THE FIGHTER COLLECTION

EAGLE DYNAMICS

DCS SERIES

DCS: F-16C Viper

Early Access Guide

Updated 21 February 2021

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LATEST CHANGES

Significant changes to the guide will be noted on this page. Changes may be identified by a black bar next to the new or revised text as shown here in the right margin.

15 Oct 2019 – Added IFF Interrogation procedure to radar section.

20 Oct 2019 – Updated AIM-9 diamond and uncage behavior description in AIM-9M/X Employment sections.

22 Oct 2019 – Added Track While Scan radar submode description.

25 Oct 2019 – Added INS alignment procedures.

28 Oct 2019 – Added section on SMS MFD page and Selective Jettison.

05 Nov 2019 – Added Air Refueling procedures.

08 Nov 2019 – Added Link 16 Datalink information.

15 Nov 2019 – Added additional CMDS DED Page descriptions.

24 Nov 2019 – Added information on the radar display's Expand Feature.

21 Jan 2020 – Added EEGS Level V gunsight information.

28 Jan 2020 – Added information on filtering FCR display datalink tracks.

11 Feb 2020 – Added slave/bore HOTAS functionality to AIM-9 employment section.

25 Feb 2020 – Updated TACAN band change procedure in the TACAN Navigation section.

15 Mar 2020 – Added M61A1 Gun dispersion information to the Gun Employment section.

31 Mar 2020 – Added Time and ALOW DED page descriptions to the UFC section.

26 Aug 2020 – Substantially revised Targeting Pod section to add new functionality. Added Stored Heading and Inflight INS alignment procedures.

27 Aug 2020 – Added procedures for kneeboard usage to the Bomb Seeker Laser Code section. Added radar display missile DLZ to AIM-120 Employment section. Added details on Dogfight and Missile Override modes.

28 Aug 2020 – Added new section describing Autopilot functions. Substantially revised section describing DED Pages with emendations and many additional pages.

31 Oct 2020 – Added AGM-88 HARM section with HAS mode procedures.

3 Nov 2020 – Added AGM-65 Maverick section.

6 Dec 2020 — Added Using Visual Initial Points, Visual Reference Points, and Pull-Up Points section, and POS mode (RUK profile) to AGM-88 HARM section.

15 Dec 2020 — Added a section on Sensor Point of Interest (SPI) and Cursor Zero mechanics. Added section on TGP track modes.

14 Feb 2021 — Added Aircraft History and F-16C Stores sections.

DCS: WORLD FUNDAMENTALS

USAF Photo
by SrA Daniel Snider

Health Warning!

Please read before using this computer game or allowing your children to use it.

A very small proportion of people may experience a seizure or loss of consciousness when exposed to certain visual images, including flashing lights or light patterns that can occur in computer games. This may happen even with people who have no medical history of seizures, epilepsy, or “photosensitive epileptic seizures” while playing computer games.

These seizures have a variety of symptoms, including light-headedness, dizziness, disorientation, blurred vision, eye or face twitching, loss of consciousness or awareness even if momentarily.

Immediately stop playing and consult your doctor if you or your children experience any of the above symptoms.

The risk of seizures can be reduced if the following precautions are taken, (as well as a general health advice for playing computer games):

Do not play when you are drowsy or tired.

Play in a well-lit room.

Rest for at least 10 minutes per hour when playing the computer game.

Installation and Launch

You will need to be logged into Windows with Administrator rights in order to install DCS World and the DCS: F-16C Viper module.

After purchasing DCS: F-16C Viper from our e-Shop, start DCS World. Select the Module Manager icon at the top of the Main Menu. Upon selection, your aircraft will automatically install.

DCS World is the PC simulation environment that the F-16C Viper simulation operates within. When you run DCS World, you in turn launch DCS: F-16C Viper.

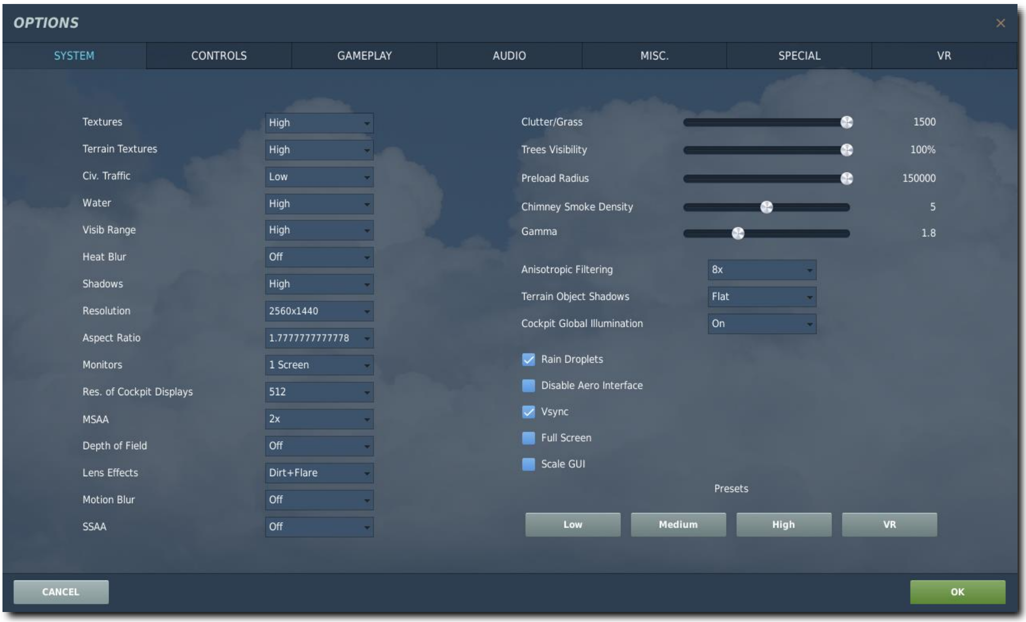
As part of DCS World, a map of the Caucuses region, the Su-25T Frogfoot attack aircraft, and TF-51 training aircraft are also included for free.

After executing the DCS World icon on your desktop, the DCS World Main Menu page is opened. From the Main Menu, you can read DCS news, change your wallpaper by selecting either the F-16C Viper icon at the bottom of the page, or select any of the options along the right side of the page. To get started quickly, you can select Instant Action and play any of the missions listed for the F-16C Viper.

Configure Your Game

Before jumping into the cockpit, the first thing we suggest is to configure your game. To do so, select the Options button at the top of the Main Menu screen. You can read a detailed description of all Options in the DCS World Game Manual. For this Early Access Guide, we will just cover the basics.

Upon selecting the Options screen, you will see seven tabs along the top of the page.

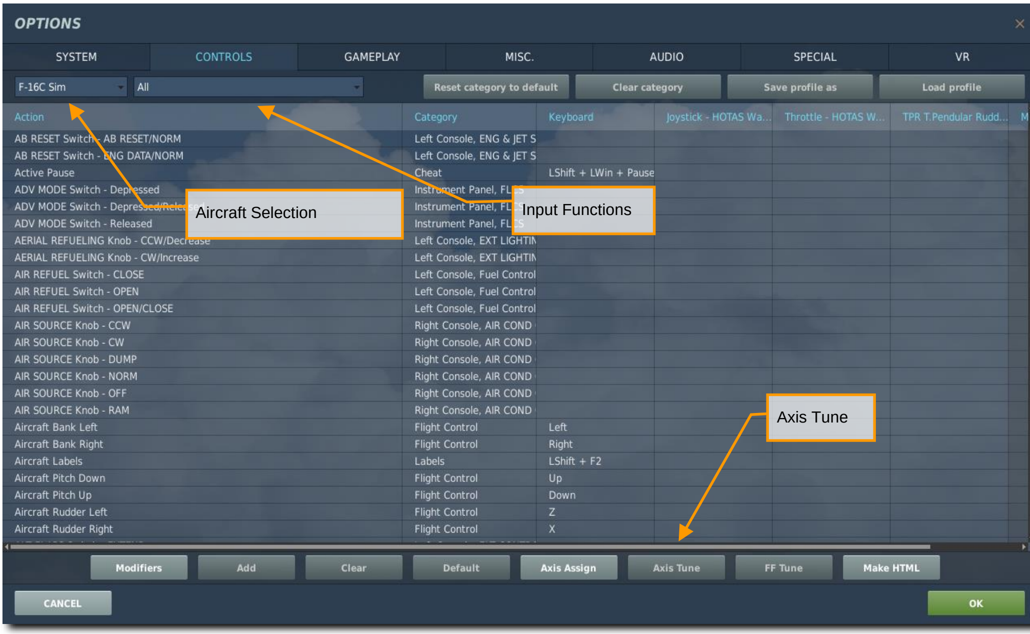


SYSTEM. Configure your graphics options to best balance aesthetics with performance. You have PRESET options along the bottom of the page, but you can further adjust your graphics settings to best suit your computer. If you have lower performance, we suggest selecting the Low PRESET and then increase graphics options to find your best balance.

Items that most affect performance include Visible Range, Resolution, and MSAA. If you wish to improve performance, you may wish to first adjust these System options.

CONTROLS. Set up your controls and functional bindings. Let’s take a closer look at this page:

First, select the aircraft you wish to assign control inputs to by use of the Aircraft Selection drop-down. Next, along the left side of the screen are all the ACTIONS associated with the selected Input Function drop down. To the right are all the detected input devices that have been detected to include keyboard, mouse, and any joysticks, throttles and rudder pedals.



1. **Aircraft Selection**. From this drop-down menu, select F-16C Sim.
2. **Input Functions**. This displays various categories of input functions, such as axis devices, views, cockpit functions, etc. To assign a function, double mouse-click in the box that corresponds to the desired input function and the input controller device. Once selected, press the button or move the axis of the device to assign it.
    a. Example 1: if setting a pitch axis for a joystick, first select AXIS COMMANDS from the Input Functions drop down. Find the box where your Joystick input device and the Pitch Action intersect, and double mouse-click in the box. In the ADD ASSIGNMENT PANEL, move your joystick forward and back to assign the axis. Press OK when done.
    b. Example 2: if setting a keyboard of HOTAS command like cycle the landing gear, first select ALL as the Input Function category. Find the box where your input device and the LANDING GEAR CONTROL HANDLE – UP/DOWN Action intersect, and double mouse-click in the box. In the ADD ASSIGNMENT PANEL, press the keyboard or controller device button you wish to assign to the action. Press OK when done.
3. **Axis Tune**. When assigning an axis (like X and Y axis for a joystick), you can use this sub-page to assign a dead zone, response curve, and other tuning. This can be very useful if you find the aircraft overly sensitive to control. The Deadzone, Response Curve Saturation Y, and Invert and the most common and useful elements to tune your controls.

GAMEPLAY. This page primarily allows you to adjust the game to be as realistic or casual as you want it to be. Choose from many difficulty settings like labels, tooltips, unlimited fuel and weapons, etc.

To help improve performance, turning Mirrors off can assist in this.

AUDIO. Use this page to adjust the audio levels of the game. You also have the option to turn on and off different audio effects.

MISC. This is a catch-all of features to further tune the game to your preference.

VR. The VR tab allows you to enable support for a wide variety of VR Headsets and adjust their functionality. When using VR, be particularly aware of the Pixel Density setting as it can have a dramatic effect on game performance.

Fly a Mission

Now that you have configured your game, let's get to why you purchased DCS: F-16C, to fly some missions! You have several options to fly a single or multi-player mission.

1. **INSTANT ACTION**. Simple missions that place you in the task of your choice. We will be using several of these in this Early Access Guide to test what you learn.
2. **CREATE FAST MISSION**. Set various mission criteria to allow a mission to be created for you.
3. **MISSION**. More in-depth, stand-alone missions.
4. **CAMPAIGN**. Linked missions to create a campaign narrative.
5. **MULTIPLAYER**. Create your own or join an internet server.
6. **MISSION EDITOR**. Use this very powerful Mission Editor to create your own missions.

On the Main Menu page, you have the options to fly the Viper in an INSTANT ACTION mission, CREATE FAST MISSION, load a MISSION, play a CAMPAIGN, or create a mission in the MISSION EDITOR. You also have the option to jump online and fly with others.

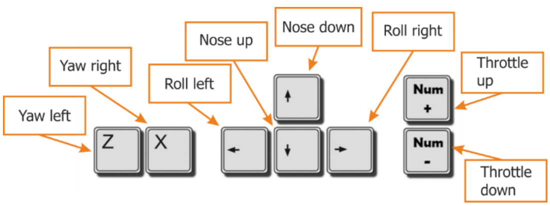
Select the INSTANT ACTION from the right side of the screen. From here, you will be presented several INSTANT ACTION missions to choose from.

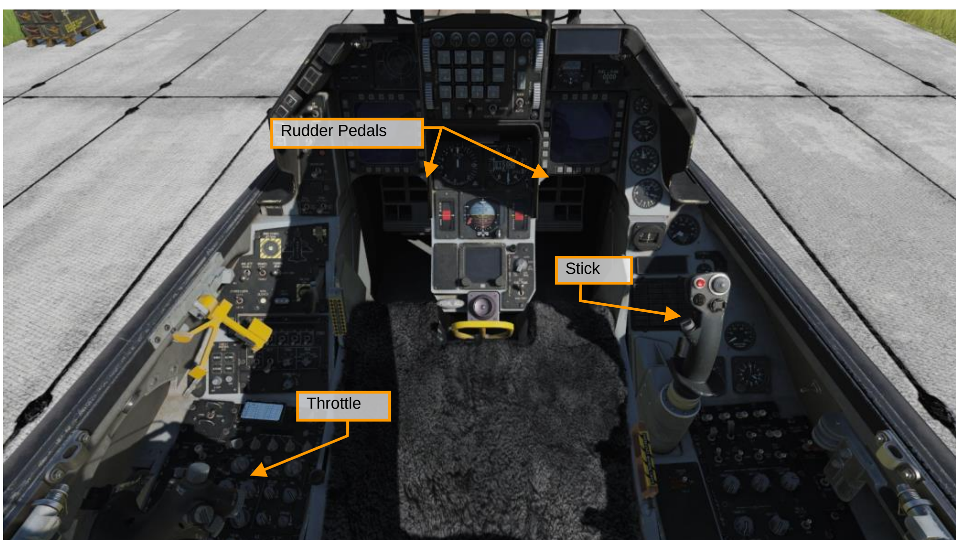
To get started, we suggest the FREE FLIGHT mission. Later, you can also use these missions to practice starting up the aircraft, takeoffs, landings, navigation and sensor / weapon employment. The MISSIONS selection holds several combat and practice missions.

Flight Control

Primary aircraft flight controls include the flight control stick, throttle, and rudder pedals. The stick is used to roll the aircraft left and right to perform turns and pitch the nose up and down to climb or descend. The throttle is used to control engine power and resulting airspeed. The pedals are used to yaw the airplane left and right using the rudder (like a boat). Pedal use in flight is limited to eliminating sideslip and helping to coordinate smooth turns, but they are also used on the ground to turn the nose wheel when taxiing.

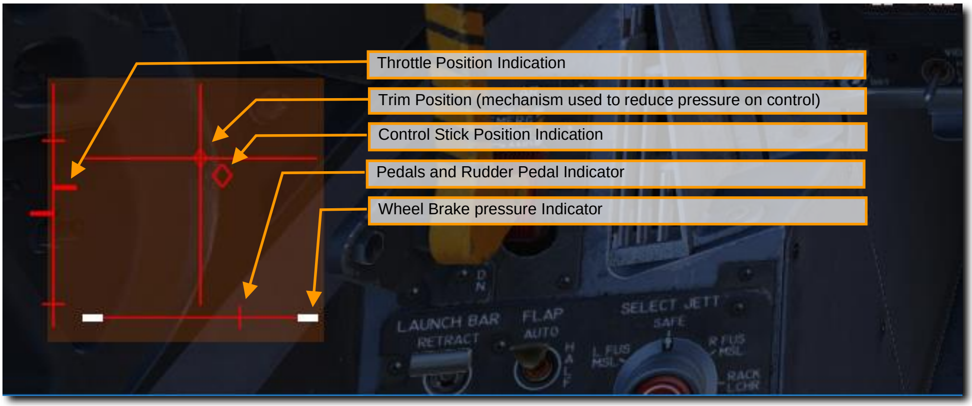
If you are flying only with a keyboard, the primary flight control keys will be arrow keys to control roll and pitch, **[Numpad+]** and **[Numpad-]** to control throttle, and **[Z]** / **[X]** to control the rudder pedals. If you do have a joystick, it may be equipped with a throttle handle and/or a twist grip, which will allow you to control the rudder pedals.





To fly the aircraft to the right or left: roll the aircraft in the direction you wish to go and gently pull back on the stick. The more you pull back on the stick, the faster your turn rate will be and the more speed you may lose.

When flying from the cockpit, you can toggle the Controls Indicator display by pressing **[Right Control + Enter]** to see a visual reference of the positions of your flight controls.



Changing Airspeed

To increase and decrease your airspeed, you have several methods available to you:

- **Aircraft engine power.** The more you advance your throttle, the more thrust the engines will produce.
- **Aircraft pitch angle and pitch rate.** Generally, when pointing the nose up in positive pitch, the aircraft will slow down. When pointing the nose down in negative pitch, the aircraft will speed up. The more rapid you make a pitch change can also affect speed. Whether it is a pitch change in the horizontal plane or in the vertical plane, the more rapid and greater the pitch change, the greater the G-loading on the aircraft. The greater the G-loading, the greater the negative effect on your speed.
- **Speedbrakes.** By opening the speedbrakes you can slow down the aircraft due to drag.
- **Landing Gear.** The landing gear can also slow you down due to increased drag, but they should only be lowered when below 300 knots.

Changing Altitude

To increase or decrease your altitude, you will do so by changing the pitch of the aircraft.

- **To increase altitude**, pull back on the stick to raise the nose of the aircraft. As you increase pitch though, you will start to lose airspeed. If the aircraft starts to stall, you will need to lower the nose or increase power.

- **To decrease altitude**, push the stick forward and lower the nose of the aircraft below the horizon. As you pitch down though, you will increase your airspeed. To maintain current airspeed, you can reduce throttle or open the speedbrakes.

To monitor altitude, view the barometric and radar altimeters on the HUD and the altimeter gauge on the instrument panel.

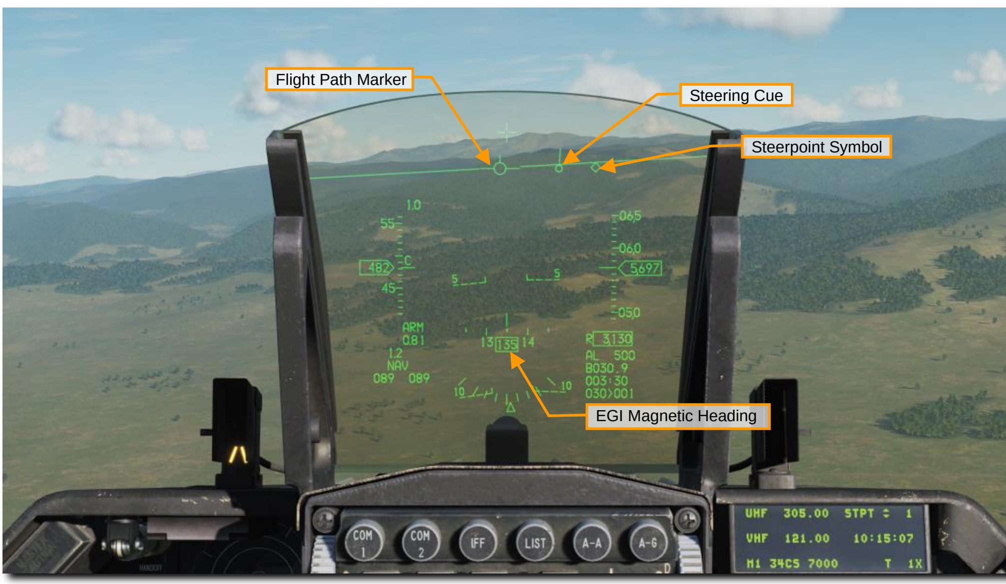
You can also view your positive or negative vertical velocity with the Vertical Velocity Indicator on the instrument panel.

Changing Heading

To turn the aircraft in the horizontal plane to a new heading, you need to move the stick to the right or left and gently pull back. By rolling the aircraft in the direction you wish to point the aircraft and then pulling back on the stick, the aircraft will pull its nose in that direction (you can think of it as a horizontal loop). When you have reached the new, desired heading, center the stick and roll the aircraft back in the opposite direction to level the wings.

Note the following:

- The greater the roll angle will equate to the greater amount you must pull back on the stick to keep from losing altitude.
- The more you pull back on the stick to make a turn will generate a higher G-loading on the aircraft and slow you down. If you lose too much speed, the aircraft may become uncontrollable.
- To keep from changing altitude during a turn, keep the HUD Flight Path Marker on the Horizon Line and adjust pitch and roll input on the control stick to do so.



You can view your current heading on the top or bottom of the HUD, depending on the selected master mode. The heading scale shows your current magnetic heading indicated by the central caret. The Steering Cue shows the heading to your steerpoint. If you turn the aircraft to align the Flight Path Marker with the Steering Cue, you will be flying to your steerpoint.

You can also view your current heading on the Horizontal Situation Indicator (HSI). The indicated heading at the top of instrument that is aligned with the top of the lubber line indicates your current heading.

Game Problems

If you encounter a problem, particularly with controls, we suggest you back up and then delete your Saved Games\User Name\DCS\Config folder, which is created by DCS on your operating system drive at first launch. Restart the game and this folder will be rebuilt automatically with default settings, including all the controller input profiles.

If problems persist, we suggest consulting our online technical support forums at https://forums.eagle.ru/forumdisplay.php?f=437

Useful Links

DCS Homepage:

http://www.digitalcombatsimulator.com/

DCS: F-16C Viper forum:

https://forums.eagle.ru/forumdisplay.php?f=638

THE F-16C VIPER

USAF Photo
by SSgt Deana Heitzman

Aircraft History

The history of the F-16 is closely linked to the history of fly-by-wire. Fly-by-wire substitutes the traditional hydromechanical link between pilot and control surfaces for a computer. When the pilot moves the stick left, they are essentially telling the fly-by-wire computer that they wish to turn left; it's then up to the computer to decide how to translate that command into a series of control surface deflections. Fly-by-wire opened the door to aircraft designed with relaxed static stability: designs that would be too unstable for a human pilot to fly manually, but whose instability translated to improved maneuverability.

The F-16's pioneering fly-by-wire system is owed to a man named Harry Hillaker. In the 1940s, fresh out of college, Hillaker joined Consolidated Aircraft as an aircraft designer. There Hillaker contributed to the designs of the B-36 Peacemaker and the F-111, among others, and in doing so, he began to lament a trend among Air Force aircraft: Each new generation was becoming bigger, heavier, and less efficient. By the mid-1960s, Hillaker started contemplating a small, agile fighter that forsook contemporary Air Force dogma.

While Hillaker pondered his new fighter, NASA was breaking ground on a novel technology: fly-by-wire. Fly-by-wire was first used on the Gemini 2 capsule, and ultimately made its way to the Apollo lunar landers, where it impressed astronaut Neil Armstrong. Following the cancellation of the Apollo program, Armstrong was promoted to Deputy Associate Administrator for Aeronautics at NASA. Wanting to further investigate fly-by-wire technology, Armstrong acquired a lunar lander computer, and had it installed in an F-8 Crusader, to be used as a testbed for airborne fly-by-wire. This F-8, designated NASA 802, flew in May of 1972, thus becoming the United States's first fly-by-wire aircraft. NASA 802 caught the notice of Hillaker, who noted the drastic improvement in control responsiveness, a full 2.5 times that of an unmodified F-8.

NASA 802 (NASA)

The Fighter Mafia

Col. John Boyd (US)

Few fighter pilots are as well-known (or notorious) as Col. John Boyd. Following a 1953 tour in Korea as an F-86 Sabre pilot, Boyd attended the USAF Fighter Weapons School, where he quickly became a star pupil. His outstanding performance earned him an invite to return as an instructor, and through the 1960s, Boyd worked as teacher and tactician, conceiving of and developing his energy-maneuverability theory. E-M theory was an entirely novel analysis of aircraft combat, with a quantifiable underpinning contributed by mathematician Thomas Christie. Boyd and Christie crunched the numbers using Air Force computers, and the results led Boyd to the conclusion that a fighter with maximal thrust-to-weight ratio and minimal energy loss in turns would hold a competitive advantage over contemporary designs, with their emphasized bigger, heavier engines and airframes.

In the late 1960s, in an effort to continue to push his ideas, Boyd put together a team of likeminded experts: The "Fighter Mafia." Among them was Harry Hillaker of Consolidated Aircraft, which had since been sold to General Dynamics. The Fighter Mafia worked from inside the Air Force to advance the concept of a lightweight fighter.

In 1967, Boyd was recalled to USAF headquarters to apply his E-M theory to the flagging F-X project. The F-X project was to be the next generation USAF fighter aircraft, but it had stalled amidst doubts among USAF generals that it had become too large and costly. Boyd's analyses helped convince the Air Force to reduce the weight and complexity of the F-X. The lighter F-X proposal would be nicknamed the F-X "Blue Bird," but Boyd and the Fighter Mafia continued to push for an even smaller, even more nimble air superiority fighter, which they called the F-X "Red Bird."

The Fighter Mafia was a diverse group of fighter pilots and engineers, but they all had in common a desire to see the Air Force adopt a lightweight fighter design. This put them squarely at odds with the Air Force brass, most of whom leaned heavily on the upcoming "Blue Bird." The F-X program was seen as a sort of rebirth for the USAF fighter inventory, at this time comprised mostly of F-111s and F-4s. The F-111 had by then evolved into something ungainly and sluggish, and the F-4 was thought of as the Navy's bird, something the Air Force adopted only afterwards. The F-X represented a prideful Air Force future, embracing its "higher, faster, further" motto, and many in the USAF command ranks were emotionally invested in an aircraft that embodied those words.

F-15 Eagle (USAF)

The F-X program continued undeterred. In 1970, the Air Force announced that McDonnell-Douglas was selected to develop the F-X, now designated the F-15 Eagle.

Lightweight Fighter Program

Towards the end of the 1960s, the Deputy Secretary of Defense, David Packard (of Hewlett-Packard) had become concerned that the upcoming USAF and Navy frontline fighters — the F-15 and the F-14 Tomcat — represented future budget problems for the Armed Forces. The Fighter Mafia had continued to push the USAF towards their "Red Bird" concept, now also known as the F-XX. Their studies also helped convince manufacturers such as General Dynamics and Northrop to start investigating potential lightweight fighter designs. In late 1970, as the F-14 continued to experience budget and maintenance issues, Lockheed-Martin took the initiative and delivered to Packard an unsolicited proposal for a lightweight fighter. Other companies in the industry quickly followed suit, including General Dynamics.

David Packard (DoD)

Deputy SecD Packard had been looking to implement a new "fly-before-you-buy" purchasing policy, and had become recently enamored of competitive prototyping. He saw the new LWF proposals as a way to advance his ideas. The Air Force as a whole was still lukewarm to the idea of a lightweight fighter, until the Fighter Mafia coined the "high/low mix" — the concept that the F-15 and F-XX would complement each other, occupying the high-cost and low-cost brackets of Air Force spending, respectively. The high/low mix idea reframed the LWF as an ally to the F-15, and lifted resistance among Air Force brass.

Packard's Lightweight Fighter RFP produced five proposals, among which two were selected for funding: The General Dynamics Model 401, and the Northrop P-600. Each company would be granted funding to build demonstrator aircraft, which would be tested against each other in a series of trials — the fingerprint of Deputy SecD Packard's influence. The P-600 would be redesignated the YF-17, and the Model 401 would become the YF-16.

Air Combat Fighter Competition

At General Dynamics, Robert. H Widmer became the chief engineer on the YF-16 project. At Harry Hillaker's insistence, the YF-16 was to incorporate a production fly-by-wire system — but as the engineers were still uncertain if fly-by-wire was feasible, the YF-16 program was designed with a contingency. Should it be necessary, the YF-16's wings could be shifted aftward to restore the airframe's static stability, and the analog fly-by-wire system was designed to be easily removable and replaced with traditional flight controls.

Along with its revolutionary control system, the YF-16 became a testbed for other innovations: The aircraft would be capable of 9-g maneuvers, and the seat was reclined 30° to improve the pilot's g-tolerance. The reclined seat, and concern about the pilot's ability to manipulate systems during high-g maneuvering, guided the

YF-16 Rollout, 1973 (GD)

development of its HOTAS, which put more capability on the stick and throttle than prior aircraft. The small cockpit necessitated that the stick be moved to the side, so that it wouldn't obscure cockpit instruments.

In December 1973, the completed YF-16 prototype was unveiled at Edwards Air Force Flight Test Center, where it began flight trials. Its first flight on January 20, 1974 was unintended: During a fast-taxi run, a fault in the fly-by-wire system created a worsening control problem that forced the test pilot to lift off for a trip around the pattern. The actual, intended first flight occurred a few weeks later in February, following repairs of the prototype.

The Air Force had set the initial stakes of the LWF competition by committing to purchasing 650 aircraft of whichever model won. But by early 1974, interest in the Lightweight Fighter competition had grown, and as word spread to NATO allies, other countries began committing to purchases of the winner as well. In response to the heightened interest, the LWF competition was expanded into a new program called Air Combat Fighter (ACF). The ACF program specified a multirole lightweight fighter aircraft, and required that any purchase of the winning model must also be in parallel to a purchase of F-15s. This requirement shut down the last of the resistance to the LWF program within the Air Force.

The expanded ACF program brought in foreign competitors, among them Dassault-Breguet, SEPECAT, and Saab. Ultimately, after flying 330 trial sorties spanning 417 flight hours, test pilots unanimously favored the YF-16. So it was January 13, 1975 when Secretary of the Air Force John L. McLucas announced that General Dynamics had won the ACF competition, and with it, hundreds of domestic and foreign orders for the F-16.

The F-16A and B

Through 1974 and 1975, General Dynamics developed the YF-16 into the F-16, making numerous structural modifications. What was originally envisioned as Boyd's lightweight fighter now had to become a multirole aircraft, per the ACF program requirements. The radome was enlarged to fit the AN/APG-68 radar, and two more pylons were added. These and other changes ultimately netted a 25% weight increase.

First production F-16A bl.10 (USAF)

So much was the Air Force's desire to keep the new fighter from impinging on the F-15's glory, that Air Force brass prohibited the F-16 from carrying AIM-7 Sparrows, the medium-range BVR missile of the day. (This requirement would impel one of the Fighter Mafia, General Mike Loh, to order the design of a medium-range missile that could be mounted on AIM-9 Sidewinder stations — a project that would ultimately produce the AIM-120 AMRAAM.)

In late 1975, the first F-16A FSD (full-scale development) was manufactured, and on October 20, 1978, the first production model rolled off the assembly line. The production F-16A first flew in November of that year, and the Air Force received its first delivery in January. The F-16 entered operational service with the 388th Tactical Fighter Squadron at Hill AFB, Utah in 1979. A year later, the F-16 was given the official moniker of "Fighting Falcon" — but of course, its pilots called it the "Viper."

In all, 475 F-16As and Bs (dual-seat variant) were produced. The model variant spanned blocks 1, 5, 10, 15, and 20. Many Block 20 F-16As have since undergone the mid-life upgrade (MLU), becoming functionally equivalent to F-16Cs.

The F-16C and D

On June 12, 1987, the block 30 F-16 was introduced, designated the F-16C and D. Block 30 was the result of the Alternative Fighter Engine (AFE) program, a project to allow the F-16 to be configured with either the existing Pratt & Whitney F100-PW-220 engine, or with the General Electric F100-GE-100 as an alternative. The original plan was for the F-16 to have a common engine bay, allowing any aircraft to swap between the two engines. This idea was scrapped when it was discovered that the GE engine required widening the inlet. Due to the airframe change, beginning with block 30, the blocks were split in two: The 30, 40, 50, and 70 blocks were equipped with a GE engine, and the 32, 42, 52, and 72 blocks had a P&W.

Along with the diversity of engine choices, the block 30/32 Viper received an upgraded mission computer with more storage, an AN/ALE-47 countermeasures dispenser, and the capability to employ AGM-45 Shrike and AIM-120 AMRAAM missiles.

Block 30/32 F-16s would be delivered to the USAF Thunderbirds demonstration squadron in 1986 and 1987; these aircraft are today some of the oldest still-operating F-16s. Other block-30/32s were delivered to the US Navy, re-designated the F-16N, and used as stripped-down aggressor aircraft in USN air combat training.

F-16C (MSGT Michael Ammons, USAF)

The block 40/42 model, commonly called the “Night Falcon,” was debuted in December 1988. As implied by its nickname, the Night Falcon introduced a suite of night attack technologies, including the LANTIRN navigation and targeting pods, and terrain-following radar. The aircraft also got an upgraded fire control radar and RWR, a holographic HUD capable of displaying FLIR video, and an improved mission computer. The aircraft got an exterior makeover as well: The hull was treated with radar-absorbent materials, and the iconic gold-tinted canopy debuted. Despite all these improvements, the USAF was in general disappointed with the increased weight and decreased performance of the Night Falcon series.

January 1991 saw the start of Operation Desert Storm in Iraq, and with it, the F-16’s first combat deployment for the USAF. On December 27, 1992, LTC Gary North of 33rd Tactical Fighter Squadron earned the first combat kill in a USAF F-16 after shooting down a Syrian MiG-25 that violated airspace restrictions. The MiG-25 was also the first aircraft destroyed by an AIM-120 AMRAAM.

In October of 1991, block 50/52 rolled out, restoring the Viper’s performance and maneuverability. The aircraft got an up-rated engine (the F100-GE-129 or the F100-PW-229), and with it a 20% increase in thrust. The radar was again upgraded, integrated datalink modem (IDM) support was added, and the block-40’s holographic HUD was replaced with the original block-30 HUD. Some block 50 Vipers were configured to carry the advanced HARM Targeting System (HTS) pod; these SEAD aircraft were designated the F-16CJ and DJ.

January 1991 saw the start of Operation Desert Storm in Iraq, and with it, the F-16’s first combat deployment for the USAF. On December 27, 1992, LTC Gary North of 33rd Tactical Fighter Squadron earned the first combat kill in a USAF F-16, after shooting down a Syrian MiG-25 that violated UN airspace restrictions. The MiG-25 was also the first aircraft destroyed by an AIM-120 AMRAAM.

The F-16C continues to see improvements and upgrades to keep it in step with technological innovations. Between 2003 and 2010, the Air Force’s Common Configuration Implementation Program (CCIP) modernized and standardized the avionics and capabilities across the fleet of block-40 and block-50 F-16Cs. The FCC was upgraded, the MFDs were replaced with new color displays, support for JHMCS and Link16 was added, and the IFF was modernized. F-16CJ and DJ SEAD models that underwent modernization through this program were redesignated the F-16CM or DM.

F-16V (L-M)

Today, while the USAF no longer purchases F-16s, it still operates a fleet of over 1,000 active-duty F-16Cs and Ds. F-16s have served in virtually every US air combat action since Operation Desert Storm, and F-16s are scheduled to continue to remain in service until 2025, when they will be replaced with the F-35A Lightning II.

Aside from the US, twenty-six other countries have purchased or leased F-16s, and all but one (Italy) continue to fly them as an integral part of their air forces. After purchasing General Dynamics, Lockheed-Martin continues to improve on the F-16 for foreign customers. The United Arab Emirates funded development of the F-16E and F models (block 60), and many other countries have pledged to purchase the upcoming F-16V (block 70/72). The V model is expected to be delivered to buyers starting in 2023.

F-16C Stores

M61A1 Vulcan 20mm Cannon

Allspamme (CC-SA)

The F-16 is equipped with an M61 Vulcan internal cannon. The M61 fires standard M50 20mm rounds at 6,000 rounds per minute. It is effective against both surface and air targets. The ammunition drum carries 510 rounds.

In DCS, you can load the following ammunition types:

HEI. High-explosive incendiary rounds. HEI rounds have both explosive and incendiary effects, making them effective against personnel and light vehicles.

HEI-T. High-explosive incendiary rounds with tracer mix. Tracer rounds are substituted for HEI rounds at regular intervals. The tracer rounds glow brightly when fired, allowing the pilot to visually see the ballistic path of the fired projectiles.

AP. Armor-piercing rounds. Armor-piercing rounds are made from depleted uranium, making them able to penetrate many layers of armor. They have no incendiary or explosive effects upon impact, and as such as less effective against personnel.

TP. Target practice rounds. TP rounds are inert with only kinetic effects upon impact. TP mix always contains tracer rounds at regular intervals.

SAPHEI. Semi-armor piercing high-explosive incendiary rounds. These rounds have both incendiary/explosive effects and armor-piercing capability. The rounds are constructed such that the incendiary and explosive effects are triggered after penetration of the armor. SAPHEI rounds are effective against a wide range of vehicles, but are not generally effective against personnel.

AIM-9 Sidewinder

David Monniaux (CC-BY-SA)

The AIM-9 Sidewinder is an infrared-guided (heat-seeking) short-range air-to-air missile. It first entered service in 1956, and has since become one of the most successful missiles in the West. Its longevity is thanks to its versatility and continued improvement over multiple generations.

The AIM-9 uses an array of up to five scanning infrared sensors, cooled by an internal argon bottle (L and M models). The Sidewinder has a maximum speed of over Mach 2.5 and a maximum range of around 10 to 20 miles, depending on the variant. Minimum range is around 3,000 feet.

A single AIM-9 can be mounted on any of the F-16's air-to-air stations.

AIM-9L Sidewinder. The 1977 "Lima" model was the first all-aspect Sidewinder, meaning it no longer required the target to present a rear profile. The AIM-9L earned its first kill when it struck a Libyan Su-22, after being fired from an F-14 Tomcat, in the infamous Gulf of Sidra engagement of 1981.

AIM-9M Sidewinder. The 1982 "Mike" model improved on the Guidance Control Section (GCS). Susceptibility to flares was reduced, and background discrimination was improved, resulting in a greater chance of lock-on. The motor's smoke signature was reduced, making the missile less likely to be detected.

AIM-9X Sidewinder. The 2003 "X-ray" model is the latest iteration of the Sidewinder. The X-ray adds high off-boresight (HOBS) capability and the ability to slave the seeker head to the JHMCS. The missile's maneuverability was boosted with all-axis thrust-vectoring capability. These changes allow the pilot to simply "point their head and shoot" in nearly any direction, and the missile will make its way to the target. The infrared sensor was replaced with focal-plane arrays (FPAs) and counter-countermeasures capability was improved further. Electronic fuzing was added to reduce minimum range.

CAP-9M. Captive variant of the AIM-9M. The captive variant has the same size, weight, and drag characteristics as the AIM-9M, for training effectiveness. It also contains an integrated infrared sensor, and will provide audio and visual guidance cues to the pilot, but it does not have a motor and does not release from the aircraft.

AIM-120 AMRAAM

The AIM-120 AMRAAM is an active radar homing (ARH) medium-range air-to-air missile. First introduced in 1982, the AMRAAM was intended to replace the semi-active radar homing AIM-7 Sparrow, which was the medium-range BVR missile in the US inventory at the time.

SCDBob (CC-SA)

The AIM-120 uses both command guidance and radar homing to reach its target. The AIM-120's integral radar has a comparatively short range, and so until the missile is within that range, it is guided by datalink commands sent automatically from the launching aircraft. The AMRAAM has a maximum speed around Mach 4 and a maximum range of 30 to 40 miles.

AIM-120B AMRAAM. This 1994 variant is the earliest variant still in production.

AIM-120C AMRAAM. The 1996 variant improved target detection, homing capability, and fuzing.

AGM-88 HARM

The AGM-88 High-speed Anti-Radiation Missile (HARM) is a passive radar homing air-to-ground missile used in the suppression of enemy air defenses (SEAD) role. The HARM has a radar receiver and processor that detects and identifies signals from enemy surface radars. When launched, it can guide to the target by homing on its specific radar emissions. The missile also has an inertial guidance system to provide mid-course guidance prior to detection of the radar signal (or if the signal is lost).

SSGT Scott Stewart (USAF)

The AGM-88 has a maximum speed of Mach 1.84 and an operational range of around 80 nautical miles. It uses a laser proximity fuze for detonation.

AGM-88C. This mid-1980s variant incorporates field-reprogrammable software and improved guidance and fuzing.

AGM-65 Maverick

The AGM-65 Maverick is a medium-range air-to-ground missile designed for the close air support role. The AGM-65 family contains a diverse set of variants and guidance systems, including infrared, electro-optical, and laser guidance.

The AGM-65 has a maximum range of around 13 nautical miles. It was first delivered in 1972. A single Maverick can be mounted to an LAU-117 rack, or up to 3 can be carried on an LAU-88 rack.

SSGT Glenn B. Lindsey (USAF)

AGM-65D Maverick. The D model contains an imaging infrared sensor and guidance system. The sensor is capable of locating and tracking targets during daylight and night, in clear or restricted-visibility weather conditions. It contains a 126-pound shaped-charge warhead.

AGM-65G Maverick. The G model has the same guidance system as the D model, but with a larger 300-pound penetrating warhead, making it more effective against hardened targets.

AGM-65H Maverick. The H model uses a digital CCD sensor, making it effective in daylight only. The H model is capable of forced correlation and does not require a target centroid to track. It contains a 126-pound shaped-charge warhead.

AGM-65K Maverick. The K model has the same guidance system as the H model, but with a larger 300-pound penetrating warhead.

