix E: The RedViper Configuration Editor

The Red Viper Configuration Editor
If you are not familiar with the standard F4Patch utility, then you this section is written to familiarize you with how it works.
RV uses this utility to set a wide range of preferences and options that are not available in the User Interface (UI). The menu list has been organized into specific categories as show below in the picture.



- Campaign Settings
- Cockpit Settings
- Controller Settings
- Graphic Settings
- Multiplayer Settings
- Simulation Settings
- Sound Settings
- View Settings

Upon opening up the utility, you should make note of several key features of the interface as follows:

- Executable window: Should point to the RedViper.exe
- The Windows style folder listing in the main menu. Note that you have to click on the + signs to open up the scrolling option interface.
- Once you open up one of the folders, you'll notice a listing of options with a check box beside them. In some cases the box is already checked, while in others it is not. This shows the pre-sets that are recommended with RV.
- Once you click on the text bars for each option, a brief description of what the patch does comes up in the right hand text box.

While you may want to take time and go through the entire list, which is extensive; please note the following:

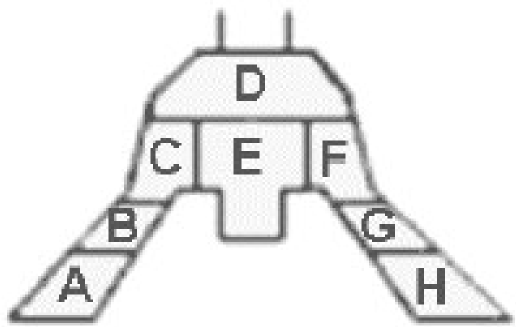
- Airbase relocation is not recommended unless you want to use it during a campaign. It is recommended that you turn this switch on, enter your campaign, relocate, save your campaign, then come back and turn this back off. Leaving airbase relocation on during a campaign does not work well with RV.
- Large strike packages: This option will cause the ATO to generate 16 ship strike packages if it can. You should use this option only if you have enough planes to generate these larger strike packages. Otherwise you may find the ATO will note generate many missions.
- In the View Settings, note the TIR setting options.

Appendix F: Training Missions Updates

Training missions are an easy introduction to some of the most important new features in Falcon 4.0. They give you a calm and peaceful training environment where you can learn about the new avionics and other exciting new options.

02 Takeoff: Ramp Start / Engine Startup

When committing to a mission, you have a the option of selecting TAXI, TAKEOFF or RAMP Start.
Choosing RAMP start puts you in the cold jet with all systems turned off. When committing to a mission, you have a new option in addition to TAXI and TAKEOFF: Choosing RAMP puts you in the cold jet with all systems turned off. It's your job to get this baby running! To have enough time to power up the avionics, align the INS and start the engine, you must commit at least 15 minutes before takeoff.
Capitalized letters in brackets (A) denote the cockpit panel where the switch can be found, as noted on the drawing below. Text in Grey denotes additional information and checks that are not mandatory for successful startup. And check out the interactive
"SP3 Ramp Start Trainer" in the Falcon 4 folder.



The first step is to prepare the jet for engine startup:

- (C) Set the parking brake - we don't want the jet to roll off once the engine is running!
- (B) Set the switch on the ELEC panel to MAIN PWR to power the systems.
- (D) This activates various warning lights - ignore them for now: ELEC SYS, SEC ON and SEAT NOT ARMED on the warning panel, HYD OIL ON on the right eyebrow panel.
- (B) Go to the external lights panel, set the master switch to NORM and turn anti-collision lights to ON. Switch the position lights on Wing Trail and Fuselage to BRT and set them to FLASH.
- (B) Set MASTER FUEL to ON and ENG FEED to NORM.
- (B) Check that the EPU switch is set to NORMAL.
- (E) Check that the Fuel Readout Switch (FUEL QTY SEL) is set to NORM.
- (G) Set the AIR SOURCE to NORM.

Now the engine can be started:
Move your throttle to idle.

- (B) Set the JFS to START2. You can now hear the engine spinning up.
- (D) While the engine starts, the RPM needle begins to move. As soon as it goes over 20%, advance the throttle to 50% and...
- (C) ...toggle the idle detent switch on the throttle. The engine RPM will now increase to the current throttle setting (e.g. 70%).
- (B) Check that the JFS has switched itself OFF.

The HYD OIL warning light should have switched off between 25% and 70% RPM. With the engine running at idle, power up the avionics:

- (G) Turn on FCC, SMS, UFC, MFD, GPS and DL.
- (G) Set the INS to ALIGN NORM. The gyroscopes will begin to spin up.
  The INS will be fully aligned after about 8 minutes.
- (F) Power on the left and right hardpoints, turn on the FCR and set RDR ALT to STBY.
- (F) Enable the flight path marker by setting the ATT/FPM switch from OFF to FPM.
- (D) Turn on the HUD using the SYM knob (press multiple times to increase brightness).
- (D) Observe the INS status in the DED: The first line shows status and remaining time, starting at "0.0/99". It will be fully aligned when the status reaches "10.0".
- (E) Check that no flags are shown anymore on the ADI, VVI or AOA displays.
- (A) Check that trim is reset.
  (B) Adjust audio volumes for COMM1, COMM2, MSL and THREAT audio.
- (C) Power the EWS: Set THREAT WARN AUX, EWS PWR, EWS JMR, EWS CHAFF, EWS FLARES to ON. Then switch EWS MODE to MAN. Arm the ejection seat.
- (G) Once INS is fully aligned, enable it by switching to NAV on the avionics power panel.
- (F) Set RDR ALT to ON.
- (C) Switch the landing lights ON and the PARKING BRAKE to OFF.
- (D) Enable Nose Wheel Steering (NWS) to taxi [Shift-/ (the key left of the right Shift)].
  You're ready to go! Just wait for your take-off time, the tower will call you.
  You can check the current time by pressing the "6-TIME" button on the UFC.

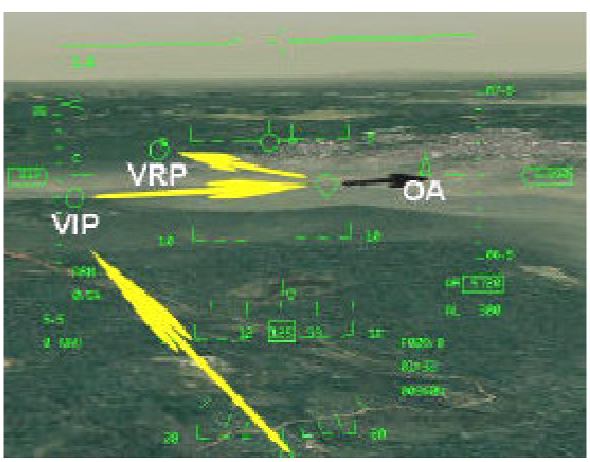
19 Bombs With CCRP: Bombs With CCRP, Pop-Up Attack Using VIP/OA/VRP
While flying Training Mission 19 (19 Bombs with CCRP), you can practice the missing using the VIP/OA/VRP procedure outlined in detail below.
Caution: This is a highly advanced training mission. Recommended for veteran pilots only!
Load the default Falcon 4 training mission 19 to practice this professional deployment procedure.
The idea behind VIP/OA/VRP
The basic function of the VIP (Visual Initial Point), OA (Offset Aimpoint) and VRP (Visual Reference Point) is the fine tuning of the attack run heading in Air-to-Ground missions. While the normal waypoints allow for general mission navigation, VIP, OA and VRP are additional points of reference that can be set around the target waypoint for improved situational awareness (However, they are only visible in the HUD and only while the target waypoint is selected).
In SuperPAK, VIP/OA/VRP are only useful to the human player (and aren't used by the AI). They can be used to fine-tune the attack run, therefore allowing high-precision pop-up attacks. A pop-up attack is a safe way to bomb a target because you give the enemy little time to react and fire AAA or MANPADS at you. However, this kind of attack needs careful preparation.
In addition, by using careful mission pre-planning, VIP, OA and VRP allow to deconflict multiplayer attack runs on a ground target.
Using VIP/OA/VRP
In this tutorial, we will use the additional waypoints in the following matter to setup a pop-up attack pattern:
* The VIP is the point of pop-up: After a low-level ingress, this is where we pull up to gain altitude before rolling and pulling into the target.
* The OA is used as a reference point for the target heading in relation to the pop-up point: When the pilot turns into the target after pop-up, the OA can give additional visual information about the heading to the target (because we set it as an extension to the imaginary line between pop-up and target).
* The VRP is a reference point for a successful escape after the attack.
VIP/OA/VRP are entered into the navigation system during RAMP start (because it takes a moment to input them). Their positions are defined well before, during mission planning: By looking at the map around the target, we can evaluate the best way to attack the target and the best way of escape.
In training mission 19, our target is a bridge running north-south over a river that runs east-west. South of the bridge is a larger city. Using the waypoints assigned by the mission generator, we evaluate optimum positions for our VIP, OA and VRP and note their coordinates (distance and

bearing relative from the target waypoint). In real life, these coordinates depend not only on the threat situation, but on the weapon type used, the attack/release altitude and speed, the wind situation etc. For our tutorial, we forget about that for a moment - I just want to demonstrate the basic usage of these reference points.

Having evaluated the situation in the mission map view, VIP, OA and VRP are defined as follows:

- As we approach the target from north-west and because the target runs north-south, we set up the VIP about 3 miles north of the bridge.
- The OA is located just south of the bridge, extending the targeting line from the VIP to the target.
- After bomb delivery, we don't want to overfly the city, but make a sharp turn left, evading the AAA before continuing toward waypoint 5.Looking at the map, we estimate the positions and note them before continuing into the flight. We start in the cockpit, at a position 2-3 miles south-east of waypoint 3, heading towards the target. As we find ourselves already in the cockpit, rapidly approaching the target, please freeze the simulation [Shift-p] to gain enough time to enter the VRP, OA and VIP (as mentioned, this would normally be done during ramp startup procedures while still on the ground).
- To enter the VIP, press ICP LIST, then select 3VIP. Now enter the VIP's coordinates as noted in the map above: Use the DCS to move down one position (the target bearing is already 0°), then type "14000" and click ICP ENTR to enter the range.
- Next, enter the OA: Press ICP LIST, then select 1DEST. Now press SEQ to get to the entry page for OA1 and input its coordinates (pressing SEQ again would bring up the entry page for a second OA, but that one isn't used in this tutorial): 7000 - ENTR - 1800 - ENTR.
- And to find our way out again, enter the VRP: Press ICP LIST, then select 9VRP. Now enter the VRP coordinates like you did for the VIP: 950 - ENTR - 15000 - ENTR. When you have finished entering all coordinates, go to the HUD-only view [1]: You should be able to see all three reference points as shown in the screenshot on the next page. The VIP and VRP are shown as small circles, while the OA is the thin pyramid on the right.