CBU-87 CEM

The CBU-97 Combined Effects Munitions (CEM) is an unguided cluster bomb. It was first developed in 1986. Each bomb contains an SUU-65/B canister and 202 submunitions. The submunitions have both fragmentation and incendiary effects and are effective against both vehicles and personnel.

SRA Edward Braly (USAF)

After being released, the CBU-87 begins spinning. It falls to a preprogrammed burst altitude, at which point the canister separates and the submunitions are dispersed.

The CBU-87 can be mounted directly to any air-to-ground pylon, or up to three can be mounted on a TER-9A triple ejector rack.

CBU-97 SFW

The CBU-97 Sensor Fuzed Weapon (SFW) is an unguided cluster bomb containing target-discriminating submunitions. Each bomb contains a SUU-66/B canister and 10 BLU-108 submunitions. When the bomb approaches its preprogrammed burst altitude, the canister opens and all 10 submunitions are released. The submunitions deploy parachutes at preprogrammed intervals to increase lateral spacing. Once the submunitions reach the burst altitude, the parachute is separated, and a rocket motor spins the submunition and stops its descent. Each submunition contains four “skeets,” which are then released in four different directions.

Cindy Farmer (US)

The skeets have ground-facing laser and infrared sensors. Both sensors are used to detect the presence of a vehicle. When a vehicle is detected, the skeet detonates, firing an explosively-formed projectile (EFP) downward toward the vehicle. The EFP strikes the top of the vehicle (which is usually the most lightly-armored portion) and penetrates its armor at high speed.

The skeets do not detonate if a vehicle is not detected, instead becoming inert and hitting the ground. This helps reduce collateral casualties associated with the use of cluster munitions.

The CBU-97 can be mounted directly to any air-to-ground pylon, or up to three can be mounted on a TER-9A triple ejector rack.

Paveway II Laser Guided Bomb

SSGT Glenn B. Lindsey (USAF)

The Paveway II is a series of laser-guided bombs based on conventional general-purpose bombs. The guidance kit consists of a laser detector and processor in the front and a set of steering fins in the back. The bomb detects and tracks reflected laser energy off a target. The laser designation can come from the launching aircraft, another aircraft ("buddy lasing"), or from a laser-capable ground unit such as a JTAC.

The Paveway II series was introduced in the early 1970s to replace the first-generation Paveway series of laser-guided bombs. The Paveway II improved sensor reliability and added extendible rear fins to extend glide range. The Paveway II series uses "bang-bang" control (where the fins can only deflect fully in either direction), limiting its maximum range and forcing it to follow a sinusoidal path to the target.

The Paveway II series of weapons can be mounted on any air-to-ground pylon. The GBU-12 can be mounted in pairs using a TER-9A triple ejector rack.

GBU-12. Paveway II bomb based on the Mk. 82, a 500-pound conventional bomb.

GBU-10. Paveway II bomb based on the Mk. 84, a 2,000-pound conventional bomb.

Mark 80-Series General-Purpose Bomb

SSGT Randy Mallard (USAF)

The Mk. 80-series of general purpose bombs is a series of unguided bombs dating back to the Vietnam War. The bombs come in nominal weights of 500, 1,000, and 2,000 pounds. The bombs are very versatile, and they can be fitted with both nose and tail fuzes, as well as different guidance kits.

GP bombs can be fitted to any air-to-ground pylon. The Mk. 82 can also be mounted to a triple ejector rack (the TER-9A) in pairs or triples.

Mk. 82. A general-purpose bomb with a nominal weight of 500 pounds.

Mk.82 Snakeye. A Mk. 82 with retarding petals that extend after release. The petals reduce the bomb's downrange speed after release, allowing aircraft to perform low-level straight-through deliveries at lower altitudes without risk of frag damage.

Mk. 82 AIR. A Mk. 82 with an Air Inflatable Retarder (AIR). The AIR is a ballute that expands after release, performing the same retarding function as the Snakeye. The AIR is a newer technology and is more effective than the Snakeye, making the bomb safe to use at higher speeds than the Snakeye.

Mk. 84. A general-purpose bomb with a nominal weight of 2,000 pounds.

Rockets

The LAU-3 is a rocket pod that can carry up to 19 folding-fin aerial rockets (FFARs). It is designed to carry Hydra 70mm FFARs, but can carry any 70mm rocket. The Hydra 70 is a versatile rocket that accepts many different types of explosives and fuzes. The LAU-3 can be loaded on any air-to-ground pylon. In DCS, you can load the following FFAR variants:

BrokenSphere (CC-BY-SA)

MK151 HE. A high-explosive warhead with fragmentation effects, effective against personnel and light vehicles.

MK156 WP. A non-lethal white phosphorous warhead that creates a smoke effect when loaded. Used for aerial target designation.

MK5 HEAT. A high-explosive anti-tank warhead that has both fragmentation and armor piercing effects, usable against personnel and most vehicles.

MK61 WP. A white phosphorous warhead intended for training use.

WTU-1/B WP. A white phosphorous warhead intended for training use.

Fuel Tanks

External fuel tanks carry additional fuel to increase the F-16's range and combat radius. Like most munitions, the fuel tanks are capable of being jettisoned when needed. The external tanks can be refueled during air-to-air refueling. The weight of the tank depends on the amount of fuel carried.

SMSGT Edward E. Snyder (USAF)

370-gallon tank. The 370-gallon variant adds approximately 2,500 pounds of fuel. It can be carried on pylons 3 and 7.

300-gallon tank. The 300-gallon variant adds approximately 2,000 pounds of fuel. It can only be carried on pylon 5.

AN/AAQ-28 LITENING II Targeting Pod

The AN/AAQ-28 LITENING II is an electro-optical and infrared targeting pod that can be attached to the right chin hardpoint on the F-16. It includes a steerable camera with a wide zoom range, capable of daylight and nighttime target detection and laser designation.

To learn how to use the LITENING II, see TGP Activation.

BDU-33

The BDU-33 is an inert, releasable training munition with the same weight and drag profile as the Mk. 82 general-purpose bomb. Upon impact, the BDU-33 releases a smoke cloud that can be used to identify the impact point.

The BDU-33 can be loaded in sets of three on the TER-9A triple ejector rack.

AN/ASQ-T50 TCTS Pod

The AN/ASQ-T50 is a Tactical Combat Training System (TCTS) pod. It incorporates a sensor platform and datalink transceiver, allowing it to record and transmit real-time aircraft telemetry to monitoring stations. TCTS pods are used during training exercises to monitor and record aircraft positions, for many purposes, including debriefing analysis.

The TCTS pod is captive and cannot be released. It can be mounted to either outboard wingtip station.

MXU-648 Travel Pod

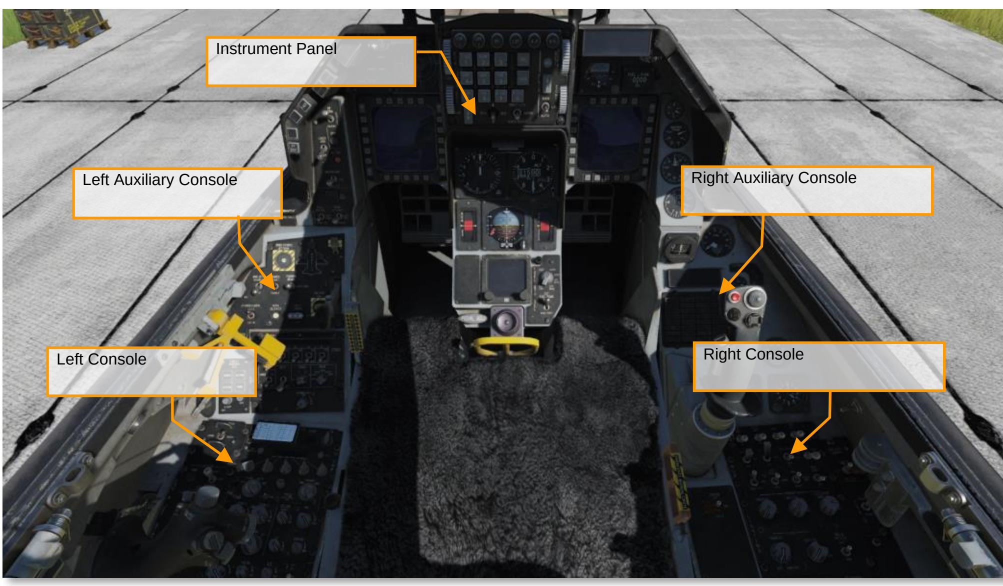
The MXU-648 is a travel pod, used to transport equipment or the pilot's belongings when the aircraft is repositioned. The MXU-648 has a maximum load capacity of 300 pounds, and an internal volume of 4.75 cubic feet.

The MXU-648 can be mounted on any air-to-ground pylon.

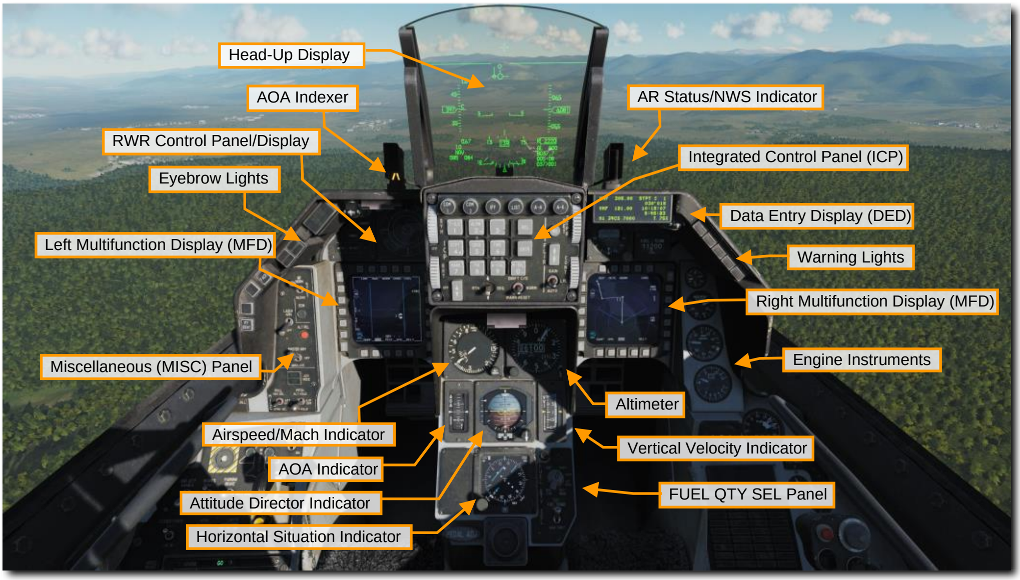
Cockpit Overview

Once in the cockpit, it's best to have a general understanding of where the various controls are located. To help locate items more easily, we have broken the cockpit into five primary areas: **Left Console**, the **Left Auxiliary Console**, the **Instrument Panel**, the **Right Auxiliary Console** and the **Right Console**.

We will reference these locations in later sections of this manual.



Instrument Panel



Head-Up Display (HUD)

The HUD provides flight symbols relating to attack, navigation, weapon, aiming, and landing modes. It also provides symbols for essential aircraft performance data including altitude, airspeed, attitude, and heading.

AOA Indexer

The angle of attack indexer consists of three lights. If the top light is illuminated with a red chevron, you are above 14-degrees of angle attack and you are pulling with an energy depleting angle of attack. If the center, green circle is illuminated, your angle of attack is between 11 and 13 degrees and you are on-speed with optimal angle of attack; and if the lower light with an amber chevron is illuminated, your angle of attack is below 11-degrees and you are energy gaining with an angle of attack less than optimum. This is duplicated on the angle of attack gauge on the instrument panel and the angle of attack bracket on the HUD, which is only visible with the gear down.

When landing, you will be shooting for between 11 and 13 degrees of AoA. Also note that these lights are always on, not just with gear down.

AR Status/NWS Indicator

The center NWS light illuminates green when nosewheel steering is engaged. When engaged, rudder pedal movement allows steering of the nosewheel. When performing aerial refueling the top ready light is blue and indicates the door is open and ready, the middle AR light is green when the refueling boom is latched, and the bottom disconnect light is displayed when a disconnect occurs.

Integrated Control Panel (ICP)

The integrated control panel, or ICP, fills the top portion of the center instrument panel and is one of the core systems of the communications, navigation, and IFF, or CNI, in the Viper. This is covered in its own section below.

Data Entry Display

The data entry display, or DED, provides a display of communication, navigation aids, and identification, termed CNI, and weapon delivery related information. Manipulation of the DED is done with the ICP.

RWR Prime Control Panel/Azimuth Display

The ALR-56M threat warning azimuth indicator is the radar warning receiver scope in the Viper. It is a plan-form design with your aircraft in the center and emitters projected 360-degrees around it. To the left of the scope are the threat warning indicator lights.

Eyebrow Lights

IFF Identification Light. Pressing the IFF identification button initiates and IFF response to an interrogation or request from air traffic control.

Fault Acknowledge Light. When a fault appears on the Pilot Fault List Display, or PFLD, the fault acknowledge button is pressed to clear the fault.

Master Caution Light. The master caution light will illuminate anytime a caution light is lit to indicate malfunction or specific condition has occurred. It can be reset by pressing on the light button.

Left and Right Multifunction Display (MFD)

The left multifunction display, or MFD, consists of a full color CRT screen with 20 surrounding option select buttons, or OSBs, in four groups of five. At the corners of the MFD are rocker switches for display gain, symbol brightness, contrast, and display brightness.

Miscellaneous (MISC) Panel

Autopilot Roll and Pitch Switches. The two autopilot switches allow you to set pitch and roll. The pitch switch can be set to ALT HOLD to maintain the current altitude, the A/P OFF setting turns it off, and the ATT HOLD setting sets the aircraft to maintain the current pitch/roll attitude. The roll switch includes the HDG SEL setting to have the aircraft turn to and maintain the heading selected with the bug on the HSI, ATT HOLD maintains the current roll/pitch attitude, and STRNG SEL directs the autopilot to steer to the selected steerpoint on the DED. Both switches can be used in unison.

ADV Mode Switch. The terrain avoidance button here is for terrain following radar and not used in the Block 50 Viper.

Master Arm Switch. The master arm switch has three positions. In the off position, weapons release is inhibited except for an emergency jettison. In ARM and SIMULATE the radar and store management system operate normally, but no weapons can be released in SIMULATE. SIM mode is normally used in training to get weapons symbology without actual release/launch, except for an emergency jettison.

ALT Release Button. The alt release button functions as a back up to the weapons release button on the control stick in case of its malfunction.

Laser Arm Switch. If a targeting pod is loaded, the laser arm switch arms the laser.

ECM Enable Light. When ECM is transmitting, the ECM light will illuminate.

RF Switch. The radio frequency, or RF, switch, is a three-position switch that allows you to control emissions from your aircraft. When set to silent, all electronic signals for the aircraft are disabled, to include the radar, radar altimeter, data link, TACAN transmit, and ECM. In quiet mode though, the radar, TACAN, and data link transmit but all other emissions are inhibited.

Warning Lights

Engine and Engine Fire Warning Lights. Along the right eyebrow are a series of split emergency lights that often require immediate action when illuminated. The Engine light will illuminate when RPM and FTIT indicator signals indicate an over-temperature, flameout, or stagnation has occurred. This means an RPM of less than 60 percent or an FTIT of 1000 Celsius or more. The Engine Fire light illuminates if a fire is detected in the engine bay.

Hydraulic and Oil Pressure Warning Light. Both the hydraulic and oil pressure lights will illuminate if the oil pressure falls below 10 psi for more than 30 seconds, or if either the A or B hydraulic system is below 1000 psi.

FLCS and DBU Warning Lights. The FLCS warning light illuminates if a malfunction is detected with the FLCS processors, power supplies, input commands or sensors, angle of attack, or air data inputs. It will also illuminate if the leading-edge flaps are locked or built in test fails. The DBU light will illuminate if the FLCS digital back up is enabled.

Takeoff and Landing Configuration Warning Lights. The takeoff and landing configuration light illuminates if the landing gear is not down when the aircraft is below 10,000 feet, the airspeed is less than 190 knots, and the descent rate is greater than 250 feet per minute. This will also correspond to the landing gear intermittent horn sound.

Canopy and Oxygen Low Warning Lights. The canopy light is lit when the canopy is not down and locked and the low oxygen light will illuminate if the oxygen system is below 5 PSI or there is a BIT test failure.

Engine Instruments

Oil Pressure Indicator. The engine is equipped with a self-contained oil system to lubricate the engine and gear box. The indicator reads between 0 and 100 PSI. Normal idle throttle PSI is around 15 when on the ground and 60 when at military power and above.

Engine Nozzle Position Indicator. The engine nozzle is variable and consists of two sections, the divergent nozzle that moves freely in conjunction with the nozzle. The nozzle is opened and closed by four hydraulic actuators and the percentage the nozzle is open is indicted by this gauge.

Engine RPM Indicator. The RPM indicator indicates engine RPM as supplied by the engine alternator. It’s expressed as a percentage value of 1 to 110.

FTIT Indicator. The Fan Turbine Inlet Temperature, or FTIT, indicates an average temperature in degrees Celsius, and it can range from 200 to 1200 degrees in increments of 100.

Airspeed and Mach Indicator

The Airspeed and Mach indicator is pneumatically powered by the pitot-static system. Airspeed is indicated by the outside gauge and pointer between 80 and 850 knots, and Mach is indicated in the window near the top of the indicator between 0.5 and 2.2 Mach. The red triangle on the indicator indicates the VNE, or velocity never exceed.

Altimeter

The altimeter is servo-pneumatic that can indicate altitudes between negative 1,000 to plus 80,000 feet. It has both a primary electrically powered mode and a secondary pneumatic mode. If in secondary mode, the PNEU flag appears on the gauge to indicate pneumatic mode.

The barometric setting knob allows you to input the desired altimeter setting, as indicated in the small window below and to the right of the digital altimeter window.

Angle of Attack Indicator

The angle of attack indicator duplicates the same information as on the angle of attack indexer next to the HUD, but ranges between -32 and +32 degrees. The tape is colored to match the indexer lights next to the HUD. The bar in the center of the tape indicates your current angle of attack in relation to the center of the tape.

Attitude Director Indicator

The attitude director indicator, or ADI, displays the aircraft’s pitch and roll attitude as supplied by the inertial navigation system, or INS. The indicator also includes a turn rate needle in which one needle width equates to 1 to 1.2 degrees per second turn rate and a ball, slip indicator.

The pitch trim knob can be used to adjust the sphere in relation to the aircraft symbol.

When the instrument landing system (ILS) is enabled, the ADI will also display localizer and glideslope bars with associated off warning flags.

Vertical Velocity Indicator

The vertical velocity indicator, or VVI, displays the rate of climb or descent on a moving tape with a range of 6,000 feet per minute in a climb or dive.

Horizontal Situation Indicator

The horizontal situation indicator, or HSI, displays a plan-view with the aircraft in the center of the display. The compass around the aircraft symbol is driven by the INS so that magnetic north is always read at the lubber line.

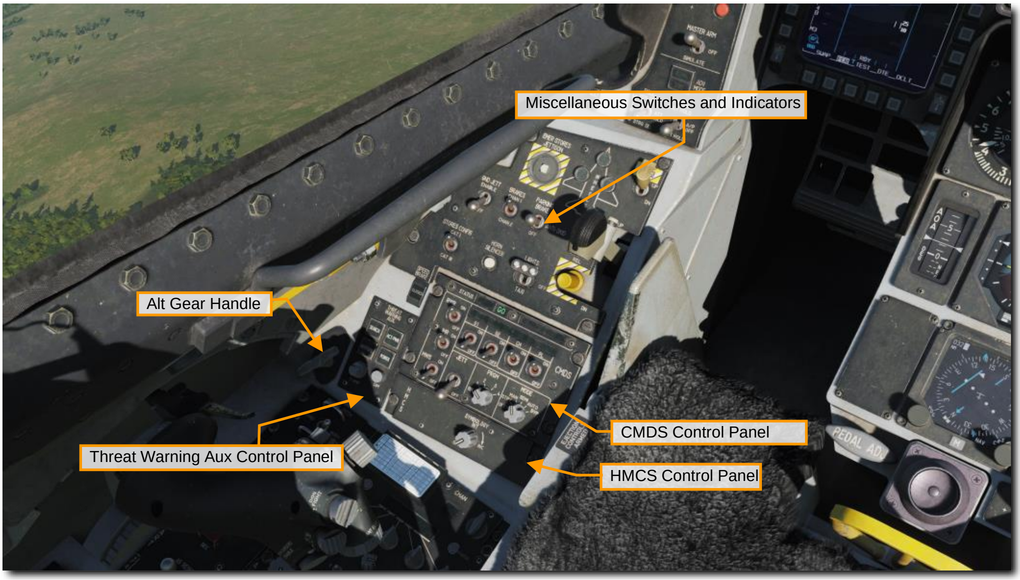
The heading set knob allows you to set the heading indicators and the course knob allows you to set the course.

Fuel Quantity Select Panel

The Fuel Quantity Select panel allows you to determine what fuel information is displayed on the fuel gauge.

- Test will place both pointers at 2000 pounds and the totalizer should display 6000 pounds. Both fuel low caution lights should illuminate.
- In NORM, the AL pointer indicates remaining fuel in the aft left reservoir and the A-1 fuselage tank, and the FR pointer indicates the sum fuel in the forward right reservoir tank and the F-1 and F-2 fuselage tanks.
- Reservoir (RSVR) moves the AF and FR pointers to display fuel in the aft and forward reservoir tanks.
- Internal Wing (INT WING) moves the AF and FR pointers to display fuel in the internal left and right fuel tanks.
- External Wing (EXT WING) moves the AF and FR pointers to display fuel in the in the wing external fuel tanks
- External Centerline (EXT CTR) moves the FR pointer to indicate the centerline external fuel tank load.
- The External Fuel Transfer switch allows you control fuel transfer from the external tanks. NORM transfers from the centerline tank then the wing tanks. WING FIRST transfers from the wing tanks first then the centerline.

Left Auxiliary Console



Miscellaneous Switches and Indicators

EMER STORES JETTISON Button. The emergency jettison button will jettison all fuel tanks, carted suspension racks, and free fall ordnance.

WHEELS Down Lights. These show the state of the mains and nosewheel. When green, the gear is down and locked. When the landing gear is transit, the landing gear handle will shine red and when the main/nose gear are in the position commanded by the gear handle, its light will turn off

HOOK Switch. This switch extends the hook for emergency arrestment on airfields equipped with an arrestment system. Once the hook is dropped though, the hook cannot be fully retracted from the cockpit.

ANTI-SKID Switch. The brake switch can be set to anti-skid or parking brake modes.

LANDING TAXI LIGHTS Switch. The landing and taxi light switch allows you to set the lights for takeoff/landing or taxi operations.

DN LOCK REL Button. The down lock override button mechanically unlocks the spring-actuated handle lock if the electrical solenoid should fail or not be powered. It overrides all electrical LG control signals.

LG Handle. Movement of the handle operates electrical switches to command landing gear retraction or extension. A warning light in the LG handle illuminates when the gear and doors are in transit or have failed to lock in the commanded position. The warning light also illuminates when all LG are not down and locked, airspeed is less than 190 knots, altitude is less than 10,000 feet, and rate of descent is greater than 250 feet per minute.

SPEED BRAKE Position Indicator. The speed brake indicator has three possible indications, closed, open, and no power. When closed the indicator displays closed, when open it has a series of nine dots, and when it has no power it has stripped lines.

STORES CONFIG Switch. The stores configuration switch has positions for CAT I and CAT III. This generally translates to CAT 1 being air-to-air load outs and CAT III being heavier air-to-ground load outs or lots of gas under the wings. When set to CAT III the FLCS limits the angle of attack and onset rates in order to increase departure resistance.

HORN SILENCER Button. The landing gear horn silence button allows you to turn off the audio horn when you get below 190 knots, below 10,000 feet, trailing flaps extended, and the landing gear is not down and locked. This generally warns you to lower the landing year, but you may also hear it if you get slow in a dogfight below 10,000 feet MSL.

GND JETT ENABLE Switch. The OFF position inhibits emergency jettison with the landing gear down and weight on wheels and inhibits selective jettison and normal release functions with the landing gear down. The ENABLE position permits all arming and release conditions, regardless of landing gear or weight on wheels conditions. This is used during maintenance operations for checkout of the aircraft armament system.

BRAKES Channel Switch. The toe brakes can be initiated by either electrical channel 1 or 2, which also operate the brake hydraulic valves. You will normally keep this set to channel 1.

CMDS Control Panel

Controls and displays related to countermeasures dispenser set are located on this panel. Modes and programs for chaff/flare dispensing and jammer use can be selected from here and activated using HOTAS controls on your stick.

Threat Warning Aux Control Panel

Controls for powering up and managing the RWR are located on this panel.

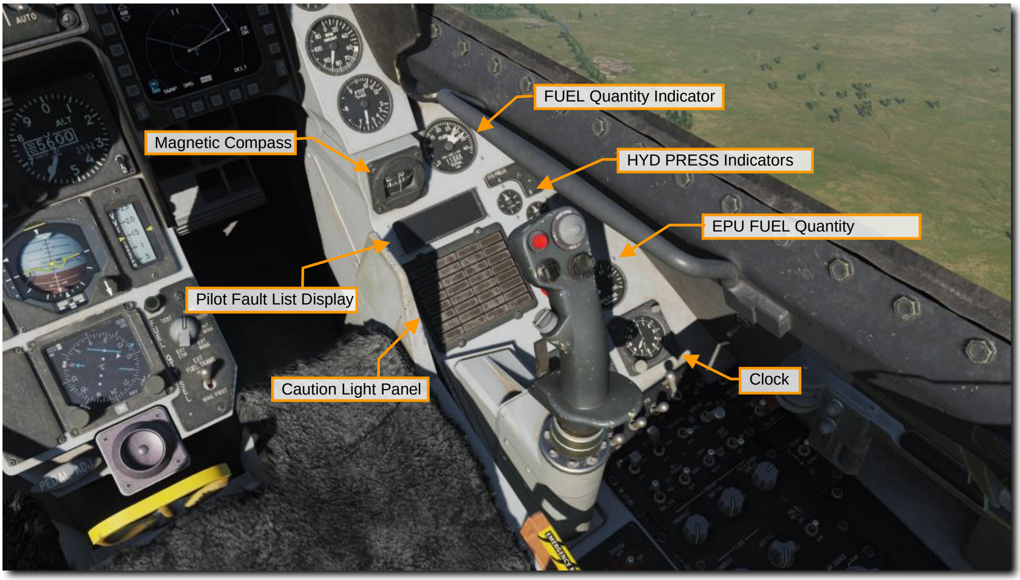
ALT GEAR Handle

The alternate landing gear release handle lowers the landing gear in case of a hydraulic failure and/or inability to lower the main landing gear handle.

HMCS Control Panel

This allows flight and weapons cue information to be displayed on the helmet visor. Rotating the knob allows you to turn it off and on and adjust its brightness.

Right Auxiliary Console



Magnetic Compass

The magnetic compass is a self-contained indicator which shows the heading of the aircraft in relation to magnetic north.

Fuel Quantity Indicator

The fuel gauge displays total remaining fuel in the digital window in pounds of fuel, and the two needles indicate fuel in the aft and left, and forward and right. If the two needles become too divergent, indicating a fuel imbalance, then red will be down at the base of a needle. In such a case, you would use the engine feed switch on fuel panel to correct the imbalance.

Hydraulic Pressure Indicators for System A and B

The hydraulic pressure in the A and B systems are indicated on the two gauges. Normal operation is between 2,850 and 3,250 PSI.

Pilot Fault List Display

The Pilot Fault List Display, or PFLD, lists all FLCS detected faults. Two types of PFLDs are displayed: warning level and caution level. Warnings are associated with the FLCS and have a bracket around them. Cautions are associated with other FLCS elements, engine, and avionics systems. When a PFLD item is displayed, its corresponding caution light indicator will illuminate and the and the master caution light will be lit. To clear a PFLD fault, the fault acknowledge button is pressed.

Caution Light Panel

The caution light panel consists of multiple lights associated with possible detected fault conditions.

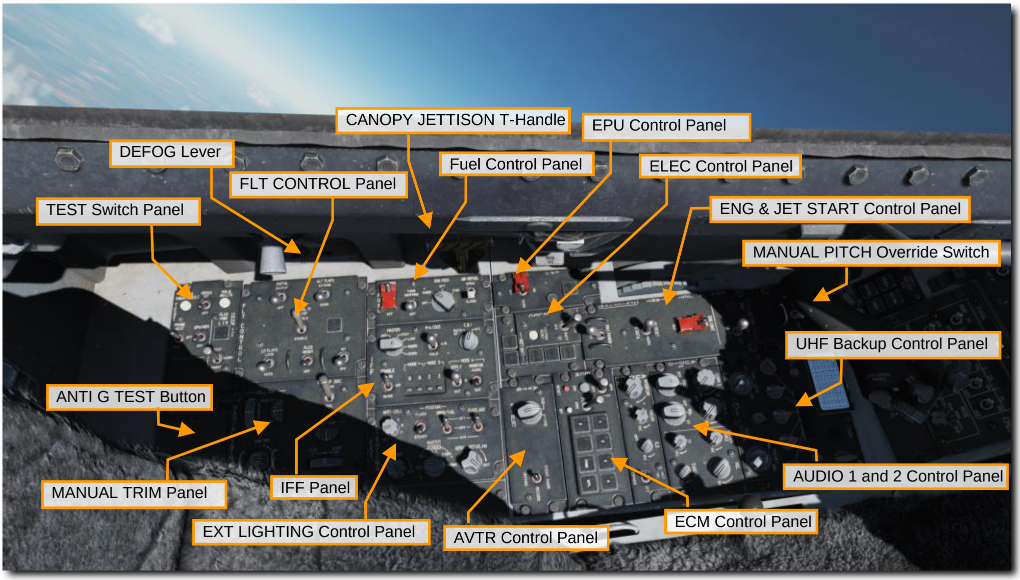
EPU Fuel Quantity Indicator

The EPU quantity indication shows the remaining supply of hydrazine as a percentage. At 100%, the EPU can run for about 10-15 minutes.

Clock

The clock is an 8-day, manually wound clock with a provision for an elapsed time of up to 60 minutes.

Left Console



Test Switch Panel

This panel includes the following controls and displays:

- A fire and overheat detection test button that tests the overheat detection system. This then triggers the overheat caution light and the engine fire eyebrow light. These in turn trigger the master caution light.
- The Pitot heat power and test switch allows heating of the data probes when in the on position. When set to test, the probe heat caution light flashes after a good test.
- A test switch for the on-board oxygen generation system (OBOGS). This will trigger the low oxygen eyebrow light.
- Emergency Power Unit, EPU, test switch tests the system after engine start.
- An indicator light test button that tests the warning and caution lights, as well as audio voice messages.
- The flight control systems, FLCS, pronounced “flickiss”, power test switch for the left and right A, B, C, and D light indicators for the four redundant flight control channels. Below it is the FLCS test power test switch, that when held to test, tests power output to the FLCS when the electrical power is first set to battery.

FLT Control Panel

As you might imagine, this panel allows you to set manual controls of the F-16’s flight control systems. Normally, you don’t have to touch most of this because Viper’s flight control systems are highly automated.

- The Digital Back Up, or DBU switch, selects the FLCS backup software. If enabled, you will see the DBU caution light and a HUD warning.
- The Alt Flap switch allows manual trailing edge flap engagement rather than the automatic schedule. You would use this if you had a flap failure with asymmetric flap settings.
- The alternate manual TF fly-up switch is for terrain following radar, and this is not used on the Block 50 Viper.
- Manual or automatic control of the leading-edge flaps is available with the LE Flaps switch. This allows the leading-edge flaps to be controlled based on the schedule or locked in place. The manual setting might be used if one lead edge flap gets stuck and you need to have both leading-edge flaps at the same setting.
- The FLCS Reset switch allows a reset of the FLCS warning and related lights, and it resets servo and electrical FLCS system failures.
- The FLCS BIT switch commands a BIT test of the FLCS if there is weight on wheels. Running the BIT test will run the flight control surface test sequence and something you'd do during start up. The switch is magnetically held to the BIT position while the BIT is run, which lasts about 45 seconds. While running, the green BIT light illuminates. Once complete and successful, the light turns off and the switch snaps back to center. A red fail light appears if a problem is encountered in the BIT, and the failure would be listed on the pilot fault list display, or PFLD.

Manual Trim Panel

Under normal flight conditions, you'll never have to use this panel as the F-16 does a great job in auto-trimming in pitch but you can trim for pitch and roll using the trim switch on the control stick.

- In the top left corner of the panel is the roll trim wheel and indicator.
- In the bottom right corner is the pitch trim wheel and indicator.
- In the bottom left corner is the yaw trim dial without indicator.
- The trim autopilot disconnect switch allows you to disable control stick trim and autopilot mode in case the trim hat on the stick malfunctions.

Fuel Control Panel

The fuel control panel includes controls for fuel system management.

- On the leftmost side is the Master Fuel switch, which is guarded. It opens or closes the main fuel shutoff valve. This is normally guarded to the on position.
- Next to it is the Tank Inerting switch that can pump non-volatile halon gas into the fuel tanks to reduce internal pressure and reduce risk for fire during an emergency… like battle damage.
- To the right of that is the Engine Feed knob that energizes or de-energizes the fuel pumps and maintains center of gravity with fuel loading.
- The engine feed dial provides you automatic or manual aircraft fuel balancing. An imbalance is indicated on the fuel gauge by a divergence between the two fuel needles. The Aft and Forward settings allow selective pump control for those fuel tanks with cross-feed. These also allow manual shifting of center of gravity. The norm position allows the fuel system to try to auto-balance, and off turns off the fuel pumps.
- On the right side of the panel is the Air Refuel switch that opens or closes the aerial refueling door on the spine of the aircraft, behind the canopy and sets the flight control gains to take-off-and land.

IFF Control Panel

The IFF control panel provides backup control of essential CNI functions and some primary functions of IFF.

EXT Lighting Control Panel

The External Lighting Control Panel controls all externally mounted lights on the aircraft.

- The anti-collision knob has an OFF and seven options that apply to the anti-collision lights when in flashing mode: 1 to 4 and A to C. These vary in their flash pattern.
- The Flash and Steady switch toggles the position lights between flashing and steady modes.
- Both the Wing/Tail and Fuselage switches have three positions that can be set to bright, OFF, or dimmed.
- In the bottom left corner of the panel is the Formation Lights Knob that controls brightness of the formation lights.
- To the right of this is the Master Covert knob that has positions for external lights overt and convert modes for night vision.
- Finally, there is the Aerial Refueling door light that sets the brightness of the light that shines on the refueling receptacle so that the air refueling boom operator can identify the receptacle during night refueling operations.

EPU Control Panel

The EPU is a hydrazine-powered, self-contained unit that can provide emergency hydraulic and electrical power for about 10 to 15 minutes. You would most often use this if you lose your engine, and the EPU would provide power to the hydraulic and electrical systems.

- At the bottom of the panel is the guarded EPU switch. In the NORM position it will operate automatically when conditions demand, like loss of both hydraulic systems and/or loss of both MAIN/STBY generators, but it can also be manually used when set to the ON position. When the EPU is running and within proper turbine range, the EPU Run light illuminates.
- The AIR light illuminates when the EPU is engaged and running on Air and not Hydrazine and the HYDRAZINE light is lit when hydrazine is used to power to the turbine.

ELEC Control Panel

The Electrical Panel selects the electrical power source for the aircraft.

- From the power switch you can select Main Power that connects external power or the main generator to the electrical system; Battery connects the battery to the battery bus; and Off disables electrical power. When starting the aircraft, you would first place the switch in battery power to run tests, and after that place that switch to main power for engine start.
- Below the switch is the Electrical Caution Reset button that can clear electrical system caution lights and resets the main and standby generators.
- On the right side of the panel are a series of lights that include an amber Main Generator light when there is no external or main generator power; an amber Standby Generator light that indicates that standby generator power is not available; an amber EPU Generator light that the EPU is running but not providing power to both emergency buses; and an amber EPU Permanent Magnet Generator that indicates the EPU has been turned on, but there is not enough power from the PMG to power all branches of the FLCS.

- Along the bottom of the panel are the Aircraft Battery Indicator Lights. The Fail light comes on if there is less than 20 volts in the battery when airborne or a battery failure on the ground; if the TO FLCS light illuminates it means that one or more FLCS branches is getting less than 25 volts while airborne or battery power is going to one or more FLCS branches while on the ground; and the FLCS RLY will illuminate if one or more FLCS branches is getting less than 20 volts or one or more are not connected to the battery.

ECM Control Panel

This panel includes controls and indicators related to ECM equipment if installed.

AVTR Control Panel

The Airborne Video Tape Recorder, or AVTR, records HUD and MFDs or helmet and MFDs depending on the setting.

ENG & JET Start Control Panel

As the name implies, the Engine and Jet Start Control Panel governs starter for the GE-129 engine and related controls.

- At the top of the panel is the Jet Fuel starter switch with OFF and START1 and START2 positions. These use one or two brake/jet fuel starter accumulators to drive the hydraulic starter motor. Using JP8 fuel, start 2 should be used.
- Next to the switch is the JFS run light that illuminates within 30 seconds after JFS initiation.
- Below is the guarded switch for Primary and Secondary engine control modes. You normally have this in primary mode unless you run into a failure of the engine's digital electronic control, in which case you can select secondary mode or you will have to cycle it to restart the engine after a flameout. Note that in secondary mode you have no afterburner. Also, in secondary mode, the sec light will illuminate on the caution panel and you will have a higher thrust at idle power.
- The max power switch at the bottom of the panel is inoperative and not used for the GE-129 engine.

UHF Backup Control Panel

While most of your radio use will be through the integrated control panel, or ICP, and data entry display, or DED, on the instrument panel, a backup UHF radio control panel is also available. It must be used before engine start as it's the sole radio that functions on battery power. This includes a door with the preset channel entry button behind it with the selected preset channel to the right of the door. To the right of that is the knob to select a preset channel.

For those familiar with our A-10C, this is the same UHF radio.

In the center of the panel are the controls to set a frequency with input dials display windows.

Along the bottom is the function knob to control radio power and mode, a tone signal button, the volume knob, squelch select, and mode select knob for manual, preset or guard frequency (243.0).

Audio 1 Control Panel

The audio 1 panel controls the power and volume of both radios, comm 1 and comm 2, and both radios have settings to disable the squelch, enable squelch, and guard setting. On the right side of the panel are controls to set secure voice volume, Sidewinder missile seeker volume, audio threat warning volume, and a TF tone knob that is not functional in the real jet.

Audio 2 Control Panel

Just below the audio 1 control panel is the control panel for audio 2, and this includes an intercom volume knob that controls communication volume for the ground crew and boom operator, a TACAN code volume, instrument landing system, or ILS, power and localizer identification signal volume, and a hot mic switch.

Manual Pitch Override Switch

In case of a deep stall departure, the pitch override switch allows you to command greater authority from the stabs to help get the nose pointed downhill so you can pick up speed for controlled flight. The guards on either side of the switch allow the pilot to better grip the switch in case of an inverted departure when hanging upside down from the seat straps.

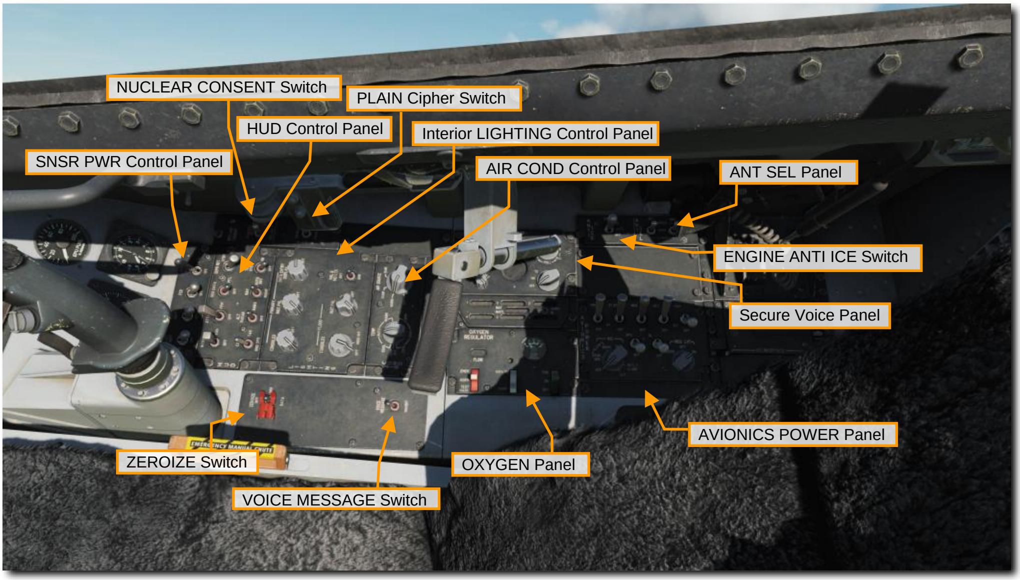
Canopy Jettison Handle

In case of emergency, you can pull the canopy jettison handle. This would be used if the primary ejection handle is pulled but the canopy fails to separate, preventing ejection.

De-Fog Lever

The de-fog lever can be moved forward and back to provide de-fogging to the canopy.

Right Console



Sensor Power Control Panel

The sensor control panel consists of four switches. They are all power switches to turn off and on power to the chin pod stations, the fire control radar, or FCR, and the radar altimeter.

HUD Remote Control Panel

As the name implies, the HUD control panel determines what and how information is displayed to the HUD. Operation is covered in detail in the HUD section below.

Interior Lighting Control Panel

The interior lighting panel consists of three knobs that turn on and control the brightness of the cockpit instruments. Most of the lighting is green to support night vision systems. The primary consoles knob controls the lighting of the left and right consoles. The primary instrument panel knob sets the lighting for the instrument panel and auxiliary panels. The primary data entry display knob controls the lighting of the DED and PFLD displays.

The dim bright switch sets the AoA indexer, nose wheel steering / aerial refueling lights, the DED, ECM control panel, MFDs, PFLD, and threat warning indicators to either bright or dim.

The flood instrument knob controls the flood light intensity on the instrument panel and the flood consoles knob controls flood light intensity on the left and right consoles.

Air Cond Control Panel

The Environmental Control System Panel is split between setting the cockpit temperature and setting the bleed air source. The temp control has no real function in a simulation, but the air source knob has options of off that closes all engine bleed air valves. NORM sets the ECS for automatic operation; DUMP dumps cockpit pressure and uses conditioned bleed air to ventilate the cockpit and avionics; and RAM dumps cockpit pressure, closes the bleed air valves, and uses ram air to ventilate the cockpit and avionics.

Secure Voice Panel

The secure voice system is used in conjunction with the UHF and VHF radios to provide secure voice communications.

Voice Message Switch

The voice message inhibit switch allows you to silence all aircraft voice messages when set to inhibit.

Oxygen Panel

The oxygen regulation panel controls the flow of O2 to the facemask. The supply lever enables the system to be off, supply air in the on setting, or also include pressure breathing for G with the PBG setting. The dilute lever can be set to normal O2 mixture or 100% 02, and the emergency lever can set the system between emergency, normal, and mask test. At the top of the panel is a gauge that indicates the PSI of the O2 system.

Engine Anti Ice Switch

The anti-ice system prevents ice buildup on probes and the engine. It is activated by placing the switch in the ON position or it can be set to AUTO and will automatically turn one if ice is detected. Off disables the system.

ANT SEL Panel

The two switches of the antenna select panel allow you to select the upper, both, or just lower antennas for IFF and the UHF radios.

Avionics Power Panel

The avionics power control panel has the following functions:

- Power to the modular mission computer, or MMC.
- Power to the store stations, or ST STA.
- Power to the two MFDs.
- Power to the upfront controls, or UFC.
- There is also a map power switch, but this is not used in the Block 50 Viper.
- Power to the GPS receiver.
- And power to the data link, or DL.

- The inertial navigation system (INS) knob has selections for off, stored and normal ground alignment, normal INS navigation, in-flight alignment (IFA), and attitude (ATT) mode. The ATT mode provides pitch, roll, and heading information only. The IFA mode allows you correct INS alignment by flying a stable attitude while the INS realigns.
- Last is the multifunctional information distribution system, or MIDS, knob that can turn off the MIDS radio or zeroize all data.

Zeroize Switch

In an emergency, the zeroize switch can erase all sensitive data from all systems like secure voice, GPS keys, and others.

HANDS-ON CONTROLS (HOTAS)

The Hands-On Controls, sometimes referred to as Hands on Throttle and Stick (HOTAS), allows control of key systems while never taking your hands off the flight controls. Switches on the throttle and stick allow hands-on interface with the fire control system and perform various weapons delivery functions. Some of these switches are multipurpose and their function at any one time depends upon master mode, weapons delivery mode, and the sensor of interest (SOI).

Stick

The primary function of the control stick is to provide pitch and roll commands to maneuver the aircraft. Pushing and pulling on the stick affects aircraft pitch (moves the horizontal tails) and moving the stick from side to side inputs roll (moves the flaperons and horizontal tails).

The stick has several buttons and hats that allow you to manipulate the various systems without having to take your hands off the stick.

WPN REL Button. Press and hold to release air-to-ground weapons, including bombs, rockets, and air-to-surfaces missiles.

Trigger Switch. Squeezing to the first detent fires the laser if a targeting pod is equipped. Squeezing the trigger past the detent fires the gun if selected and armed.

NWS A/R DISC MSL STEP Button. This button has different functions depending on the state of the aircraft:

- **Nose-wheel Steering**. On the ground, momentarily depressing the button activates and engages nose-wheel steering. Depressing the button a second time disables nose-wheel steering.
- **A/R Disconnect**. When in flight and the AIR REFUEL switch in the OPEN position, depressing the button disconnects boom latching.
- **Missile Step**. When in flight, depressing the button in EO or A-A mode selects the next weapon station. Depressing the button in A-G Mode cycles between CCRP, CCIP and DTOS. A long press of the button switches between missile types in A/A mode.

TRIM Button. Positioning the button forward and aft trims the aircraft nose up and nose down. Positioning the button left and right trims the aircraft left wing down and right wing down.

Display Management Switch (DMS). The DMS is used to control Sensor of Interest (SOI) selection.

Direction	Duration	HUD	FCR	TGP	WPN
Fwd	Short		SOI to HUD	SOI to HUD	SOI to HUD
	Long				
Aft	Short	SOI to MFD	SOI MFD Swap	SOI MFD Swap	SOI MFD Swap
	Long				
Left	Short		Next LFT MFD Format	Next LFT MFD Format	Next LFT MFD Format
	Long				
Right	Short		Next RT MFD Format	Next RT MFD Format	Next RT MFD Format
	Long				

Target Management Switch (TMS). The TMS controls target designation and data management for the radar, AGM-65 Maverick missile, and the targeting pod.

Direction	Duration	HUD	FCR	TGP	WPN	HSD
Fwd	Short	DTOS/EO-Vis Designate	RWS Spotlight / ACM BORE	Point Track	Track	Designate
	Long					
Aft	Short	Target Reject	Target Reject		Target Reject	Drop
	Long					
Left	Short		Interrogate All	Polarity Swap	Polarity Swap	
	Long		Interrogate Tgt			
Right	Short		TWS bug step / ACM rotary	Area Track		
	Long		TWS/RWS Swap			

Countermeasures Management Switch (CMS). The CMS controls deployment of countermeasures and operation of the ECM pod if installed.

Direction	Function
Fwd	Dispenses selected manual program
Aft	Gives consent in SEMI and enables AUTO dispense modes
Left	No function
Right	Disables AUTO dispense mode

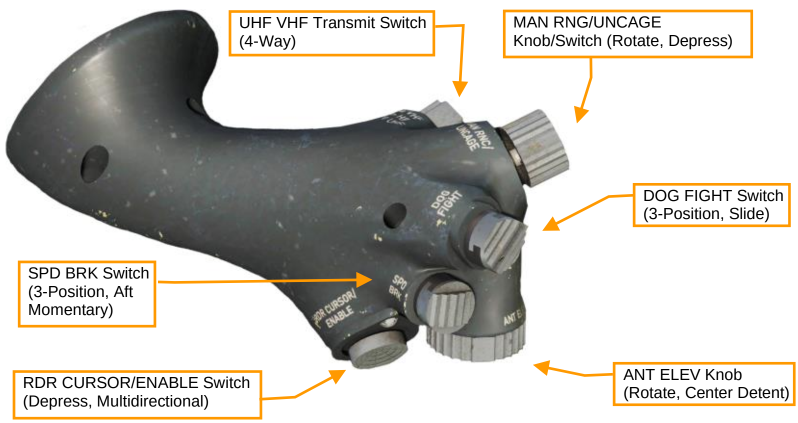
Expand/FOV Button. Pressing this button cycles through the available field-of-view for the sensor or system that is currently selected.

Paddle Switch (not shown). This switch interrupts the autopilot while switch is depressed.

Throttle

The engine is controlled by a throttle mounted above the left console with detents at OFF, IDLE, MIL, and MAX AB. The OFF position terminates engine ignition and fuel flow. The IDLE position commands minimum thrust and is used for all ground starts and air starts. From IDLE to MIL, the throttle controls the output of the engine. Forward of the MIL position, the throttle controls the operation of the afterburner.

The throttle also contains switches that provide various systems control. As with the control stick, the HOTAS functions of the throttles vary in functionality depending on the state and operational modes of the aircraft. Those are discussed in the appropriate sections of this document.



UHF VHF Transmit Switch. The switch initiates UHF (aft) and VHF (forward) transmissions. Depressing inboard (right) short (less than .5 seconds) filters datalink information on the FCR display. Depressing outboard (left) short toggles datalink tracks on and off.

Manual Range/Uncage/Gain (MAN RNG/UNCAGE) Control. This has different functions depending on the master mode and selected system. Rotating the knob controls zoom level for Targeting Pod video. Depressing the switch commands the AIM-9 or AGM-65 seeker to uncage.

Dogfight/Missile Override (DOGFIGHT) Switch. DOGFIGHT is a three-position switch that overrides any mode except emergency jettison. Returning the switch to the center returns to the last selected Master Mode.

- DOGFIGHT (outboard): This provides symbology on the HUD for both 20mm gun firing and A-A missile delivery.
- Missile Override (inboard): This position provides symbology for A-A missile firing only.

Antenna Elevation (ANT ELEV) Knob. The ANT ELEV knob is used to manually set the radar antenna elevation angle.

Cursor/Enable (CURSOR/ENABLE) Control. This control is used for slewing of the fire control radar cursor or TGP/weapon video. Depressing the control changes the BORE/SLAVE option for the AIM-9 and AIM-120 missiles in A-A master mode. Depressing the control will step through PRE/VIS/BORE options for the AGM-65 missiles in A-G master mode.

Speedbrake Switch. The open (aft) position allows the speed brakes to be incrementally opened. The closed (forward) position closes the speedbrakes.

Sensor of Interest (SOI)

The SOI is the sensor or display for which the hands-on controls are currently active. Similar functions are activated by the same switches, whenever possible, to provide consistent operation regardless of the SOI or mode selected. Further operation of these switches is detailed in the appropriate mode discussions later in this guide.

The current SOI can be identified by the box around the MFD screen or the asterisk in the top left of the HUD.

The SOI is changed from display to display with the Display Management Switch (DMS). Basic functionality as it applies to SOI is:

- **DMS FWD.** SOI transitions to the HUD if in A-G Master Mode
- **DMS AFT.** SOI transitions from the HUD to the highest priority MFD. DMS Aft again swaps SOI to the other MFD.

Sensor Point of Interest (SPI)

The sensor point of interest (SPI) is the location that all sensors onboard the aircraft are normally slaved to. Without any input from the pilot, the SPI follows the current steerpoint, and so all sensors that are slaved to the SPI will initially be looking at the current steerpoint.

The SPI can be moved off the steerpoint location by slewing the cursor of a sensor, such as the air-to-ground radar or targeting pod. When the sensor cursor is slewed, the SPI follows it, and all steerpoints offset by the slew amount. To wit, if your steerpoint #1 were directly over a road intersection, and your steerpoint #2 were 200 feet south of a tank column, and you slewed your SPI 200 feet north to put it directly on the tank column, your steerpoint #1 would now be 200 feet north of the road intersection. In fact, all your steerpoints will be shifted 200 feet north.

Steerpoint #2 is directly over a road intersection

Steerpoint #3 is 200 feet to the left of a tank column

Steerpoint #3 is slewed onto the tank column

Steerpoint #2 is now shifted to the right of the road intersection

This behavior might seem puzzling at first, but remember that prior to the availability of GPS, coordinates were not precise and navigation systems would drift over time. It is assumed that if the target steerpoint is not directly over the target, then by slewing the sensor to the target, any accumulated drift in the navigational system has been removed.

The change in SPI position caused by slewing the sensors is called “system delta.” To remove system delta, you can press the pushbutton labeled Cursor Zero (CZ), PB9 in the above picture. This will remove any delta from the system; steerpoint 2 will be back at the road intersection, and steerpoint 3 will no longer be over the tank column. The CZ pushbutton is available on most MFD sensor formats.

In addition to the system delta, some sensors (such as the AGM-65 WPN page) can have their own deltas, independent of system delta. When you slew the targeting pod cursor, it changes the system delta; however, when you slew the AGM-65 cursor, it changes only its own delta, and the system delta (and SPI) are not moved.

Both the TGP and AGM-65 start with no delta, positioned directly over the current steerpoint.

First the TGP is slewed, creating system delta and moving the SPI. The AGM-65 seeker follows the SPI.

Then SOI is moved to the WPN page and the AGM-65 is slewed. No new system delta is added, and the TGP does not move.

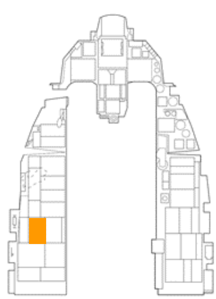
Pressing the Cursor Zero (CZ) button on the TGP page will erase system delta, moving the SPI (and the targeting pod) to the original steerpoint location. The AGM-65 maintains its own delta and does not move.

UPFRONT CONTROLS (UFC)

The upfront controls (UFC) include the Integrated Control Panel (ICP) and the Data Entry Display (DED). These provide for quick access of either navigation control, radio frequencies and channels and fire control system modes and data. Most of your time will be spent using the ICP to control these functions but less frequently used functions, such as power and audio volume, are located on console panels.

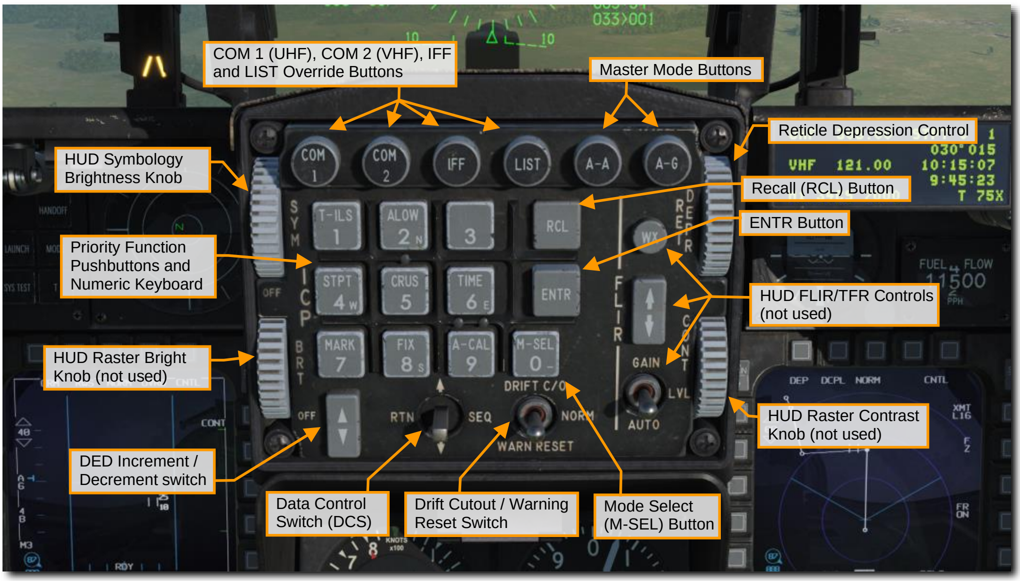
Data accessed through the ICP is displayed on the DED.

The upfront controls are available during normal operations when the C&I knob (IFF Control Panel) is set to the UFC position. This provides for control of communications, navigation, and IFF primarily via upfront controls. In the event of failure of the upfront controls, the BACKUP position provides for alternate operation of the radios and IFF, using their cockpit panels.



Integrated Control Panel (ICP)

The ICP provides master mode selection, control of communication, navigation and identification (CNI) equipment, data entry of weapons delivery related information, and HUD power/intensity control.



Master Mode Buttons. Depressing these buttons selects the Air-to-Air or Air-to-Ground master mode. This configures the aircraft systems and displays for the selected attack mode in one easy step. Depressing the same button a second time returns to the previous mode.

Override Buttons. Four override buttons provide for quick selection and control of high priority systems. These override the current DED page to show the page that corresponds to the depressed button. Depressing the button a second time returns to the previous page.

- COM 1 selects the UHF (primary) radio page
- COM 2 selects the VHF (aux) radio page
- IFF selects the IFF page
- LIST displays a list of less frequently used pages that may be selected by depressing the corresponding number on the keyboard

Priority Function Buttons. Depressing one of the nine labeled buttons on the keypad selects the associated page for that frequently used function. The keyboard may then be used to enter or change data.

Data Control Switch (DCS). This switch is used to move the asterisk on DED pages, sequence through different data fields, toggle wind data on the CNI page, and return to the CNI page from other pages.

DED Increment/Decrement Switch. This switch increases or decreases values for the field selected on the current DED page. Values that can be increased or decreased are identified by an up and down arrow next to them on the display. The DCS is used to cycle between available fields.

Mode Select (M-SEL) Button. This button is used on some pages to cycle through available modes.

Enter (ENTR) Button. Depress this to enter the numbers typed into a field with the keyboard.

Recall (RCL) Button. Depress this button once to erase the last digit that was entered, i.e. backspace key. Depress it a second time to restore the originally entered value.

Symbology Brightness (SYM) Knob. Rotate this knob to turn the HUD on and adjust the symbology brightness.

Reticle Depression (RET DEPR) Control. This knob raises and lowers the depressible reticle when it is displayed on the HUD. Values from 0 to 260 milliradians can be set.

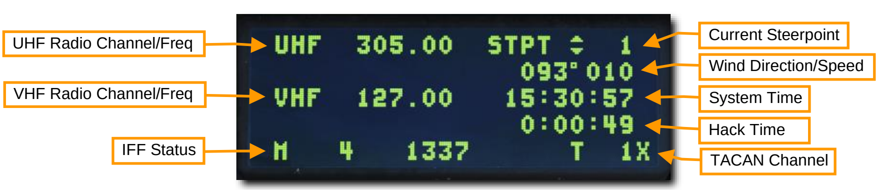
Drift Cutout (DRIFT C/O)/Warn Reset (WARN RESET) Switch. This switch is used to reset flashing warnings displayed on the HUD and to center the flight path marker and pitch line when they drift out of view from crosswinds or sideslip.

Data Entry Display (DED)

The DED shows a digital readout of communications, navigation and IFF (CNI) systems data. Different pages are called up and manipulated using the controls on the ICP as described above.

CNI Page

This page shows the current UHF and VHF channel or frequency, steerpoints, system time, IFF status, and TACAN channel. Wind data can be turned on and off by toggling the DCS switch to SEQ. Hack time is displayed below system time when enabled at the Time page. The CNI page is displayed at power-up and can be accessed any time by toggling the DCS to RTN.

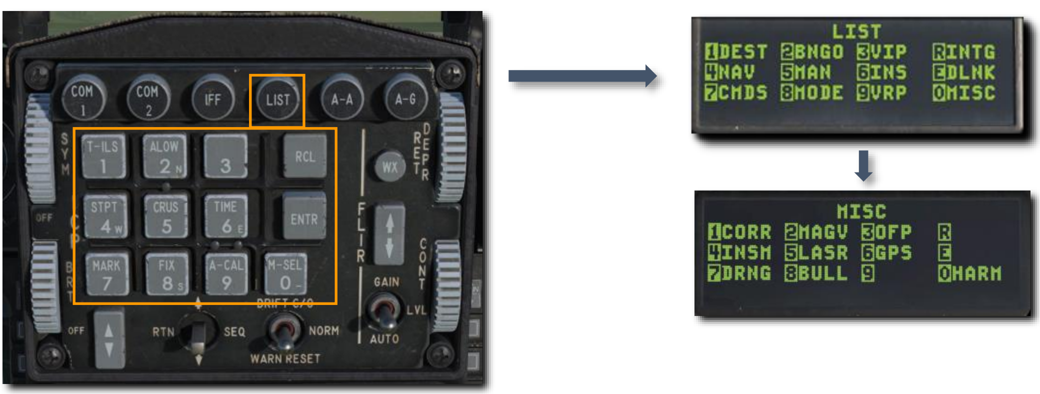


COM 1 and COM 2 Page

See the Radio Communications section for a detailed description.

LIST Page

Depressing the LIST button calls up a list of additional pages that may be accessed for display on the DED. Depress the character on the keyboard that corresponds to the desired page.



An additional list may be accessed by selecting the 0-MISC option.

T-ILS Page

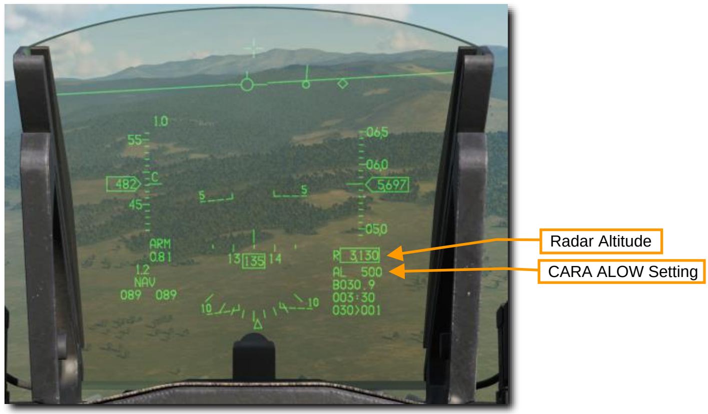
See the TACAN and ILS Navigation section for details.

ALOW Page

This page allows you to set the altitudes the ALTITUDE – ALTITUDE aural alerts that are played by the Voice Message System (VMS). It is accessed from the ALOW (2) priority function button.

CARA ALOW. The VMU provides an ALTITUDE – ALTITUDE aural warning when descending through the CARA ALOW altitude. The AL value will also flash on the HUD. This message is based on **radar altitude** and requires an operational radar altimeter to function.

To enter a new altitude, DCS up or down until the asterisks are at the CARA ALOW field. Type the new altitude with the ICP keypad and depress ENTR. The new setting will be visible on the HUD.



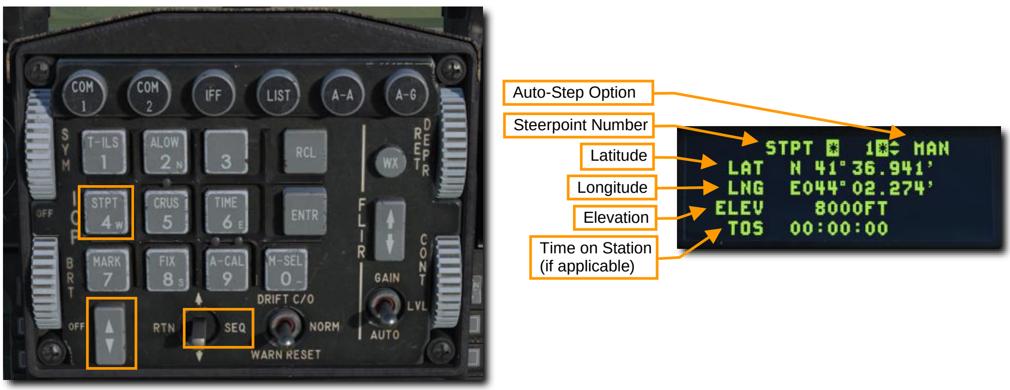
MSL FLOOR. The VMU also provides an ALTITUDE – ALTITUDE aural warning when descending through the MSL FLOOR altitude. This message is based on **barometric altitude**.

To enter a new altitude, DCS up or down until the asterisks are at the MSL FLOOR field. Type the new altitude with the ICP keypad and depress ENTR.

Both messages are inhibited when the landing gear are down.

STPT Page

This page shows information on the currently selected steerpoint. It is accessed from the STPT (4) priority function button.



Auto-Step Option. Positioning the DCS switch right to SEQ toggles between manual (MAN) and Automatic (AUTO) advancement to the next steerpoint in sequence. With MAN selected, steerpoints are selected using the Increment/Decrement switch on the ICP. With AUTO selected, the next steerpoint is selected when the aircraft is within two nautical miles of the current steerpoint and range is decreasing.

Steerpoint Number. The current steerpoint is displayed. Steerpoints may be selected using the Increment/Decrement switch or by typing in the desired steerpoint number with this field highlighted.

Latitude. The latitude of the selected steerpoint. New coordinates may be entered using the keypad when this field is highlighted.

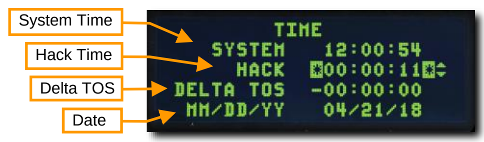
Longitude. The longitude of the selected steerpoint. New coordinates may be entered using the keypad when this field is highlighted.

Elevation. The elevation in feet of the selected steerpoint. A new elevation may be entered using the keypad when this field is highlighted.

Time over Steerpoint. If applicable, the desired time over steerpoint / time on target may be entered into this field.

TIME Page

This page shows the current date and time used by the aircraft's avionics systems. It is accessed from the Time (6) priority function button.



System Time. This is the time used by aircraft systems for navigation. System time is automatically entered into the avionics system based on GPS data. No manual entering of system time is required. However, to enter a new system time, position the DCS switch up or down until the asterisks are next to the system time field. Enter the time using the ICP keypad and depress the ENTR pushbutton.

Hack Time. This allows for an additional time reference independent of system time. Examples of its use include setting a backup time reference for local, or some other pre-arranged time or using it as a stopwatch for low level navigation.

To enter a new time, position the DCS switch up or down until the asterisks are next to the hack time field. Enter the time using the ICP keypad and depress the ENTR pushbutton. The new hack time will be displayed here and on the CNI page.

Depressing the INC/DEC switch up to INC starts the timer. Depressing it again stops the timer.

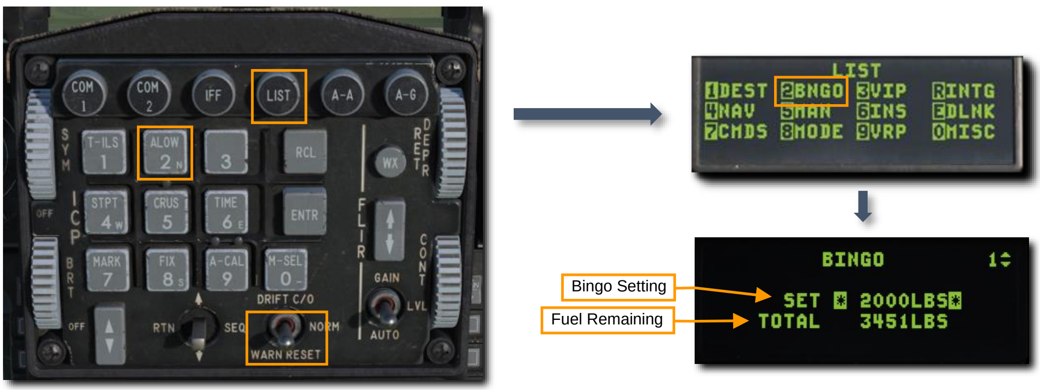
Depressing the INC/DEC switch down to DEC resets the timer to zero.

Delta Time over Steerpoint (TOS). This allows you to update the Time over Steerpoint for all steerpoints from one place. This could be useful if, for example, the planned time on target for all aircraft in a strike package changes. TOS may be updated by entering a delta TOS value on the DED. The entered time will be added to or subtracted from all TOS values. Enterable values range from -23:59:59 to 23:59:59.

Date. A new date may be entered here using the MM/DD/YY format.

BNGO Page

This page allows entry of a bingo fuel value. Voice Message and HUD warnings will be based on the amount of fuel in pounds entered here. It is accessed by selecting option (2) from the LIST menu.

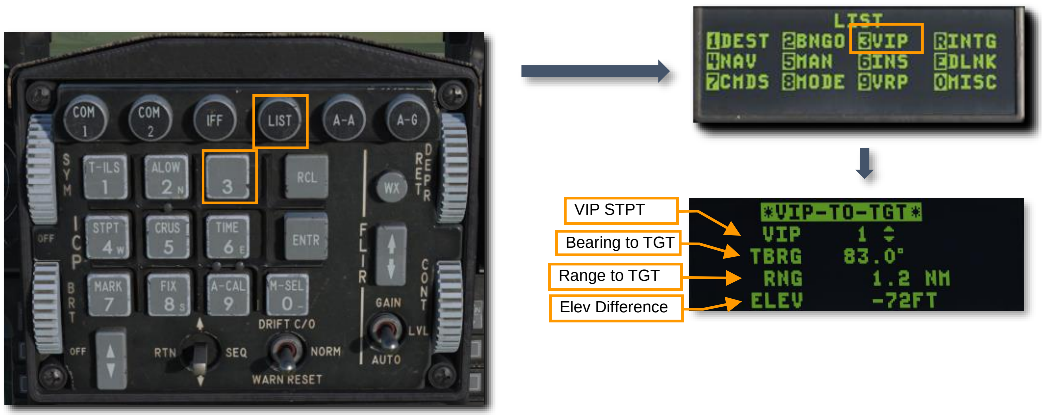


Bingo Setting. The desired bingo fuel setting may be entered here. When total fuel remaining decreases below this value, "Bingo-Bingo" will be heard through the pilot's headset, the letters FUEL will be displayed in the lower left of the HUD and the letters FUEL will flash in the center of the HUD. The flashing warning may be reset by positioning the DRIFT C/O switch on the ICP to the WARN RESET position. All three warnings may be reset by entering a bingo level lower than current fuel remaining.

Fuel Remaining. Total fuel remaining in pounds.

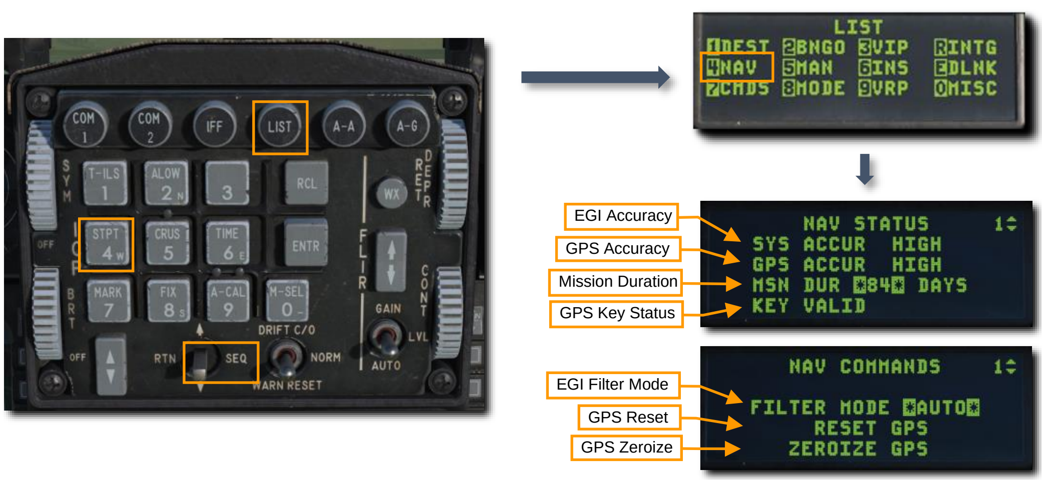
VIP Page

This page allows you to define a visual initial point (VIP) for a steerpoint. A VIP is used when the target location is known only relative to a visually-identifiable reference. See Using Visual Initial Points for more information.



NAV Page

This page shows the status and health of the navigation system. It is accessed by selecting option (4) NAV from the LIST menu. Cycle between the NAV STATUS and NAV COMMANDS page by toggling the DCS right to SEQ.



EGI Accuracy. This is an estimation of total nav system accuracy. Possible options are HIGH (less than 50 ft), MED (less than 600 ft), or LOW (greater than 600 ft).

GPS Accuracy. This is an estimation of GPS system accuracy. Possible options are HIGH (less than 300 ft), LOW (greater than 300 ft), and NO TRK (no satellites tracked).

Mission Duration. This is an enterable number that represents the desired number of consecutive days of GPS keys. This affects the GPS Key Status listed below.

GPS Key Status. The validity of loaded GPS keys for the number of entered days. Possible options are KEY VALID (valid daily keys), KEY INVALID (invalid daily keys), INSUFF KEYS (insufficient keys for entered mission duration), KEY NOT VERIFIED (key validity unknown), EXPIRE AT 2400 HRS (keys expire at next midnight GMT), Blank (no keys loaded).

EGI Filter Mode. Reception mode of the GPS receiver. This may be toggled between AUTO and INS by depressing any keypad number.

GPS Reset. The GPS Receiver may be reset by highlighting this field and depressing the M-SEL (0) button on the keypad.

GPS Zeroize. The GPS data may be erased (zeroized) by highlighting this field and depressing the M-SEL (0) button on the keypad. This erases crypto data from the GPS and INS memory.

MAN Page

See the Air to Air Gunnery section for a detailed description.

INS Page

See the INS Alignment section for a detailed description.

DLNK Page

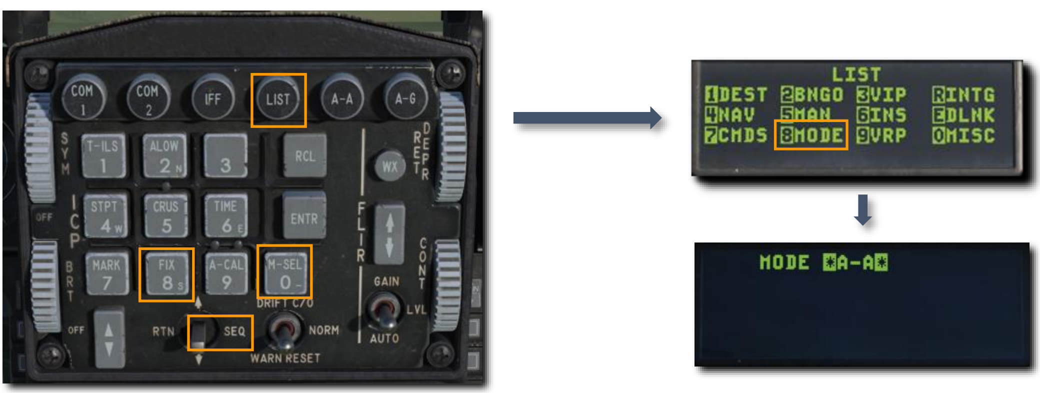
See the Link 16 Datalink section for a detailed description.

CMDS Page

See the Defensive Systems section for a detailed description.

MODE Page

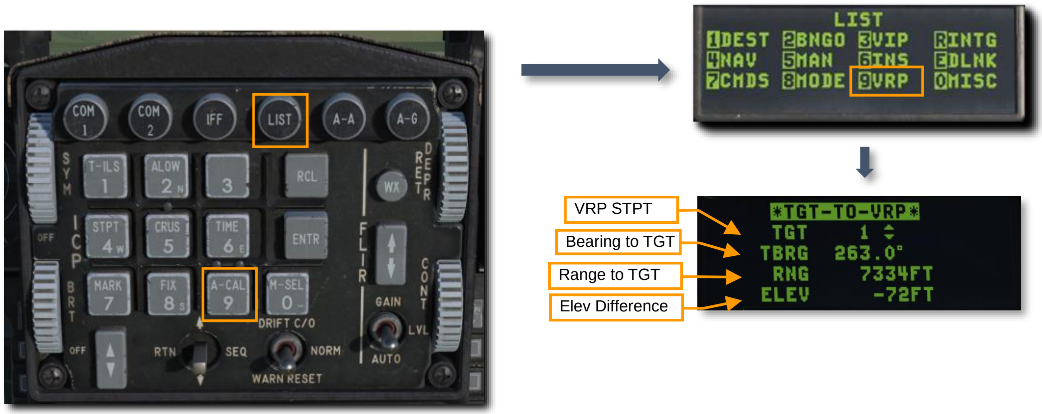
This page allows a backup capability to change master modes in the event of a master mode button failure. It is accessed by selecting option (8) MODE from the LIST menu.



Depressing any ICP number key or sequencing the DCS switch right to SEQ toggles the highlighted field between A-A and A-G. Depressing the M-SEL (0) key selects that master mode.

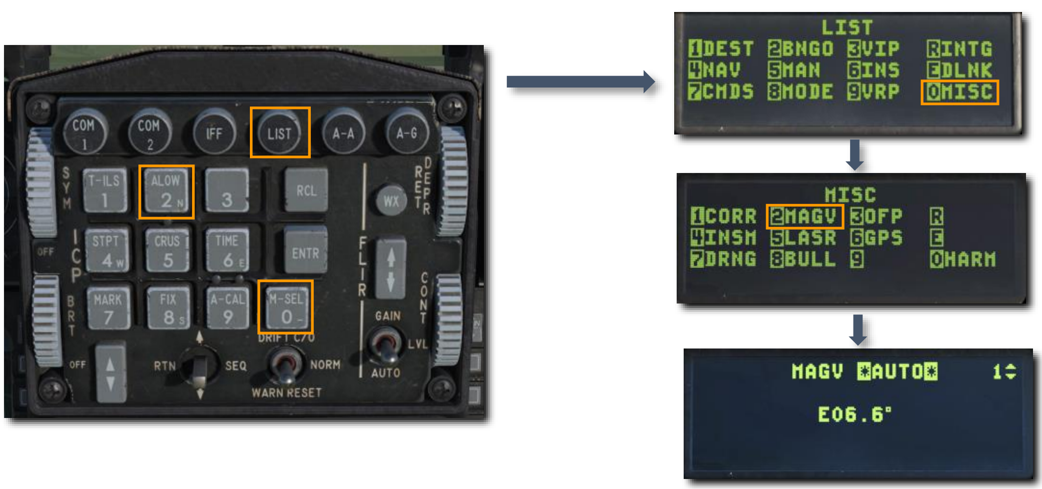
VRP Page

This page allows you to define a visual reference point (VRP) for a target steerpoint. A VRP is to indicate a location relative to the target steerpoint on the HUD. See Using Visual Reference Points for more information.



MAGV Page

This page allows manual entry for Magnetic Variation, or number of degrees between magnetic north and true north. This data is used by the aircraft navigation system. It is accessed by selecting option (0) MISC from the LIST menu, then pressing 2 to select the MAGV page.



Two options are available: **AUTO (automatic)** and **MAN (manual)**. These may be toggled by pressing any number key on the ICP or positioning the DCS Switch right to SEQ.

In AUTO, magnetic variation is set based on values stored in the navigation system for the aircraft location. In MAN, a new value may be entered manually by highlighting the field and entering the desired value.

LASR Page

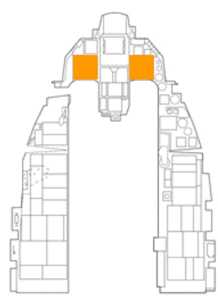
See the Targeting Pod section for a detailed description.

MULITFUNCTION DISPLAYS (MFD)

Two color multi-function displays (MFD), left and right, provide video and text data for the following systems:

- Fire Control Radar
- Targeting Pod
- AGM-65 Weapon Video
- Stores Management Set
- Horizontal Situation Display
- Data Transfer Equipment
- Tests
- Flight Controls

Systems are controlled through option select buttons (OSBs) around the display screen of each MFD. Each OSB interacts with the text displayed next to it to toggle through functions or select different sub-pages.



Horizontal Situation Display (HSD)

The HSD displays a plan-view of your current tactical situation with the symbols representing your aircraft position (Ownship), current steerpoint, active flight plan, and range rings.

Tactical information is also displayed based on pre-planned threat locations, information received through onboard sensors, or information received through the Link 16 datalink. See the section on Link 16 for details.

Stores Management Set (SMS)

The Stores Management Set (SMS) MFD page and subpages allow for viewing, configuration and status monitoring of loaded stores. Different options are available depending on the type of weapons that are selected. An Inventory page is available that shows the stores loaded on each station and allows modification if required. A Selective Jettison page is also available that allows selected stores to be jettisoned in an unarmed state.

Functions of the SMS page that relate to normal employment of weapons are covered in the following sections:

A/A Guns SMS Page

AIM-9 SMS Page

AIM-120 SMS Page

Bombs SMS Page

A/G Guns SMS Page

Rockets SMS Page

Inventory Page

Stores inventory can be viewed or changed by selecting the OSB adjacent to INV. This displays loaded stores by station, starting with station 1 at the bottom left, and ending with station 9 at the bottom right. The type of gun ammunition and number rounds remaining is displayed at the top right.

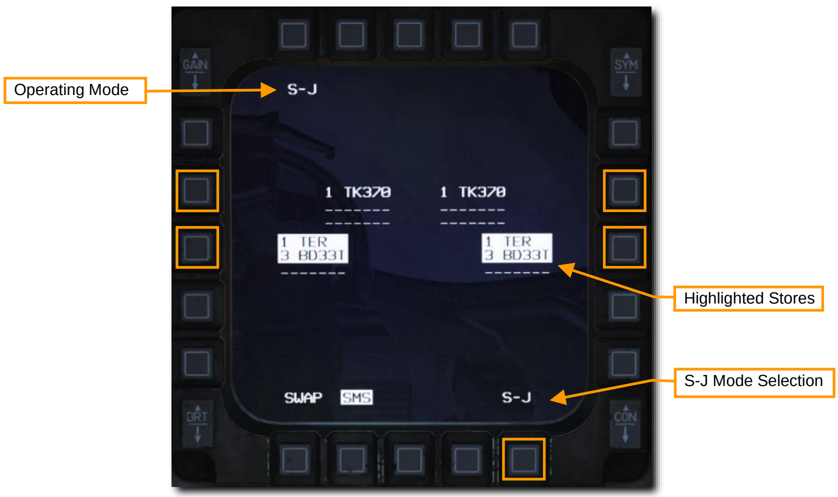

Inventory Page Selection
Gun Rounds Remaining and Type
Station 5
Station 4
Station 6
Station 3
Station 7
Station 2
Station 8
Station 1
Station 9
CCIP
INV
80GUN
M56
1 TK370
1 TK370
1 MAU
1 TER
3 BD33T
1 MAU
1 TER
3 BD33T
1 MAU
1 TA9LM
SWAP
SMS
HSD
S-J

Selective Jettison (S-J) Page

This page allows jettison of selected stores in an unarmed state. This provides more flexibility in the stores that are jettisoned than is available with the Emergency Jettison button, that jettisons all jettisonable stores.