If you don't see all three reference points, don't panic: If you haven't frozen the sim immediately after entering the cockpit, it can be that you are already too close to the target to see all 3 points together. In this case, just make a few turns with the plane and look out for the reference points. If they still don't show up, verify the data you entered.



Now we are ready to start our zigzag attack run! The plan is to make a low-level ingress below 500 feet towards the VIP, then pop-up to about 1500 feet and finally roll and pull 90° right into the target for a successful CCRP delivery (using the AOA as a supporting heading reference between VIP and target). Finally, after bomb release, we break left towards the VRP for escape. Once there, we proceed to the next "normal" waypoint.

For more information about ground attack deconflicting and pop-up attacks, check out the USAF Multi-Command Handbook 11-F16, "F-16 Combat Aircraft Fundamentals", Chapter 5.
There are different methods on how to use VIP, OA and VRP. Basically, in SuperPAK, they allow you to setup a maximum of four reference points around the target waypoint. The tutorial describes one typical way on how to use them, but not necessarily a perfect or correct one.
The following is a description of a pop-up attack flown by a real life F-16 pilot using Falcon 4:
We used TE training mission 20 (CCIP). After doing some level flight deliveries, it was time to do it differently, flying a pop-up delivery pattern. Here's how it's done:
* Initial conditions: speed 480kts, altitude <500ft AGL (the lower the better), CCRP mode selected, A/G radar lock on target, flying straight to target.
* At 5 miles slant range from the target (it's in the bottom-right of the HUD, top number), fly 45° left from original course [Halfway between STP 3 and IP 4 in our example].
* At 2.5 miles slant range from the target, pull up 15-20°, pulling 4g [The VIP in our example].
* At 1200 ft AGL roll right 90° and pull max G into the wanted dive angle (10-20°) onto target [Use the OA behind the bridge for heading orientation]. Your apex (highest point of pop-up) will be at 1800ft AGL.
* When the bomb line passes through your HUD, roll wings level. You'll be in a 10-20° dive.
* Align your FPM with the steering line, switch to CCIP. Get ready to pickle (You should have about 3 seconds to make small final adjustments). Deliver the bomb.

After pickling, perform an escape maneuver: do a max G break until your heading is at least 60° off your original course [break left towards the VRP in our example]. Continue low level flight.

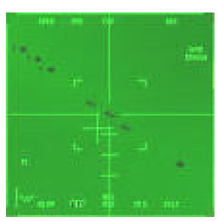
24 Mavericks: AGM-65 Maverick Missile
Load the default Falcon 4 training mission 24 to practice the updates to the deployment procedures. If you have been flying updates to the original F4 (SP, FF or F4AF), then this can be skipped since you should already know these procedures.
BMS Note: AGM-65 Maverick missiles will take up to 3 minutes for the seeker gyro to spool up if you use the settings in the RV config editor. This “realism” tweak can be switched on by clicking the appropriate box in the RV config editor. Rather than using the default spool time of 5 seconds, the spool up time will be 3 minutes. This reflects real life and thus the "NOT TIMED OUT" message will disappear after 3 minutes and Mavericks will be ready to launch.
Use the following procedure to properly set up your cockpit:
* When the mission begins, set the Master Arm switch [Shift-m] to ARM (so you can fire) and select A-G [Shift-Num-.] as your master mode (you want to attack ground targets).

* Select the FCR page in your left MFD and the SMS page in your right MFD (using the OSBs 12/13/14).
* On the SMS page, switch to the AGM-65 missile (OSB 6) and power it up (OSB 7).

* Switch to the WPN page on the right MFD (OSBs 12/13/14).

* On the FCR page (in your left MFD), set your radar mode [F2] as required (GM/GMT).





Now you can choose your target area:
* Still on the radar screen, slew the radar cursor over your target [Cursor keys] and designate it [NumKP-0].

* The SOI (Sensor of Interest) now changes to the right MFD. Finally, it's time to ready the missile and launch it:
* Uncage [u] the missile (this removes the protective lens cover from the AGM-65). You can now see the target area that you designated before.
* Slew the video cursor [Cursor keys] (use EXP mode [Shift-v or OSB 3] for zoom view) and lock it onto the final target [NumKP-0].
* Check weapon range.
* Pickle to launch the missile [Space]. Repeat these four steps for each additional missile that you want to fire into the
target area. If you want to attack a target further away, undesignate the current target [NumKP-.] and return to search mode.
The pictures on the right depict the 3 stages of the WPN view: caged (no video available yet - uncage the missile!), uncaged (slew with cursor to target) and locked (target has been designated).

25 Laser-Guided Bombs: Laser-Guided Bombs

Load the default Falcon 4 training mission 25 to practice the updates to the deployment procedures. If you have been flying updates to the original F4 (SP, FF or F4AF), then this can be skipped since you should already know these procedures.

Use the following procedure to set up your cockpit properly:

* When the mission begins, set both the Master Arm switch [Shift-m] and the Laser Arm switch [Alt-L] to ARM.
* Select A-G [NumKP-/] as your master mode (because you want to attack ground targets).
* Select the FCR page in your left MFD and the SMS page in your right MFD (using the OSBs 12/13/14).
* On the SMS page, switch to the GBU (OSB 6). *GBU is the US designation for LGBs.*
* Switch the right MFD to TGP (*not* WPN!) mode (using the OSBs 12/13/14). You will now see the FLIR video from the targeting pod.
Do also check if the laser is armed: a large "L" should be visible in the lower right part of the image.
* On the FCR page (in your left MFD), set your radar mode [F2] as required (GM/GMT).
Now you can choose your target area:
* Still on the radar screen of the FCR page, slew the radar cursor over your target [Cursor keys] and designate it [NumKP-0]. The SOI (Sensor of Interest) now changes to the right MFD with the WPN view / FLIR video.
* Slew the laser around [Cursor keys] and designate your target [NumKP-0].
Use the TGP's zooming capability [Shift-v] to get a better view. You can also undesignate a wrongfully selected target [NumKP-.] while still keeping a ground lock on the area. This allows you to precisely select the correct target.
* Do a CCRP bomb release.
* Check if the laser is firing: the "L" in the lower right corner of the WPN view should start flashing as soon as the impact timer meets the Laser timer value (8 seconds before impact).
You can also manually lase your target by holding down the first trigger detent [Ctrl-/] (you will see

the "L" flashing whenever the laser fires). This will override auto lasing - you must therefore keep lasing until weapon impact.

32 JDAMs
The JDAM training mission allows you to practice using PB as well as TOO bombing techniques. Refer to the instructions given earlier in this document for deployment of this weapon.

33 JSOWs
The JSOW training mission allows you to practice using PB as well as TOO bombing techniques. Refer to the instructions given earlier in this document for deployment of this weapon.

34 Carrier Operations: F/A-18C Hornet
While carrier missions aren't fully implemented (no tower comms), you can land on a carrier and takeoff from it. The single most important thing to know is: Always extend the landing hook [Ctrl-k] before touch-down!

1. Lower the flaps
2. Lower your hook
3. Lower your landing gear when below 300 kts IAS
4. Control your descent with the throttle and maintain 200 kts IAS as you approach
5. Carrier landings are flatter landings than normal landings on runways. Keep your AoA much lower than you would for normal landings and allow your speed to control your descent.
6. Hit the deck at about 180 kts IAS and immediately go to full afterburner in case you miss the wire and bolter.

Tip: The hook doesn't catch the wire as long as the nose wheel is still in the air. Push the nose down the moment you land and you´ll catch the wire.

After a successful landing, retract the arrestor hook [Ctrl-k] and taxi into a parking position. You can also taxi to the beginning of the start ramp and relaunch for another landing attempt.
You can also fly campaign missions from a carrier if one is positioned in the theatre: After selecting a campaign, look for an airbase symbol just off the coast. Click this "airbase" and continue the campaign. You will now fly for a carrier based squadron!

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Appendix G: FreeFalcon 3 Manual Notes

Integration of New BMS Features Into FF3

Free Falcon 3 has integrated many new features made available by the BMS Team in their latest BMS.exe. These new features required the creation of a new LE program by Dr. Fred Balding to allow for integration of new model animations. Additionally new data requirements were added to the aircraft FMs.

New BMS features include:

1. 3D animations like rolling wheels and additional degree of freedom (DOF) switches for many aircraft in FF3.
2. Aircraft-specific automatic flight envelope behaviors; including trailing edge flaps, leading edge flaps, engine flame-outs and two engine modeling behaviors.
3. Improved A-A refueling features that feature boom and probe and drogue operations.
4. Improved aircraft taxiing sequences while waiting to take-off.
5. Editable height of cockpits according to actual height of aircraft on runway.
6. Custom flare and chaff locations for individual aircraft.
7. Individual A-G weapons release altitudes for each aircraft.

Aircraft Flight Models in FF3

Aircraft flight models (FM) tend to receive more attention from users than any other data. Free Falcon 3 has a diverse set of FMs that range from high quality to unknown quality. The FM work by Tom “Saint” Launder is excellent and is based upon real world data when available. While there exists substantial FM data on most Western aircraft, finding quality data on other aircraft is difficult or not available. The FM set in FF3 could be classified into 3 different categories as follows:

High quality: Those FMs that have good data available and the FM designer (Tom) is able to create a quality FM simulation within the parameters of the Falcon 4.0 code. This includes new BMS feature code edits performed by Tom himself which include; 2 engine modeling, advanced stall features, airframe specific engine flame-outs and flight actuator controls. For more information, read the section from the FF2 Release Notes below titled: Aircraft Specific Notes: By Tom "Saint" Launder. FMs in FF3 that are high quality are:

a. F-16 (multiple variants)
b. F/A-18 (multiple variants)
c. F-15C/E
d. F-14 (multiple variants)

Good quality: These would be FMs that were developed for SP2 and include many of the OPFOR aircraft like the MiG-29 or Su-27 and well as planes like the A-10. Some of these FMs may be high quality as well. Additionally, this includes new aircraft like the EF-2000 or JAS-39, which are hard to replicate due to advanced flight control systems and classified flight envelopes.

Unknown quality: This is the last group of FMs which could range from good to mediocre depending on the airframe. In general, all of these FMs have been tested for basic functions like take-offs, landings and generally flying simulation. No doubt, some of these FMs have some unrealistic performance parameters, but having high quality FMs for over 100 aircraft in a simulation may not be possible due to manpower or data availability limitations.

Flight Model edits in FF3:

The FF3 Team has performed the following FM edits for FF3:

1. Added BMS specific data.

2. Fixed gear height. Users should note that there may be some problems as follows:

a. Aircraft with uneven landing gear (A-4/A-7) will not sit correctly on the runway.

b. Some aircraft may still appear to be sinking into the runway or taxiways due to z-buffering issues with the BMS.exe.