The S-J Page is accessed by selecting the OSB adjacent to S-J at the bottom right. Jettisonable stores are displayed and available for selection. Depressing the OSB next to the store highlights it for jettison.

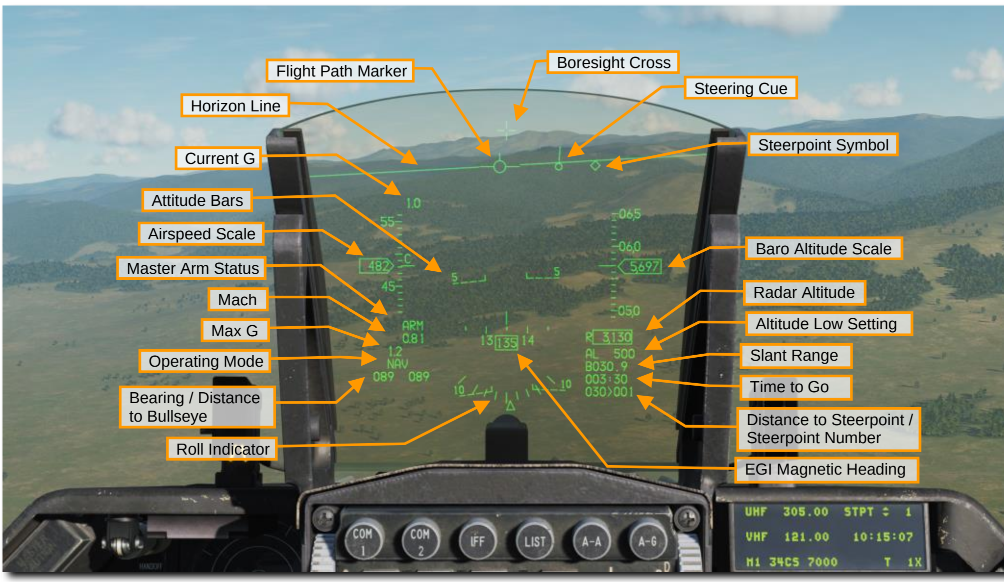
If more than one jettisonable store is loaded on a station, for example stores on a TER-9 rack, one depression of the OSB highlights the store and another depression highlights both the store and the rack.



The highlighted stores are jettisoned when the Weapons Release button on the stick is depressed.

HEAD-UP DISPLAY (HUD)

The Head Up Display, or HUD, is one of your most important instruments and provides valuable information as to your aircraft flight performance and weapon / sensor information. In later sections of this guide we will discuss aspects of the HUD that are specific to certain weapons and sensors, but the HUD does have a common set of information that is almost always displayed.

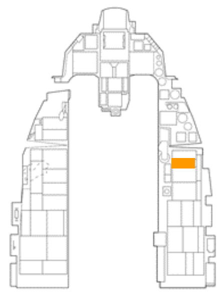


All information is displayed on a combining glass mounted in the forward field of view at eye level. The symbology is focused at infinity and superimposed upon the outside world along the flightpath of the aircraft. The HUD remote control panel (right console) provides control of the HUD set.

Together, the remote and integrated control panels control the symbology displayed. HUD data is displayed as a function of the selected master mode and submode. The display surface field of view is 25° in diameter, and extends down to a line 10.5° below the FOV center.

HUD Remote Control Panel

As the name implies, the HUD control panel determines what and how information is displayed to the HUD. The panel consists of eight switches.



Scales Switch. When set to VV/VAH, the vertical velocity scale, velocity scale, altitude scale, and heading tape are displayed. When set to VAH, all the scales are displayed except the vertical velocity scale. Off removes all scales but digital readouts.

Flightpath Marker Switch. When set to ATT/FPM displays both the flight path marker and attitude reference bars. When set to FPM, just the flight path marker is displayed. Off removes both.

DED Data/PFL Switch. This switch allows data from these displays to visible on the HUD, based on DED or PFLD selection. Off displays neither.

Depressible Reticle Switch. The depressed reticle switch controls selection of the primary and secondary standby reticles on the HUD. Standby displays the standby reticle and removes all other HUD symbology. Primary displays the primary reticle but does not remove any HUD symbology. Off does not display either reticle.

Velocity Switch. The airspeed switch allows airspeed to be displayed as calibrated airspeed, true airspeed, or ground speed.

Altitude Switch. This switch allows the altitude tape to indicate radar altitude, barometric altitude, or automatic. When set to automatic, radar altitude is displayed when above ground altitude is below 1,500 feet and barometric altitude when above.

Brightness Control Switch. The HUD brightness switch has default brightness settings for day and night and an auto brightness function that will adjust accordingly.

Test Switch. Displays a test pattern in ON. The TEST STEP position steps through the four different test patterns.

NAVIGATION

USAF Photo
by MSgt Burt Traynor

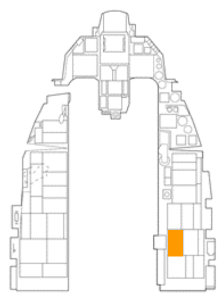
The F-16C uses a variety of navigation methods to direct you to mission locations. Depending on the mission or stage in the mission, you may use different navigation sources. While we have reviewed many of the navigation systems in the Cockpit Controls chapter, this Navigation chapter will review the practical application of these systems.

Embedded GPS/INS (EGI) Navigation

The EGI is the primary navigation system of the F-16C and provides accurate attitude, navigation, and vertical and horizontal steering information. The Up Front Controls (UFC) are the primary interface device to the EGI. In this Navigation chapter we will discuss the practical application of using the EGI for navigation purposes.

INS Alignment

The navigation system can be aligned by a variety of methods on the ground or in the air. This is started by positioning the INS knob on the Avionics Power panel to the desired position. The INS knob is set to NAV when the alignment is complete.



The **Normal (NORM)** Alignment is the primary alignment mode. The NORM alignment requires approximately eight minutes to fully accomplish.

The **Stored Heading (STOR HDG)** Alignment allows for a quick alignment in 90 seconds or less in some conditions. This can only be used if the aircraft has been set up specifically for this alignment beforehand.

An **Inflight Alignment (INFLT ALIGN)** places the INS in ATT mode and performs an in-flight alignment. The pilot must hold the aircraft steady and level during this process.

In **Attitude (ATT)** mode, only attitude and heading information is given to the avionics.

Normal Gyrocompass (NORM) Alignment

A full INS alignment in the NORM position should be accomplished prior to every flight. This is normally started just after engine start and avionics power-up to allow time for the full alignment to complete prior to taxi.

1. Position the INS knob to the NORM position.

This begins the INS alignment and calls up the INS page on the DED. The progress of the alignment may be monitored from here.

Time Into Alignment. This is the elapsed time in minutes and decimal seconds since the INS alignment began.

Alignment Status. This is an estimate of the alignment quality. Values count down from 99 with the following meanings:

- 99 – Initialization
- 90 – Valid attitude data, coarse align begins
- 79 – Valid heading data
- 70 – Degraded navigation state, steady RDY displayed on DED, steady ALIGN displayed on HUD
- 60-20 – Circular error probability (CEP) multiplier compared to fully aligned state; 60 = 6.0 times normal CEP, 20 = 2.0 times normal CEP
- 10 – INS fully aligned, RDY flashes on DED, ALIGN flashes on HUD
- 6 – INS fully aligned and enhanced to 0.6 times normal precision with GPS data or other techniques

Latitude. Latitude of start position.

Longitude. Longitude of start position

System Altitude. Altitude used by the fire control computer for air to ground weapons delivery

True Heading. Last known true heading or heading derived during alignment

Ground Speed. Current ground speed.

2. Enter the latitude, longitude and altitude for the starting location.

The last known coordinates and estimate of altitude are displayed when the alignment begins, however the data must be re-entered even if it is still correct.

If the data is accurate, use the DCS switch to highlight each line and press ENTR for each in turn. If the data is not accurate, enter the correct data for each field with the ICP keypad.

Failure to enter the data will flag the alignment as degraded and not allow important monitoring functions to take place. Navigation, weapons delivery and targeting pod pointing errors may also result.

The alignment will stop and start again if the data is entered later than two minutes into the alignment.

3. Monitor alignment progress and switch INS knob to NAV.

The RDY on the DED and ALIGN on the HUD will begin to flash when the alignment is complete. This should happen in 8 minutes or less. Position the INS knob to NAV to accept the alignment.

Stored Heading (STOR HDG) Alignment

A Stored Heading alignment option is available to allow a faster INS alignment in certain situations. This can be useful for 'scramble' missions or for situations when your play time is limited.

This alignment assumes a full gyrocompass alignment was already performed before the aircraft was last shut down and the aircraft has not been moved. The previously computed true heading is stored in the Inertial Navigation Unit (INU), a component of the INS, and is used to give the alignment process a head start. The new alignment should take about 90 seconds.

1. Position the INS knob to the STOR HDG position.

This begins the INS alignment and calls up the INS page on the DED. The progress of the alignment may be monitored from here just as on a normal alignment.

2. Verify, but **<u>do not enter</u>** the latitude, longitude, altitude and true heading for the starting location.

3. Monitor alignment progress and switch INS knob to NAV.

The RDY on the DED and ALIGN on the HUD will begin to flash when the alignment is complete. This should happen in about 90 seconds. Position the INS knob to NAV to accept the alignment.

Inflight (INFLT) Alignment

It is possible to lose your INS alignment inflight due to electrical failure, battle damage or switchology errors. A new alignment may be obtained while airborne provided the INS is functional and GPS data is available. If GPS is not available, the inflight alignment will not complete.

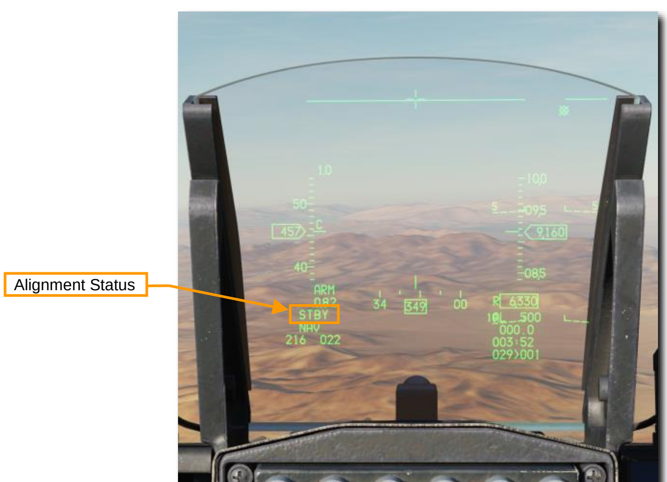
1. Position the INS knob to OFF for 10 seconds.

2. Maintain straight, level and unaccelerated flight.

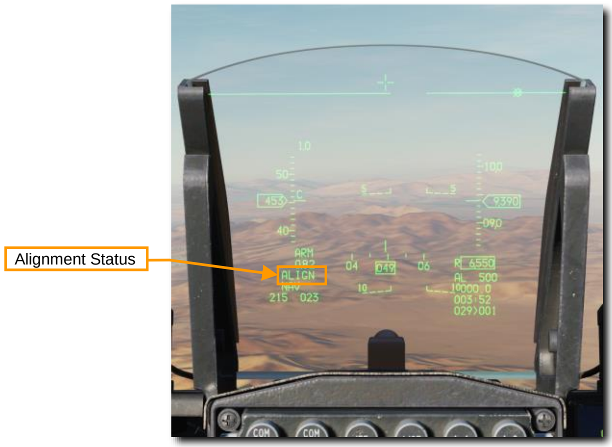
3. Position the INS knob to the INFLT position.

This begins the inflight INS alignment and calls up the INFLT ALIGN page on the DED. No action or data entry is required on this page if GPS data is available. An initial heading may be entered based on magnetic compass reading or other outside sources but this is not required.

The STBY mnemonic will replace the max G indication in the HUD, showing that coarse alignment of the inertial platform is in progress. Horizon line, pitch ladders and compass information may be displayed but will not be accurate.



4. Maintain straight, level and unaccelerated flight for approximately one minute, until ALIGN appears in the HUD.

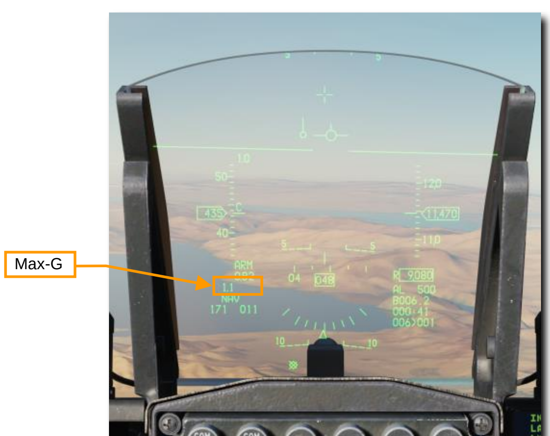


This indicates that coarse alignment is complete and fine alignment is in progress. Attitude information becomes available in the HUD and ADI, and the aircraft may be maneuvered normally.

Shortly after attitude information appears, the flight path marker, steering cue, aircraft heading, and HSI navigation data become available. Reliability of the data increases as the alignment progresses.

5. Switch INS knob to NAV after Max-G replaces ALIGN in the HUD.

Replacement of ALIGN with Max-G shows that the alignment is complete. The mission may proceed normally from there.



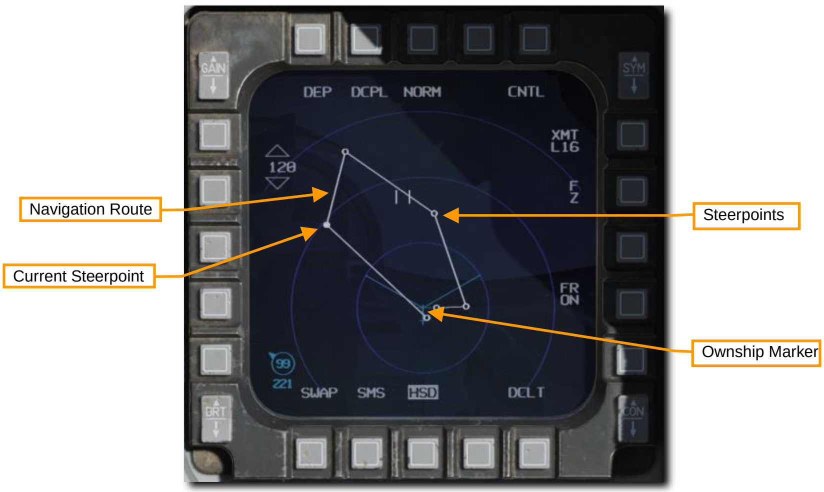
HUD Indication

You can view your current heading on the top or bottom of the HUD, depending on the selected master mode. The heading scale shows your current magnetic heading indicated by the central caret.

The Steering Cue shows the heading to your selected steerpoint. If you turn the aircraft to align the Flight Path Marker with the Steering Cue, you will be flying to your steerpoint.

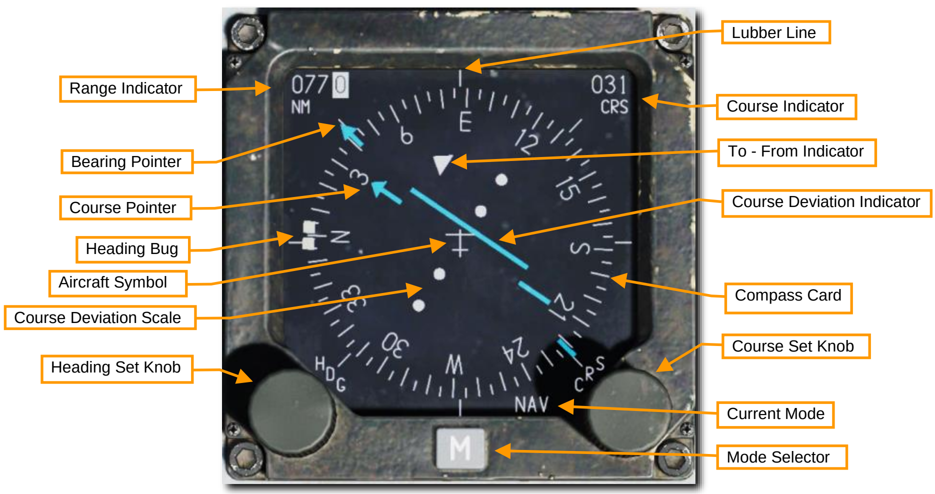
Horizontal Situation Display (HSD) Indication

When there is an active steerpoint, it will be displayed on the HSD as a solid circle. Other steerpoints will be displayed as empty circles with lines connecting them all to show the route. The ownship marker shows your aircraft's current position.



Horizontal Situation Indicator (HSI) Indication

The HSI is your primary gauge to assist in navigation to steerpoints, TACAN beacons, and radio beacons. While you will likely be using HUD symbology for most of your navigation purposes, a firm understanding of the HSI is necessary for access to additional navigation data that is not present on the HUD or DED displays, and in case of battle damage.



Compass Card. Arrayed around the periphery of the HSI, this is a compass that rotates such that the top of the compass indicates the aircraft's magnetic heading.

Aircraft Symbol. In the center of the gauge is the aircraft symbol that always remains static. All HSI displays are in reference to this symbol.

Lubber Line. This is a fixed line that runs from the aircraft symbol to the top of the gauge. This line represents current aircraft heading in relation to the compass card.

Range Indicator. Indicating range in nautical miles, this three-place drum indicator provides slant distance from your aircraft to the selected steerpoint or TACAN station.

Bearing Pointer. This arrow-shaped indicator moves around the outside of the compass card and points to the current steerpoint or TACAN station. Located 180-degrees from the Bearing Pointer head is the tail that represents the reciprocal bearing.

Heading Set Knob. Located in the lower left portion of the gauge, when rotated, this knob allows you to set the position of the Heading Marker on the compass card.

Heading Bug. Shown as two thick lines on the outside of the compass card, this marker can be moved around the compass card using the Heading Set Knob. After being set, this marker rotates with the Compass Card to provide a heading to the selected magnetic bearing.

Course Set Knob. Positioned in the lower right corner of the gauge, this knob, when rotated, allows you to set the course numeric in the Course Selector Window and move the course pointer around the compass card.

Course Indicator. This window displays the course set using the Course Set Knob numerically in degrees.

Course Pointer. Set by the Course Set Knob, these two lines represent the set course and reciprocal course on the compass card.

Course Deviation Indicator. This line that runs through the center area of the gauge provides an indication of how accurately you are flying on the set course line. When the line runs through the aircraft symbol in the center of the gauge, you are on course. If it is to either side, you need to correct your heading to place the aircraft back on the course line.

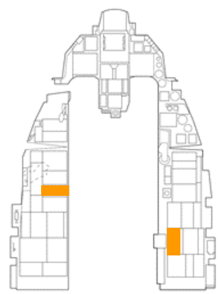
To-From Indicator. These two triangles along the intended course line indicate the course the aircraft will fly to or away from the selected TACAN station or steerpoint.

TACAN (TCN) Navigation

The Tactical Air Navigation (TACAN) system is a world-wide array of omni-directional beacons with unique frequency codes used primarily by military aircraft. Civilian aircraft use a similar system called VOR's (VHF omni-direction Beacon) on a different frequency range. Many VOR stations are collocated with a TACAN. These stations broadcast both signals so they can be used by military and/or civilian aircraft. These stations are known as "VORTACS".

TACAN beacons can not only be set on the ground, but they can also be attached to aircraft and even ships (aircraft carriers). TACAN serves as a useful means to quickly navigate to a defined location.

The TACAN is part of the MIDS terminal and must be activated by rotating the MIDS LVT knob on the Avionics Power Panel to the ON position. TACAN audio tone volume is controlled on the AUDIO 2 panel.



The currently selected TACAN station is always displayed on the bottom right of the DED CNI page. You can see station 1X is selected in this example.

Before navigating using TACAN though, you will want to do the following:

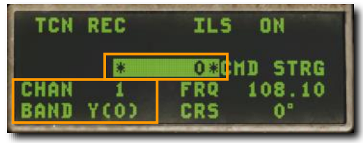
Select TACAN Station

1. To select a new station, depress the T-ILS priority function button on the ICP. That displays the TACAN/ILS page on the DED. Information on the TACAN system is displayed on the left half of the page.

2. On the ICP, toggle the DCS switch down to highlight the CHAN field. Use the ICP keypad to type in the new channel. Press ENTR to accept the changes.

In this example, channel 25 is entered. The system has identified it as beacon GTB, a TACAN station at Tbilisi.

3. If required, you may change the band by typing 0 (M-SEL) into the CHAN field or scratchpad and depressing ENTR. This toggles the band between X and Y.



4. On the ICP, toggle the DCS right to cycle through the following options: REC, T/R, A/A REC, or A/A TR.

REC. The TACAN operates in receive mode only and provides bearing, course deviation, and station identification.

T/R. The TACAN acts in a transceiver mode (send and receive) and provides bearing, range, deviation and station identification. This will be your most common selection.

A/A REC. TACAN operates in Air-to-Air mode and can only receive bearing, course deviation and station identification for a TACAN-equipped aircraft.

A/A T/R. TACAN operates in Air-to-Air transceiver mode and provides bearing, range, deviation, and station identification with a TACAN-equipped aircraft.

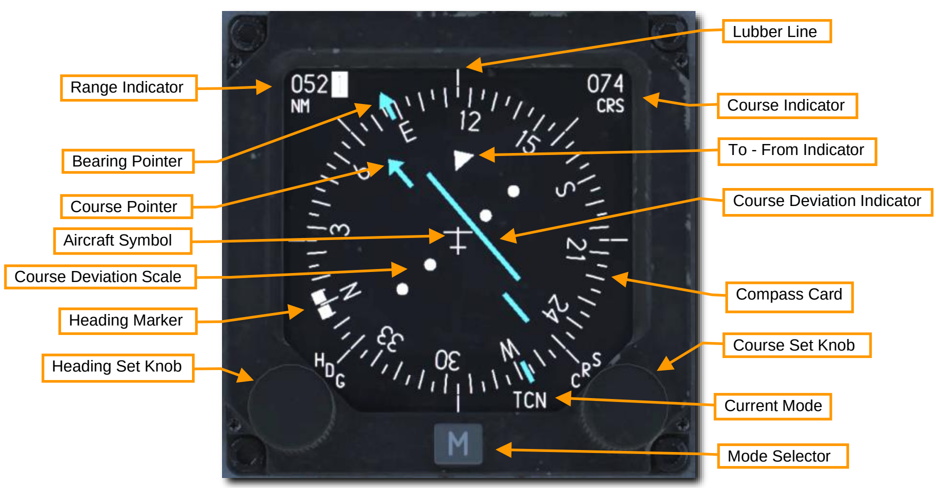
In most cases, you will keep the TACAN set to the T/R mode.

5. Toggle the DCS left to RTN. This will return you to the CNI page where your new TACAN channel is displayed at the bottom right.

Navigate to Selected TACAN Station

Once a valid TACAN station has been entered on the DED, the station is within operative range, steering information is available on the HSI.

Press the Mode selector until TCN is displayed in the Current Mode field. Operation is identical to steerpoint navigation except the bearing pointer points to the TACAN station instead of the steerpoint.



Note: TACANs are considered reliable for only 130 nm, so the maximum distance between TACAN stations is generally 260 nm.

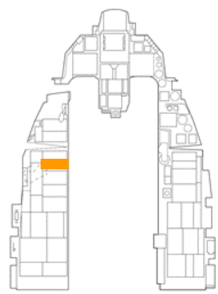
Instrument Landing System (ILS) Navigation

The landing approach using the Instrumented Landing System (ILS) is generally used under Instrument Flight Rules (IFR) conditions due to night or bad weather. When used, the ILS provides vertical and horizontal steering information to help you fly down the correct glide slope and heading to a safe landing. The ILS frequency is set using the Up Front Controls (UFC) and ILS steering is selected on the HSI. Steering information is then presented on the HUD, ADI and HSI instruments. The ILS provides steering for a straight in approach.

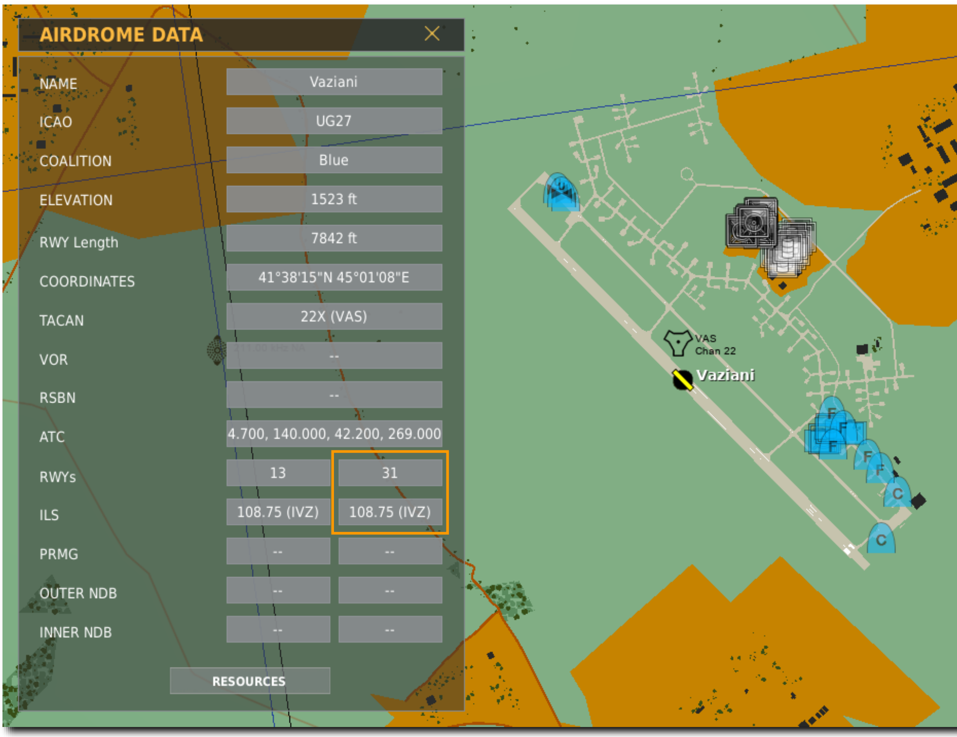
In addition to the instrument indications, the ILS has a localizer audio signal. The ILS provides an audio cue when flying over either the outer or inner marker beacons. You can control the audio levels on the Audio 2 control panel.

Most, but not all runways, allow landings from either direction but will depend on the wind direction. The ILS system should be used for the appropriate landing runway as directed by ATC.

The ILS system must be activated by rotating the ILS knob on the Audio 2 Control Panel out of the OFF position.



The ILS operates between 108.1 and 111.95 MHz. The frequency for any runway equipped for ILS may be seen on the Mission Planner map before mission start or in-game using the F10 map view. Click any airfield and the information will be displayed.



In the next example, we will set the system up for a landing at Vaziani runway 31, using frequency 108.75.

Select ILS Frequency

1. To select a new station, depress the T-ILS priority function button on the ICP. That displays the TACAN/ILS page on the DED. Information on the ILS system is displayed on the right half of the page.

2. On the ICP, toggle the DCS switch down to highlight the FREQ field. Use the ICP keypad to type in the new frequency.

Press ENTR to accept the changes.

3. Then, toggle the DCS switch down to highlight the CRS field. Use the ICP keypad to type in the localizer course.

Press ENTR to accept the changes.

In this example, we set the system up for a landing at Vaziani runway 31, using frequency 108.75. CMD STRG is highlighted indicating the ILS signal is being received.

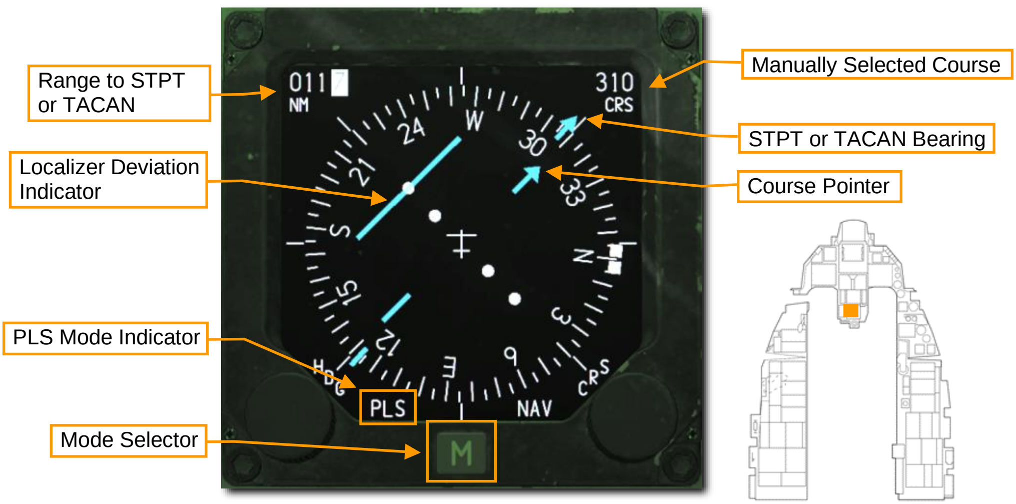
Navigate with ILS Glide Slope and Localizer

Once a valid ILS station has been entered, the station is within operative range, and ILS is selected as the activate navigation mode, you will be provided steering information on the ADI and HSI to the selected station (much like TACAN).

Selecting one of the PLS (Precision Landing System) modes on the HSI is required before ILS deviation data (localizer and glide slope) can be displayed on the HSI, HUD, and ADI.

HSI Indications

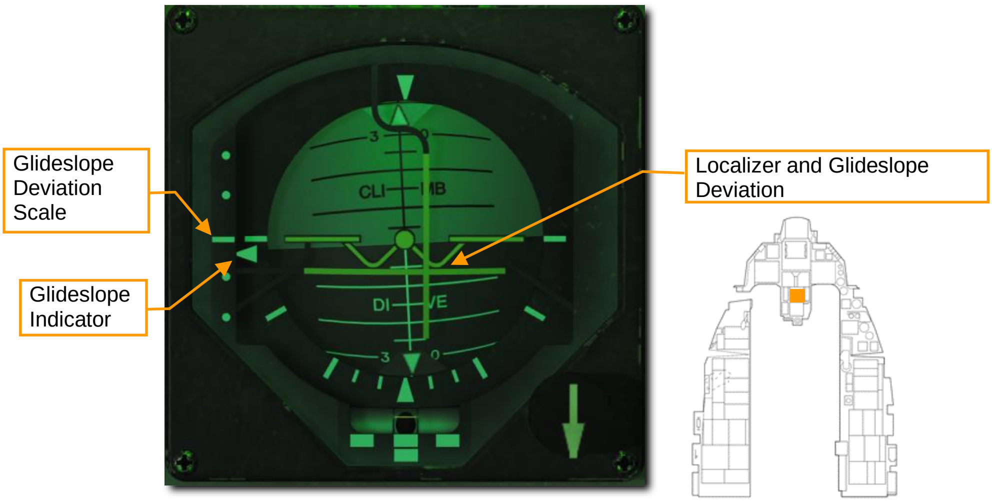
Depress the Mode Select button on the HSI until either PLS NAV or PLS TCN mode is displayed.



Operation is identical to steerpoint navigation except the bearing pointer points to the ILS localizer instead of the steerpoint.

ADI Indications

The ADI provides indications that show your position in relation to the glideslope.



Localizer and Glide Slope Deviation. When the horizontal bar is centered on the ADI, you are flying on glide slope. If the bar is above the center of the ADI, it indicates that you are below glide slope and you need to increase altitude. The vertical localizer bar indicates if you are left or right of runway alignment. If the bar is right of ADI center, fly to the right to center it, then resume localizercourse. For a proper glide slope approach, you want the two bars centered and forming a perfect cross on the ADI (aka “center the bars”).

Glide Slope Deviation Scale and Glide Slope Indicator. Located along the left side of the ADI, this fixed scale and moving caret indicator displays the position of the glide slope in relation to the aircraft. Basically, the caret is the glide slope. If it is high, you are low. For example: if the caret is on the bottom dot, you are above the glide slope. The common terminology would be “you are 2 dots high”. Conversely, if the caret is on the first dot above middle you are below the glide slope. The term would be “you are 1 dot low”. It is a general rule that if you go more than 1 dot low or more than 2 dots high you go missed approach and try again.

Glide Slope and Localizer Warning Flags (not visible). When displayed, this indicates that there is a problem in receiving adequate ILS glide slope or localizer signal.

HUD Indications

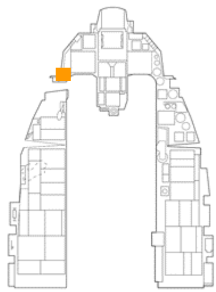
The HUD also shows your position in relation to the glideslope. Command Steering guidance is also provided if CMD STRG is highlighted on the ILS DED page.

Command Steering Symbol. This symbol will be displayed on the HUD to guide you through the approach when valid localizer data is received. A tic mark appears on the symbol when nearing the center of the glideslope to indicate the pitch steering data is valid.

Localizer and Glide Slope Bars. These bars serve the same function as those on the ADI. When the horizontal bar is centered on the **Flight Path Marker (FPM)**, you are flying down the glide slope projected by the ILS vertical steering component. If the bar is above the center of the FPM, it indicates that you are below glide slope and you need to increase altitude. The vertical localizer bar indicates if you are left or right of runway alignment. If the bar is right of FPM center, fly to the right to center it. For a proper glide slope approach, you want the two bars centered and forming a perfect cross on the FPM (aka “center the bars”).

Autopilot

The two autopilot switches allow you to set and hold pitch and roll. Any combination of switch settings may be used.



PITCH – ALT HOLD. This maintains the aircraft at a constant altitude. The autopilot will attempt to maintain the current altitude from when the switch is set but may not be able to capture the desired altitude if the aircraft is in a climb or dive. An altitude within the control authority of the autopilot will be commanded. The altitude may be changed by depressing the paddle switch on the stick, flying to a new altitude, and releasing the paddle switch.

PITCH – ATT HOLD. This maintains the aircraft's current pitch attitude, nose up or nose down. The autopilot will not engage if the pitch angle exceeds +- 60 degrees, however, the switch may remain engaged. The stick may be used to change the attitude in this mode.

ROLL – HDG SEL. This causes the aircraft to fly the heading selected on the HSI. Roll commands are limited to a 30 degree bank or a 20 degree per second roll rate to capture the desired heading. The autopilot will not engage if the roll angle exceeds +- 60 degrees, however, the switch may remain engaged.

ROLL – ATT HOLD. This maintains the aircraft's current roll attitude. The autopilot will not engage if the roll angle exceeds +- 60 degrees, however, the switch may remain engaged. The stick may be used to change the attitude in this mode.

The switches are held in place until they are returned to the OFF position or any of these situations occur:

- air refueling door opened
- alt flaps extended below 400 knots
- A/P FAIL PFL
- AoA exceeds 15°
- DBU on
- landing gear extended
- low-speed warning
- MPO switch in OVERRIDE
- STBY GAIN PFL
- TRIM/AP DISC switch set to DISC

Holding the paddle switch on the stick depresses disengages the autopilot until the switch is released.

RADIO COMMUNICATIONS

USAF Photo
by TSgt Christopher Boitz

Overview

In order to receive radio communications from other mission entities and have your transmitted messages received, it is vital that you have your radios set up properly! If not, you will be essentially talking to yourself.

Radio Frequencies

The current frequency for the UHF (COM 1) and VHF (COM 2) radios are shown on the DED CNI page.

When a mission is created, each agency is provided a VHF or UHF frequency. Each frequency corresponds to a preset channel on your radios but you may also manually enter them. These are generally noted in the mission briefing and should be set on your radios at the start of the missions.

Generally, the following rules apply:

- Your flight is most often assigned a VHF frequency. You will use the corresponding channel for intra-flight communications.
- Other friendly flights operate on a common UHF frequency assigned to the operating area. When set correctly, you will hear radio communications from other flights operating in the area. AWACS will usually be on this common frequency.
- The JTAC is most often assigned a unique VHF or UHF frequency.
- Each airbase ATC is assigned a unique VHF or UHF frequency.
- Each tanker is assigned a unique VHF or UHF frequency.

As such, you may have to juggle multiple frequencies during a mission. The frequency preset features on the radio will become a big help.

Preset Frequency Change

1. Depress the COM 1 or COM 2 override button on the ICP.
2. Type in the desired preset channel and press ENTR
3. The radio will now transmit and receive on the new preset frequency.

With a preset channel selected, you may now cycle through available channels.

4. Toggle the DCS up or down until the arrows are displayed next to the preset channel.
5. Use the Increment/Decrement switch to change the channel.

Manual Frequency Change

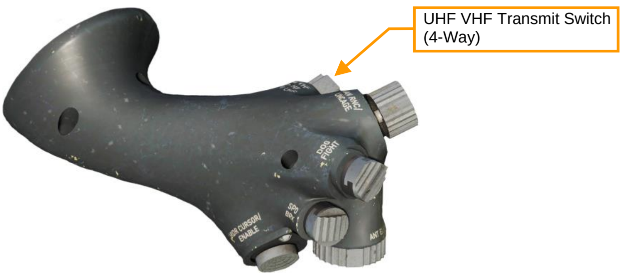
1. Depress the COM 1 or COM 2 override button on the ICP.
2. Type in the new frequency with the ICP keypad and depress ENTR
3. The radio will now transmit and receive on the new frequency.

Radio Commands

Commands or requests to and from other agencies must be made through the radio system. On the ground, the radio communications window may be accessed by a press of the **[\] backslash** key. Once airborne, communications are only initiated using the HOTAS controls:

UHF VHF Transmit Switch.

- Forward: VHF (Aux) radio [**RCTRL + \]**
- Aft: UHF (Prim) radio [**RALT + \]**
- Up: No function
- Down: No function



There are two optional modes of using the radio that depend on the "EASY COMMUNICATION" OPTION under the GAMEPLAY tab.

Easy Communication Not Enabled

This is the more realistic mode and requires you to know the correct modulation / frequencies for each recipient. You must select the correct channel pre-set or manually enter the frequencies on the correct radio.

Easy Communication Enabled

The radio communications window is accessed by a press of the \ backslash key (this is for US keyboards; other language keyboards may vary). Upon doing so, the list of radio command recipients is displayed along with the function (Fx) key required to view its sub-command window.

When the radio menu is displayed, recipients are color-coded as follows:

- Recipients on which at least one of the radios is tuned to are colored white.
- Recipients on which at least one of the radios can be tuned to, but are not currently on the correct frequency, are colored gray.
- Recipients that cannot be contacted due to range or terrain masking / earth curvature are colored black.

Each will also have their modulation / frequency listed. When you select a recipient, the appropriate radio will automatically be tuned to communicate with the selected recipient.

After a recipient has been selected to communicate with, the appropriate radio will be automatically tuned to the correct frequency.

Using the transmit switch, recipients will be color-coded according to their being on the same modulation as the selected radio.

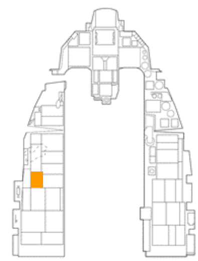
PROCEDURES

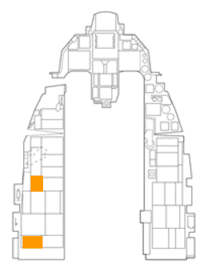
USAF Photo
by TSgt Robert Cloys

Cold Start

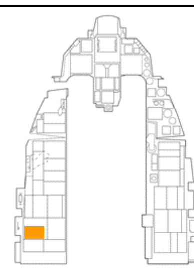
There are two methods you can use to start a cold and dark aircraft. The first, and easiest, is the Auto-Start. By pressing **[Left Win + Home]**, the aircraft will be started automatically for you. To cease the Auto-Start, you can press **[Left Win + End]**.

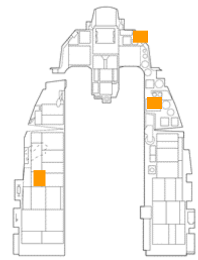
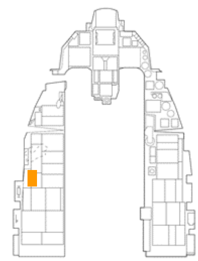
Being a DCS title though, the aircraft really shines when you take advantage of the detailed systems modeling, like manually starting the aircraft.