3. Add new models for aircraft like the J-10, JH-7 and Rafale.

4. Repaired some FM parameters that should improve AI flights of non-high quality FMs, including the MiG-29s.

Aircraft Specific Notes: By Tom "Saint" Launder
FF2 features a revised and further improved set of flight models. The flight model work that was done for SP3 release is now the standard starting point for the further improved flight models. Where new models were created, the same methodology that was used to create the models for SP3 was used for FF2.

Aircraft Specific Notes:
F-16: FF2 begins the process of separating the F-16 flight models based on model, block, and engine. This release contains all Pratt and Whitney engines (F100-PW-220, 220/E, 229). In the future, the GE engines will be modeled. These F-16 models have had improvements made in the flight limiters based on Andre Joseph's work.

a. F-16A: Block15
b. F-16B: Block 15
c. F-16AM-B & N: Block 20
d. F-16C/KF-16C B.32/ F-16 AGSR/F-16XL: Block 32
e. F-16CG: Block 42 (default)
f. F-16DG: Block 42
g. F-16CJ/F-16C HAF/KF-16 B.52: Block 52
h. F-16DJ: Block 52

F-14A, B & D: The F-14 models have received a thorough review based on some new performance data. Some data was available for both the F-14A and F-14D models. Areas tested were acceleration, time to climb, sustained turns, takeoff/landing speeds, and performance envelope. These models are close to the charts. The models have two stages of manual flaps. The roll rates, engine spool, and TSFC were adjusted.

F-15C/E : The F-15 models (C/E) received a minor adjustment to the limiters to correct some poor landing performance. The F-15C and E models will receive a further review for FF3.

F/A-18C/D/E & F: The F/A-18 models have all been reviewed and further improved. The F/A-18s have two stage manual flaps. FF2 brings new F/A-18E and F models. These also have two stage manual flaps.

EF-2000: This aircraft flight model was difficult to estimate. According to pilot reports, the aircraft is capable of supercruise flight. The EF-2000 outperforms everything but the F/A-22. Because there were no performance charts available, approximations were used in the performance envelope to simulate what is published about the aircraft.

Mirage III, 2000 series: All new models were made for the Mirage family of aircraft. There are multiple versions being simulation in FF2. A new wing was also approximated for a cambered delta wing. The 2000 aircraft are simulating the SNECMA M53-P2 engine. The 2000 series also has a fly by wire system that limits AOA to 29 degrees. The Matra Spirale electronic warfare system is modeled with 112 chaff and 16 flares. It should be noted that the Mirage III is quite inferior to the 2000 version. Many of the problems encountered with the delta wing were corrected in the 2000 model by Dassault.

JAS-37 and 39: Initial approximation work was done on these two aircraft.

For some other aircraft, multiple minor changes were necessary. Also, many changes (like gear, flaps, speed brake, and canopy) were necessary due to new 3D aircraft models.

The flight model work in FF2 is a continued improvement, but due to the volume of flight models available (140+), not all models have been reviewed. As time permits, models will continue to be reviewed and improved.

CFT, Dorsal Spine and Fuel Weight Estimates used in FF3:

CFTs empty =~ 900 lbs. (2 x 450 lbs.)
Spine = unknown, estimated @ 750 lbs. (classified)
Total= + 1,450 lbs. added to regular empty weight of aircraft.

* Block 60 estimated added weight: 500 lbs.

Block 52 Empty weights with GE 229 engine:
C: 18,917 lbs.
D: 19,421 lbs.

Total empty estimate for HAF F-16C Block 52+: 19,817 lbs.
Total empty estimate for HAF F-16D Block 52+ and F-16I Sufa: 20,871 lbs.
Total empty estimate for F-16E (Block 60): 20,317 lbs.
Total empty estimate for F-16F (Block 60 with spine): 21,371 lbs.

Internal Fuel + 3050 lbs. in CFTs:
F-16C/E: 7,162 lbs. + 3050 lbs. = 10,272 lbs. of internal fuel for HAF C+ and F-16E
F-16D/F/I: 5,924 lbs. + 3050 lbs. = 8,974 lbs. of internal fuel for HAF D+, F-16I and F-16F

Notes:
1. All aircraft with spine have 2nd seat and reduced internal fuel capacity.
2. Estimate of JP-8 is 6.77 lbs. per gallon of fuel.

Missile Flight Models in FF3:

The FF Team has reviewed the missile FM set in the FF3 simdata.zip file. With some exceptions, these files are identical to the set that came with SP3. While some controversy exists about the quality of the original SP3 missile FMs, insufficient data is available to determine whether editing any of them would achieve more realistic results. After review by several FF Team members, it was agreed to leave the SP3 missile FMs as they were with a few exceptions. The FF Team has made some minor edits for FF3 as follows:

1. SAM missile edits (listed in the Surface to Air Missile chapter).

2. New missiles: Several of the new weapons in FF3 required new missile FMs. These were created using existing FMs and then making basic data edits that would accommodate the new weapon.

FreeFalcon 3 Data base edits

In previous versions of Free Falcon, the “data edits” have been criticized by some people. Some of this came from the release of some modified flight models with the initial FF1 release. This purpose of this section is to describe and document the data edits in FF3 so that users can understand exactly what data edits were performed by the FF Team. This should alleviate any concerns about the quality of the data edits in FF3. The following explains some of the basics about what “data edits” really means.

All versions of Falcon 4.0 use two sets of files that contain data for aircraft, weapons, vehicles and features (buildings). One group is found in the C:\MicroProse\Falcon4\terrdata\objects folder and can be viewed or edited by using Julian Onions' F4Browse. The other set of files are found in the simdata.zip file and once unzipped has several folders that contains aircraft flight models, missile flight models and radar data files for SAMs.
From the very beginning of Free Falcon, it was never the intent to make wholesale changes to the data files by the FF Team. A general philosophy used for data edits was "if it ain't broke, don't fix it". <u>The core DB files in FF3 remain an extension of the files modified by the RPG used in RP5 and the additional data added by the F4UT for SP3. In many areas, little of this data has been changed beyond what was known to be an improvement or bug fix.</u> There was never any reason to go and "reinvent the wheel" with any data edits since most of the data had been proven to be as realistic as possible and had been generally accepted by the Falcon 4.0 community. This also made adding new data for new entries much easier since existing DB data was considered reliable and adding items like new weapons could be scaled within the existing damage point system. Additionally, extensive testing is not required in many areas of data edits if the data has not been modified from a previous patch that it has been proven reliable and tested through extensive use by the using community.

Some of the initial goals for FF1 in working with the DB files were:

1. Add new data for new aircraft, weapons, ground units and vehicles using the best information available.
2. Fixing some known bugs.
3. Reworking the entire ATO system to accommodate multiple F-16 variants, improved weapons loads for campaigns as well and other improvements.

For FF2, the FF Team began to do more data edits that included:

1. Reworking the naval section to improve realism as much as possible.
2. Rework the hit points and hit boxes of all features/objectives (buildings/stationary structures) so they have more realistic damage potentials that are scaled properly with the damage points of all weapons.
3. Move most cluster bombs (CBUs) to a different point system to improve the CBU damage realism.
4. Re-scale the damage points of all AGM-65s which were over modeled.
5. Repair some more bugs found with radar guided and IR SAMs.
6. Add new data for new aircraft, weapons, ground units and vehicles using the best information available.

Some facts to remember when considering data edits in Falcon 4.0 are:

1. All data is limited to the limits of the executable code.
2. A large percentage of the data in Falcon 4.0 affects the performance of the AI and not the human pilot. This includes a large portion of data used for the 2D world and campaigns as well as the limitations of the bubble range.
3. Some areas of data are used for multiple purposes by the code so the data is shared by more than one function. This may warrant a compromise depending on priorities for that particular data.
4. Many types of data that Falcon 4.0 is attempting to simulate is not available for use or does not exist in real life. This is typical of damage points and hit point values assigned to aircraft, weapons, vehicles and features (buildings).
5. There will always be limitations in the data when dealing with human v. AI pilots. This is especially true with human pilots in multi-player where the skill levels are much greater than the AI code in Falcon 4.0.
6. Some sources of data have conflicting values so the data may be correct according to one source, but incorrect according to another.
7. Simmers who fly Falcon 4.0 should always realize that there are limitations of the simulation and enjoy it for having come this far since its initial release in December 1999.

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FF3 Data Review:
For FF3, the Free Falcon Team has performed a comprehensive review of multiple files within the FF3 DB. Some of these files have had corrections made where obvious errors were found. The FF Team has also made comprehensive edits to certain sections of the DB based upon updated information that has become available or discovery of areas of the DB that were in need of rework and updates.
Overall, there are literally hundreds of major and minor tweaks, bug fixes, data corrections and updates were made to the DB files. In some cases, hours were spent perfecting some of the weapons loads and rack settings in the DB, while in other instances, many hours were invested in collecting information that was used in the FF3 DB. There are many areas of work in FF3 where the users will notice subtle improvements that are a part of the FF Team's attention to details. While some shortcomings exist, the FF3 DB is a compilation of many hours of DB work by all teams that have worked on Falcon 4.0 and with the new updates in FF3, represents a solid DB that users can enjoy for a long time to come.
Comprehensive notes are given for all of these data edits. A listing of the files and what data changes have been made are as follows:

Vehicle files (Falcon4.vcd):
The vehicle files (Falcon4.vcd) include aircraft and ground vehicles. The vehicle file contains some key data for all vehicles as well as serving as a placeholder within the DB for other files needed to create all of the data required for each vehicle. All data in the vehicle files in FF3 is an extension of RP5, SP3 and FF2. Data updates for FF3 include a revised "stats" section to give more balanced AI scores for all aircraft in 2D and 3D and this has been integrated into the "stats" section of the unit files as well.

With the exception of new entries, stats updates and ATO edits; this data remains relatively unchanged from the original SP3 data. Data in the vehicle files include data used for the following purposes:

a. GUI weapons load screen (weight/fuel/weapons loads listing from the .wld file)
b. Flight altitudes, fuel amounts and stats section used in planning the ATO flight plan
c. IR signature, RCS, radar type, flags section and other
d. Damage points and listing of individual damages according to weapon type

Unit files (Falcon4.ucd):
The unit files (Falcon4.ucd) contain a single set of unit files for ground vehicles and ships, but has a dual set of unit files for all aircraft. These files contain some of the most important data used by Falcon 4.0. This data has a huge affect on campaigns, ATO, 2D AI, unit structure and 2D damage values. Changes made to the unit files for FF3 include editing the "stats" edits described below and the ATO updates listed in the ATO section.
Data in the vehicle files includes data used for the following purposes:

a. ATO: Includes fuel flow rates, range, number of planes per squadron and role scores.
b. Stats: The stats section is used by the AI to calculate 2D damage rates as well as impact on the sortie rate generated by the ATO.
c. Damage: Affects hit point damage scores in both 2D and 3D.
d. Unit composition for ground vehicles.

Vehicle and unit Stats section update for FF3: Unit data updates for FF3 include a revised "stats" section to give more balanced AI scores for all aircraft in 2D and 3D and this has been integrated into the "stats" section of the unit files as well. Some of the "stats" data is automatically updated with calculations from the weapons control data files and is determined by what weapons are loaded on the aircraft. However, the strength and range fields for different types of targets have to be edited by the FF Team as well as the strength and range stats for the individual unit files. These edits will affect AI performance in 2D and 3D, ATO sortie generation rate and particularly the total scores assigned to 2D squadrons in a campaign.

For FF3, the FF team used the following criteria in determining the rationale for the edits:

1. What era/age is the aircraft?
2. What are the capabilities of the aircraft and what weapons does it carry?
3. How should the aircraft perform when stacked up against other aircraft?

In using the above guidelines, the stats have been modified to give similar results to all combat aircraft within a particular class, age of airframe and weapons capabilities. As a result of these edits, all modern fighter aircraft will have similar stats due to modern radars, weapon systems and weapons. This also means more modern F-16 types will have stronger stats than older ones and that F-16s with a 2nd seat will have identical stats to the one seat aircraft of the same Block. Additionally, this means planes like the F-15C and the Su-27 will have similar A-A strengths, while planes like the F/A-22 and the EF-2000 will have higher A-A strengths than the F-15C, Su-27, MiG-29 or F-16.

Radars (Falcon4.rcd):
Most of the radars in FF3 are based upon the work done by the RPG team for RP5. Except where there are new radars or data updates, these radars are relatively unchanged from the data edits in RP5. The FF Team has performed a review of all radars modeled in the FF3. While there are limitations to radars in Falcon 4.o, all radars were checked for range, look-down, sweep time and azimuth scan values to ensure no obvious anomalies were present. In some cases, minor adjustments were made to accommodate aircraft (e.g. J-8B Block 02 look-down value) which have better radar capability than previously modeled.

Chaff chance in FF3:
In some previous non-FF versions of Falcon 4.0, chaff chance percentage was modeled for all aircraft radars. This was an assigned percentage for each aircraft's radar and meant that if a human pilot pumped enough chaff, the SARH missile would fail due to the guiding aircraft having lost its radar lock. This only affected SARH missiles and had no effect on IR or ARH missiles.
In FF3, the chaff chance has been lowered for most modern fighters to a minimal or non-existent level. Modern aircraft radars (including MiG-29/Su-27/F-15C), have the ability to screen out the effects of chaff on the aircraft radar partly due to the use of Doppler radars. This means the use of chaff has very little if any chance of causing the radar to lose radar lock. This also means SARH missiles like the AA-9, AA-10A or the AIM-7M will now be more lethal since the guiding aircraft radar will not be easily spoofed by chaff and lose lock, causing the missile to go ballistic. Users used to being able to easily spoof missiles like the AA-10A, will now have to show more for respect aircraft like the MiG-29A and work much harder at dodging missiles. The chaff chance for older aircraft (e.g. MiG-21/F-4D) remains at a level that should simulate the effect of chaff on the guiding aircraft.

Weapons control data (Falcon4.wcd):
The weapons control data file is a very important file and controls many of the parameters of weapons in Falcon 4.0. Data in the weapons control files includes data used for the following purposes:

a. Assign a weight to the weapon, fuel tank or weapons rack/pylon.
b. Assign a damage type, blast damage and blast radius.
c. Set extra parameters like area affect (bombs), CBU affects and tracers.
d. Drag of weapons, gas tanks and racks/pylons on hardpoints
e. Fuel amounts and empty weights of gas tanks.
f. Rack/pylon assignments of all entries for inclusion in the rack.dat file.
g. Set AI parameters for certain weapons like AAA guns.

For FF3, the weapons files have had the following changes from SP3:

a. Recalculated the fuel amounts of US fuel tanks for JP-8 @ 6.77lbs/Gal. This means all US fuel tanks now have slightly more fuel than in FF2. This is a follow-on edit to FF2, where all of the fuel tanks were recalculated to a common scale using either US gallons, Imperial gallons or liters; depending on the type of tank.

b. Assign weights to aircraft racks and pylons.
c. Assign same damage amounts of some bombs of the same type (e.g. Mk-84/GBU-10/GBU-31 JDAM). Now all bombs of a similar warhead type have the same damage properties.
d. Add damage estimates for new weapons based upon the current damage scale of other similar weapons.
e. Adjust the 2D hit chance of certain A-G weapons. This edit affects the 2D scoring only, and does not affect 3D outcomes. The idea behind this edit was to rescale the 2D hit chance so that guided munitions would have higher scores than non-guided (e.g. GBU v. Mk-84) and that smaller weapons would have lower hit chance than larger ones (e.g. Mk-82 v. Mk-84). This will also affect the ATO selection of weapons loads. In some cases, certain weapons were continuously being selected by the ATO even though they would not be as effective as other weapons available for use. This is one area of the DB where the code uses the same data for several different uses and modifying these fields should assist the ATO in making better weapons selections during campaigns. Additionally, PGMs should have higher scores than non-PGMs since their probability of kill is higher.
f. Damage Effects of selected weapons (CBUs and AGM-65s):
The damage effect of cluster bombs (CBUs) has been a point of interest since the release of SP3. In many cases, the damage effect of a CBU-58 bombing run resembled the effects of a small nuclear device. This effect is in part largely due to the damage type of the weapon (explosion type) being the same as regular HE/GP bombs. CBUs should not have the same damage effect as regular bombs since most CBUs are not HE/GP but rather fragmentation bombs. The exception is the use of penetration type CBUs like the CBU-97 SFW or combined munitions dispensers like the CBU-87CEM, which has several types of munitions. F4 does not model CEM type munitions so the effects of CEMs will not be as realistic as other types of CBUs.

    1. FF has made changes to the explosion type of most CBUs in FF2/3. This also includes reduction in the damage and blast radius values which were found to be too high. In FF2/3, CBUs will retain high effectiveness against soft targets, but will have minimal effect on harder targets. Soft targets would include; aircraft parked at airfields, light armored vehicles, SAM sites, personnel, trucks and some small buildings. Harder targets would include armored vehicles, buildings, factories, bridges and runways.
    2. The damage effects of all AGM-65s have been adjusted. AGM-65A, B & Ds will continue to be effective against ground vehicles and some other soft targets, but will be minimally effective against ships, bridges or buildings unless fired in significant numbers. AGM-65Gs and Fs are PEN type weapons that have larger warheads. These AGMs will have higher effectiveness against harder targets and can be used to destroy some smaller ships.

Sim weapons data (Falcon4.swd):
The sim weapons files are closely linked to the weapons control data files. Each weapon in Falcon 4.0 has an assigned sim weapon file. For FF3, the sim weapons data is relatively unchanged except for the addition of new weapons files. Data in the sim weapons data files includes data used for the following purposes:

a. Assignment of a missile FM if applicable
b. Assign a weapon name that is seen in the MFD in 3D.
c. Assign a weight to non-guided bombs.

Squadron stores data (Falcon4.ssd):
The squadron stores file contains the weapons lists and amounts of stores for each weapon used in campaigns. These files have been edited to make sure all of the new weapons featured in FF3 are usable in campaigns. Additionally, most aircraft are using one of two main lists used by

aircraft and both lists have similar amounts of most weapons which gives a fair advantage to all sides in any campaign.

Infra-red control data (Falcon4.icd):
The ICD file contains the infra-red data used by missiles in Falcon 4.0. The FF Team has made extensive edits to the Falcon4.icd file.

Radar warning data (Falcon4.rwd):
Aircraft in Falcon 4.0 that have radar-warning receivers have an assigned AI RWR to use in combat. Editable parameters include: range, scan angles and ability to determine type and direction of emitting radar. RWR data in FF3 is the same data as in RP5/SP3 except for assigning new aircraft a correct RWR type.

Visual sensor data:
All vehicles in Falcon 4.0 have visual sensor data (Falcon4.vsd) which tells the AI what it is able and not able to see. This is based upon visual angles and range. Much of this work was revised by the RPG during the RP series and still remains as quality data edits. The only edits made to this data by the FF Team is the assigning of new vehicles to a visual sensor set based upon the type of aircraft and cockpit visibility or correcting some assignments of current aircraft.

Aircraft Data (Falcon4.acd):
The aircraft control data file serves as a placeholder for the AI sensor data for all aircraft as well as the FM assignment (airframe). FF3 has had a comprehensive review of sensor data for all aircraft including; RWRs, radar types, visual ranges and visual angles. Some sensor data errors were found in FF2 data and all aircraft now have correct AI radar, sensor and RWR assignments.

Rockets:
The rocket data file serves as a place holder that links the rocket pod with the individual rockets. It also assigns the amount of rockets per pod. The FF Team has reworked the rocket data files and has made several corrections to weights, amounts of rockets as well as adding new rocket pods.

Weapons load data (Falcon4.wld):
The weapons load data file contains all of the individual weapons load entries for all aircraft. In many instances, the weapons loads have been taken from available data, including all US aircraft. This file has had extensive modification since FF2 which includes:

a. New weapons loads using new weapons
b. New weapons loads for new aircraft
c. Modified weapons loads for new models (e.g. F-15E)

FF3 also features improved weapons loads that are more specific to aircraft from particular countries, including:

1. UK/RAF
2. GAF/Luftwaffe
3. PRC/PLAAF
4. France/Armee ‘le Air/Aeronavale
5. Sweden/Flygvapnet

Features Control Data (Falcon4.fcd):
This features control data file holds most of the information for all of the features (buildings/structures) in Falcon 4.0 which make up all of the objectives. Objectives are groupings of buildings that are placed on the map and may involve targets used in missions (e.g. airbase, factory, power plant).
This file had extensive modifications to the hit points system for FF2. The only changes made for FF3, was to increase the damage effect of PEN (penetration) type weapons on runways. This means users can now get better results of airfield strikes using PEN type weapons.

Hit points of features:

The hit points (damage values) of all of the features (stationary ground objects) in Falcon 4.0 were adjusted for FF2 and have been only slightly edited for FF3. In earlier versions of Falcon 4.0, many of these values were set too low and only a small bomb could destroy a large building or bridge. In real life, bomb damage can vary from situation to situation and from structure to structure. Simulating these kinds of variances is not possible in Falcon 4.0. But to give the user an idea of how the values were set, here is some background on bombs and damage.