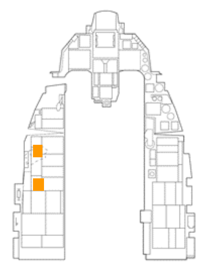
<table>
<tr><td rowspan="3">1.</td><td>MAIN PWR switch</td><td>BATT</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2">a. Verify the FLCS RLY light is on

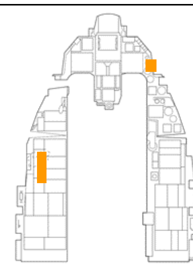
The amount of power available from the battery is limited so do not leave the MAIN PWR switch in BATT or MAIN PWR for more than 5 minutes. Start the engine or apply external power if more time is needed.</td></tr>
<tr><td rowspan="3">2.</td><td>FLCS PWR TEST switch</td><td>TEST and hold</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2">a. Verify lights on ELEC Panel:
• FLCS PMG on
• TO FLCS on
• FLCS RLY light turns off

b. Verify lights on TEST Panel:
• FLCS PWR (4) on

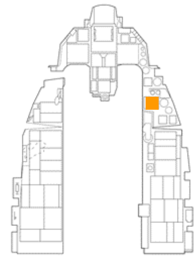
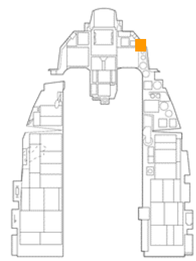
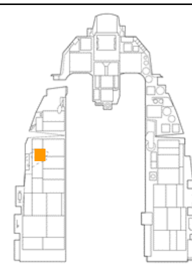
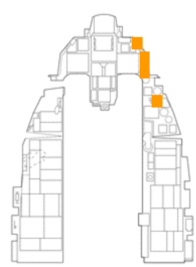
This test verifies operation of the Flight Control Computer with the aircraft battery as the power source.</td></tr>
<tr><td rowspan="3">3.</td><td>FLCS PWR TEST switch</td><td>Release</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2"></td></tr>
</table>

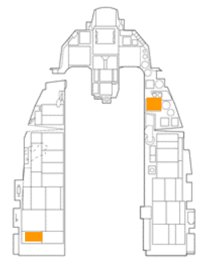
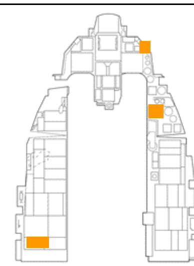
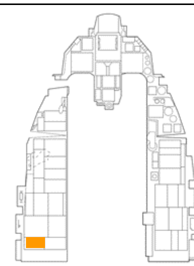
<table>
<tr><td rowspan="3">4.</td><td>MAIN PWR switch</td><td>MAIN PWR</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2">Verify lights on:
• ENGINE
• HYD/OIL PRESS
• ELEC SYS
• SEC
• FLCS RLY</td></tr>
<tr><td rowspan="3">5.</td><td>EPU GEN and EPU PMG lights</td><td>Confirm off</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2">Illumination of either light indicates criteria for EPU activation are met. The EPU will activate and create a hazardous condition if the EPU safety pin is removed by the ground crew.

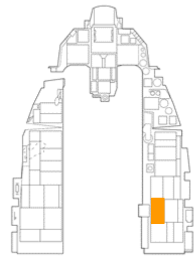
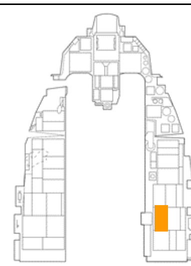
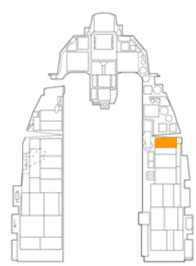
Turn the MAIN PWR switch to OFF and abort the aircraft (re-start the mission) if the lights are on.</td></tr>
<tr><td rowspan="3">6.</td><td>JFS switch</td><td>START 2</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2">The JFS RUN light illuminates within 30 seconds indicating the Jet Fuel Starter is operational. Engine rpm should start to increase.

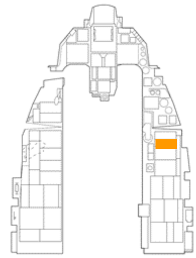
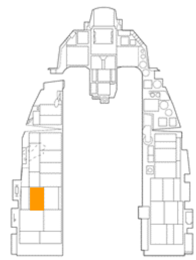
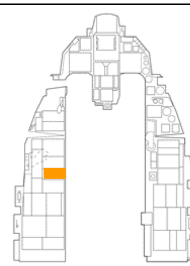
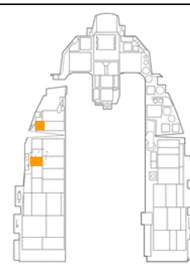
Power is applied to the Flight Control System relays when the JFS Switch is set to either position. The FLCS RLY light should turn off and the FLCS PMG light and ACFT BATT TO FLCS light should illuminate.</td></tr>
<tr><td rowspan="3">7.</td><td>At 20% RPM - Throttle</td><td>Advance to IDLE</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: RShift + Home</td></tr>
<tr><td colspan="2">Advance throttle to IDLE after 20 percent rpm is reached.

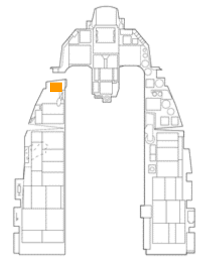
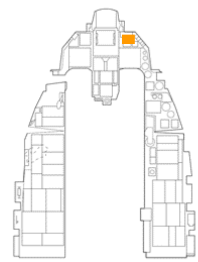
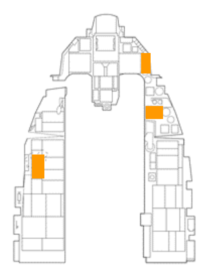
The engine should light-off within 10 seconds and engine RPM and FTIT should increase. Only the RPM and FTIT indicators function until the standby generator is on line.</td></tr>
</table>

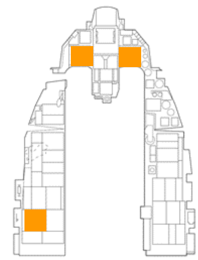
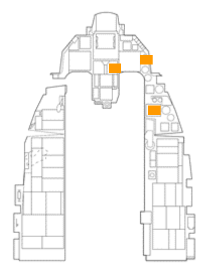
8.	**SEC caution light** Keyboard Command: N/A The SEC caution light goes off at 20 percent rpm.	**Off**	
9.	**ENGINE warning light** Keyboard Command: N/A The standby generator becomes operational at approximately 60% RPM. This should extinguish the ENGINE warning light. Five to ten seconds after the standby generator comes on line, the main generator comes on line and the standby generator goes off line. Checking the SEAT NOT ARMED caution light and three green WHEELS down lights are on prior to the main generator coming on line confirms the emergency busses are being powered by the standby generator.	**Off**	
10.	**JFS Switch** Keyboard Command: N/A The JFS should have automatically shut down at approximately 55% RPM. Turn the JFS off if that did not occur.	**Confirm Off**	
11.	**ENGINE INSTRUMENTS** Keyboard Command: N/A Normal indications after engine start are: • HYD/OIL PRESS warning light – Off • FUEL FLOW – 700-1700 pph • OIL pressure – 15 psi (minimum) • NOZ POS – Greater than 94 percent • RPM – 62-80 percent • FTIT – 650º C or less • HYD PRESS A & B – 2850-3250 psi	**Check**	

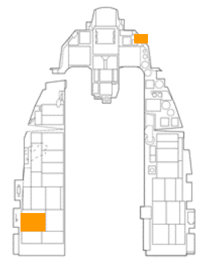
12.	**PROBE HEAT**	**Check**	
	Keyboard Command: N/A		
	a. PROBE HEAT switch – PROBE HEAT • Verify PROBE HEAT caution light off. • Illumination means one or more probe heaters are inoperative or a failure of the monitoring system has occurred. b. PROBE HEAT switch – TEST • PROBE HEAT caution light should flash 3-5 times per second. • The probe heat monitoring system is inoperative if this does not occur. c. PROBE HEAT switch – OFF		
13.	**FIRE & OHEAT DETECT button**	**Test**	
	Keyboard Command: N/A		
	Verify ENG FIRE warning light and OVERHEAT caution light illuminated when button is pushed. This checks for continuity of the fire and overheat detection loops.		
14.	**MAL & IND LTS button**	**Test**	
	Keyboard Command: N/A		
	All cockpit warning, caution and indicator lights should illuminate when the button is depressed. Voice Message System (VMS) audio alerts should play in priority sequence (i.e., PULLUP, ALTITUDE, WARNING, etc.). A brief LG warning horn should be heard prior to the WARNING and CAUTION words.		

15.	**AVIONICS POWER Panel**	**Set**	
	Keyboard Command: N/A		
	a. MMC Switch – MMC b. ST STA Switch – ST STA c. MFD Switch – MFD d. UFC Switch – UFC e. GPS Switch – GPS f. DL Switch – DL g. MIDS LVT Knob – On This applies power to the aircraft's avionics and begins running built-in-test (BIT) checks.		
16.	**EGI/INS Knob**	**ALIGN NORM**	
	Keyboard Command: N/A		
	This begins alignment of the EGI/INS ring laser gyro navigation system. A normal alignment takes eight minutes or less to accomplish if the aircraft remains stationary. The knob should be set to NAV prior to taxi. See the INS Alignment section for details.		
17.	**SNSR PWR Panel**	**Set**	
	Keyboard Command: N/A		
	a. LEFT HDPT Switch – OFF b. RIGHT HDPT Switch – As Required c. FCR Switch – FCR d. RDR Alt switch – RDR ALT Set RIGHT HDPT On if a Targeting Pod is installed on the hardpoint. Radar and Radar Altimeter transmission is inhibited until the aircraft becomes airborne. Activation of these systems may be delayed until just before takeoff if desired.		

<table>
<tr><td rowspan="3">18.</td><td>HUD Control Panel</td><td>As Desired</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2">Set switches to display you desired HUD symbology and format.</td></tr>
<tr><td rowspan="3">19.</td><td>C&I Knob</td><td>UFC</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2">This enables control of primary communications, navigation and identification functions from the upfront controls.</td></tr>
<tr><td rowspan="3">20.</td><td>ECM panel</td><td>As Required</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="3">21.</td><td>Throttle SPD BRK switch</td><td>Cycle and Close</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2">This verifies proper operation on the speedbrakes. Confirm visually and monitor speedbrake indicator.</td></tr>
</table>

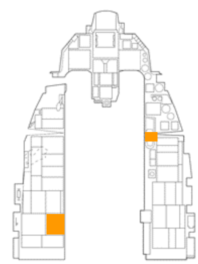
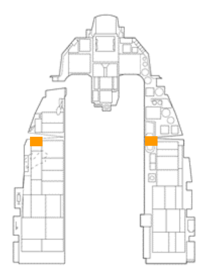
22.	**WHEELS down lights**	**Check three green**	
	Keyboard Command: N/A		
	This indicates all three landing gear are down and locked.		
23.	**SAI**	**Set**	
	Keyboard Command: N/A		
	Pull and rotate knob to uncage the stand-by attitude indicator.		
24.	**Engine SEC Mode**	**Check**	
	Keyboard Command: N/A		
	a. ENG CONT switch – SEC b. SEC caution light – On c. RPM – Stabilized. RPM may drop up to 10 percent from PRI value before stabilizing. Stabilized SEC idle rpm may be up to 5 percent lower than that in PRI. d. Throttle - Snap to MIL and then snap to IDLE when rpm reaches 85 percent. Check for normal indications and smooth operation. e. NOZ POS - 10 percent or less within 30 seconds after selecting SEC f. ENG CONT switch – PRI g. SEC caution light – Off h. NOZ POS – Greater than 94 percent This checks engine operation in the Secondary Engine Control (SEC) mode. This mode is selected in the case of failure of the engine-mounted digital computer that controls scheduling of engine fuel flow.		

25.	**FLCS BIT**	**Initiate and Monitor**	
	Keyboard Command: N/A		
	a. Flight Controls – Cycle This is done in preparation for running the Flight Control System (FLCS) bit check. Maximum stick inputs warm and remove air bubbles from the hydraulic fluid b. Position BIT switch to BIT. The RUN light on FLCP illuminates. At successful completion of BIT (approximately 45 seconds), the RUN light goes off, the BIT switch returns to OFF, and the FAIL light and FLCS warning light remain off. A BIT pass message appears on the FLCS MFD page. Other tasks may be completed while the FLCS BIT runs.		
26.	**FUEL QTY SEL knob**	**Check**	
	Keyboard Command: N/A		
	a. TEST - FR, AL pointers indicate 2000(+-100) pounds and totalizer indicates 6000 (+-100) pounds. FWD and AFT FUEL LOW caution lights illuminate. b. NORM - AL pointer indicates approximately 2810 pounds. FR pointer indicates approximately 3250 pounds. c. RSVR - Each reservoir indicates approximately 480 pounds. d. INT WING - Each wing indicates approximately 550 pounds. e. EXT WING - Each external wing tank indicates approximately 2470 pounds for full tanks. f. EXT CTR - FR pointer indicates approximately 1800/1890 pounds for full tank. AL pointer drops to zero. g. FUEL QTY SEL knob - As desired		

<table>
<tr><td rowspan="3">27.</td><td>DBU</td><td>Check</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2">a. DIGITAL BACKUP switch - BACKUP. Verify that DBU ON warning light illuminates.

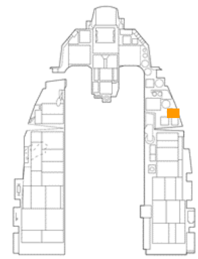
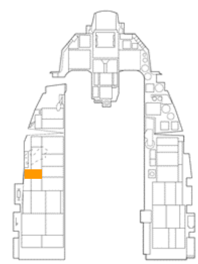
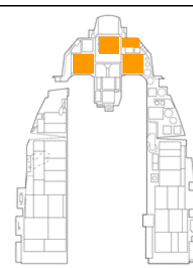
b. Operate controls - All surfaces respond normally.

c. DIGITAL BACKUP switch - OFF. Verify that DBU ON warning light goes off.

This checks operation of the digital backup software. It is used if problems arise with the primary FLCS software.</td></tr>
<tr><td rowspan="3">28.</td><td>Trim</td><td>Check</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2">a. TRIM/AP DISC switch - DISC
Stick TRIM button - Activate in roll and pitch
No control surface motion
No TRIM wheel or indicator motion
b. TRIM/AP DISC switch - NORM
Stick TRIM button - Check and center
Control surface motion
TRIM wheel and indicator motion
c. Rudder trim check.
YAW TRIM knob - Check and center</td></tr>
<tr><td rowspan="3">29.</td><td>MPO</td><td>Check</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2">a. Stick - Full forward and hold; note horizontal tail deflection.

b. MPO switch - OVRD and hold; confirm that horizontal tail trailing edges move farther down.

c. Stick and MPO switch – Release; confirm that the horizontal tail returns to its original position.</td></tr>
</table>

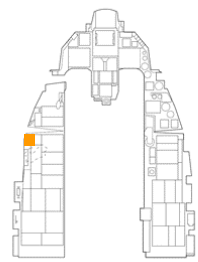
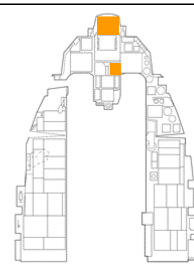
30.	**EPU FUEL quantity**	**Check 95-102 percent**	
	Keyboard Command: N/A		
	This indicates the percentage of hydrazine remaining.		
31.	**EPU**	**Check**	
	Keyboard Command: N/A		
	a. OXYGEN - 100% b. Engine rpm - Increase 10 percent above normal idle c. EPU/GEN TEST switch - EPU/GEN and hold. Check lights: • EPU AIR light – On • EPU GEN and EPU PMG lights - Off (may come on momentarily at start of test) • FLCS PWR lights - On • EPU run light - On for a minimum of 5 seconds • EPU/GEN TEST switch – OFF d. Throttle – IDLE e. OXYGEN – NORMAL This check verifies EPU electrical power is available in case of an emergency. It may be delayed until just before takeoff if desired.		
32.	**Avionics**	**Program as required**	
	Keyboard Command: N/A		
	Use the time on the ground as your INS aligns to check and set your systems for the assigned mission. Things to consider include SMS pages and profiles, radio channels and frequencies, navigation data, bingo fuel settings, ALOW settings and any other system applicable to the mission.		

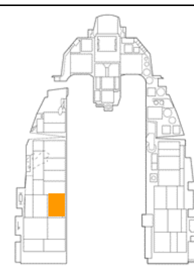
Taxi

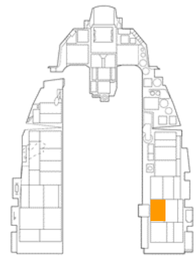
Whether you have completed a cold start or are starting the mission in a “hot” aircraft, your next step will be to taxi to the runway.

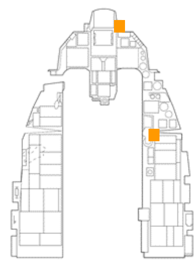
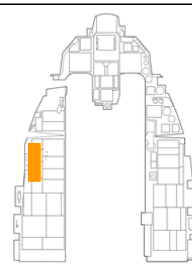
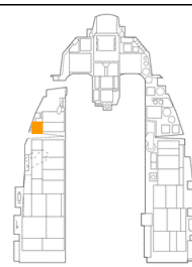
When you are ready to start rolling, slowly advance the throttle **[PAGE UP]** or **[Num+]** and use the rudder pedals to steer left **[Z]** and right **[X]**. Reduce throttle by pressing **[PAGE DOWN]** or **[Num-]**. Press **[W]** to apply wheel brakes.

Nosewheel steering gain is proportional to ground speed. As your aircraft speeds up, the rudder will become less sensitive when controlling the nosewheel.

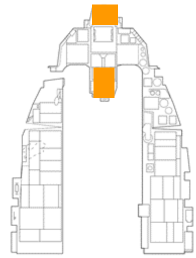
<table>
<tr><td rowspan="3">1.</td><td>Canopy</td><td>Close and Lock</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: LCtrl + C</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="3">2.</td><td>Altimeter</td><td>Set and Check</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2">Verify altitude displayed on your HUD matches the altitude on your altimeter.

Check that the altimeter readings in ELECT and PNEU are +-75 feet of a known elevation and are +-75 feet of one another.</td></tr>
<tr><td rowspan="3">3.</td><td>Exterior Lights</td><td>As required</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2"></td></tr>
</table>

<table>
<tr><td rowspan="3">4.</td><td>EGI Knob</td><td>NAV</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2">Verify flashing RDY is visible on the DED INS page or flashing ALIGN is visible on the HUD if full alignment is desired.

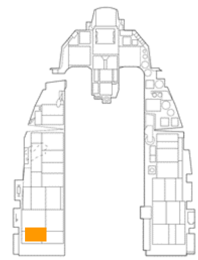
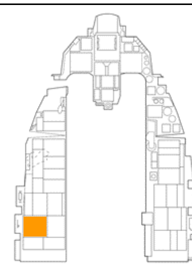
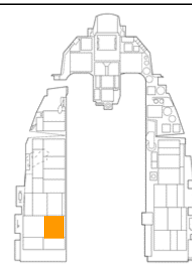
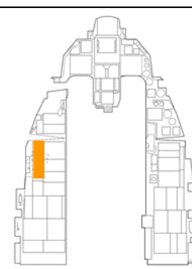
See INS Alignment section for details.</td></tr>
<tr><td rowspan="3">5.</td><td>NWS</td><td>Engage</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2">Press the NWS/AR Disc button on your stick. The NWS/AR light right of the HUD should illuminate to indicate NWS is engaged.</td></tr>
<tr><td rowspan="3">6.</td><td>Throttle</td><td>Advance</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2">A throttle setting just beyond idle will be required to begin rolling. Return throttle to idle after desired speed is reached.</td></tr>
<tr><td rowspan="3">7.</td><td>Brakes and NWS</td><td>Check</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2">Gently test the brakes and nosewheel steering immediately after your aircraft begins to move forward.

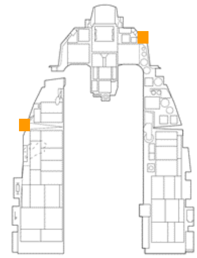
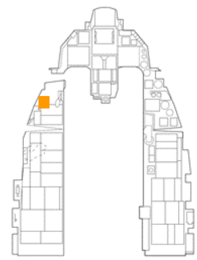
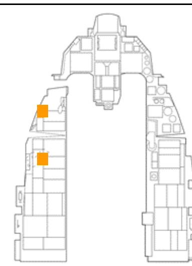
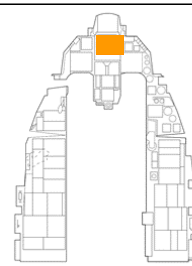
Heat may build up quickly if brakes are used for an extended period so do not ride the brakes to control taxi speed. Use one firm application of the toe brakes to slow the aircraft.</td></tr>
</table>

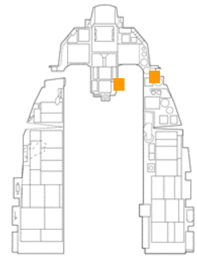
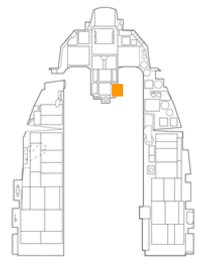
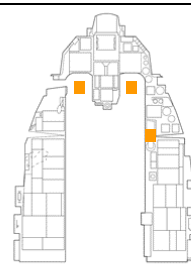
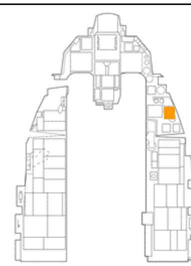
8.	Heading and Flight Instruments	Check	
	Keyboard Command: N/A		
	Verify aircraft heading updates as your aircraft turns and that all instruments behave as expected.		

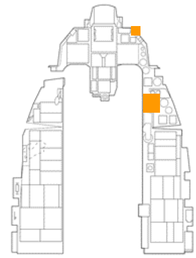
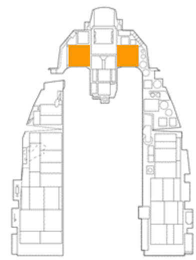
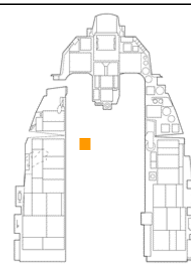
Before Takeoff

A series of last-minute checks should be made just prior to entering the runway. Some airfields have arm/dearm areas you may temporarily park at to keep the taxiway clear for other traffic. You may also perform these checks while parked on the taxiway.

1.	**PROBE HEAT switch**	**PROBE HEAT**	
	Keyboard Command: N/A		
	This should be done at least two minutes prior to takeoff if icing conditions exist. Delay selection of probe heat as long as possible prior to takeoff if icing is not expected to prevent overheat and damage to probe components.		
2.	**ALT FLAPS Switch**	**Verify NORM**	
	Keyboard Command: N/A		
3.	**Trim**	**Check**	
	Keyboard Command: N/A		
	Pitch and yaw trim - Centered Roll trim - As required This is a final verification the trim settings are correct for takeoff and have not been inadvertently changed.		
4.	**ENG CONT switch**	**Verify PRI (gd down)**	
	Keyboard Command: N/A		

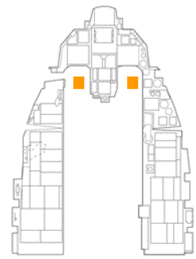
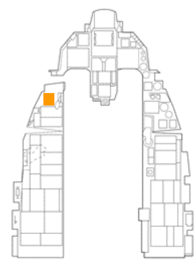
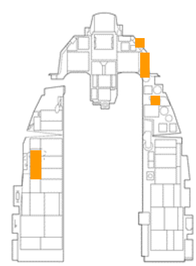
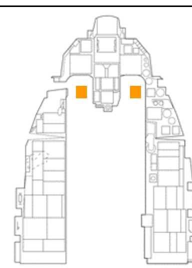
5.	**Canopy**	**Verify closed, locked, light off**	
	Keyboard Command: N/A		
6.	**STORES CONFIG switch**	**As Required**	
	Keyboard Command: N/A		
	In general: CAT I: Air to Air loadouts without external wing tanks. CAT III: Air to Ground loadouts, or any loadout with external wing tanks.		
7.	**Speedbrakes**	**Verify closed**	
	Keyboard Command: N/A		
8.	**IFF**	**Set and check**	
	Keyboard Command: N/A		

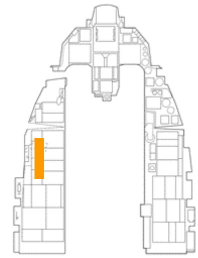
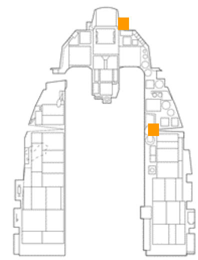
9.	**External Tanks** Keyboard Command: N/A Wing external fuel tanks should feed first and have a lower quantity than at engine start. The internal wing tanks should be full. If three external tanks are installed, verify that the centerline tank is feeding. This action checks that pressurization is available to all tanks.	**Verify Feeding**	
10.	**FUEL QTY SEL knob** Keyboard Command: N/A The FUEL QTY SEL knob must be set to the NORM position to allow the automatic forward fuel transfer system, trapped fuel warning, and for the BINGO fuel warning computation to be based on fuselage fuel.	**NORM**	
11.	**Flight Controls** Keyboard Command: N/A This is to verify freedom of movement and ensure controls are not obstructed.	**Cycle**	
12.	**OIL Pressure** Keyboard Command: N/A Normal indication is 15-65 psi	**Check psi**	

13.	**All warning and caution lights**	**Check**	
	Keyboard Command: N/A		
	Verify no unexpected indications.		
14.	**TGP**	**Stow (if installed)**	
	Keyboard Command: N/A		
	Targeting Pod is stowed by selecting STBY on the Targeting Pod Control Page. This is done prior to takeoff and before landing to prevent foreign object damage to components.		
15.	**Ejection safety lever**	**Arm (down)**	
	Keyboard Command: N/A		
	This arms the ejection seat and allows ejection when the ejection handle is pulled. This is delayed for as long as possible to prevent inadvertent ejection on the ground. Egress through other means is usually preferable.		

Takeoff

Once lined up for takeoff on the directed runway, you may perform a final run-up check:

<table>
<tr><td rowspan="3">1.</td><td>Brakes</td><td>Hold</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="3">2.</td><td>Parking Brake</td><td>Verify disengaged</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="3">3.</td><td>Throttle</td><td>90% RPM</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2">Check for normal engine indications:
• HYD/OIL PRESS warning light – Off
• OIL pressure – 25-65 psi (must increase as RPM increases)
• FTIT – 935º C or less
• HYD PRESS A & B – 2850-3250 psi</td></tr>
<tr><td rowspan="3">4.</td><td>Brakes</td><td>Released</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2"></td></tr>
</table>

<table>
<tr><td rowspan="3">5.</td><td>Throttle</td><td>Advance to desired thrust</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2">Engine FTIT and RPM should stabilize within 5-15 seconds while on the takeoff roll. Check for normal acceleration and normal engine indications.</td></tr>
<tr><td rowspan="3">6.</td><td>NWS</td><td>Disengage at 70 Knots</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2"></td></tr>
</table>

Gently pull back on the stick and establish takeoff attitude (8-12 degrees) at approximately 10 knots below takeoff speed for mil-power or 15 knots below takeoff speed for AB.

Acft Weight (lbs)	20,000	24,000	28,000	32,000	36,000	40,000	44,000
TO Speed (KIAS)	128	142	156	168	178	188	198

Low stick forces are needed for rotation. Pulling back on the stick early may lead to uncontrollability due to early lift-off at low speed and increase the distance needed to take off.

Ensure a positive rate of climb is established and raise the landing gear. The trailing edge flaps retract at the same time as the landing gear and may cause the aircraft to settle and scrape the runway when lift is lost.

The landing gear should be up and locked before exceeding 300 knots. Higher airspeeds may detach wiring and other components or cause structural damage to the landing gear doors.

Crosswind Takeoff

When taking off in a crosswind, the aircraft will want to weather-vane into the wind (turn into the wind). This will have the result of raising the upwind wing. To counteract, you want to use a slight amount of left or right stick into the wind direction. This will help keeping the wing level. You will also want to use a little rudder input to keep a straight takeoff roll down the center of the runway.

During rotation, be careful to smoothly blend rudder input to establish a proper crab angle into the wind. With a proper crab angle, the Flight Path Marker (FPM) should be aligned down the runway when becoming airborne.

Normal Flight

There are no specific procedures to follow once airborne. You will need to rely on your own understanding of aircraft systems and basic flight to keep the aircraft in one piece and accomplish the mission.

In-Flight Checks

At frequent intervals, check the aircraft systems, engine instruments, cockpit pressure, and oxygen flow indicator and system operation. Monitor fuel in each internal and external tank to verify that fuel is transferring properly by rotating the FUEL QTY SEL knob and checking that the sum of the pointers and totalizer agree, and that fuel distribution is correct.

Trimming the Aircraft

The Flight Control System does a great job of maintaining aircraft trim but there are some situations where you will need to manually trim the aircraft. When out of trim, you will notice the aircraft wanting to pitch, roll or yaw (roll being the most common).

The trim switch on the stick is used to move the control stick to a new "neutral "position. For example: if the nose wants to raise, you can input some nose down trim that will move the neutral point forward to a new position. This relieves you from maintaining continuous pressure on the stick to maintain level flight when out of trim.

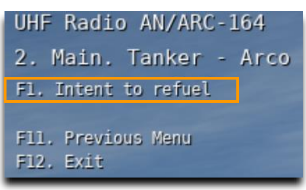
The most common need for trim is when stores are released that cause an asymmetric configuration. For example, releasing a bomb from a left wing station but not the right will cause a roll to the right, in the direction of the heavier wing. Roll trim will be required for the aircraft to maintain wings level flight with no stick input.

Air Refueling

Some missions may require air refueling to ensure you have enough fuel to reach the target and return safely to base. Even if more fuel is not required, you may wish to top off your tanks to allow more options in the target area, like a low altitude, high speed ingress or more liberal use of the afterburner.

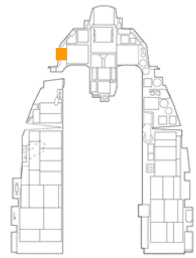
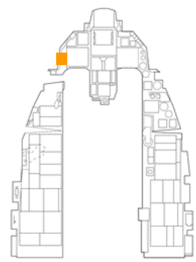
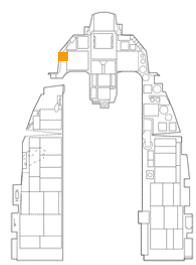
Tanker locations will be noted in the mission briefing or displayed on the Mission Planner screen. Tankers are also equipped with air to air TACAN to help with the rendezvous. If in doubt, you may also request a vector to the nearest tanker from AWACS.

You should announce your intent to refuel before approaching the tanker using the communications menu.

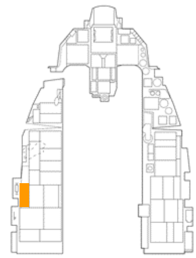
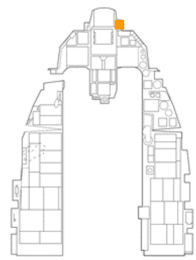
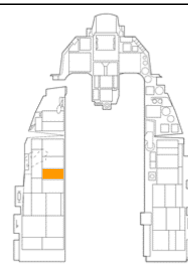
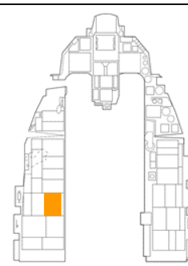


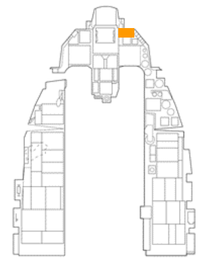
The tanker will respond with their current altitude and airspeed and clear you to the pre-contact position. Continue to fly the rendezvous using radar or TACAN as a guide.

The following steps should be taken to make your aircraft safe before approaching the tanker.

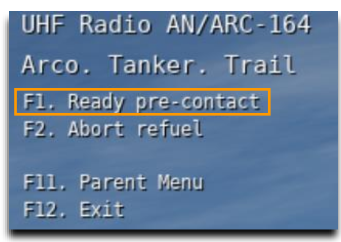
1.	**MASTER ARM Switch**	**OFF**	
	Keyboard Command: N/A		
2.	**LASER ARM Switch**	**OFF**	
	Keyboard Command: N/A		
3.	**Emitters**	**OFF/STBY**	
	Keyboard Command: N/A		
	Electrical signals from emitters like ECM, Radar or Radar Altimeter may present a hazard to tanker aircraft and personnel. Use them during the rendezvous if required but turn them off prior to reaching the pre-contact position. This can be done using the individual panels for each system or with the **RF Switch**. When set to silent, all electronic signals for the aircraft are disabled, to include the radar, radar altimeter, data link, TACAN transmit, and ECM. In quiet mode though, the radar, TACAN, and data link transmit but all other emissions are inhibited.		

Take the following steps to configure the aircraft for refueling.

4.	**AIR REFUEL Switch**	**Open**	
	Keyboard Command: N/A		
	This should be done 3-5 minutes prior to refueling with external fuel tanks to depressurize the tanks and allow them to be filled. Flight control gains change to takeoff and landing settings to allow fine control.		
5.	**AR status light**	**Verify RDY**	
	Keyboard Command: N/A		
6.	**HOT MIC / CIPHER switch**	**HOT MIC**	
	Keyboard Command: N/A		
	This allows direct communication through the refueling boom.		
7.	**Exterior lights**	**As required**	
	Keyboard Command: N/A		
	At night, exterior lights should be set to DIM and STEADY settings and the Anti-Collision light should be set to OFF.		

8.	**DED Bingo Page**	**Monitor**	
	Keyboard Command: N/A		
	As a technique, you may choose to pull the Bingo page up on the DED by selecting LIST→2 on the ICP. Your total fuel load will be displayed. This allows you to verify you are tasking fuel without going heads-down to the fuel quantity indicator. 		

Take the pre-contact position directly behind the boom and report you are ready to refuel.



The boomer will clear you to the contact position. Use small, smooth control inputs and add a very slight amount of throttle. Be patient and allow that power change to move you forward.

Allow the boom to pass just left or right of your canopy, about 2-3 feet above your head. This serves as a good first check that you are at the proper height relative to the tanker. Continue to move slowly forward, maintaining alignment with the yellow stripe painted on the bottom of the tanker.

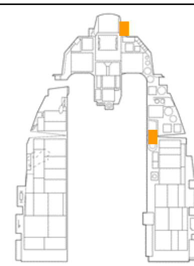
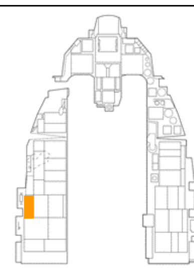
Fly formation on the tanker and allow the boom operator to fly the boom into the refueling receptacle behind the cockpit on your aircraft. Use the director lights on the bottom of the tanker to maintain a position within the limits of the boom.

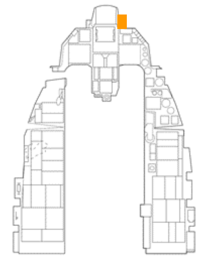
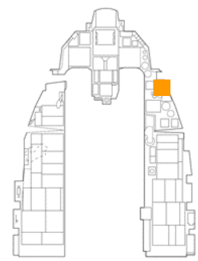
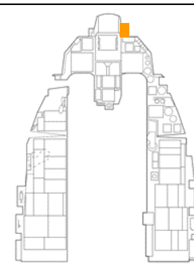
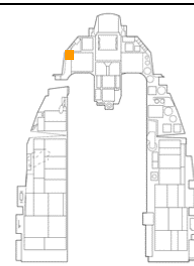
The lights are directive, meaning they tell you the direction to travel and not your current position. In other words, preface the D, U, F and A with the word Go. If the light moves toward the D, go down and if it moves toward the U, go up. If the light moves toward the A, go aft and if it moves toward the F, go forward.

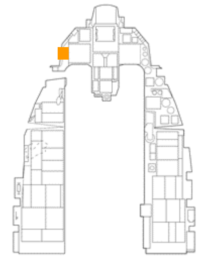
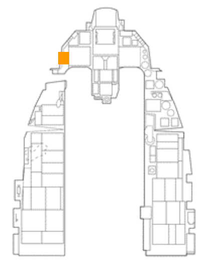
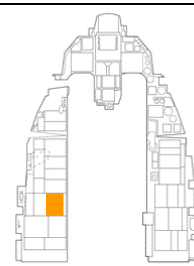
The boomer will announce ‘contact’ and ‘you are taking fuel’ when the connection is established. The AR/NWS light next to the HUD will illuminate. Monitor your fuel transfer on the DED or Fuel Quantity indicator.

It is likely you will unintentionally disconnect at some point in the process, especially on your first few attempts. If this happens, return to the pre-contact position and try again.

Perform the following steps when refueling is complete.

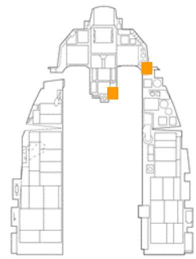
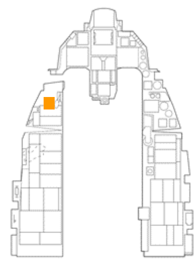
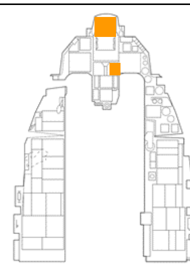
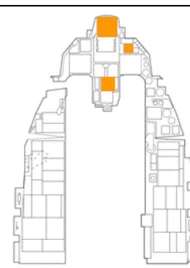
1.	**A/R DISC button on stick**	**Depress**	
	Keyboard Command: N/A		
	This unlatches from the boom. Verify the DISC light is illuminated next to the HUD.		
2.	**AIR REFUEL Switch**	**CLOSE**	
	Keyboard Command: N/A		

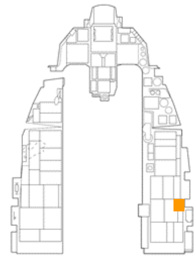
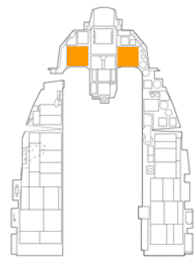
3.	**AR Status Lights**	**All OFF**	
	Keyboard Command: N/A		
	This allows direct communication through the refueling boom.		
4.	**Fuel Quantity**	**Check**	
	Keyboard Command: N/A		
	Verify proper transfer and balance after refueling is complete.		
5.	**AR Status Lights**	**All OFF**	
	Keyboard Command: N/A		
	This allows direct communication through the refueling boom.		
6.	**Emitters**	**As Required**	
	Keyboard Command: N/A		
	Emitters like ECM, Radar or Radar Altimeter were turned off prior to refueling. If this was done on the individual cockpit panels, set them back to the desired positions. If this was done using the **RF Switch**, set the switch to the desired position.		

7.	**MASTER ARM Switch**	**As Required**	Keyboard Command: N/A	
8.	**LASER ARM Switch**	**As Required**	Keyboard Command: N/A	
9.	**Exterior lights**	**As Required**	Keyboard Command: N/A	

Descent/Before Landing

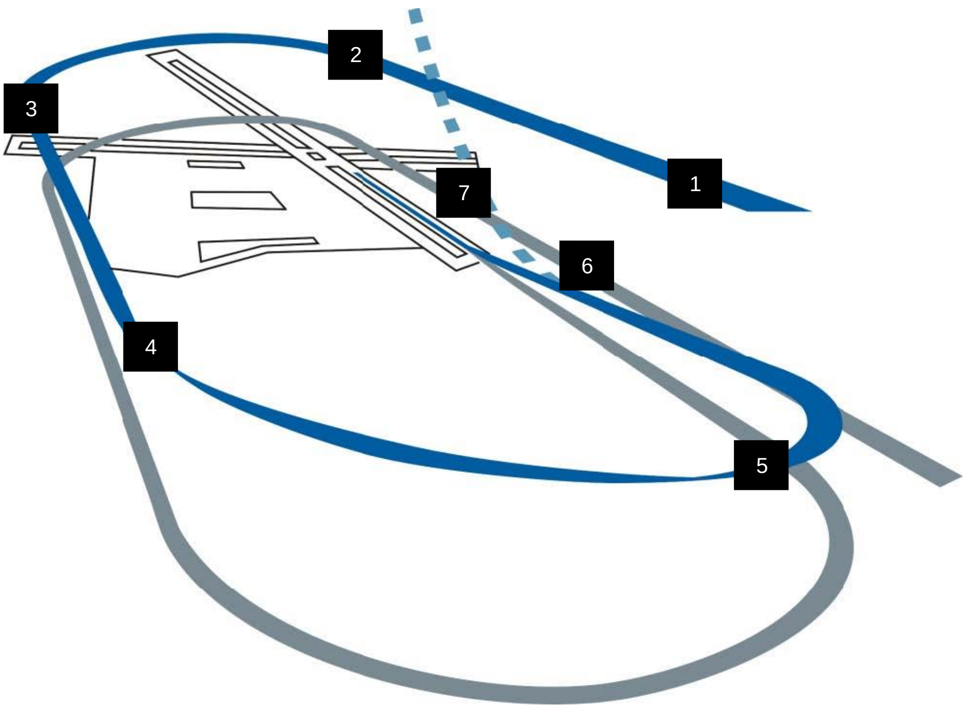
You should set up the aircraft in preparation for landing the aircraft.

1.	**Fuel**	**Check quantity/transfer/balance**	
	Keyboard Command: N/A		
2.	**Landing Light**	**On**	
	Keyboard Command: N/A		
3.	**Altimeter**	**Set and Check**	
	Keyboard Command: N/A		
	Verify altitude displayed on your HUD matches the altitude on your altimeter. Check that the altimeter readings in ELECT and PNEU are +-75 feet of a known elevation and are +-75 feet of one another.		
4.	**Attitude references**	**Check**	
	Keyboard Command: N/A		
	Attitude indications for ADI, HUD and SAI should agree.		

5.	**ANTI ICE Switch**	**As required**	
	Keyboard Command: N/A		
6.	**TGP**	**Stow (if installed)**	
	Keyboard Command: N/A		
	Targeting Pod is stowed by selecting STBY on the Targeting Pod Control Page. This is done prior to takeoff and before landing to prevent foreign object damage to components.		

Landing

After completing a sortie, perhaps the most challenging part may still await you… the landing.