1. First we must understand the difference between being damaged and being destroyed. In the recent air campaign in Iraq, we have witnessed the most precise bombing ever done in any war. In spite of the repeated bombing of some buildings in downtown Baghdad, some of those buildings were left standing and their remains some doubt as to whether they were destroyed or heavily damaged. In some cases, these buildings were hit with bunker buster weapons that left the building still standing even after several strikes with 2,000 pound guided munitions. This is not uncommon in wars and is one of the reasons for BDA (bomb damage assessments). In many wars, targets that were bombed, were found to be damaged and not destroyed. Those targets were then re-targeted for more airstrikes in order to make sure the targets were destroyed. In the airwar over Vietnam, the story of the Thanh Hoa Railroad and Highway bridge is another example. This bridge was able to withstand repeated airstrikes from USAF and USN aircraft over an extended period between 1965 and 1968. While the bridge was certainly damaged on several occasions, it wasn't until May 1972 that it was destroyed and it collapsed into the water. This came only after the use of precision guided munitions.

   There are simply some targets that are much harder to destroy than others and the effects of weapons on some targets can prove to be unpredictable much more difficult to estimate.

   In simulating the effect of weapons against targets in Falcon 4.0, the users should understand that any edits to damage values, while increasing the "realism" effect of the simulation, will always have limitations.
2. In Falcon 4.0, the simulation uses math to calculate the damage values of all entities within the simulation. The damage output of weapons is calculated against the "hit points" of targets and if the math of the weapons output is higher than the target hit points, the target is then destroyed. The damage values of objectives are derived from editing the hit points of the individual features that make-up the objectives. The FF1 patch made some edits to the hit points and the FF2 patch has made more extensive edits. The rationale for determining the hit point values included factors such as; size of feature, materials of feature and types of weapons used against the feature. In previous patches, a single Mk-82-500 pound GP/HE (general purpose/high explosive) bomb could destroy any bridge in Falcon 4.0. This was the same for most buildings as well as factories. Adding in the high output of a CBU in SP3, the simmer could destroy a whole city of buildings using just 8-CBU-58A/Bs.
3. Falcon 4.0 uses multiple categories to calculate the damage effects of weapons. Two principal categories are GP/HE and AP/PEN (penetration type munitions). There are some targets where a GP/HE weapon should be more effective than a penetration type weapon and vice versa. In the case of some bridges, a GP/HE type guided bomb may be preferred over a penetration type weapon as the penetration weapon may simply knock a hole in the bridge and not destroy it. The same results should be for use of these two types of bombs against many large or non-hardened targets. The "rule of thumb" used by the FF team, is that most bridge spans should have normal hit points of at least 600, which would imply that you will need direct hits from at least 2-2,000 pound LGBs to destroy the bridge span. If you hit the bridge with ordinance that has less damage points than 600, the bridge will be damaged but not destroyed. However, there are larger bridges in F4 that may require more than 2-2,000 pound bombs.

   This same scale is used for many buildings in the simulation that would be attacked using GP/HE bombs. There are a few smaller buildings that would be destroyed using 1-2,000 pound bomb, but many will either require at least 2-2000 pound bombs or 4-5 smaller

bombs. Additionally, using PEN type weapons on bridges or non-hardened structures will produce poor results. In the case of a bridge, a PEN weapon is more likely to punch a hole into the structure and detonate below it, causing less damage than a GP/HE weapon.
In FF2/3, you will notice several of the PGMs have either GP or PEN attached to the name of the weapon. This is used to help the simmer decide which weapon is better suited for the tasked mission.

4. Destroying airfields has always been a key part of the strategy in winning campaigns. The damage values of airfields have not been changed from except for the damage points of PEN type weapons. The use of PEN type PGMs is advised since they can be dropped from higher altitudes and from distances that would keep the flight out of most enemy air defense envelopes. Also, newer weapons like the Storm Shadow (PEN) or the Bombkapsel/90 are good choices to use as stand-off weapons against heavily guarded air bases.

Hit boxes of features:
The hit box is the 3D size of an objective. In many cases, these were too high resulting in damage to buildings and other features that was not realistic. Additionally, the simmer could easily collide with buildings even if they flew over 50 feet away. The hit boxes of all features that make up objectives in F4 were adjusted according to the size of the LOD model of that feature by Simon "Balu" Balazs for FF2.

“Balu's Hit Box & Hit Points Edits”: by Simon "Balu" Balazs:
For the Hit Box sizes I wrote a little calculator program, and gave the inputs the +x, -x, +y, -y and -z coordinates. Then the program gives back the radius of the feature (only the -z, because features do not "go" underground). It can be used to calculate hit boxes for vehicles too, but you have to enter the bigger Z coordinate to the -z slot.
For the hit points, I used the radius of the feature and used the following rationale: Simply the bigger the radius, the more hit points the feature will have. Now there are some exceptions if the object is unique, for example an oil tank or radar antennae. For an oil tank, I gave it less hit points as it is a softer target while if it was something like a HAS I gave it more hit points. I also checked the weapon damages to adjust the
hit points. The biggest changes I made were in the vulnerability percentages. All of them were changed for FF2/3, and they are more realistic now than in SP3. Every weapon is capable of inflicting damage, but of course you only inflict 5% damage with an aircraft canon on a huge building.

Simple logic was uses as follows:

a. Unknown: always 100%

b. AP/PEN: This was hit point dependant and radius driven. The larger the object, the
less damage points it would receive from the AP/PEN weapon since it should take more damage due to its size. For hardened targets like bunkers or runways, then the damage would be 80-100%, since the AP/PEN type weapon is simulating penetration of those types of target which would increase its effectiveness.

c. GP/HE: Always 100% (except hardened shelters and runways)

d. Anti-Runway: Always 10% (except the Runways = 200%)

e. Incendiary: The value comes from the answer of this question: How flammable is this object? If it is flammable, then the larger the value is. For non-flammable, the hit point determines the value.

f. Proximity: Hit Point and Radius dependant, which means the larger the object, the less damage percentage it will be assigned to accommodate the size of the object.

g. Bullet: Hit Point and Radius dependant, which means the larger the object, the less damage percentage it will be assigned to accommodate the size of the object.

h. Water: Set to same value as GP/HE.

i. Chemical: Features not affected. For the power generators I left them as they were.

j. Nuclear: Always 100% no exception

k. Other: Always 50% no exception

Object Control Data (Falcon4.ocd) and FED files (Falcon4.tree.fed):
These files control the type and composition of all of the objectives in Falcon 4.0. The Falcon4.tree.fed file received some extensive modification or the FF2.1 patch. This work was done in conjunction with the work on the Falcon4.pd/phd files. Any additional structure added to the file, also had the objective scoring system adjusted so the new structure is now added to the campaign point scoring system. Upgraded objectives for FF3 are as follows:

1. Additional buildings and hangars added to some airbases.
2. All Army bases were restructured with new buildings, extras items and trees.
3. Depots were modified to either include better building layouts or more buildings and trees.
4. Most ports were modified to include more buildings, improved layouts and trees.
5. All radar sites were modified to include more buildings, improved layouts and trees.
6. Some depots and Army bases now include their own ground vehicles that are permanently parked at the site.

Point data/Point Header data or PD/PHD files (Falcon4.pd/Falcon4.phd)
The pd/phd files in Falcon 4.0 control the parking places for vehicles. These files tell aircraft where to go at airbases as well as tell SAM or AAA vehicles where to park at objectives. These files have been modified for FF3 to accommodate some of the latest BMS airbase work by Dr. Fred Balding. Also, additional PHD/PD data has been modified for FF3 as follows:

1. Adjustment of locations of SAM/AAA parking spots at some airbases. SAM/AAA vehicles should no longer be parked in the water at some airbases (e.g. Wonson).
2. Adjustment of locations of SAM/AAA parking spots at ports. This includes aligning the parking spots with the new buildings so that the SAMs/AAA are now less likely to shoot their own buildings.
3. Adjustment of locations of ships at ports. Ships should be able to line themselves correctly alongside piers. Most ports can support up to 7 ships at one time.
4. Addition of SAM/AAA parking spots for many objectives including; army bases, depots, radar sites, most factories and most power plants. This means SAM/AAA units will no longer place themselves in a straight line, but will place themselves in a protective ring around the potential target.

Tactical Engagement Unit List Notes:
The TE units list in FF3 is divided into sections according to type. This enables easier selection of units in designing TEs. The lists are:

1. Air Defense –Allied

2. Armored/Mechanized

3. Infantry/HQ/Engineer

4. Artillery/Rocket

5. Air Defense –OPFOR

Surface to Air Missile Edits for FF3
The FF Team has conducted a review of SAM systems in FF2/3. The FF Team has spent considerable time checking existing data against best available data to ensure all data represented in FF3 is as realistic as possible. Comprehensive data on SAM systems is not easy to find. Several sources have conflicting data and some data is listed in details that the Falcon 4.0 code is unable to replicate. For example, the maximum ranges of some SAM systems are listed by different altitudes or against different targets (fighter v. helo v. bomber) while moving at different speeds. Some distances were given for an approaching aircraft as well as for an aircraft flying perpendicular to the SAM radar. Users need to understand that compromises have to be made when translating real world data into data used by the Falcon 4.0 code.

The data edits to the SAM systems in FF3 are three-fold:

1. Data base edits within the Falcon4.wcd file.

2. Individual SAM radar edits.

3. SAM flight model edits.

For Free Falcon 3, the FF Team used a variety of sources to evaluate the parameters of all SAM systems in FF3. These sources include:

1. Jane's Land Based Air Defense 2001-2002 (primary source).

2. Various web based sources.

3. Use of existing data already in previous patches, including RP5.

SAM Ranges and Altitudes:
Each SAM system in FF3 was reviewed for range and altitude parameters. They include: maximum altitude and range, and minimum altitude and range. The settings in FF3 represent only moderate changes from other Falcon 4.0 patches as follows:

1. Users will see very little difference between the SAM systems in FF3 when comparing them to previous patches. However, FF3 includes new SAM systems that required updated data input.
2. Older SAM systems which include the SA-2, SA-4 and SA-5; will typically fire at a range that is close to the maximum rated distance for that system. Data shows that in many combat situations, SAMs are often fired in less than optimum conditions and in some instances, the SAM was fired in and attempt to "scare off" the enemy aircraft. During the Vietnam War, SA-2 missiles were often fired in an attempt to drive strike aircraft to lower altitudes where they could be engaged by AAA. Allowing the AI to fire their SAMs at near maximum ranges may or may not yield realistic percentage of kills (PK).
3. The threat circles in the GUI screen and the HSD screen in the MFD will reflect the actual launch ranges of SAMs at ~25K ft AGL. This means that if you fly within the threat circle of an operational SAM battery, you are very likely to get engaged, but if you fly outside the threat range circle, SAMs will not engage your flight. Additionally, as your altitude decreases, so does the actual threat range circle.