1. Initial Approach. Align your aircraft with the landing runway at 1,500 feet above ground level (AGL) and 300 knots calibrated airspeed (KCAS).

2. Overhead Break. Break left or right over the desired touchdown point, set throttle to about 80% RPM, and open the speedbrakes. Fly the break at about 70 deg of bank and 3-4 G. Align the HUD Flight Path Marker with the Horizon Line to maintain a level turn.

3. Downwind Leg. Roll out on the downwind leg opposite the landing heading at about 200-220 KCAS and 1,500 feet AGL. Extend the landing gear and confirm three green gear down indications. Reduce speed as required to prevent excessive airspeed buildup in the base turn and trim to an angle of attack (AOA) of 11 degrees.

4. Base Turn. Initiate the base turn when abeam the rollout point. You may estimate this position by starting the turn when your wingtip is at the end of the runway when viewed from the cockpit. Lower the nose to 8-10 degrees and fly the turn at 11 degrees AOA.

5. Final Turn. Use your throttle to control airspeed while using the stick maintain 8-10 degrees nose low and 11 degrees AOA through the turn. Roll out on final and raise the nose to maintain proper glide path. The goal is to roll out in line with the runway at approximately 300 feet AGL one mile from the touchdown point. Align the HUD flight path marker and 2.5-degree pitch ladder with the runway threshold to ensure proper glidepath while maintaining 11-degrees AOA.

6. Short Final. When over the overrun, the portion of the runway before the primary surface starts, shift the flight path marker forward to a point 300-500 down the runway. Gently pull back on the stick to flare and reduce the descent rate but do not level off. Pull the throttle back to idle and touchdown with a maximum AOA of 13 degrees. More than 15 degrees during the landing roll-out may cause the speedbrakes or engine nozzle to contact the runway so use gentle stick inputs to avoid overcontrolling the aircraft.

7. Roll-Out. Maintain 13 degrees nose-up attitude for two-point aerodynamic braking until your airspeed has reduced to approximately 100 knots. Reduce back stick pressure and lower the nosewheel to the runway. Open the speedbrakes fully and maintain full aft stick for maximum braking effectiveness.

Apply moderate to heavy braking to slow the aircraft. Engage nosewheel steering when below 30 knots unless it is required earlier to prevent departure from the runway.

Crosswind Landing

When landing in a crosswind, you should maintain wings-level and allow the aircraft to crab through touchdown.

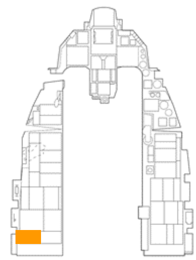
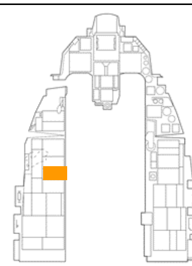
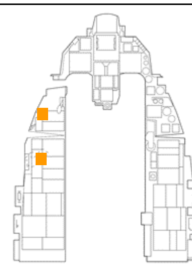
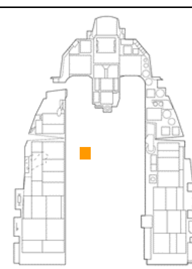
At touchdown, quickly correct with rudder to maintain alignment down the runway. After touchdown, the aircraft will want to weathervane into the wind, so you must compensate with rudder use or differential braking. A small amount of left or right stick into the wind direction may be required to help keep the wings level.

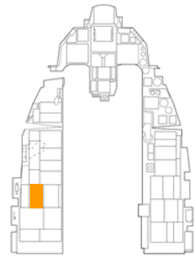
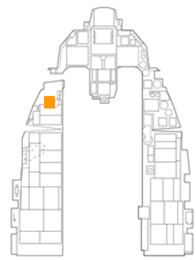
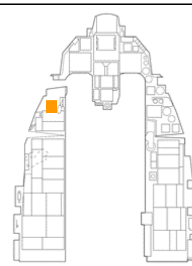
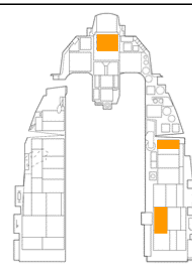
Perform the landing roll-out as described above but maintain two-point aerobraking until below 80 knots or aircraft control becomes a problem.

High rudder pedal force may cause an abrupt yaw as nosewheel steering is engaged. Center the rudder before engaging nosewheel steering if possible.

After Landing

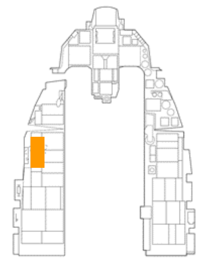
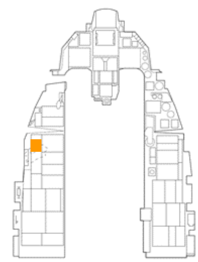
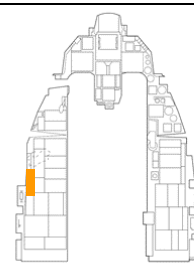
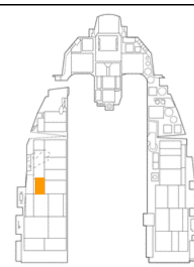
When the aircraft is safely back on the ground it is time to start powering down systems and preparing for shutdown. These tasks may be performed as you taxi clear of the runway. You may also pull into an arm/dearm area to complete the tasks if desired.

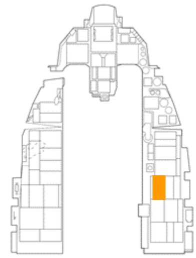
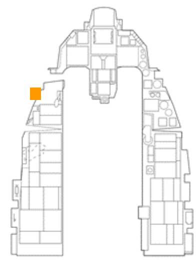
<table>
<tr><td rowspan="3">1.</td><td>PROBE HEAT switch</td><td>OFF</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2">Leaving heating applied to the probe without airflow to cool it may damage probe components.</td></tr>
<tr><td rowspan="3">2.</td><td>ECM Power</td><td>OFF</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="3">3.</td><td>Speedbrakes</td><td>Close</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="3">4.</td><td>Ejection safety lever</td><td>Safe (up)</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2">The ejection seat is safed after landing to prevent inadvertent ejection. A ground egress is usually preferable to ejection in an emergency on the ground.</td></tr>
</table>

<table>
<tr><td rowspan="3">5.</td><td>IFF MASTER knob</td><td>STBY</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="3">6.</td><td>LANDING TAXI lights</td><td>As required</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="3">7.</td><td>Armament Switches</td><td>Off, Safe, or Normal</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2">This should be accomplished before ground personnel approach the aircraft.</td></tr>
<tr><td rowspan="3">8.</td><td>Avionics</td><td>Off</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2">This may be delayed until you are stopped at the parking location if you wish to record data or maintain INS alignment.</td></tr>
</table>

Engine Shutdown

Perform the following after coming to a stop in your parking location. This is much simpler than aircraft start-up because the order is less critical and proper operation of the systems are not being checked.

<table>
<tr><td rowspan="3">1.</td><td>Throttle</td><td>Off</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: RShift + End</td></tr>
<tr><td colspan="2">This terminates ignition and shuts off the fuel supply to the engine. The engine spools down and the generator drops offline. Caution and Warning lights are to be expected.</td></tr>
<tr><td rowspan="3">2.</td><td>JFS RUN light</td><td>Confirm Off</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="3">3.</td><td>EPU GEN and EPU PMG lights</td><td>Confirm off</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2">Check after main generator power drops offline. Lights on may indicate impending activation of the EPU and a hazardous condition.</td></tr>
<tr><td rowspan="3">4.</td><td>MAIN PWR switch</td><td>Off</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2">Delay placing MAIN PWR switch to OFF until after engine rpm decreases through 20 percent. This delay should allow the exhaust nozzle to remain open and makes it easier for the crew chief to accomplish the post flight inspection.</td></tr>
</table>

<table>
<tr><td rowspan="3">5.</td><td>OXYGEN REGULATOR</td><td>Off and 100%</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: N/A</td></tr>
<tr><td colspan="2">This closes the regulator valve and prevents damage from foreign objects or small particles entering the system.</td></tr>
<tr><td rowspan="3">6.</td><td>Canopy</td><td>Open</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Keyboard Command: LCtrl + C</td></tr>
<tr><td colspan="2"></td></tr>
</table>

APG-68 FIRE CONTROL RADAR

USAF Photo
by A1C Jordyn Fetter

Overview

Perhaps the most important sensor of the F-16C is its AN/APG-68 Fire Control Radar (FCR). The AN/APG-68 is an all-weather, coherent, multimode, search-and-track sensor that uses programmable digital processors to provide great flexibility in air-to-air tasks. It features pulse-doppler, look-down / shoot-down capability for both Beyond Visual Range (BVR) and close in, Air Combat Maneuvering (ACM) situations. The radar can locate and track targets within 60º left and right of the nose and 60º up and down.

Air-to-Air Modes

The FCR provides two basic A-A modes for target detection, acquisition, and tracking:

Combined Radar Mode (CRM). This mode combines air-to-air submodes used for search under one interface. Submodes are:

- Range While Search (RWS)
- Track While Scan (TWS)

Air Combat Mode (ACM). This mode combines all submodes for automatic target acquisition under one interface. Submodes are:

- 30° x 20°
- Boresight
- 10° x 60°
- Slewable

Single Target Track (STT) is an additional mode entered by locking a target in RWS or ACM submodes.

Air-to-Air weapon employment using the radar is discussed in the following sections:

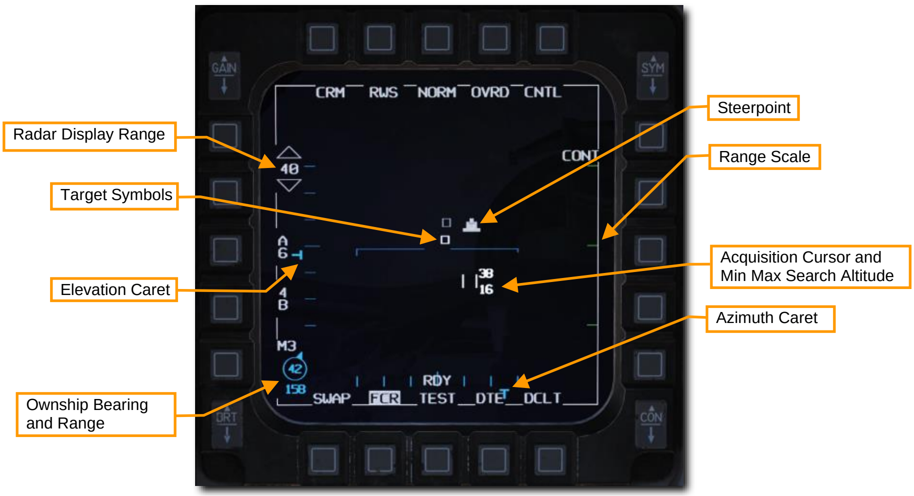
Air to Air Gunnery

AIM-9M/X Employment

AIM-120 Employment

We will first discuss aspects of the radar that spans multiple modes, and then later we will discuss radar functions specific to unique applications/weapons.

The air-to-air radar display uses a standard B-scope format in which the ownship (your aircraft) is in the bottom center of the display. As such, all indications on the b-scope are ahead of the ownship. Targets on the scope are displayed in range from the closest being at the bottom and the more distant being toward the top. Contacts left and right of the ownship are represented as being indicted left and right of the center of the display to indicate azimuth.



Fire Control Radar (FCR) Display

Important, basic components of the display include:

Radar Display Range. The currently selected range displayed on the MFD is shown on the left of the display. This can be increased or decreased by depressing the adjacent OSBs or by slewing the acquisition cursor to the top or bottom of the display.

Target Symbols. Target symbols are displayed as solid squares (bricks). The horizonal position of the target symbol indicates angular position in respect to ownship heading. The vertical position indicates range.

Acquisition Cursor. Consisting of two parallel, vertical lines, this cursor is moved in response to Cursor/Enable Switch commands on the throttle. When in a RADAR search mode, the altitude band being covered by the RADAR beam is indicated above and below the cursor.

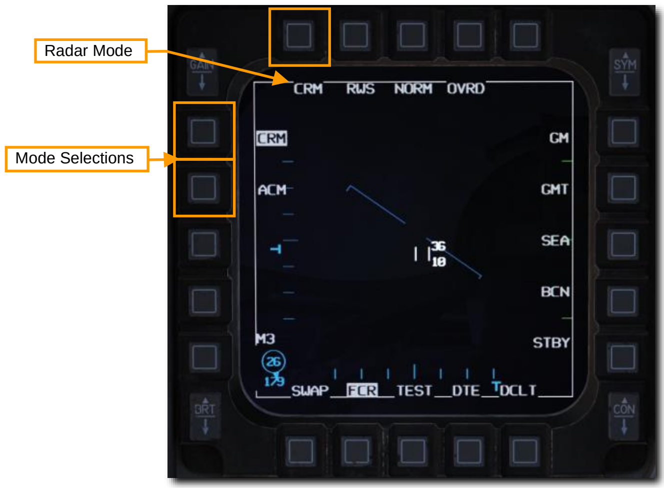
Targets are locked by slewing the cursor over the target symbol and commanding TMS Up on your stick.

Range Scale. The right side of the b-scope represents RADAR range. The scale includes marks for ¼, ½, and ¾ of the selected radar range.

Antenna Azimuth and Elevation Caret. The current radar azimuth is shown by a T symbol on the bottom of the display. The current radar elevation is shown by a T symbol on the left of the display. The carats move along scales that show the full ±60º sweep range of the antenna.

Ownship Bearing and Range. This shows the bearing and range from your own aircraft to the Bullseye.

Modes are selected by depressing the OSB adjacent to the current mode. A menu of all available air-to-air modes is displayed on the left side of the display. Depress the OSB adjacent to the desired mode to select it.



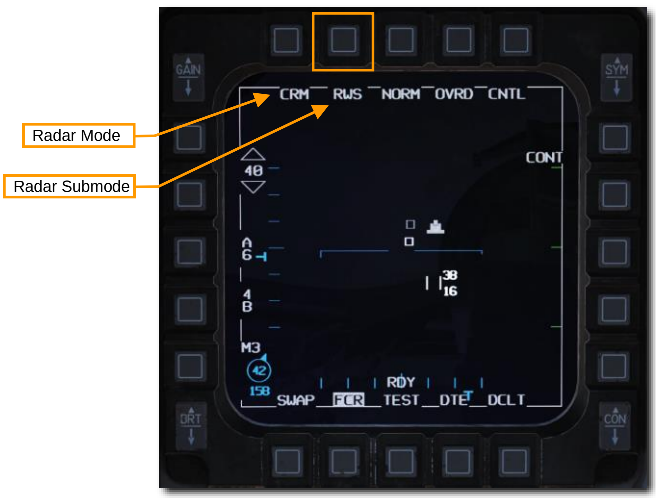
Fire Control Radar (FCR) Mode Selection

Combined Radar Mode (CRM)

This mode is selected by default at power-up. It is designed to reduce pilot workload by combining air-to-air submodes used for search under one interface. Submodes are:

- Range While Search (RWS)
- Track While Scan (TWS)

The RWS and TWS submodes may be cycled by depressing the OSB adjacent to the submode.



Combined Radar Mode (CRM)

These may also be cycled using the HOTAS by holding TMS right for more than one second.

Range While Search (RWS) Submode

The Range While Search (RWS) submode is used for long-range acquisition and engagement. The pilot can set the acquisition range (10, 20, 40, 80, or 160 nautical miles) and change the azimuth width and elevation.

Targets may be acquired and tracked in two ways: Situational Awareness Mode (SAM) acquisition or Single Target Track (STT) acquisition.

1. Situational Awareness Mode (SAM) acquisition. Target acquisition and lock is initiated by placing the acquisition cursor over a target, positioning the TMS on the stick forward once, then releasing the TMS. This starts the Situational Awareness Mode (SAM) acquisition sequence.

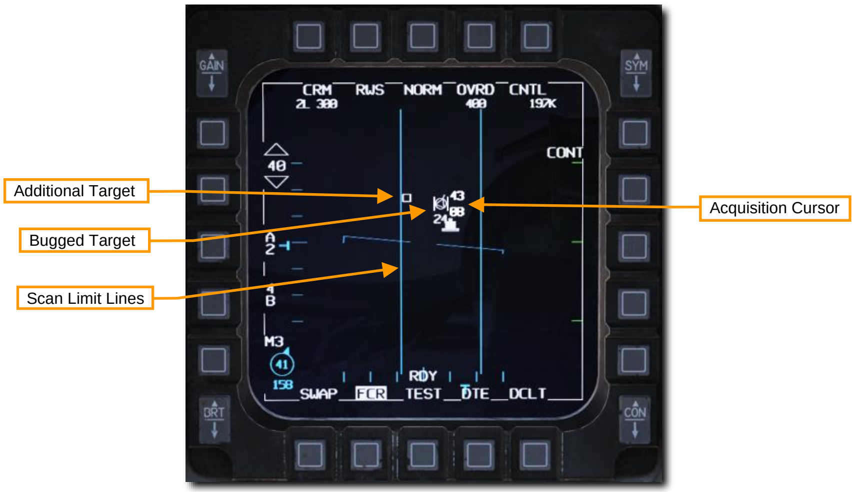
During acquisition, the antenna is directed to the last known target position, and a 4-bar, ±10-degree Spotlight search is performed.

Spotlight Scan

If a target is not under the acquisition cursor when TMS forward is released or no target is detected, the scan coverage reverts to the previous scan pattern.

After a successful acquisition, the SAM mode is entered. The target is tracked but the radar continues to scan the area and display additional targets. This is commonly referred to as ‘designating’ or ‘bugging’ a target.

An AIM-120 AMRAAM will guide on the bugged target even without an STT lock.



Situational Awareness Mode (SAM)

SAM mode may be exited with TMS aft on the stick.

Positioning TMS forward with the acquisition cursor over the SAM target enters Single Target Track (STT) mode.

2. Single Target Track (STT) acquisition. Target acquisition and lock is initiated by placing the acquisition cursor over a target, positioning the TMS on the stick forward twice in quick succession, then releasing the TMS. The acquisition sequence is the same as above except only one target is tracked.

The radar now focuses all its energy on a single target and provides constant updates. However, the radar will no longer detect other contacts and the enemy may be alerted by this radar lock.

Single Target Track (STT)

STT mode may be exited with TMS aft on the stick. TMS Aft once returns to SAM mode with the target bugged. TMS Aft twice returns to RWS mode.

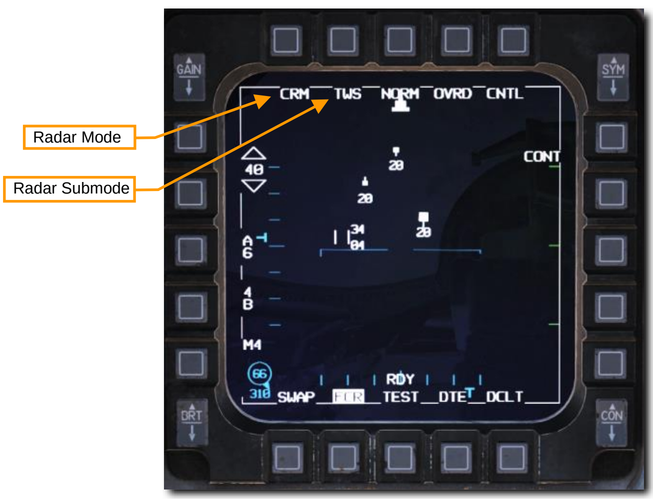
This mode is discussed in the Single Target Track (STT) section below.

Track While Scan (TWS) Submode

This mode combines the information unique to RWS and STT modes. Generally, the TWS display is very similar to the RWS display, however, each contact has a vector line that points in the direction of the contact's heading and a digital altitude indication below it. It permits having detailed target data on a contact while still being able to scan for other targets.

TWS has several restrictions. The radar will attempt to build track files for each contact, but given a large scan volume, there will be a sizable refresh time between scans. During each scan the radar will try to predict the position of the contact for the next scan. If, however the target takes evasive, high-G maneuvers and quickly changing its trajectory and speed, the radar can lose the track by making an incorrect track file prediction. Using such a defensive tactics, the hunter can quickly become the hunted.

TWS, when combined with the AIM-120, provides a powerful ability to engage multiple targets quickly. Nevertheless, the target tracking reliability is less than that of SAM and even more so than STT. Unlike STT though, a TWS launch with AIM-120 will not provide the enemy aircraft with a radar lock and launch indication. As such, the first warning the enemy pilot will likely get is when the active radar seeker of the AIM-120 goes active near the target.



Track While Scan (TWS) Submode

Track files are established on up to 10 targets based on information received on each radar sweep. The radar scan volume options are identical to those used for RWS but are reduced to 3-bar, ±25 degrees when a target is designated.

Four types of target symbols are available to help sort contacts in order of priority: **Search Target, Track Target, System Target** and **Bugged Target**.

Search Target. These are radar contacts that have not been resolved well enough to build a track. These are displayed as a small box in much the same way as in RWS.

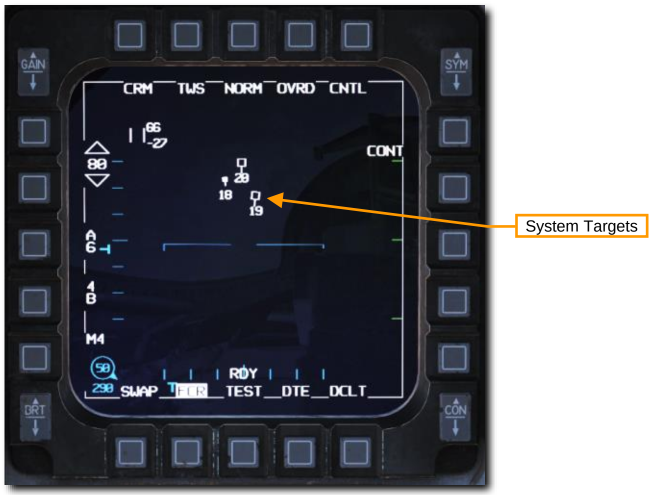
These targets disappear after a few sweeps if a track cannot be obtained. If a valid track is obtained, usually after being detected on two consecutive sweeps, the contact becomes a Track Target.

Track Target. These targets are displayed as large filled boxes with a velocity vector line showing their direction of travel. Their altitude is displayed just below each contact. Up to 10 of these tracks may be present at one time.

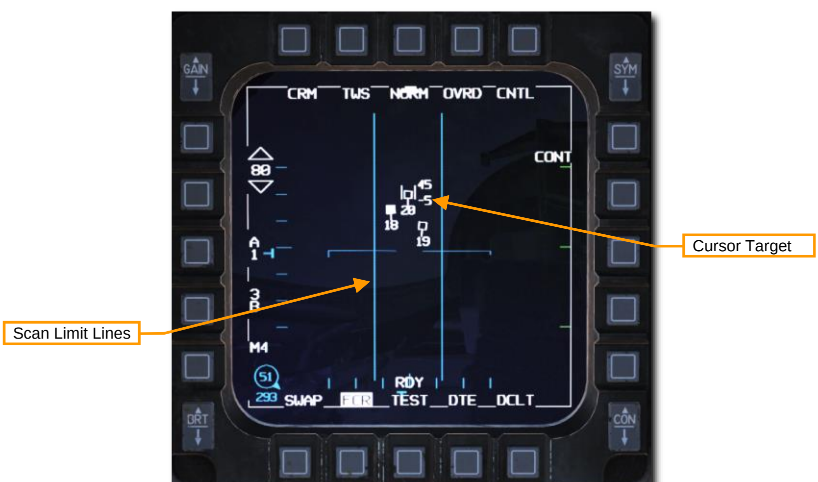
Track targets can be considered the baseline contact type. Other options become available after a contact has reached this stage. Contacts that are determined to be friendly through IFF interrogation or other means may be left as a Track Target. Contacts that require closer attention can be transitioned to System Targets.

System Target. The propose of system targets is to ease designation and tracking of the contacts considered most important. These are displayed as empty boxes and include the velocity vector line and altitude.

Track targets can be transitioned to system targets in two ways: either place the radar cursor over a track target and **TMS Up** on the stick to transition only that target or **TMS Right** on the stick to transition all track targets to system targets if no other system targets are displayed.



One option that then becomes available is establishment of a Cursor Target. This is done by positioning the cursor over any system target.



This transitions the scan to 3-bar, ±25 degrees centered on that target to provide faster updates and reduce the chance of losing the track. This does not designate the target for AIM-120 employment but increases its priority for radar updates.

The priority target can be changed by slewing the cursor to another system target. Slewing away from all system targets returns to the normal scan.

System targets can be designated as the bugged target by placing the radar cursor over it and **TMS Up** on the stick. This transitions the scan to 3-bar, ±25 degrees centered on the bugged target to provide faster updates and reduce the chance of losing the track.

Bugged Target. This is the highest priority of all the tracked targets and the target an AIM-120 missile fired at that moment will engage. It is displayed as a contact with a circle around it.

TMS Right will also select the closest system target as the bugged target. Subsequent presses of **TMS Right** will cycle through all displayed system targets, making each the bugged target in turn.

With this in mind, engagement of multiple targets with AIM-120 missiles can be carried out as follows: Transition the track targets you wish to engage to system targets. Bug the highest priority system target and fire the missile. Cycle through system targets and fire a missile at each in turn when it is bugged.

Additionally, the bugged target may be transitioned to an STT track by selecting **TMS Up** with the cursor over the bugged target.

Selecting **TMS Aft** from STT returns to the TWS mode. Each subsequent **TMS Aft** downgrades the status of the track files.

Air Combat Mode (ACM)

The Air Combat Mode (ACM) automatically acquires aircraft at short ranges. This mode is used most often when the target is already acquired visually. The pilot flies the aircraft to position the target in the proper position for radar acquisition.

Different scan patterns are available in the four different submodes:

- Boresight (BORE)
- 10°x 60° (Vertical Scan)
- 30°x 20° (HUD Scan)
- Slewable

The radar locks the first target it detects within each submode's search pattern. Maximum acquisition range is 10 nautical miles for all ACM submodes except Boresight, where acquisition out to 20 nautical miles is possible. Each submode has its own strengths and weaknesses and is best used in different situations.

ACM may be entered in two ways:

1. Position the Dogfight/Missile Override (DOGFIGHT) Switch on the throttle to DGFT. This selects ACM automatically.

or

2. Depress the OSB next to the radar mode and select ACM from the options on the left of the screen.

ACM Radar Mode Selection

The 30° x 20° submode is entered in a non-radiating (NO RAD) state by default when ACM mode is selected. The radar is activated when a submode is selected by either cycling through submodes on the MFD or using the Target Management Switch (TMS) on the stick.

ACM Radar Submode Selection

HOTAS functions of the TMS in ACM radar mode and the radar as SOI are:

- TMS Up
  - Boresight (BORE) Submode
- TMS Down
  - Without target lock: 10°x 60° (Vertical Scan)
  - With target lock: Target Reject and 30°x 20° (HUD Scan) NO RAD
- TMS Right
  - 30°x 20° (HUD Scan)
- TMS Left
  - No function

30° x 20° (HUD Scan) Submode

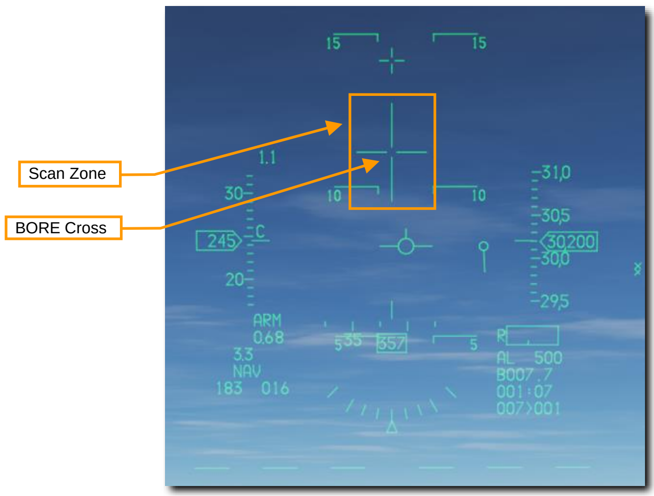
The 30° x 20° HUD scan pattern searches an area slightly larger than the HUD field of view. The lock range is 10 nautical miles. The radar automatically locks on to the first target in this zone. When locked, the target is automatically tracked in STT mode.

There is no special HUD symbology for this submode.

This submode is less precise than the BORE submode and may take longer to achieve a lock because of the larger target area for the radar scan to cover.

Boresight (BORE) Submode

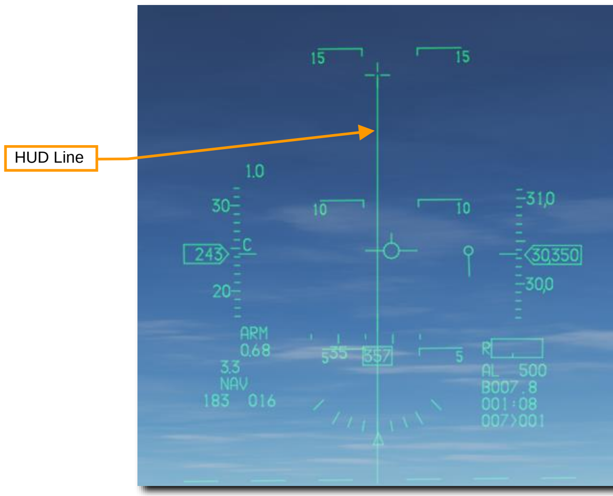
The BORE scan pattern searches a small one-beamwidth area located 3° below the HUD's gun cross. An additional **Boresight Cross** is displayed on the HUD at the center of the radar scan zone to aid in positioning the target in the radar beam.

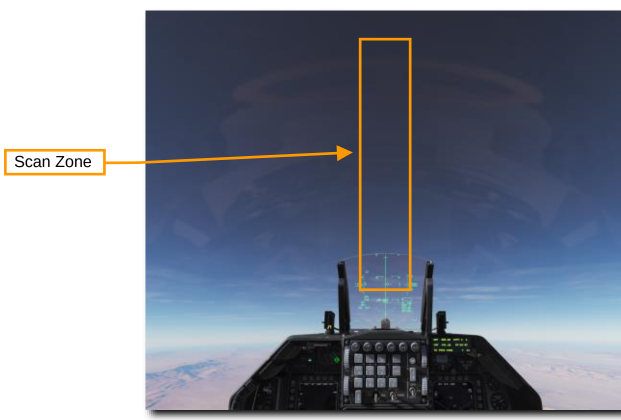


BORE is useful for quickly locking a target within visual range (WVR) and allows a degree fine control as to the target being locked. The first target detected within 20 nautical miles is locked and automatically tracked in STT mode.

10° x 60° (Vertical Scan) Submode

In the 10° x 60° vertical scan submode, the radar searches an area with 10 degrees in width and 60 degrees in the vertical. The scan center is 23° above the HUD’s gun cross. This mode is indicated by a vertical line extending from the gun cross to the bottom of the HUD.





The lock range is 10 nautical miles. The radar automatically locks on to the first target in this zone. When locked, the target is automatically tracked in STT mode.

This mode is most often used during air combat maneuvering (ACM) dogfights. During such fights, you are often trying to place the target on the lift vector and "pull" the target into the HUD. When in this mode, you can often lock on to the target earlier, even when it is well above the HUD frame.

Slewable Submode (later in early access)

The scan pattern is approximately 20° high x 60° wide. When selected, the scan is centered directly in front of the aircraft on the horizon. The scan is slewable via the CURSOR/ENABLE control on the throttle until a target is acquired. The amount of slew is limited by the radar gimbal limits.

As with the other submodes, the radar automatically locks on to the first target in this zone. When locked, the target is automatically tracked in STT mode.

This mode is useful when you have a direction to look, for example ‘bandits 2 o’clock high’, but have not picked them up visually yet.

Single Target Track (STT) Mode

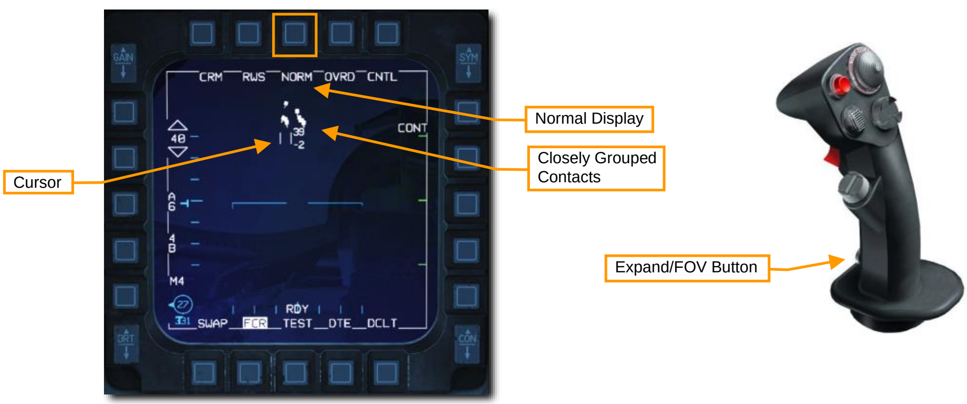
After you have locked the target from RWS or ACM submodes, the radar will change to STT mode. The radar now focuses all its energy on a single target and provides constant updates. However, the radar will no longer detect other contacts and the enemy may be alerted by this radar lock.

The MFD display in STT mode remains much the same as RWS mode with these differences: The **locked radar target** is displayed as a circled triangle symbol with a flight vector line. The **target's altitude** is displayed below the target symbol. The top of the display shows **aspect angle, ground track, calibrated airspeed**, and **closure rate**.

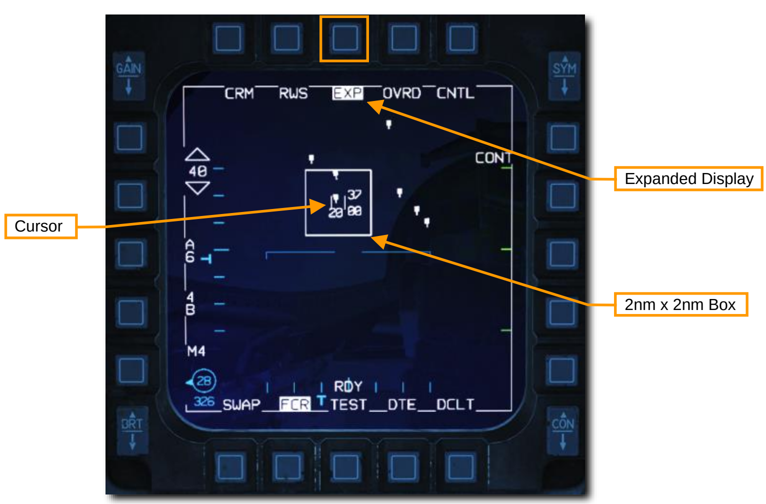
Expand (EXP) Feature

The radar provides the ability to enter an expanded field of view display that allows sorting and resolution of closely grouped contacts. This can be thought of as a zoom feature that provides a 4:1 scale view centered around the radar cursor. This feature is available in all radar modes.

The expanded display may be toggled on or off by selecting the OSB next to NORM/EXP or by depressing the **Expand/FOV Button** (pinky switch) on the stick while the FCR is sensor of interest.



The expanded display features a 2 nm x 2 nm reference box centered on the cursor. Basic functions and symbology are unchanged from the normal display.



IFF Interrogation

The Identification Friend or Foe (IFF) system allows interrogation of aircraft to determine if they are friendly or hostile. This is done by transmitting a coded signal aimed at a specific radar contact or volume of space within the selected radar azimuth and elevation. Transponders in friendly aircraft receive this signal and reply with the correct coded response.

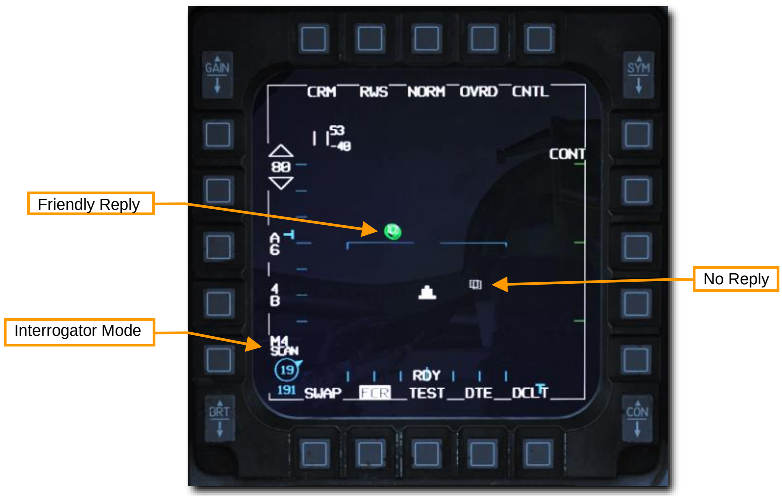
Contacts are classified based on the response and symbols identifying contacts as friendly or hostile are displayed on the radar screen. The IFF system is not radar dependent so interrogation of contacts is still possible with the radar off.

The IFF Master Switch must be set to NORM or LOW on the IFF panel to enable IFF interrogation.

Interrogation is initiated by HOTAS command in one of two modes:

- **Scan.** Press TMS Left short (1 second or less) to interrogate all contacts in the radar scan volume.
- **Line of Sight (LOS).** Press TMS Left long (more than 1 second) to interrogate the locked target or immediate area around the radar cursor.

If the contact is friendly a green circle is drawn around the contact for three seconds. If no reply is received, no indication is displayed, and the contact is classified as unknown. These contacts may be assumed to be hostile depending on the rules of engagement (ROE) in your current scenario.



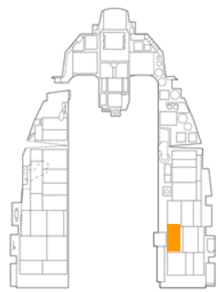
LINK 16 DATALINK

USAF Photo
by SrA Julianne Showalter

Overview

The aircraft relies on the Multifunction Information Distribution System (MIDS) radios that allow the transmission and reception of data over the Link 16 Tactical Data Information Link (TADIL) network. Link 16 allows NATO and other services to share data with each other.

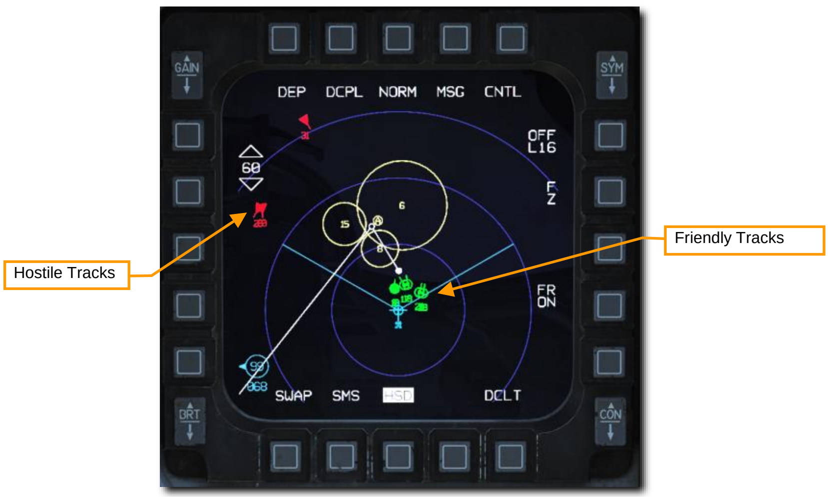
Link 16 is part of the MIDS radio system and must be activated by rotating the MIDS LVT knob on the Avionics Power Panel to the ON position. The DL switch next to the knob is not applicable to this block of the F-16C and may be left OFF if desired.



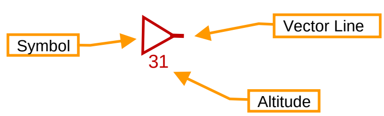
The primary purpose of Link 16/MIDS is to provide a near-realtime picture of the tactical area around the pilot's aircraft. Data from ownship sensors, other friendly fighters on the network, and surveillance assets like AWACS are correlated to create a unified situational awareness picture. This in turn allows a more coordinated engagement and less chance of fratricide.

Display Symbology

Each trackfile is represented by a symbol on the HSD and Radar Display. Depending on the shape and color, you can determine whether it is friendly or hostile, and what the source of the track is; onboard systems, offboard donors, or a combination of the two.



Horizontal Situation Display (HSD)

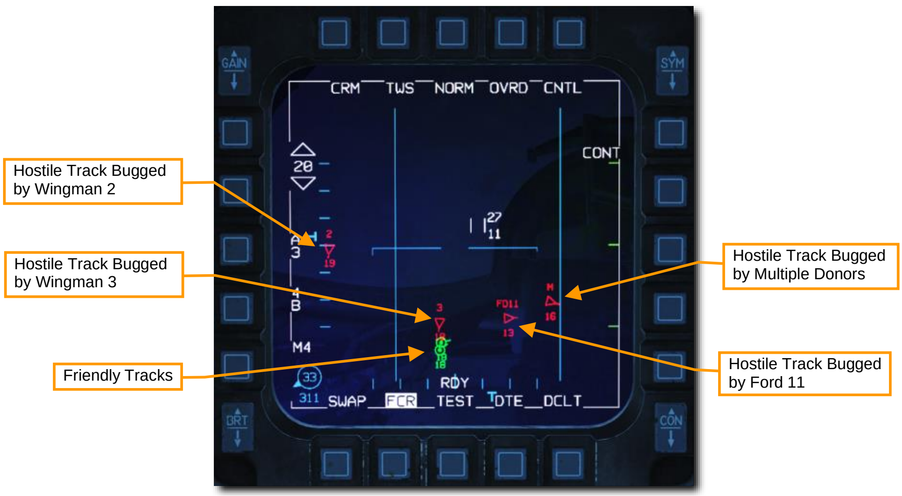


Symbol. The basic symbol changes shape and color to represent different information. See below for examples.

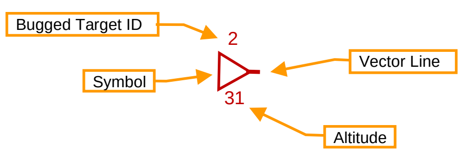
Vector Line. This line points in the direction the track is heading.

Altitude. This displays the track's altitude in thousands of feet

The Radar Display presents the information in much the same way as the HSD but includes an additional identifier when a target is ‘bugged’ as the primary target by another donor aircraft on the network. This is a great aid to target sorting as it allows the pilot to prioritize targets not being engaged by other aircraft in the area.



Radar Display



The **Bugged Target ID** shows the aircraft that is currently targeting a hostile track and may be interpreted as follows:

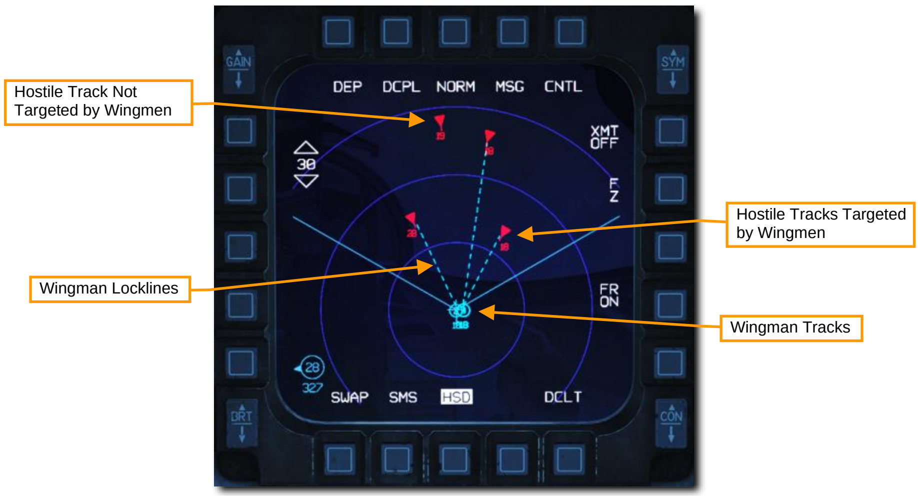
2, 3, or 4. These identify the member of the pilot’s flight that is currently bugging the target.

FD11, EN23, CY14, etc. The first and last letters of the callsign and flight position number is displayed when a target is bugged by a donor that is not a member of the pilot’s flight. For example, FD11 identifies Ford 11, CY14 identifies Chevy 41, and so on.

M. The target is bugged by multiple donors.

Bugged targets are identified differently on the HSD than on the radar display. A dashed cyan **Wingman Lockline** is drawn from wingmen to their currently bugged targets. Wingman Locklines are only displayed for flight members and not for all donors on the network.

Bugged Target IDs are shown on the radar display only and Wingman Locklines are displayed on the HSD only.



Link 16/MIDS can receive and display three types of track files:

- **Surveillance Tracks.** These are tracks provided by data sources like AWACS and radar ground stations.

	Hostile	Unknown	Suspect	Friendly
Surveillance Tracks	31	25	21	29

- **Fighter Tracks.** These are tracks provided by donor aircraft, other fighters providing track data, on the network. They are all correlated against each other to avoid duplicate trackfiles. These are visually identical to surveillance tracks.

	Hostile	Unknown	Suspect	Friendly
Fighter Tracks	31	25	21	29

- **Precise Participant Location and Identification (PPLI) Tracks.** These show the location and status of members of the pilot's own flightand up to four additional donor aircraft.

	Wingman	Other Donor		
PPLI Tracks	2 29	22		

Trackfiles from each of these three sources (offboard) are then correlated with the sensors of the player's aircraft (onboard). This is termed Multi Source Integration (MSI).

	Hostile	Unknown	Suspect	Friendly
Tracks Correlated with Onboard Sensors	31	25	21	29

	Wingman	Other Donor		
PPLI Tracks Correlated with Onboard Sensors	2 29	22		

Radar Display Filtering

Track symbols displayed on the FCR page may be filtered using the UHF/VHF Transmit switch. This affects tracks displayed on the radar display only and does not affect those displayed on the HSD.

Positioning the switch **inboard short** (less than .5 sec) rotates between three filter options

ALL. All symbols are displayed

FTR+. Surveillance tracks are removed

TGTS. Surveillance and PPLI tracks are removed.

Positioning the switch **outboard short** (less than .5 sec) selects **NONE** and removes all datalink tracks. Selecting **outboard short** again returns to the previously selected filter option.

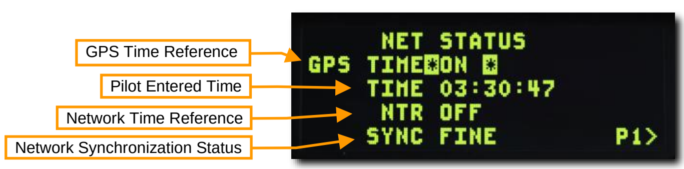
The current option is displayed at the bottom left of the radar display.

DLNK DED Pages

Three datalink (DLNK) pages are available on the DED to monitor and verify configuration of the Link 16 system. The first page is accessed by depressing the LIST button on the ICP and selecting ENTR (E). The next page can be selected by toggling the DCS right to the SEQ position.

Network Status

Page 1 displays network status and time references.



GPS Time Reference. All Link 16 network participants must work off a common time reference. This is provided by GPS clock data when this is set to ON.

Pilot Entered Time. If GPS is not used or not available, network participants may enter a time based on a pre-arranged reference.

Network Time Reference. If enabled, this identifies the aircraft as the network controller. This is normally set to OFF.

Network Synchronization Status. This displays the quality of time synchronization with the network.

MIDS Radio Options

Page 2 sets MIDS radio options, including channels for data reception and transmission power.

Fighter, Mission and Surveillance Channel selection. This selects the MIDS channel data from flight members, other flights and AWACS aircraft is received on. These are pre-set and do not need to be changed.

Callsign. This is the identifier for data coming from the aircraft.

Flight Lead Identifier. If enabled, this identifies the aircraft as the flight lead.

Transmission Power. This selects the power output for the MIDS radios.

Flight Management

Page 3 allows management and identification of flight members on the network.

Flight Member Track Numbers. These identify the tracks for members of a flight. These are pre-set and do not need to be changed.

Own Flight Position. This identifies the aircraft's position in the flight.

LITENING AT TARGETING POD

USAF Photo
by MSgt Kevin J. Gruenwald

Overview

The targeting pod provides you the ability to view, track, or designate targets day or night. There are two live video modes: Charge Coupled Device (CCD) (like a TV display) and Forward Looking Infrared (FLIR) in both Black Hot and White Hot submodes.

The main function modes and submodes for the TGP include:

- Standby (STBY)
- Air-to-Ground (A-G)
  - Slave (Ground)
  - AREA Track
  - POINT Track
  - INR Track
  - Laser Spot Search (LSS)
- Air-to-Air (A-A)
  - Slave (Body)
  - POINT Track
  - RATE Track
- HUD

Each of these modes also has a Control Page that provides you with the ability to configure TGP features.

TGP Activation

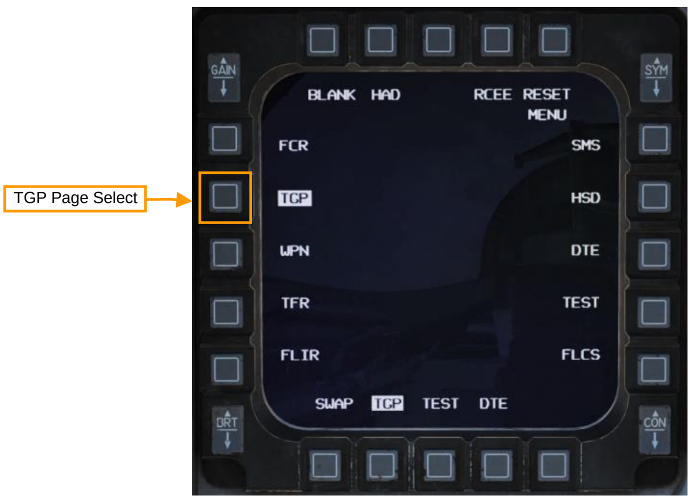
The following switches must be set on the Avionics Power Panel for all TGP features to function:

- MMC switch – MMC
- ST STA switch – ST STA
- MFD switch – MFD
- UFC switch – UFC
- EGI/INS – NORM

Power is applied to the TGP from the Sensor Control Panel:

- RIGHT HDPT switch – RIGHT HDPT

Select TGP from the MFD Menu to access the TGP page.



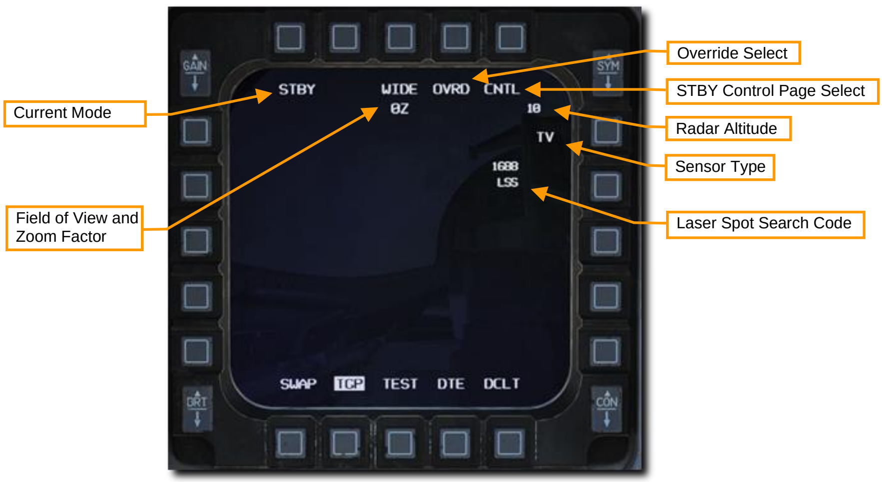
When the TGP is initially activated, the Standby page will be displayed with a “NOT TIMED OUT” message displayed in the upper center portion. Time is needed to run automatic power-up self tests and for the FLIR sensor to cool down.

A “FLIR HOT” message is displayed in white text on a black background with half the text height as the “NOT TIMED OUT” message. After about three minutes, the message will be removed, video will appear, and the Standby mode page will be selected.

Standby (STBY) Mode

This will be the first TGP mode screen displayed upon activation of the TGP. After the "NOT TIMED OUT" message has been removed (after 3 minutes), the mode may be exited by selecting one of the other two TGP modes or the standby control page.

The following OSB functions may be displayed:



Current Mode. This is the mode the TGP is currently in.

Field of View. Depressing this OSB toggles between Narrow Field of View (NFOV) or Wide Field of View (WFOV). These views can vary between the CCD and FLIR sensors in the TGP.

- FLIR field of view:
  - Wide Field Of View (WFOV) is 4-degrees x 4-degrees
  - Narrow Field Of View (NFOV) is 1-degree x 1-degree
- CCD field of view:
  - Wide Field Of View (WFOV) is 3.5-degrees x 3.5-degrees
  - Narrow Field Of View (NFOV) is 1-degree by 1-degree

Zoom Factor. Within an FOV selection, you may additionally adjust the zoom-factor by zooming in and out with the RANGE knob on the throttle. The zoom range goes from 0Z (no zoom) to 9Z (highest level of zoom within FOV). Objects within the TGP field of view double in size from 0 to 9 zoom.

OVRD Select. Depressing this OSB overrides any current mode and returns to STBY. The last selected mode is returned to when OVRD is selected a second time.

STBY Control Page Select. Depressing this OSB selects the STBY Control Page. Options and functions are described below.

Radar Altitude. The current radar altitude is displayed.

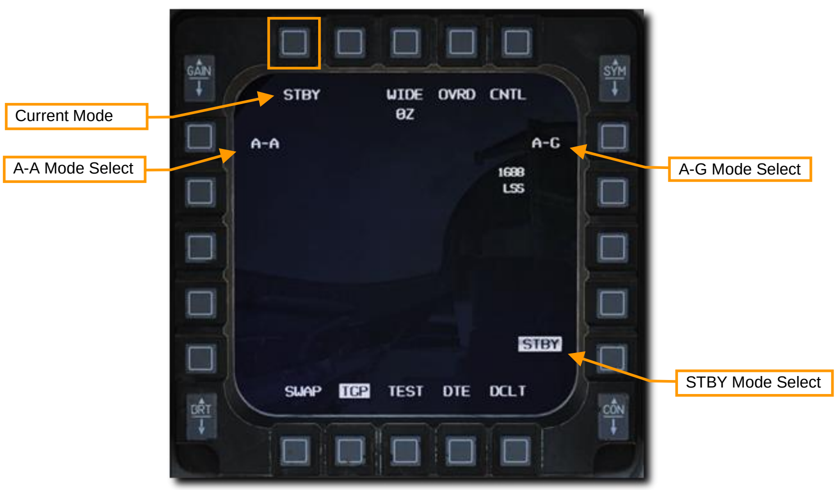
Sensor Type. Displayed in the upper right corner, this text field indicates the current video mode that the TGP is collecting in. The three options include:

- WHOT. Using the FLIR camera, hot objects appear lighter than a cooler background.
- BHOT. Using the FLIR camera, hot objects appear darker than a cooler background.
- TV. The Charge Coupled Device camera displays this image. This is a daytime, electro-optical camera.

Laser Spot Search Code. This is the laser pulse rate frequency (PRF) code the TGP will attempt to locate in laser spot search (LSS) mode.

Mode Selection

You may change modes by depressing the OSB 1 adjacent to STBY. The following options will be displayed depending on Master Mode:



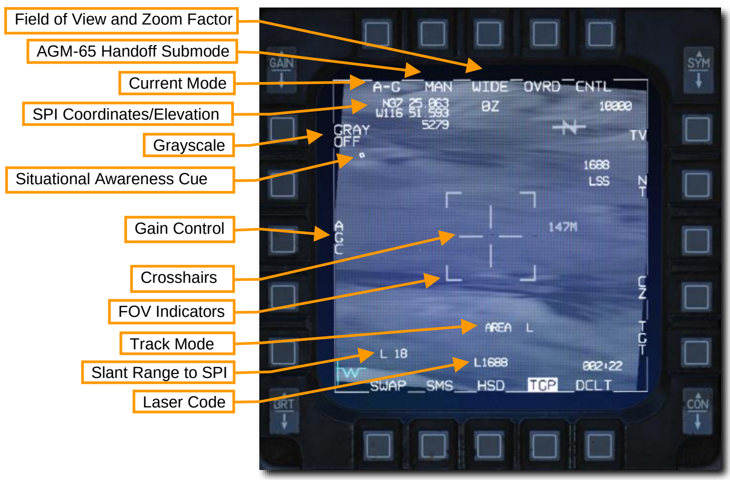
A-A Mode Select. Depressing this OSB selects A-A mode.

A-G Mode Select. Depressing this OSB selects A-G mode.

STBY Mode Select. Depressing this OSB selects STBY mode.

Air-to-Ground (A-G) Mode

When A-G mode is first entered, the TGP will boresight at 150 mils below the zero sight line of the aircraft, directly forward and slightly down. The following elements may be displayed:



Field of View. Depressing this OSB toggles between Narrow Field of View (NFOV) or Wide Field of View (WFOV). These views can vary between the CCD and FLIR sensors in the TGP.

- FLIR field of view:
  - Wide Field Of View (WFOV) is 4-degrees x 4-degrees
  - Narrow Field Of View (NFOV) is 1-degree x 1-degree
- CCD field of view:
  - Wide Field Of View (WFOV) is 3.5-degrees x 3.5-degrees
  - Narrow Field Of View (NFOV) is 1-degree by 1-degree

Zoom Factor. Within an FOV selection, you may additionally adjust the zoom-factor by zooming in and out with the RANGE knob on the throttle. The zoom range goes from 0Z (no zoom) to 9Z (highest level of zoom within FOV). Objects within the TGP field of view double in size from 0 to 9 zoom.

AGM-65 Handoff Submode. This OSB toggles between **MAN** and **AUTO** for AGM-65D/G Maverick hand off mode.

- MAN. The AGM-65 will be slaved to the Line of Sight of the TGP but will not automatically be handed off the lock. Pilot must manually change SOI to AGM-65 and command lock manually.
- AUTO. TMS right will hand off the lock to the AGM-65 if the target contrast and size meets criteria of missile lock.

Current Mode. This is the mode the TGP is currently in.

SPI Coordinates/Elevation. The lat/long coordinates and elevation in feet of the current System Point of Interest (SPI) is displayed. This is usually the point in the center of the crosshairs at ground level.

Grayscale. When pressed, it displays a 10-stage gray scale bar at the bottom of the display. When enabled, the label changes to GRAY ON.

Situational Awareness Cue. The SA cue provides you a reference to indicate the TGP's current line of sight in reference to the pod's longitudinal (boresight) axis, which is coincidental with the aircraft longitudinal axis. The cue is represented as a small square that can move to any spot within the display. The position of the SA square represents the current TGP line of sight.

Gain Control. Pressing this OSB toggles between manual and automatic gain control for the FLIR video.

- MGC. If selected, level control arrows are displayed on the OSBs below (not shown). Gain may be controlled with the physical gain rocker switch on the top left of the MFD. The current selected gain is indicated on the top left corner of the TGP page (not shown).
- AGC. Gain is adjusted automatically, and the level control arrows and gain indicator are both removed.

Note: The AGC/MGC label and associated OSB labels are displayed even if the TGP is in TV mode.

Crosshairs. Line of sight for targeting and laser fire.

Field of View (FOV) Indicators. These four corner brackets are only shown when WIDE FOV is enabled and indicate the portion of the image that will be displayed if NARO FOV is enabled.

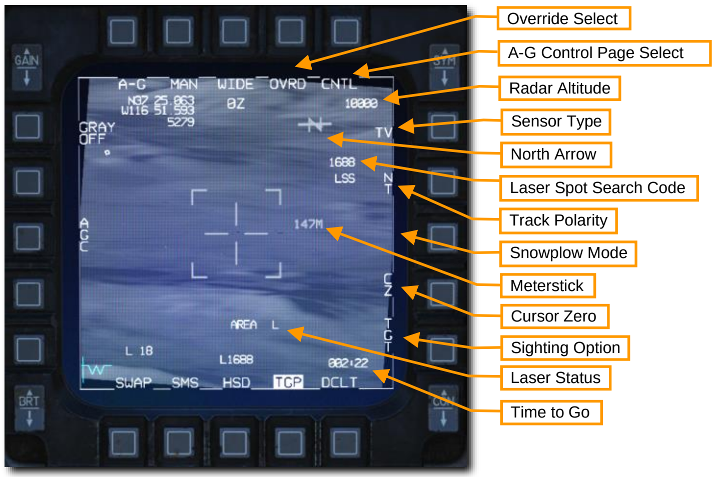
Track Mode. If the TGP is in a track mode, this field will indicate the track mode it is in. Types include:

- AREA. In AREA track mode, the TGP performs image correlation to track an overall scene. AREA track mode is effective at tracking fixed objects.
- POINT. In POINT track mode, the TGP attempts to follow the centroid of a visible object using edge detection. POINT track mode is effective at tracking moving objects that are well-defined against their background, either because they are warmer (in HOC/COH submodes) or brighter (TV submode).
- INR (inertial rates). In INR mode, the TGP maintains its LOS on a position using only inertial integration. It does not do any image processing. INR track mode is effective at approximately maintaining the TGP LOS when the target is at risk of being masked or obscured.

Slant Range to SPI. This indicates the slant range in nautical miles to the SPI. The preceding letter indicates the source of the range data.

- L. Laser (priority over all other sources)
- T. TGP passive ranging
- (blank). Sensor that is not the TGP is providing range (for example, FCR A-G ranging)

Laser Code. If the laser is firing (flashing L), the targeting pod laser code being used should display the code as set on the LASR DED page. This is an octal value of 1 to 8 with a range between 1111 and 2888.



OVRD Select. Depressing this OSB overrides any current mode and returns to STBY. The last selected mode is returned to when OVRD is selected a second time.

A-G Control Page Select. Depressing this OSB selects the STBY Control Page.

Radar Altitude. The current radar altitude is displayed.

Sensor Type. Displayed in the upper right corner, this text field indicates the current video mode that the TGP is collecting in. The three options include:

- WHOT. Using the FLIR camera, hot objects appear lighter than a cooler background.
- BHOT. Using the FLIR camera, hot objects appear darker than a cooler background.
- TV. The Charge Coupled Device camera displays this image. This is a daytime, electro-optical camera.

North Arrow. The north arrow cue consists of the letter N with an arrow, displayed on the top right corner of the TGP base page. The arrow points to magnetic north in 1.4-degree increments relative to the TGP cross hairs line of sight.

Laser Spot Search Code. This is the laser pulse rate frequency (PRF) code the TGP will attempt to locate in laser spot search (LSS) mode.

Track Polarity. For either FLIR or TV, depressing this OSB toggles between Neutral Track (NT) and White Track (WT). When TV is selected, the OSB cycles between NT, WT, and Black Track (BT).

- NT mode allows both white and black targets to be point tracked. This is the default A-G mode.
- WT only allows white point targets to be tracked. This is the default A-A mode
- BT allows black point targets to be tracked.

Depressing this OSB twice within 0.5 seconds toggles the Laser Spot Tracker (LST) function on and off.

Snowplow Mode. This mode is available in NAV and A-G modes while the TGP is not tracking. This mode is available when SP is displayed adjacent to the OSB (not shown). When SP is pressed, both the FCR and TGP are commanded to snowplow mode.

In snowplow mode, the TGP LOS is commanded straight ahead and angled downwards to point to the ground ahead at ½ of the currently selected FCR scale (for example, if selected FCR scale is 40nm, the TGP will look at the point on the ground 20nm ahead). Because the location determined by the reticle is snowplowing, the SPI itself will also snowplow.

Slewing is disabled; however, it is possible to ground-stabilize by pressing TMS-fwd. This will exit SP mode and enter a normal AREA track.

Meterstick. The meterstick is a number to the right of the reticle that indicates the length of the ground under the crosshair, in meters.

Cursor Zero. Pressing CZ erases the cursor slew and returns the SPI to the currently selected steerpoint.

Sighting Option. This OSB will cycle between TGT-OAP1-OAP2 where OAP is the Offset Aim-Point (OAP) which can be added to each steer point. An OAP can be useful if the target is obscured by weather, but the OAP is in the clear. By selecting OAP1 or 2, the TGP slaves to the clear OAP and the aiming can be confirmed, although the steering and weapon delivery calculations will be to the target.

Laser Status. This displays the current state of the laser designator.

- (blank). Laser not armed
- L. Laser armed.
- Flashing L. Laser firing.

Time to Go. This shows the time to the next event depending on the aircraft status. Time to reach the steerpoint is displayed if in NAV master mode. Time to release weapon is displayed if in A-G mode if a target has been designated in an auto-delivery mode. Time to impact is displayed if a weapon has been released.

Weapons delivery using the TGP in A-G mode is covered in the Laser Guided Bombs section.

Track Modes

The LITENING II targeting pod can employ one of three different modes to track a target: AREA, POINT, INR (inertial rates), and SP (snowplow). Each track mode is suitable for a different situation.

- In AREA track mode, the TGP performs image correlation to track an overall scene. AREA track mode is effective at tracking fixed objects.
- In POINT track mode, the TGP attempts to follow the centroid of a visible object using edge detection. POINT track mode is effective at tracking moving objects that are well-defined against their background, either because they are warmer (in HOC/COH submodes) or brighter (TV submode).
- In INR mode, the TGP maintains its LOS on a position using only inertial integration. It does not do any image processing. INR track mode is effective at approximately maintaining the TGP LOS when the target is at risk of being masked or obscured.
- In SP mode, TGP LOS is commanded straight ahead and angled downwards to point to the ground ahead at ½ of the currently selected FCR scale (for example, if selected FCR scale is 40nm, the TGP will look at the point on the ground 20nm ahead).

Therefore, it is recommended to use AREA track mode for stationary targets and POINT track mode for moving targets. In situations where the targeting pod is likely to become masked (intensive maneuvering, concealment behind terrain, or turning away from the target), it's recommended to first change the TGP to INR track mode to preserve the LOS as best as possible. SP mode is useful for locating targets directly ahead without reference to steerpoints or other anchor points loaded into the aircraft.

When the targeting pod is initially brought out of standby, it is not in any track mode. The pilot can move the targeting pod between track modes using the TMS switch:

	INR mode	**AREA mode**	**POINT mode**	**SP mode**
TMS forward	Commands POINT track	Commands POINT track		Commands POINT track
TMS right	Commands AREA track		Commands AREA track	Commands AREA track
TMS down	Commands Cursor Zero	Commands INR track	Commands INR track	

Targeting pod in INR (inertial rates) track mode (crosshair is enlarged)

Targeting pod in AREA track mode

Targeting pod in POINT track mode (box encloses track target)

When the TGP cursor is slewed, the targeting pod automatically and temporarily changes to INR track mode. The previous track mode (AREA or POINT) is re-commanded once slewing stops.

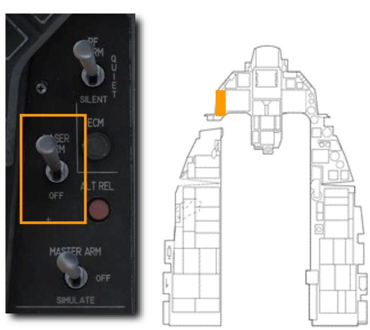
Laser Ranging

One very important feature of the Targeting Pod's laser designator is the ability to measure the slant range to the target. The laser is fired and the time it takes to receive the reflected laser energy is measured, providing a precise range. This information is then fed to the Fire Control Computer to update the stored target elevation and greatly improve the accuracy of the computed firing solution.

This can and should be done when possible for all weapons delivery types, not just laser guided bombs. To facilitate this, the TGP automatically slaves to the pipper while in gun, rocket and bomb CCIP modes, and to the target designator while in CCRP and DTOS modes.

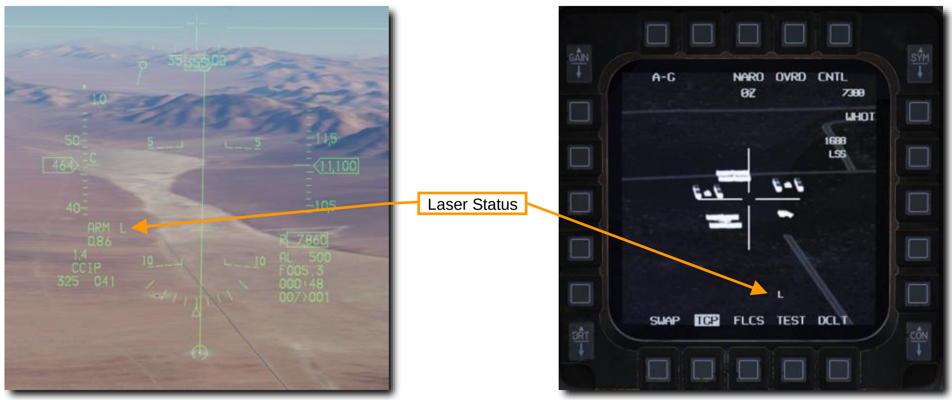
These weapons delivery modes are discussed fully in the Air-to-Ground Employment section.

To take a laser range, the Laser Arm Switch must be set to ARM. Laser firing is inhibited with the switch set to OFF.



The Laser status is displayed as an L on the HUD and TGP display when the Laser Arm switch is set to arm.

The laser is fired by squeezing the trigger on the stick to the first detent. The L flashes when the laser designator is firing. Releasing the trigger stops lasing.



Air-to-Air (A-A) Mode

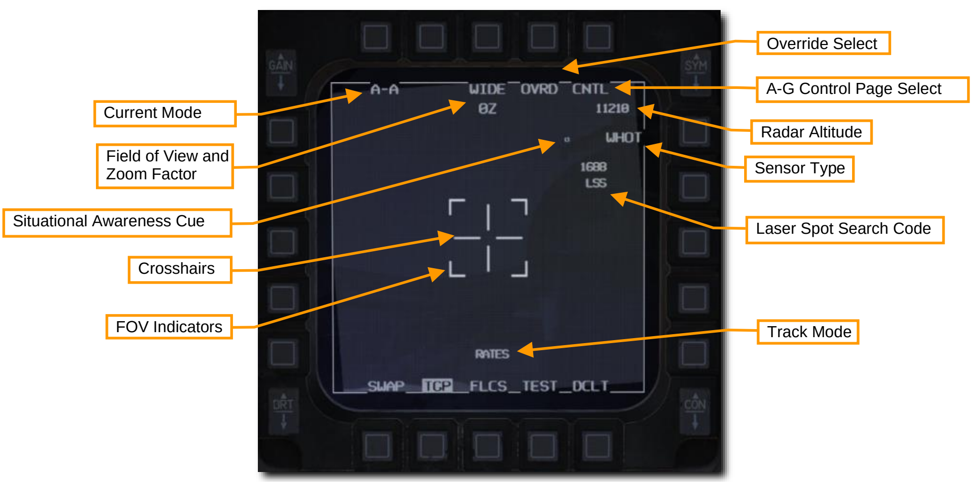
The TGP is automatically commanded to the radar line-of-sight when A-A master mode is selected, and the radar is tracking a target. If the radar is not tracking an aerial target, the pod directs its line-of-sight straight ahead at minus-3 degrees elevation.

From the boresight, you may slew the TGP crosshair using the CURSOR switch on the throttle. When slewing, the TGP camera moves in a space stabilized manner. When in this slewed mode, but not tracking a target, “RATES” is indicated on the display. After being slewed, the crosshairs will be reduced to half-size.

If the valid air target passes within the narrow field of view area (represented by the four corner markers), the TGP will attempt to track the target and place a cross “+” on it. If the target flies outside the narrow field of view area, the cross will disappear.

If you then command TMS Forward Short HOTAS command (command point track), the target will be centered in the crosshair and a box will be drawn around the target to conform to its size. When in this mode, “POINT” will be displayed as well as the tracking cross. To exit POINT track, the user may command INR track (TMS Right) or return to slave mode (TMS Aft).

The following elements may be displayed:



Current Mode. This is the mode the TGP is currently in.

Field of View. Depressing this OSB toggles between Narrow Field of View (NFOV) or Wide Field of View (WFOV). These views can vary between the CCD and FLIR sensors in the TGP.

- FLIR field of view:
  - Wide Field Of View (WFOV) is 4-degrees x 4-degrees
  - Narrow Field Of View (NFOV) is 1-degree x 1-degree
- CCD field of view:
  - Wide Field Of View (WFOV) is 3.5-degrees x 3.5-degrees
  - Narrow Field Of View (NFOV) is 1-degree by 1-degree

Zoom Factor. Within an FOV selection, you may additionally adjust the zoom-factor by zooming in and out with the RANGE knob on the throttle. The zoom range goes from 0Z (no zoom) to 9Z (highest level of zoom within FOV). Objects within the TGP field of view double in size from 0 to 9 zoom.

Crosshairs. Line of sight for targeting and laser fire.

Field of View (FOV) Indicators. These four corner brackets are only shown when WIDE FOV is enabled and indicate the portion of the image that will be displayed if NARO FOV is enabled.

OVRD Select. Depressing this OSB overrides any current mode and returns to STBY. The last selected mode is returned to when OVRD is selected a second time.

A-G Control Page Select. Depressing this OSB selects the STBY Control Page.

Radar Altitude. The current radar altitude is displayed.

Sensor Type. Displayed in the upper right corner, this text field indicates the current video mode that the TGP is collecting in. The three options include:

- WHOT. Using the FLIR camera, hot objects appear lighter than a cooler background.
- BHOT. Using the FLIR camera, hot objects appear darker than a cooler background.
- TV. The Charge Coupled Device camera displays this image. This is a daytime, electro-optical camera.

Laser Spot Search Code. This is the laser pulse rate frequency (PRF) code the TGP will attempt to locate in laser spot search (LSS) mode.

Track Mode. If the TGP is in a track mode, this field will indicate the track mode it is in. Types include:

- RATES. When in A-A mode and the slew function is released, the TGP will automatically enter RATES mode (indicated in the tracking-type field).
- POINT. As with A-G mode, the user may command a Point track over an object. This mode is also used for radar locked targets.

Situational Awareness Cue. The SA cue provides you a reference to indicate the TGP's current line of sight in reference to the pod's longitudinal (boresight) axis, which is coincidental with the aircraft longitudinal axis. The cue is represented as a small square that can move to any spot within the display. The position of the SA square represents the current TGP line of sight.

Weapons delivery using the TGP is covered in the Air to Air Employment section.

HOTAS Commands

The following HOTAS commands are available when the TGP is sensor of interest (SOI):

TMS Fwd. Enter AREA track when depressed, then POINT track when released. If POINT track fails, it remains in AREA track.

TMS Aft. If TGP is tracking, break track and return to slave mode (i.e. slaved to A/G SPI or A/A FCR line of sight). If TGP is already in slave mode, cursor zero (i.e. return to boresight position).

TMS Left. Toggle FLIR polarity between white hot and black hot.

TMS Right (Maverick not selected). Enter AREA track mode.

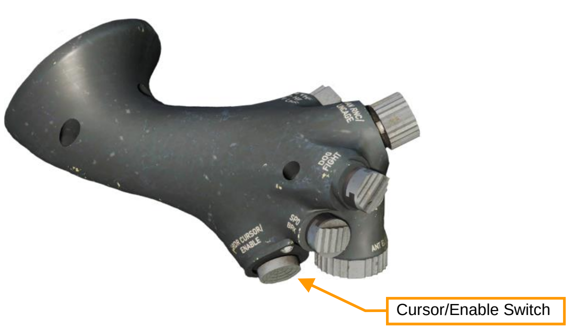
TMS Right (Maverick selected). Attempt Maverick handoff.

Trigger (First Detent). Fire Laser.

Trigger (Second Detent). Fire laser for 30 seconds if in CCIP bombing mode. (See Laser Ranging section.)

Expand/FOV. Toggle FOV between Wide and Narrow.

Manual Slew. The TGP view can be slewed to scan the scene and search for targets using the cursor controls on the throttle. Manual slew is available is either in Slave mode or in one of the tracking submodes (i.e. area track or point track).



LASR DED Page

The laser code for TGP designation and LST search are set on the LASR DED page.

1. Select the LIST page and press 0 to bring up the MISC page.
2. Then, press 5 to select the LASR page.

3. Type in the new TGP laser code or LST code on the keypad and depress ENTR.

The TGP will now fire the laser designator at the new TGP code or search for laser spots with the new LST code. Position the DCS left to return to the CNI page.

The laser designator on the Targeting Pod must be set to match the code on the bomb. See the section on the Bomb Seeker Laser Code for procedures.

HELMET MOUNTED CUEING SYSTEM

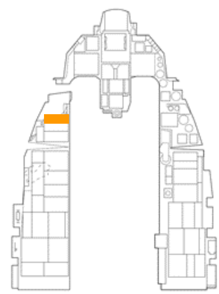
USAF Photo
by A1C Kevin Tanenbaum

Overview

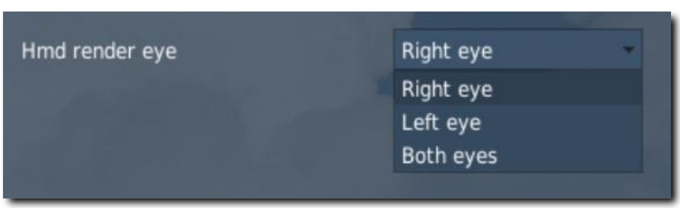
The Helmet Mounted Cuing System (HMCS) is a bolt-on kit to the flight helmet that always allows the pilot to view aircraft and weapon information on the helmet visor. This is referred to as the Helmet Mounted Display (HMD).

It also allows the slaving of sensors and weapons to the helmet's line of sight. This is a particularly effective system when paired with the AIM-9X high off-boresight dogfight missile. The helmet can slave weapons and sensor up to 80 degrees off boresight.

Power to the HMD is selected from the HMD control knob on the left auxiliary console. Rotating the knob clockwise from the OFF position to INC (increase) provides power to the HMD. Continued clockwise rotation increases HMD brightness.



Symbology on the HMD is only visible in the right eye. This may cause discomfort in VR so you may change the way it is rendered in the DCS: World options F-16C Special tab. These options are available:



Weapons delivery using the HMCS is covered in the following sections:

[AIM-9M/X HMCS Missile BORE Employment]

[AIM-9M/X HMCS Radar BORE Employment]

Non-Designated Mode

The basic features of the HMCS can be illustrated in the non-designated mode. This can be thought of as an extension of the HUD, with much of the symbology mimicked on the HMD. These features apply to all HMCS modes:

Acceleration (G). Duplication of the current G.

Airspeed. Duplication of airspeed from HUD.

Master Arm Status. Master Arm Switch Position: OFF, ARM or SIM.

Master Mode. Current Master Mode.

Bearing/Range to Bullseye. Bearing and range from your aircraft to the Bullseye.

Altitude. Duplication of the HUD barometric altitude.

Dynamic Aiming Cross. While in A/A mode in the HMD, the aiming cross can be in one of three location on the HMD, based on HMD view angle.

- When HMD LOS is 0 degrees of less above the stabilized horizon, the aiming cross is centered in the HMD.
- When HMD LOS is between 0 and 30 degrees above stabilized horizon, the aiming cross is centered between the airspeed and altitude indicators on the HMD.
- When HMD LOS is greater than 30 degrees above stabilized horizon, the aiming cross is centered above the heading tape on the HMD.

Distance to Steerpoint / Steerpoint Number. Selected steerpoint and distance in nautical miles.

Helmet heading. Digital heading indication (XXX) of where helmet is pointed.

AIR-TO-AIR EMPLOYMENT

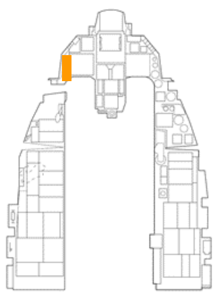
USAF Photo
by SrA Peter Reft

Air Combat Preparation

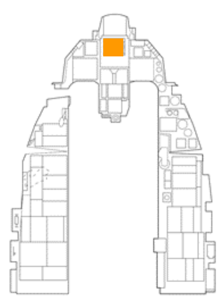
Remember to anticipate what is coming up next and stay ahead of the curve. You do not have to wait until you are about to make an attack to set the aircraft up.

When entering an area where you expect to encounter enemy aircraft, you will want to take the following steps:

1. Position the Master Arm Switch to ARM. Weapons may be released normally when in the ARM position. If the Master Arm switch is placed in the SAFE position, weapon release is inhibited.



2. Press the A-A Master Mode Button on the ICP to place the fire control system in Air to Air Missile (AAM) Mode.



This is one method for preparing the aircraft for an air-to-air attack. There are also two air-to-air override modes that can be quickly selected using HOTAS commands. Those are described below.

Dogfight and Missile Override Modes

Two override modes are available to quickly configure the aircraft for an air to air engagement: **Dogfight** and **Missile Override**. These modes are selected using the DOGFIGHT switch located on the throttle grip. It is a three-position switch that overrides any mode except emergency jettison.

- DOGFIGHT (outboard). This mode provides symbology on the HUD for both 20mm gun firing and AIM-9 Sidewinder missile delivery.
- MSL OVRD (inboard, unlabeled). This provides symbology for AIM-120 missile firing only. If no AIM-120 is loaded, AIM-9s are selected.
- Center position. Returns to the last selected master mode.

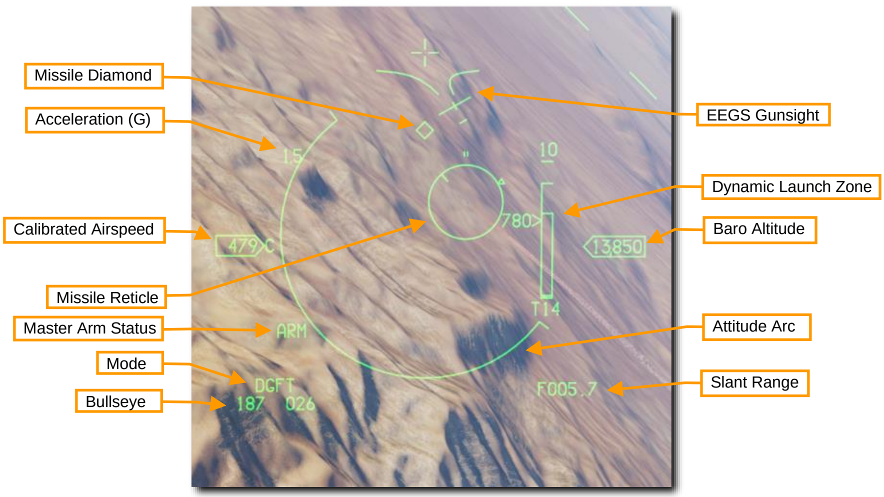
Requests for master mode changes made using the ICP will be ignored while either of these modes are active.