FF3 OPFOR & ALLIED SAM RANGE CHARTS

Name and type *IR = Infra-red homing SARH = Semi-active radar homing ARH = Active radar homing CLOS=Command-Line of Sight TVM=Track via Missile*	Maximum engagement range (nm)	Minimum engagement range (nm/ft)	Maximum altitude in feet	Minimum altitude in feet
HQ-7(CLOS with TV/FLIR)	6	1,640 ft	18,000	50
SA-2/HQ-2 (Command)	19	3.2 nm	98,000	2,250
SA-3 (Command)	10	1.35 nm	46,000	165
SA-4 (Command)	27	3.78nm	80,000	995
SA-5 (Command with ARH)	45	5.5 nm	100,000	6,200
SA-6 (SARH)	13	2 nm	46,000	547
SA-7 (IR)	1.6	1,600 ft	7,000	200
SA-8/SA-N-4 (CLOS)	6.5	4,920 ft	16,000	80
SA-9 (IR)	3.24	2,000 ft	12,000	50
SA-10/S300/SA-N-6 (TVM)	48	2.7 nm	98,000	643
SA-11/SA-N-12 (SARH)	15	1.62 nm	82,000	183
SA-12a (TVM)	40.5	23 ft	82,000	820
SA-12b (TVM)	49	43 ft	98,000	3280
SA-13 (IR with IRCCM)	2.7	656 ft	11,000	33
SA-14 (IR)	2.2	2,000 ft	10,000	200
SA-15/HQ-17/SA-N-9 (Command)	6.5	3,280 ft	19,000	33
SA-16 (IR)	2.7	1,600 ft	10,000	60
SA-17 (SARH)	22.7	1.6 nm	82,000	93
SA-18 (IR)	2.7	1,640 ft	12,000	33
SA-19 (CLOS)	4.3	3,280 ft	13,000	20

Name and type *IR = Infra-red homing SARH = Semi-active radar homing ARH = Active radar homing CLOS=Command-Line of Sight TVM=Track via Missile*	Maximum engagement range (nm)	Minimum engagement range (nm/ft) (e)=estimate/data unavailable	Maximum altitude in feet	Minimum altitude in feet
Crotale/R.440 (Command)	4.3	1,640 ft	17,000	50
Crotale-NG/VT-1 (CLOS with FLIR)	6	1,640 ft	20,000	27
Hawk (SARH)	13	3,280 ft	58,000	416
Mistral (IR with IRCCM)	3.24	984 ft	9,800	16
Nike-Hercules (SARH)	60	1.89 nm	98,000	4,512
Pegasus/K-SAM (CLOS with FLIR)	5.4	1,640 ft	20,000	50
Patriot (TVM)	49	1.62 nm	80,000	1,602
Roland-Marder (SACLOS or CLOS)	4.3	1,640 ft	20,000	33
RIM-7 Sea Sparrow (SARH)	8	4,800 ft	15,000	48
Sea Wolf (ACLOS or CLOS)	5.4	4,612 ft (e)	15,000	50
Sea Dart (SARH)	27	5,377 ft (e)	82,000	98
SM-2MR (Command/Inertial SARH)	50	4,915 ft (e)	60,000	643
SM-1MR (Command/SARH)	22	4,915 ft (e)	40,000	643

SAM Radar edits in FF3:
The simdata.zip file contains the radars that Falcon 4.0 uses for searching; acquiring and guiding all radar guided SAMs. All radars were required to be edited to accommodate the maximum range edits listed above. Additionally, some corrections were made to the search mode time sequences based upon updated data. The search ranges were calculated using the estimated maximum range of the SAM as a starting point (range to guide), and then using an average of 1,500 ft/sec calculating the search and acquire mode ranges (range to search/range to acquire) based upon the time the radar is in each mode. This method will give the search radars adequate time to step through all of its search modes and still be able to engage aircraft at its assigned maximum launch range. This method should also keep the search radars from illuminating a target until at a minimum range prior to starting the search mode and should improve SAM AI.

SAM Flight Model edits in FF3:
Several SAM flight models were edited for some minor data changes as follows:

1. The maximum flight times of some missiles were decreased. This means that the total missile flight time is relative to the maximum range and flight envelope of the individual missile. It was noted that some missiles would continue to fly and track an aircraft even though there was a very low chance of a kill. This also would not allow another launch from the battery since it was still guiding the dying missile. This was considered poor AI. In FF3, having the missile self-destruct at an earlier time was considered an improvement as in real life SAM operators would not have to wait for the first missile to self-destruct before firing another missile. Users will still see some instances of missiles being guided even though they have missed hitting something. This will be more noticeable when flying at lower altitudes while in closer proximity of the SAM battery.

2. New SAM flight models were created and edited to include available data.

Air Tasking Order
FF3 includes some updated ATO enhancements that began with the FF2.1 patch and is a continuation of the ATO edits began with FF1. To better understand what the data edits are, one needs to understand how the following files impact the ATO and what edits the FF Team has done to improve the quality of the campaign ATO/mission generator:

Role scores:
Role scores are the scores assigned to various aircraft in the unit files. These scores are the key factors in determining what types of missions aircraft will fly in campaigns. Unfortunately the list of scores is limited, particularly in the area of strike and SEAD missions, which limits the ability to fine tune the role scores to accommodate specific aircraft. The unit data file allows for the assignment of percentages to role scores and these percentages are factored into the overall mission assignment settings.

Role score edits in FF3: The role score edits in FF3 are based upon several factors:

1. Real life mission assignments for each aircraft or variant. These scores will always be subjective since situations may change in a real world conflict and the types of missions flown by a particular aircraft may change. In some cases, certain aircraft may have flown unique mission in a war, but have not been assigned those mission in FF3 (e.g. A-10s flying recon missions or F-15Es flying SEAD missions during the first Gulf War). Unfortunately the Falcon 4.0 campaign mission generator is not capable of making good decisions about unique air taskings so these special mission types are best left out of the role scoring. Otherwise, the aircraft will continually get assigned these types of missions when they should be getting assigned missions they specialize in. Additionally, due to the limitations of the strike role score, some aircraft that may specialize in certain types of strike missions, will be assigned the same types as other aircraft.

2. The role scores for F-16s in FF3 are designed to accommodate the primary variants in the Korean Theatre with the following balance of mission taskings:

   a. F-16C Block 30 (Kunsan AB): Primarily CAS, with some strike and CAP missions.

   b. F-16CG (Kunsan/Osan AB): Primarily strike missions using PGMs with secondary CAS and CAP missions.

   c. F-16CJ (Misawa AB): Primarily SEAD missions with secondary CAS, strike and CAP missions.

3. Adjustment of role scores according to how the campaign uses the various percentages. In some cases, some aircraft needed to have their role scores adjusted to accommodate the balance of A-G and A-A missions. Additionally, if other types of planes were involved (e.g. SEAD), then there needed to be adjustment to the role scores of that aircraft in order to accommodate strike packages of strike, escort and SEAD escort aircraft.

The mission.dat file:
The mission.dat file contains the basic flight plan data the sim uses to plan missions. It contains important data such as:

a. Type of action require at combat waypoints.
b. Combat altitude of aircraft during the combat waypoints.
c. Time on station for BARCAPs, on-call CAS, ELINT, and other types of missions.
d. Number of planes in formations (generally 2 or 4).
e. Conditions for escort/SEAD escorts.
f. Timing of escorts within the strike package waypoints.

This file has many limitations, one being the inability to assign different flight plans to different aircraft beyond setting the cruise altitude of that aircraft. After running several tests and having extensive experience with campaigns, the FF Team decided that using a “simple AI” method was more beneficial to the overall sim experience. When observing the chart below, users should notice that many missions are using the same altitudes as other similar missions types. This is by design and in many instances, the cruise altitude of some aircraft has been lowered from 30-35K ft AGL, to 25K ft AGL. This is for several reasons:

a. While in real life F-16s and other types of aircraft routinely can patrol at altitudes as high as 35K ft AGL, aircraft in Falcon 4.0 do note perform well when flying at those altitudes unless flying at higher than normal speeds. One of the problems seen in previous versions of Falcon 4.0, is the occurrence of aircraft getting caught in a “pitch-up” condition. This is caused by the combination of weight and drag of the aircraft, while flying too slow at too high of an altitude. This is particularly true of aircraft flying above 25K ft AGL.

b. Having similar cruise altitudes and speeds allows for better integration of strike packages in campaigns.

Users are reminded that there are many limitations with Falcon 4.0, and that while AI flights are being assigned similar waypoints, altitudes and speeds; human pilots always have the freedom to fly any way they wish.

Free Falcon 3 ATO Mission.dat file edits *(* Overridden by A-G weapons release settings)*					
Mission Type	**Interim Waypoints (3 & 4) ****Strike missions only***	***Combat Altitude**	**Time on station-minutes**	**Planes in Flight**	**Lead time for escorts-** ***seconds***
BARCAP/DCA		25K ft AGL	25 X 2	2	
TARCAP		25K ft AGL	15 X 2	2	15
HAVCAP		25K ft AGL	2 Hrs	2	15
Sweep		25K ft AGL		2-4	
Escort		25K ft AGL		4	15
SEAD Strike		25K ft AGL		2	20
SEAD Escort		25K ft AGL		4	
Fighter Strike: OCA, Interdiction, Strike & Deep Strike	25K ft AGL	20K ft AGL		4	
Bomber: Strategic Strike and Strategic Bombing	30K ft AGL	30K ft AGL		4	
CAS/Anti-ground vehicle missions: CAS (Preplan/on call) SAD, BAI & Interdiction,		18K ft AGL		2	
On-call CAS		18K ft AGL	10 X 2	2	
BAI		18K ft AGL		4	

Unit control data:
The individual unit files contain editable values that affect a wide range of the overall ATO game plan. FF3 features extensive updates to these values designed to accommodate the latest BMS.exe work.
Data edits for FF3 include:

1. Move speed: a value listed in km/hr @ SL that is the cruising speed of all aircraft for waypoint # 2 and any other waypoint. In campaigns, you will notice the move speed for waypoint # 2 is slightly lower than the other waypoints. This is because there are 2 different speeds involved: cruise speed and combat speed. Also, the code automatically calculates the difference of speed in knots depending on altitude.
   Some of the problems encountered in previous versions of F4 were:

a. In the SP3 code, the cruise speed was hard coded at 25% of the cruise speed and the combat speed was hard coded at 45%. This gave too much difference between cruise speed and combat speed creating problems with speeds and altitudes for some aircraft. In some cases, in order to give an accurate combat speed at 30K ft. AGL, the cruise speed would be as low as 215 knots, resulting in a very high AoA condition in order to maintain altitude and speed with heavy weapons loads. Some aircraft could not make the waypoint times because the AI became “stuck” in a high AoA situation. This was particularly true of A-10s.
b. Some planes could not perform their escorts of strike aircraft due to the move speeds and altitudes, while others were flying so high and so slow, that they were forced to fly along at near-stall speeds. Adding drop tanks only complicated the problem.

After testing different move speeds and altitudes in FF3/BMS, the FF team has reworked all of the move speeds, cruise altitudes and combat altitudes for FF3. In general, many of the speeds and altitudes have been simplified and standardized to accommodate a variety of aircraft flying under diverse conditions. You should now be able to fly to all of your waypoints and make the assigned times while being escorted or performing escorts and while flying with heavy weapons loads. The edits were made using the worst case scenario in regards to weapons loads and heavy drag

2. Cruise altitude: the altitude the plane will use when flying to waypoint #2 and the last waypoint during egress before landing. The cruise altitude is set to 25K ft AGL for most fighters, 30K ft AGL for most bombers and various lower altitudes (18-22k ft AGL) for attack aircraft that carry heavy weapons loads.

3. Combat altitude: the altitude used by the fight as it moves beyond waypoint #2. It is set using the mission.dat file and will vary from mission to mission type. The F4 code also uses the maximum altitude value from each aircraft’s data files to compute a cruise altitude. Note that while in 2D the mission.dat file dictates the altitude, in 3D the A-G weapons delivery altitude overrides the mission.dat file if the aircraft is flying an A-G mission.

4. Maximum altitude: Sets a maximum altitude that overrides the mission.dat file. Can be very helpful when working with aircraft that cannot fly at higher altitudes with heavy weapons loads (e.g. A-10).

5. Individual aircraft flags: Each aircraft has its own set of flags that dictate certain parameters of the ATO. Use of these flags permits the ability to group certain aircraft into categories so they will tasked combat missions either in packages or in flights not flown in strike packages. This allows some flexibility in the ATO as follows:
   a. Naval flights can be separated from USAF flights so that carrier planes are not flying large distances in order to be a part of a land based strike package. This also means aircraft from the same carrier will typically will fly their own strike packages.
   b. ROKAF flights can be separated from USAF/USN flights so that USAF strike packages are comprised of typical USAF strike package aircraft.
   c. DPRK/OPFOR aircraft can be segregated into categories so that most aircraft will fly in solo missions and not in strike packages. This means aircraft like the DPRK MiG-29A and MiG-23 will be used exclusively for air defense and not be used for escort missions. This also means aircraft like the J-5, J-6 or MiG-19 will fly in their own groups at lower altitudes and can be used exclusively for short strikes on key strategic targets or ground units in the ROK which is closer to the DPRK order of battle.

6. Fuel rates/ranges: The fuel flow rates and maximum ranges of aircraft are set in the unit file. FF3 has had extensive re-working of the fuel flow rates. In FF3, you will see an improved fuel flow AI that affects the 2D fuel flow rates, the 2D/3D waypoint ranges and the use of external fuel tanks. It is important to get these as correct as possible for the following reasons:
   a. Proper fuel flow rates improve the transition from 2D to 3D in missions. This affects AI fuel amounts upon entering the 3D world. If these settings are too low, then AI flights will be tasked for missions in 2D that they do not have enough fuel for upon entering the 3D world and are likely to run out of gas before completing their missions. And if these settings are too high, AI flights may enter the 3D world without any fuel since the sim does not remove aircraft in 2D that are out of gas. Additionally, some aircraft will not get assigned missions since in 2D they will not have enough gas, while in 3D they do.
   b. Correct use of fuel tanks for the range of mission. The ATO mission planner will use the fuel rate to determine if fuel tanks are required for the mission. If the 2D fuel rates are not similar to the 3D fuel rate, then flights will either have too many fuel tanks added or not enough to complete the 3D mission.

   In the BMS/Falcon 4.0 code, the 2D fuel flow rates, the maximum range of aircraft and the use of external fuel tanks are all based upon one simple calculation done by the code. The code uses a value that is entered in the aircraft's data files to perform all of these decisions and calculations. This term is called "fuel rate" and this value is the actual value that the code uses to determine the fuel flow rate of each aircraft while flying in the 2D world.
   For example, if a plane is given a fuel rate of 150, the code will use up 9,000 lbs of fuel in 60 minutes of 2D flying for that aircraft. This is determined by multiplying 150 (lbs./min) by 60 (minutes in an hour). It should be noted, that the 2D calculations does not take into account any other variables such as speed, altitude, weapons load and use of afterburner. Unfortunately, this is simplistic AI.
   Using this knowledge of how the code works, the FF Team has run a series of tests comparing the 2D fuel flow to actual 3D fuel flows in order to establish a general baseline that can be used for calculations. In previous versions of Falcon 4.0 (SP3/FF2), a calculator was used and the fuel flow values were determined as follows:
   1. Find the military power fuel rate
   2. Find the maximum military thrust at sea level for Mach .1.
   3. Calculate the lbs/minute value by taking 70% of #1 x #2.
   4. Enter this value into the aircraft's data files.

   While this method produced acceptable results, when comparing these estimates with actual 3D tests, the 2D fuel rates were found to be too high for most planes, including F-16s.

   In trying to produce a better fuel flow calculator, several other variables were considered as follows:
   1. What altitude is the plane cruising at?
   2. What affect will a heavy weapons load have?
   3. What will happen if the plane uses its afterburner for extended periods?

   In conducting tests, the follow criteria were used:
   1. Generate a basic mission using a TE and follow an AI aircraft as wingman for 60 minutes.
   2. Use a heavy weapon load which includes drop tanks.
   3. Make sure you perform a full afterburner take-off.
   4. At some point in time within the 60 minute test, fly for 2 minutes with full afterburner in order to simulate combat time.

5. At the end of 60 minutes, stop the mission and record the amount of fuel left. Using the original fuel amount, subtract the amount left from the original amount and then divide this by 60. This would give an actual 3D fuel flow amount in lbs/minute.

Below are the fuel flow amounts that were found in real 3D tests. It should be noted that several of the planes could have their amounts easily skewed simply by using 1-2 minutes more afterburner. This will always be an estimate and cannot be accurate, considering the multiples of a real life combat mission.

a. F-16CG = 110
b. F-16CJ = 105
c. F-15C = 177
d. F-15E = 195
e. F/A-18C = 191
f. MiG-29 = 125
g. Su-30MKK = 223
h. MiG-23 = 134
i. MiG-21 = 60
j. M2K = 128
k. A-10 = 40

Using the results of the 3D tests, the FF team has developed a new fuel flow calculator based upon the data acquired from the 3D tests. These calculations take into account variables such as external stores, afterburner use and cruising altitude. As a result of these new fuel flow values, you should see improved ATO ranges and planning and lesser situations of planes found to be out of fuel once you encounter it in the 3D world or when the plane enters the bubble.

Also, the maximum range of the planes has been adjusted to accommodate the new calculations. This means that you should now see very little missions planned where the waypoint lines are showing red. Red waypoints lines in the mission planner GUI generally mean either the speeds are too high/too low or the ranges of the waypoints are beyond the fuel capacity of the 2D fuel calculations. Remember, these calculations are based upon estimates and in a real 3D mission, the fuel rates will vary considerably depending on the combat conditions.

* Note: In real life, fighter pilots plan their missions using more complicated inputs such as:
-distance to target
-combat load (weight and drag)
-weather conditions (winds/temperature/other)
-speeds and altitudes of other planes in the strike package
-desired fuel economy (if required)

The Falcon4.aii:

The Falcon4.aii file contains substantial data that dictates key ATO parameters within the campaign. It is located in the campaign\save folder. Several key parameters are present that impact the threat thresholds that the ATO uses in determining mission planning. This includes the decision whether to use escorts/SEAD escorts and how the waypoints are planned around air defenses. The FF Team has edited this file in a way to have maximum escort/SEAD escort support, while flying missions in moderate threat environments. This may mean that flying campaign missions in FF3, you may see less missions being generated by the ATO since the ATO is avoiding some high threat areas. This also means that you will see considerably less SEAD strike missions due to the way the Falcon 4.0 code is written. The alternative of less SEAD strike missions is more SEAD escorts while flying in strike packages. Fortunately this is an editable parameter, but unfortunately users cannot have a balance of both types of missions (SEAD escort v. SEAD strike)

SEAD escort v. SEAD strike: Users can edit this parameter themselves and this may be recommended at the start of a campaign where they may want higher SEAD strikes the first few hours and then change to higher SEAD escorts later on in the campaign. Here is the line and what needs to be edited:

MaxFlymissionHighThreat=80

If you change this value to 90 or above, you will get a high volume of SEAD strikes, but low amounts of SEAD escorts. If you change this value to below 90, you will get a moderate amount of SEAD escorts and low amount of SEAD strikes.

A-G weapons release altitude:
This is referring to the altitude that all AI aircraft fly in order to deliver their A-G stores. If the aircraft is flying an A-G mission, it will change to the set A-G delivery altitude for the remainder of the combat waypoints even though those altitudes do not change in the actual waypoint settings. This is why AI planes will suddenly go into a steep dive as they approach the target waypoints, even though the waypoint altitude remains the same as the last waypoint. Another problem related to this is that AI aircraft will not dive bomb using CCIP type profiles, but rather drop all bombs flying a CCRP type approach. This makes aircraft flying at low altitudes (e.g. A-10) vulnerable to AAA or IR SAMs.
Users should understand that the waypoint settings in the GUI will not show the actual A-G weapons altitudes since the GUI does not actually "see" the 3D values set for individual aircraft.

FF3 features a new and exciting dimension to this feature by taking advantage of the latest BMS.exe work. The A-G weapons altitudes are now editable parameters located in each aircraft's FM file. This means that custom A-G weapons altitudes have been set by the FF Team and that in concert with the move speeds and cruise altitudes, FF3 now will now have a more realistic set of AI missions operating in campaigns or TEs. This means you should now see improvements to AI flights as follows:

a. Bombers like the B-52, will now continue to fly at 30K ft AGL while delivering dumb bombs and will not make huge dives upon arriving at the combat waypoints.
b. Fighters should now fly logical altitudes for delivery of A-G weapons. This includes AI deployment of ARMs, which was previously set at 1,000 ft AGL and was poor AI. Most fighters that deploy ARMs, will now continue to fly at cruise attitude and fire their missiles at high altitudes, giving a much better chance of success.
c. Attack aircraft will fly at lower altitudes on CAS missions, but will still fly above most AAA/IR SAMs. This will benefit those that enjoy flying the A-10. These settings are set to a higher altitude than used in real life, but since the AI flights will not use dive-bombing profiles, this is a compromise used to avoid low altitude air defenses.
d. Older attack aircraft like the DPRK J-5 or MiG-19 will fly missions at very low altitudes simulating attempt to sneak under Allied GCI radars.

For FF3, the FF team used a set of a basic profiles developed to simplify things since many aircraft are using similar weapons. Some exceptions were for aircraft like the A-1, J-5 or MiG-19.

Naval Operations
FF2/3 has an extensive upgrade to the naval section of Falcon 4.0 from SP3. The new features are as follows:
Naval Ship radar modeling:
To accommodate the modeling of naval air defense, FF3 is modeling 2 basic types of ship search and track radars as follows:

1. Standard search radars: These radars are typical of most search radars and should be easily identified by the ship symbol in the aircraft TWS/RWR scope. These radars will trigger a launch warning once a SAM missile is fired.
2. Phased-array radars: These radars are designed to simulate Aegis type radars that can track targets without the targets knowing it. SAMs fired from these ships will not trigger a SAM warning in the TWS/RWR scope if the guided missile is a SM-2 or a SA-N-6.

Shipboard Air Defenses:
Ships will now engage aircraft at long ranges using SAM missiles. The SAM capabilities of the ships is limited to the targeting capabilities of the simulation and in real life there would likely be much more SAM activity from ships defending themselves from attack. While the ships are capable of firing a volley of missiles, they typically only target one aircraft at a time. Other Naval SAM notes:

1. All of the SAM missiles fired by the ships in FF2 are simulations of real missiles fired by the respective ships of the different navies included. Some of the missiles will not trigger a missile launch warning in the F-16 TWS of your plane. These are the SM-2 (USN) and the SA-N-9 (CIS & PRC).
2. Several of the ships that do not have radar guided SAMs are now equipped with IR SAMs. These include SA-14, Stinger and Mistral.
3. If you move closer than the minimum range of shipboard SAMs, most ships will begin to engage you with their CIWSs which are deadly.

Ship Units:
The ship units in FF3 have not been changed from the updates featured in FF2. The ship units are arranged in units according to the best information available. While the function of ships have many limitations in Falcon 4.0, the FF Team has taken the time to add the correct names, unit composition, and in some instances; new models with high quality textures as follows:

USN (Modern):

USS John F. Kennedy CVN-67 Carrier Group:
- USS Fitzgerald DDG-62 (Arleigh Burke class Aegis destroyer)
- USS Deyo DD-989 (Spruance class destroyer)
- USS Elrod FFG-55 (Perry class Aegis frigate)
- USS Hue City CG-66 (Ticonderoga class Aegis cruiser)
- USS Vicksburg CG-69
- USS Bridge AOE-10 (fast combat support ship)

USS Carl Vinson CVN-70 Carrier Group:
- USS Bunker Hill CG-52
- USS Cushing DD-985
- USS Gary FFG-51
- USS Mahan DDG-72
- USS Princeton CG-59
- USS Ranier AOE-7

USS Chosin CG-65 Aegis Cruiser task force:
- USS Mahan DDG-72
- USS Gary FFG-51
- USS Bridge AOE-10
- USS Vicksburg CG-69

USS Deyo DD-989 Destroyer task force:
- USS Russell DDG-59
- USS Elrod FFG-55

USS Fitzgerald DDG-62 Destroyer task force:
USS Davis FFG-60

USS Hawes FFG-53 Frigate task force:
USS Chosin CG-65

USN (1970-80 Era):

USS Constellation CV-64 Carrier Group:
USS Fox DLG-33 (Belknap class cruisers DLG/CG)
USS Blakely DE-1072 (Knox class frigates/destroyer escorts)
USS Semmes DDG-18 (Adams class guided missile destroyers)
USS Wainwright DLG-28
USS Bridge AOE-10

USS Forestal CV-59 Carrier Group:
USS Fox DLG-33
USS Wainwright DLG-28
USS Sellers DDG-11
USS Bowen DE-1079
USS Ranier AOE-7

USS Wainwright DLG/CG-28 Cruiser task force:
USS Fox DLG-33
USS Sellers DDG-11
USS Bowen DE-1079
USS Bridge AOE-10

Russian Navy:

Admiral Kuznetsov Carrier task force:
Neustrashimy: (FFG Neustrashimy class frigate)
Admiral Vinogradov (DDG Udaloy class)
Bezboyaznennyy (DDG Sovremenny class)
Admiral Nakhimov (BCGN Kirov class)
Varyag (DDG Slava class)
Burnyy (DDG Sovremenny class)

Admiral Nakhimov Battlecruiser Task Force
Burnyy
Admiral Vinogradov
Bezboyaznennyy
Neustrashimy
Varyag

Royal Navy:

HMS Invincible Carrier Group:
HMS Newcastle D87 (Type 42 Destroyer)
HMS York D98 (Type 42 Destroyer)
HMS Cumberland F85 (Type 22 Frigate)
HMS Montrose F236 (Type 23 Frigate)

HMS Newcastle D87 Destroyer task force:
HMS Montrose F236
HMS York D98

Chinese Navy:

136 Haizhou Destroyer task force (DDG Sovremenny class):
- 137 Fu Zhou (DDG Sovremenny class)
- 167 Shenzhen (Luhai class destroyer)
- 109 Kiafeng (Luda-I class frigate)
- 112 Harbin (Luhu class destroyer)
- 137 Fu Zhou (DDG Sovremenny class)

521 Jangwei II Frigate task force (Jangwei-II class frigate):
- 109 Kiafeng

167 Shenzhen Frigate task force:
- 112 Harbin

Ship Damage Modeling in FF3: The damage values of all ships have been adjusted to be more realistic. Ships are now capable of taking much more damage than in previous patches. More notes:

a. When you damage ships, they will now smoke and in some cases, cease to fire their weapons. If you destroy the ships, they will stop moving and in a short while disappear. On some occasions, ships will disappear when they are destroyed. There is no current simulation available in F4 for sinking ships, so they will still disappear after a given amount of time.

b. The damage values of the ships is set high enough that you will have to make multiple strikes by most weapons in order to destroy them. In real life, most ships that are destroyed are not destroyed immediately upon impact of weapons, but rather will either sink or burn beyond use after a given period of time. Some large ships will require you to make at least 3 hits with a cruise missile type weapon before it is destroyed.

With the new ship edits featured in FF2/3, the naval strike mission not only becomes much more challenging, but more realistic as well. Destroying some of the ship units will be challenging to even the most experienced users as the surface-air capabilities of the ship units is formidable. While there are still plenty of limitations to these edits, the FF team feels this is a nice addition to the overall "sim" experience.

Users need to be aware of the limitations of the ship units and should have realistic expectations. Some of them are:

a. Ships will still move in a N-S pattern that cycles over a given period of time. If you place a ship unit too close to land, it will continue to move over land. Ships will only stop moving when you place them at a port or destroy them.

b. There are surface-surface warfare capabilities within the ship units, but the ships will not turn to engage one another. If you place ships within a certain distance of one another, they will fire and destroy one another depending on the types of weapons. This is especially true of certain S-S missiles.

APPENDIX H: [R]EDVIPER CREDITS

REDVIPER CREDITS

This patch could not be possible without the contributions of hundreds of people over the last 8 years. This list of credits only lists some of the obvious contributors. To those that were left off of this list, sincere thanks go out to you!

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- Tomas "Ataribaby" Hamarcak: 3D cockpit model instrument animation
- "Pegasus": 3D Cockpit Panels
- “Nodo”: GUI Enhancements
- “Mav-jp”: HFFMs
- Andre “Raptor One” Joseph: HFFMs
- Paul Wilson: Cockpits/airbase enhancements
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- Fibonaccov: Runway signs
- Nightfalcon: Ammo Dump and many more.

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- Jan
- TOPOLO
- CCC
- Aragorn
- Hailstorm
- Red-1
- Biker
- ihawk
- Intruder
- Snail
- Ice
- Parislord
- Pumpy
- Aristoteles
- Welsh-Madman
- Rogue
- Hailstorm
- Bird
- T-Rex
- Speaker
- WaveyDave
- Clueless
- Saint

FreeFalcon Teams:

- All of you (you know who you are).

And most of all: RPG, F4UT & BMS:

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These are individuals who have contributed their free time and energy towards the development of the Realism Patch, for no other reward than to be able to play the end results and share it with others. The members of the team are from all over the world, spread across four continents. The list is organized according to tasks, and some names will appear more than once.

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Special thanks to our friends from *MacFalcon* who were the first to master Falcon's 3D-format and supplied numerous 3D models and skins to SuperPAK! Rick 'Dragon' Prior (Master of LODEdit), Basil 'Jetfighter' Greber, Alex 'Tiger', Jay 'Scorpion', Martin 'Mapi', 'Jackal'.

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Open Falcon

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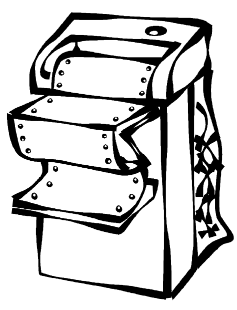

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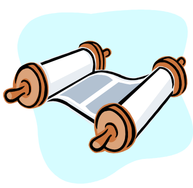
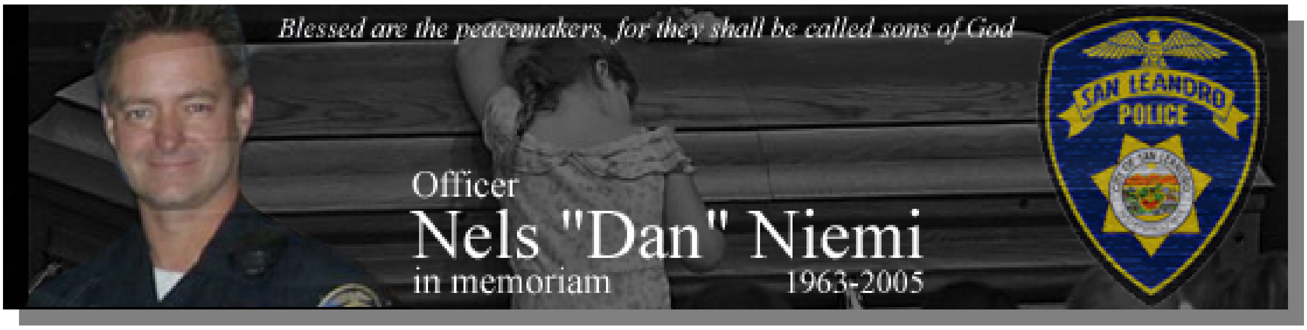


Wish you could have read it, “Dann”…..



Peace. Your little mate, “Aragorn”.

Gone but never forgotten.