Changes to missile or radar settings made while either override mode is active will be saved throughout the mission. A common technique is to configure the displays, radar and missiles for each mode as desired during ground operations. This provides three distinct weapon delivery options (Dogfight, Missile Override and Default) without the need to remove your hands from the controls.

Dogfight Mode

With the switch in the DOGFIGHT (outboard) position, the HUD is configured for Gun and AIM-9 missile firing. The left MFD is configured with the radar in ACM Boresight mode and the right MFD is configured with the Dogfight SMS page.

The Dogfight HUD combines elements of the Missile and Guns HUD modes into one decluttered display. Note that the heading bar, flight path marker and attitude bars are removed.



See the sections on Air to Air Gunnery and AIM-9 Sidewinder Employment for details on each display and how to use them.

Missile Override Mode

With the switch in the Missile Override (inboard) position, the HUD is configured for AIM-120 missile firing. The left MFD is configured with the radar in RWS mode and the right MFD is configured with the Missile SMS page.

See the section on AIM-120 AMRAAM Employment for details on each display and how to use them.

M61A1 20mm Gun

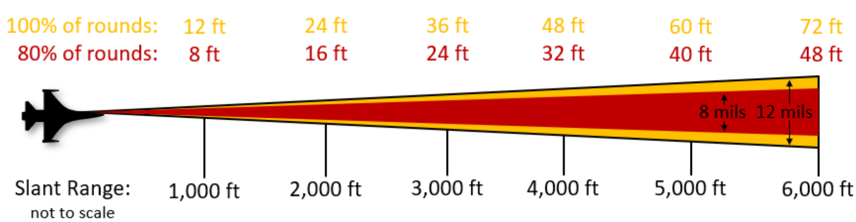
The M61A1 20MM automatic gun system provides the pilot with a formidable weapon capability. It is a six-barrel Gatling type gun mounted in the left strake of the aircraft. The system has a capacity of 512 rounds of ammunition fired at 6,000 rounds per minute.

Gun Dispersion

Rounds fired from any gun system do not follow a perfectly straight path but are dispersed in a cone shaped pattern after they leave the gun's muzzle. The dispersion pattern becomes a larger and larger cone as slant range increases. The density of rounds within the cone becomes less and less as the edge of the cone is approached.

The average dispersion of the M61A1 is 8 mils diameter for 80% of the rounds fired and 12 mils for 100% of the rounds fired.* USAF units maintain a boresight program to ensure gun systems installed on aircraft continue to meet these specifications while in operational use.

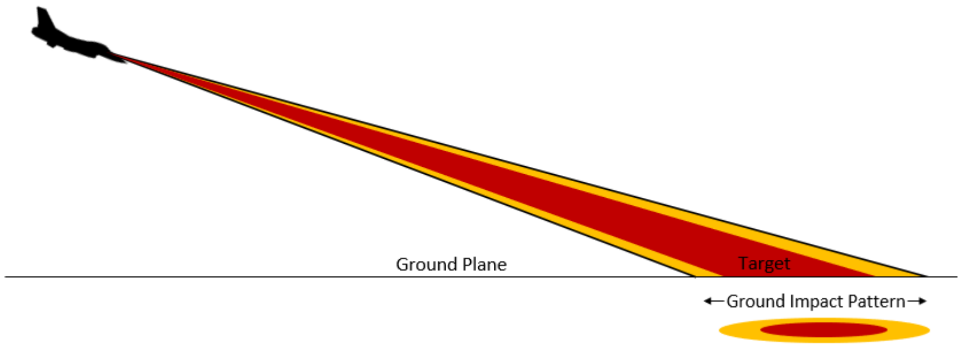
One mil is equal to 1/1000 of a radian so 8 mils equals an 8 foot diameter circle at 1,000 feet range and 12 mils equals a 12 foot diameter circle. The size of the circle continues to increase with range.



In practical terms, this means you have some leniency in accuracy when firing the gun. In this example, the green gun pipper is a 4 mil diameter circle. This is where bullets are most dense within the cone. The red shaded area is the 8 mil circle 80% of the rounds will pass through at the target range. The orange shaded area is the 12 mil circle that 100% of the rounds will pass through at the target range.

*This is based on MIL-DTL-45500/1A that states “At a range of 1,000 inches, 80 percent of a 75 round (min.) burst shall be completely within an 8.0 inch diameter circle for accuracy” and the manufacturer’s data sheet that states “8 milliradians diameter, 80 percent circle”.

The dispersion pattern of rounds fired from the gun is a circle only if the target is perpendicular to the flight path. It resembles an ellipse when firing against a horizontal target on the ground.



Summary

1. Select AAM or DGFT master mode
2. Set Master Arm Switch to Arm
3. Acquire target using ACM radar mode (optional)
4. Fly the EEGS funnel and pipper onto the target
5. Squeeze the Trigger to the second detent to fire the gun

Air to Air Gunnery

There are two ways to get into the correct SMS configuration for air to air gunnery. They are:

1a. Select the Air-to-Air Gunnery operating mode on the MFD by depressing OSB 1 until GUN is displayed.

or

1b. Position the Dogfight/Missile Override (DOGFIGHT) Switch to DGFT.

This provides symbology on the HUD for both 20mm gun firing and A-A missile delivery.

2. Verify A-A GUN symbology is displayed in the HUD.

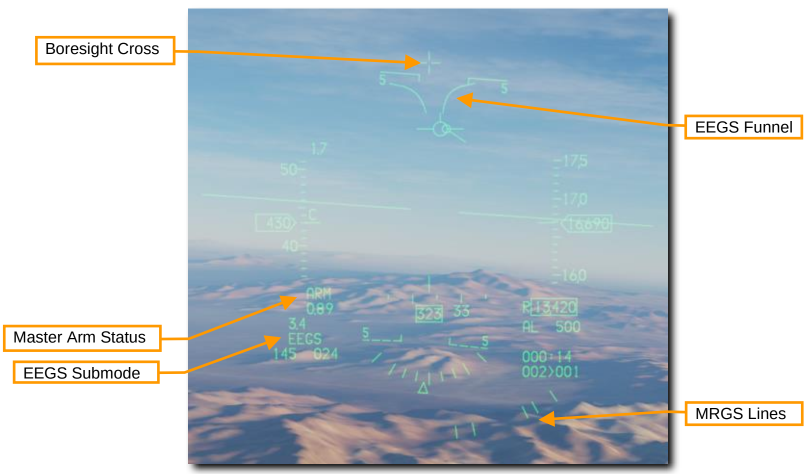
The Enhanced Envelope Gun Sight (EEGS) provides different levels of information depending on whether the radar is locked on the target.

Level I is a failure mode that only displays the **Boresight Cross** in the event of a Rate Sensor Unit (RSU) and INS failure. It should almost never be encountered.

Level II provides a prediction of the bullet path when there is no radar lock. The **Boresight Cross**, **EEGS Funnel** and **Multiple Reference Gunsight (MRGS) Lines** are provided.

Level III and IV are intermediate levels that lead to the Level V display. These are usually not seen by the pilot.

Level V is displayed after radar lock-on and a firing solution has been computed using that data. Additional references in the HUD include the **Target Designator, T-Symbol, Slant Range, Closure Rate** and **Level V Pipper.**



Level II Symbology (no radar lock)

Boresight Cross. This symbol is always available and shows the boresight direction. This is the direction rounds will travel before other influences like gravity or air resistance take effect.

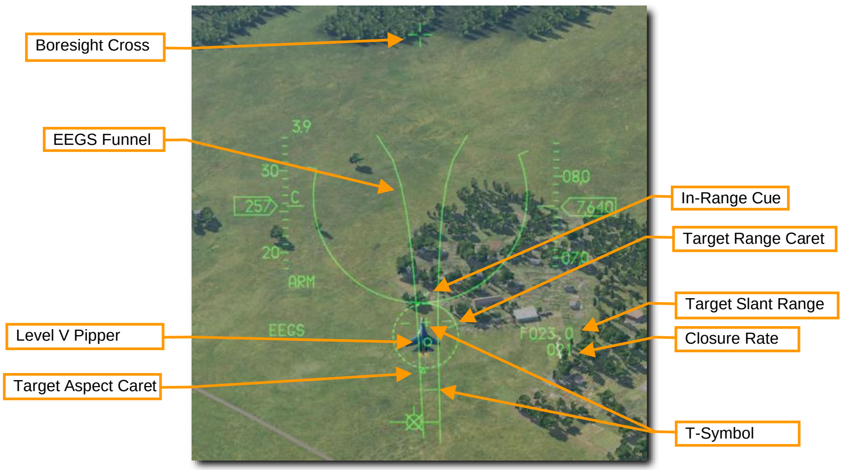
EEGS Funnel. Each point along the funnel represents the target at a specific range for which the gun is correctly aimed. In other words, an aircraft whose wings are the same width as the funnel is at the correct range to be hit by rounds fired at that moment.

As the range decreases, the target size will increase. As this occurs, you must place the target higher in the funnel in order to keep the target wingspan just touching the sides of the funnel. This results in placing the target higher in the HUD or, more importantly, closer to the Boresight Cross which results in reduced lead for the reduced range.

The target aircraft wingspan must be known for the funnel to provide accurate range information. See the section on the MAN DED Page below for procedures.

Multiple Reference Gunsight Lines. The MRGS sight is composed of a series of five line segments pointing toward the Gun Bore Line, and spaced in an arc near the bottom of the HUD. They aid in lining up long range, high aspect shots by providing the correct lateral aiming solution so the target flies up the funnel.

When using an MRGS line, if the target is smaller than the line, it is either out of range or moving faster than anticipated and requires extra lead. If the target is larger than the MRGS line, the target is moving slower than anticipated and will require less lead.



Level V Symbology (with radar lock)

Target Designator. This symbol is centered on the locked radar target. The triangular **Target Aspect Caret** shows the target's aspect angle. Maximum effective gun range is shown by an **In-Range Cue**, two small lines on the outside of the symbol. The position of the **Target Range Caret** indicates the slant range to the locked target. Each o'clock position represents 1,000 feet of slant range, so:

- 12 o'clock = 12,000 ft
- 9 o'clock = 9,000 ft
- 6 o'clock = 6,000 ft
- 3 o'clock = 3,000 ft

Target Slant Range. The distance to the locked target. Tenths of a mile are displayed for ranges greater than one mile. Hundreds of feet are displayed at ranges less than one mile.

Closure Rate. The rate of closure with the target in knots.

T-Symbol. This symbol shows two firing solutions for the locked target. The + symbol, or 'one-G pipper' shows the lead angle against a non-maneuvering target. The small horizontal bar, or 'nine-G pipper' shows the lead angle for a target turning at maximum sustained rate. These may be used as a backup in situations the Level V Pipper is not displayed.

Two maneuver potential lines are displayed on either side of the one-G pipper. The longer the lines, the greater the out-of-plane maneuver potential of the target.

Level V Pipper. This represents the gunfire solution computed for the target's current range and rates. The goal is to stabilize this pipper over the target and fire.

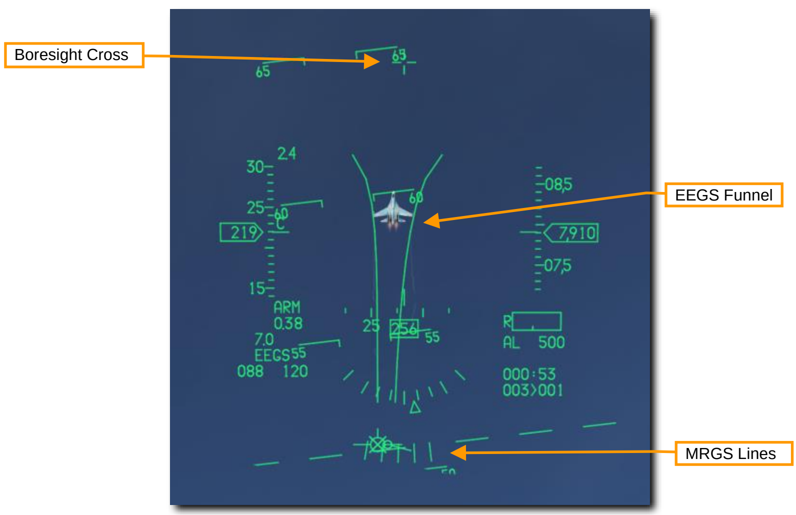
3. Maneuver your aircraft to frame the target aircraft within the EEGS funnel.

Each point along the funnel represents the target at a specific range for which the gun is correctly aimed. In other words, an aircraft whose wings are the same width as the funnel is at the correct range to be hit by rounds fired at that moment.

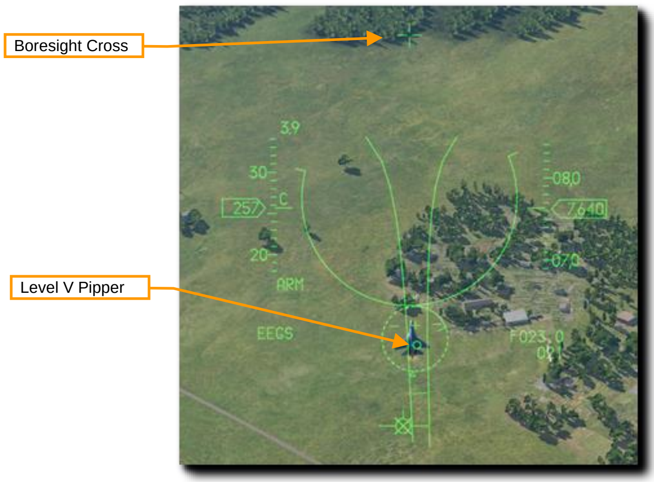
Place the enemy aircraft in the funnel so that the wingtips touch the edges or the Level V Pipper is stabilized over the target.

4. Squeeze the trigger all the way to the second detent to fire the gun when the wingtips touch the funnel (Level II) or Pipper is over the target (Level V).

Slant range greatly affects gun effectiveness. As the rounds come out of the gun, they will gradually disperse and lose velocity. Increased dispersion and loss of velocity reduce the accuracy and effectiveness of the gun. The top of funnel represents the minimum range of approximately 600 feet. The bottom of the funnel represents the maximum range of approximately 3,000 feet. If the target is smaller than the bottom of the funnel, it is out of range.

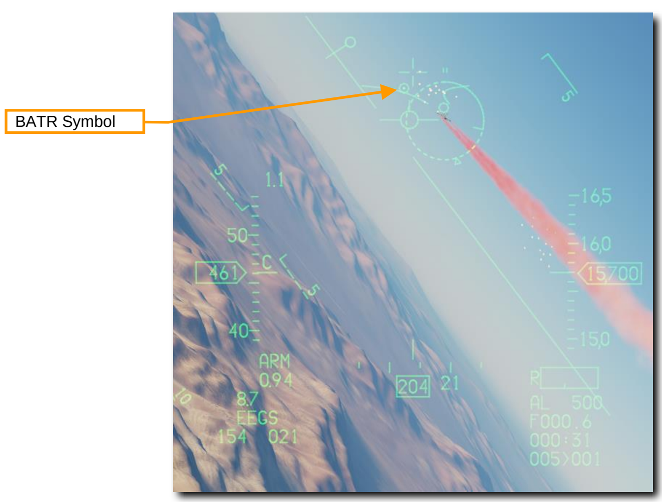


Level II Symbology (no radar lock)



Level V Symbology (with radar lock)

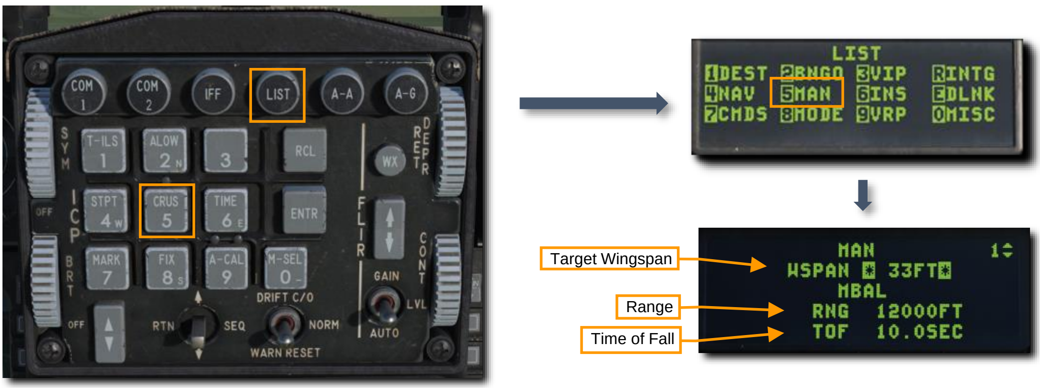
An additional symbol known as the **Bullets at Target Range (BATR) Symbol** is displayed after rounds are fired. The BATR is displayed as the first real or simulated round passes the target range and is removed after the last round has passed. This is only available with a radar lock and EEGS Level III, IV or V symbology displayed.



MAN DED Page

The EEGS Funnel feature of the gunsight must be calibrated for the target aircraft wingspan to provide an accurate estimation of the target aircraft range. That data is entered on the MAN DED Page.

The page is accessed by selecting option (5) MAN from the LIST menu.



Target Wingspan. With this field highlighted, a new target wingspan may be entered using the ICP keypad. This will adjust the width of the EEGS Funnel to provide accurate range when the target wings are bracketed within.

Manual ballistics data for weapons not integrated into the F-16 avionics may also be entered here if desired. This data is found in ballistics manuals for each munition type. Use of this feature is very rare.

Range. This data field is for manual entry of bomb range, or the horizontal distance a bomb is expected to travel under specific conditions.

Time of Fall. This data field is for manual entry of bomb time of fall, or the length of time a bomb is expected to take to impact the ground under specific conditions.

AIM-9M/X Sidewinder

The AIM-9 is a short-range, infrared-guided missile best used in a dogfight. It is fire-and-forget and can be used with or without a radar lock. The primary indication of a seeker lock is a higher-pitched lock tone. The seeker can also be uncaged to ensure the seeker is tracking the target when it has first been sensor-slaved to the target.

Note that the AIM-9 can be decoyed by flares and it's a good idea to ensure you have a good seeker lock before launching an AIM-9 with flares in the seeker field of view.

Summary

1. Select AAM or DGFT master mode
2. Set Master Arm Switch to Arm
3. Acquire target using radar (optional)
4. Maneuver until target is in launch zone
5. Depress Uncage switch to command missile track (if required)
6. Verify missile diamond is on target and lock tone is audible
7. Depress Weapon Release switch to fire missile

AIM-9M/X Employment

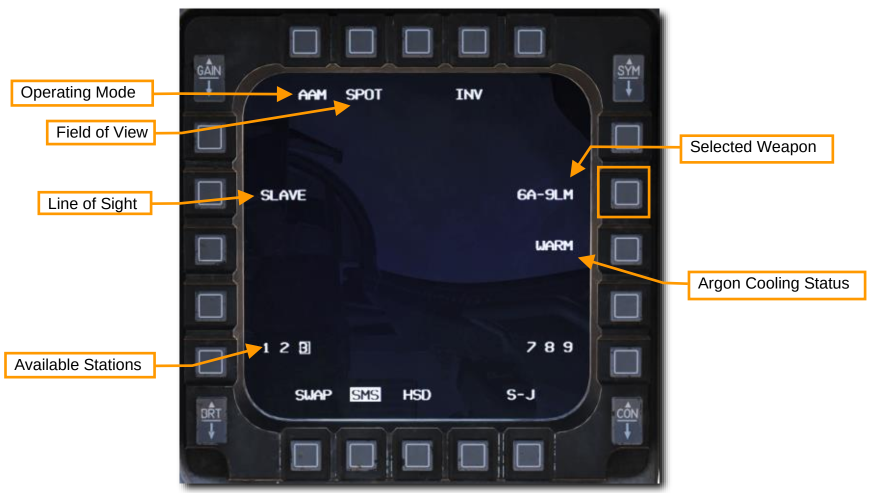
There are two ways to get into the correct SMS configuration for firing an AIM-9. They are:

1a. Select AIM-9s on the MFD by depressing OSB 7 until AIM-9s are displayed.

or

1b. Position the Dogfight/Missile Override (DOGFIGHT) Switch on the Throttle to DGFT.

This overrides any other master mode and configures the displays for air combat. The DOGFIGHT position provides symbology on the HUD for both 20mm gun firing and A-A missile delivery. The MSL position provides symbology on the HUD for A-A missile delivery only.



The number and type of missiles is displayed next to OSB 7. The stations with missiles loaded are displayed at the bottom and the selected station is boxed. Step through available stations with the MSL Step button or by selecting the adjacent OSB.

SPOT/SCAN commands the missile seeker to either scan in a narrow field of view (SPOT) or wide field of view (SCAN). The wider field of view is achieved by seeker nutation around the line of sight. Detection range is decreased when SCAN is used.

SLAVE/BORE commands the missile to either follow the radar line of sight (SLAVE) or keep looking straight ahead down the boresight (BORE). Depressing and holding the **CURSOR/ENABLE control** on the throttle overrides the current selected option. Releasing the control returns to the option selected on the MFD.

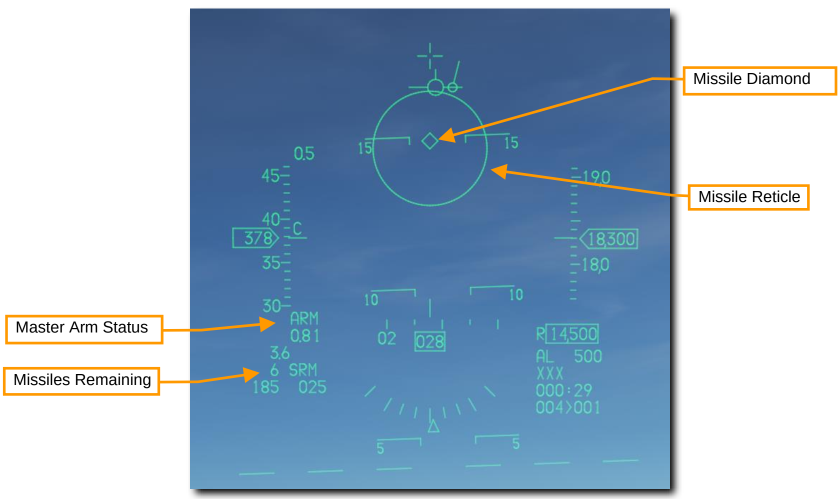
WARM/COOL activates or deactivates argon cooling of the seeker. **This should be set to COOL prior to an engagement to cool the seeker and increase detection sensitivity**. COOL is selected automatically when entering DGFT or MSL Override mode. Argon supply duration varies depending on outside air temperature, pressure and bottle charge level at installation, but the average duration is 90 minutes.

2. Verify A-A Missile symbology is displayed in the HUD.

The air-to-air HUD provides information on the status and targeting of air to air missiles. Most of the symbology from the NAV mode is retained but several new features are added to aid in target acquisition and missile launch.

The **Missile Diamond** indicates the position of the AIM-9 seeker head. This starts at the seeker boresight position but unlatches to follow the radar line of sight or track a locked target when a lock is achieved.

The **Missile Reticle** shows the seeker field of view. This will be shown as different sizes depending on the SPOT/SCAN field of view setting chosen on the MFD.



3. Acquire target using radar (optional)

Perhaps the most common and easiest way to target an aircraft with the AIM-9 is to acquire a target with one of the ACM Radar Modes. This slews the AIM-9 seeker to the radar target if SLAVE is selected on the missile. This results in an AIM-9 lock if the target is in range and other IR detection conditions are met.

4. Maneuver until target is in launch zone

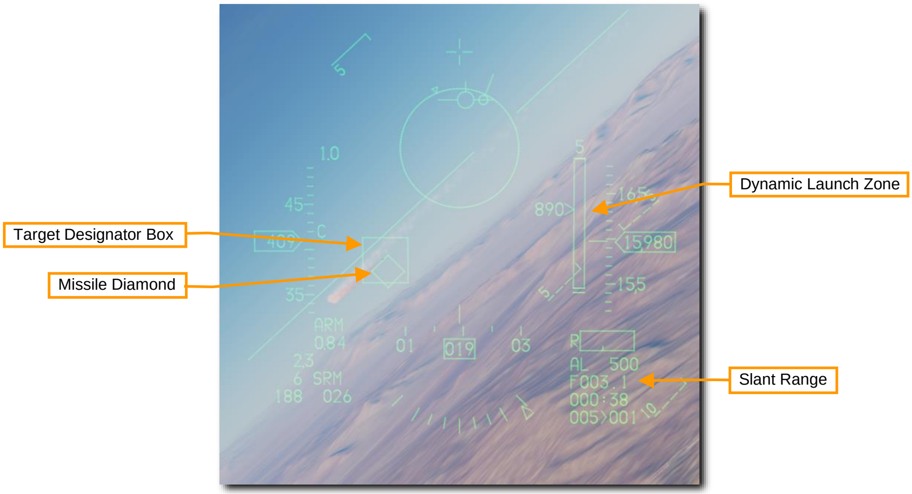
Fly the missile reticle in the HUD over a target. If the missile detects enough IR energy from the target, target detection is indicated by an audio missile detection tone (growling sound).

5. Depress Uncage switch to command missile self-track

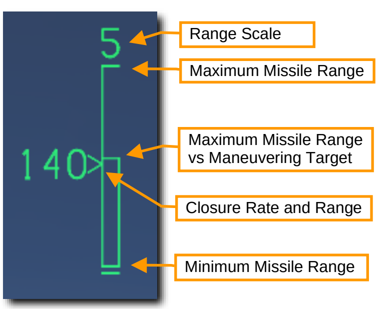
When the AIM-9 seeker detects a target, it can be uncaged by pressing the **Cage/Uncage button** on the throttle to allow the seeker lock on and follow the target within the confines of the missile seeker's field of view. The M**issile Diamond** latches to the target when locked.

6. Verify missile diamond is on target and lock tone is audible

The missile growl will become high pitched when the target is locked. A **Target Designator Box** will be present over a target locked with radar. If firing against a radar target, the **Missile Diamond** should be over the Target Designator box. The **Slant Range** to the radar locked target is displayed if radar is used.



The **Dynamic Launch Zone** (DLZ) will be displayed on the right side of the HUD when a target is designated with the radar. Monitor the DLZ and assess the threat situation to determine the optimal missile firing point. The HUD symbology flashes when target is within maximum range against a maneuvering target.



7. Depress the Weapon Release switch to fire the missile.

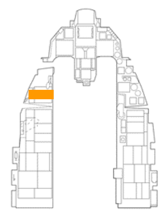
The missile will intercept the target and the next missile in sequence will be selected. The AIM-9 is a fire and forget weapon so there is no need to continue tracking the target.

AIM-9M/X HMCS Missile BORE Employment

The HMCS allows the AIM-9M or AIM-9X missiles to slave to the Helmet Mounted Display (HMD) Aiming Cross when BORE mode is selected on the missile. This is useful in situations where no radar lock is possible or desired. This can be thought of as normal AIM-9 employment, except the HMD line of sight is used instead of the HUD line of sight. The mechanization is otherwise the same.

1. Turn on the Helmet Mounted Display (HMD) symbology.

Power to the HMCS is selected from the **HMD Symbology** control knob on the left auxiliary console. Rotating the knob clockwise from the OFF position to INC (increase) provides power to the HMD. Continued clockwise rotation increases symbology brightness.

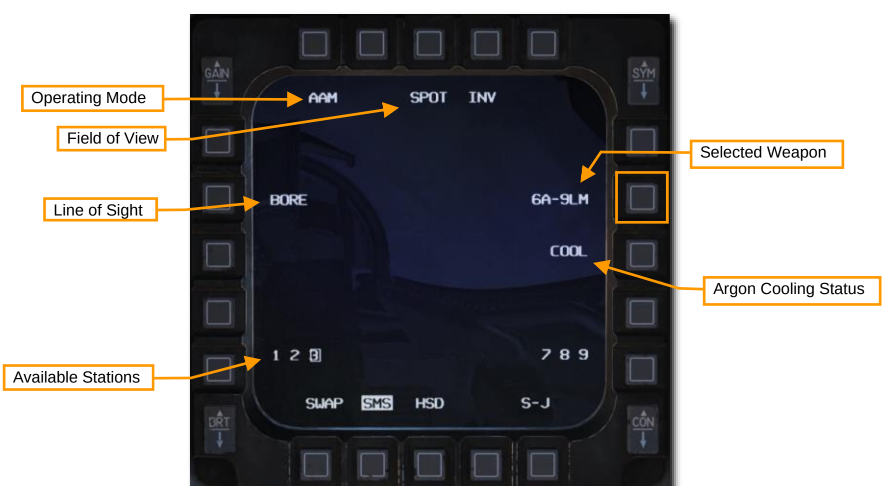


2a. Select AIM-9s on the MFD by depressing OSB 7 until AIM-9s are displayed.

or

2b. Position the Dogfight/Missile Override (DOGFIGHT) Switch on the Throttle to DGFT.

Symbology and functions are identical to non-HMCS employment. Set the **Line of Sight** mode to **BORE** to use the HMCS for AIM-9M/X targeting without radar.



2. Acquire the target in the HMD.

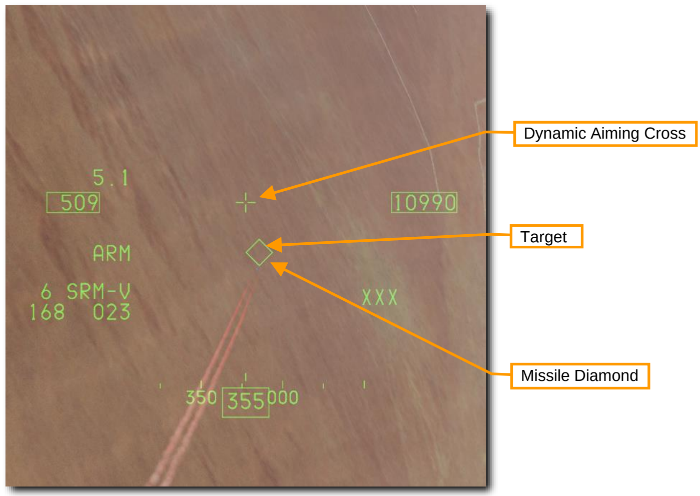
With the AIM-9 set to BORE and the HMCS on, the seeker will follow the **Dynamic Aiming Cross** in the HMD display. The aiming cross is treated as the boresight position. Simply look at the target instead of flying the aircraft all the way into position for an AIM-9 lock.

Remember, you will still be constrained by the missile seeker gimbal limits when looking around. The **Missile Diamond** shows where the missile seeker is looking. If you look too far off the aircraft boresight the seeker will not be able to follow and the diamond will not be visible.

The other symbology on the display intentionally mimics the symbology from the HUD.

3. Depress Uncage switch to command missile seeker track.

When the AIM-9 seeker detects a target, it can be uncaged by pressing the **Cage/Uncage button** on the throttle. This allows the seeker to lock on and follow the target within the confines of the missile seeker's gimbal limits. The **Missile Diamond** latches to the target when the seeker has locked on.



4. Verify missile diamond is on target and lock tone is audible.

The missile growl will become high pitched when the target is locked. The **Missile Diamond** should be latched to the target and no longer follow the **Aiming Cross**.

5. Depress the Weapon Release switch to fire the missile.

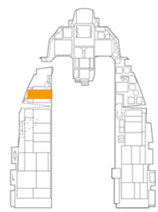
The missile will track the target and the next missile in sequence will be selected. The AIM-9 is a fire and forget weapon so there is no need to continue tracking the target.

AIM-9M/X HMCS Radar BORE Employment

The HMCS also allows the Fire Control Radar to slave to the HMCS Aiming Cross when ACM BORE radar mode is selected. This can be thought of as normal AIM-9 employment, except the HMD line of sight is used instead of the HUD line of sight. The mechanization is otherwise the same.

1. Turn on the Helmet Mounted Display (HMD) symbology.

Power to the HMCS is selected from the **HMD Symbology** control knob on the left auxiliary console. Rotating the knob clockwise from the OFF position to INC (increase) provides power to the HMD. Continued clockwise rotation increases symbology brightness.

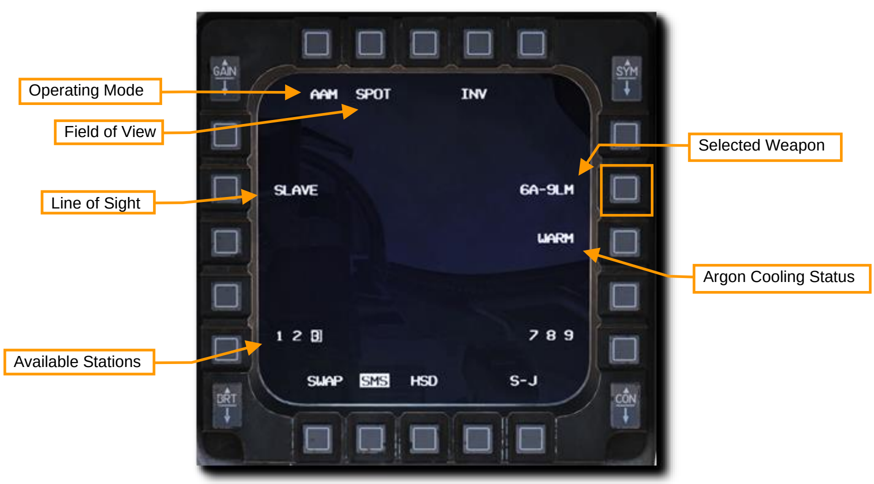


2a. Select AIM-9s on the MFD by depressing OSB 7 until AIM-9s are displayed.

or

2b. Position the DOGFIGHT Switch on the Throttle to DGFT.

Symbology and functions are identical to non-HMCS employment. Set the **Line of Sight** mode to **SLAVE** to use the HMCS and radar for AIM-9M/X targeting.



3. Select ACM BORE radar mode and acquire the target in the HMD.

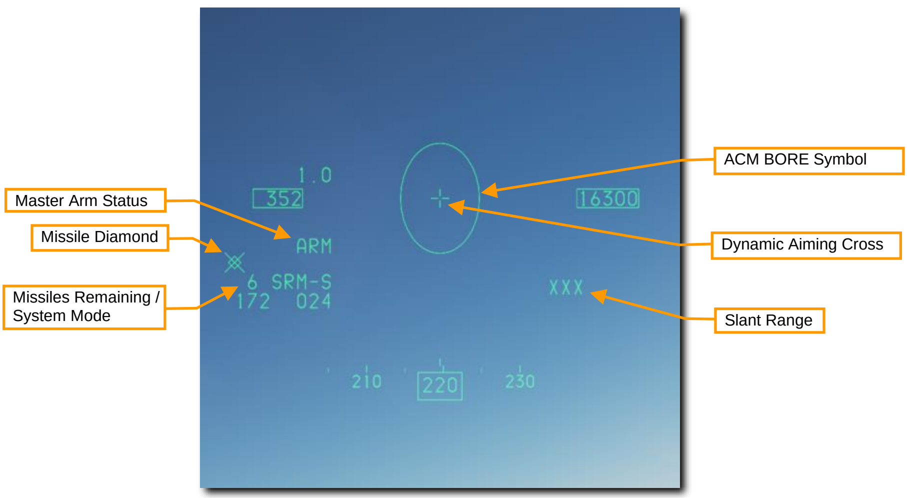
With the **ACM BORE** radar mode selected and the HMCS on, the radar will follow the **Dynamic Aiming Cross** in the HMD display. The aiming cross is treated as the boresight position. Simply look at the target instead of flying the aircraft all the way into position for a radar lock.

Remember, you will still be constrained by the radar gimbal limits when looking around. The **ACM BORE Symbol** shows where the radar is pointing. If you look too far off the aircraft boresight the radar will not be able to follow and the **ACM BORE Symbol** will not be visible.

Note that the **Missile Diamond** is outside the HMD display. The missile seeker slaves to the radar line of sight later when a radar lock is achieved.

The **Slant Range** to the locked target is displayed after radar lock.

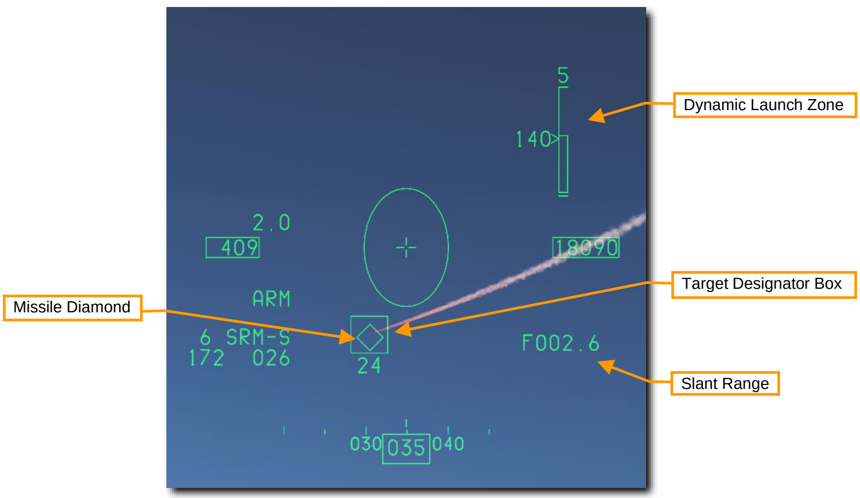
The other symbology on the display intentionally mimics the symbology from the HUD.



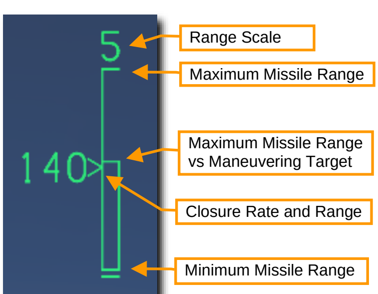
4. Achieve radar lock in ACM BORE Mode.

The radar will lock the first target detected within the **ACM Bore Symbol**. A **Target Designator Box** will be present over a target locked with radar.

With the AIM-9 line of sight set to SLAVE, the seeker will slew to the radar line of sight. When the AIM-9 seeker detects a target, it can be uncaged by pressing the **Cage/Uncage button** on the throttle. This allows the seeker to lock on and follow the target within the confines of the missile seeker's gimbal limits. The **Missile Diamond** latches to the target when the seeker has locked on.



The **Dynamic Launch Zone** (DLZ) will be displayed on the right side of the HMD when a target is designated with the radar. Monitor the DLZ and assess the threat situation to determine the optimal missile firing point. The HMD symbology flashes when target is within maximum range against a maneuvering target.



5. Verify missile diamond is on target and lock tone is audible.

The missile growl will become high pitched when the target is locked. The **Missile Diamond** should be latched to the target.

6. Depress the Weapon Release switch to fire the missile.

The missile will intercept the target and the next missile in sequence will be selected. The AIM-9 is a fire and forget weapon so there is no need to continue tracking the target.

AIM-120 AMRAAM

The AIM-120 AMRAAM is an Active Radar-Homing (ARH) air-to-air missile that can self-guide to a target using the miniaturized-radar in its nose cone. The missile can also be guided by the radar in both Single Target Track (STT) and Situational Awareness (SAM) modes. Because of the active seeker, the pilot can engage multiple targets at once and not be restricted to supporting the missile its entire time of flight.

The AIM-120 is a medium range missile and can engage targets outside 20 nm. However, engagement range is highly dependent on target aspect, engagement altitude, launch speed, and post-launch maneuvers of the target. As such, the engagement range of the AIM-120 can be less than 10 nm in some situations.

In close range air combat, the AIM-120 can also be launched in BORE mode with no need of support from the radar. Once the missile is launched, it will seek out the first target it detects within the AIM-120 reticle on the HUD. Be careful of friendlies!

Summary

1. Select AAM or MSL master mode
2. Set Master Arm Switch to Arm
3. Acquire target using radar (optional but recommended)
4. Maneuver until target is in launch zone
5. Depress Weapon Release switch to fire missile

AIM-120 Employment

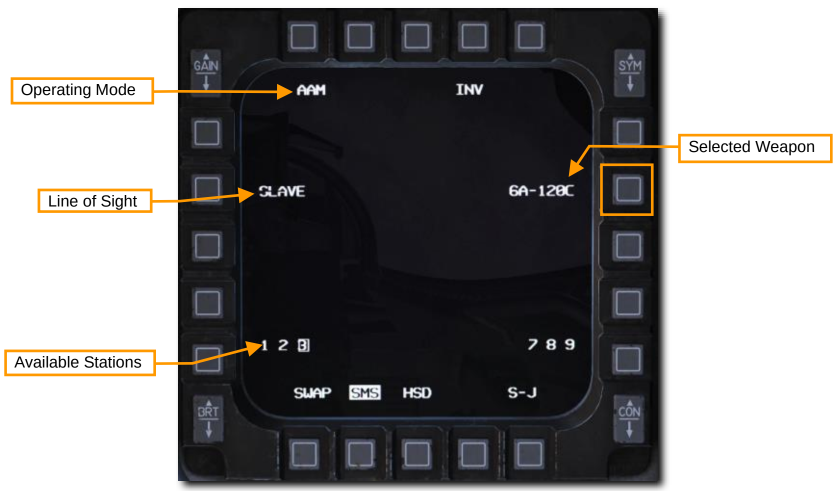
There are two ways to get into the correct SMS configuration for firing an AIM-120. They are:

1a. Select AIM-120s on the MFD by depressing OSB 7 until AIM-120s are displayed.

or

1b. Position the Dogfight/Missile Override (DOGFIGHT) Switch on the Throttle to MSL.

This overrides any other master mode and configures the displays for air combat. The MSL position provides symbology on the HUD for A-A missile delivery and selects the longest range missile type loaded.



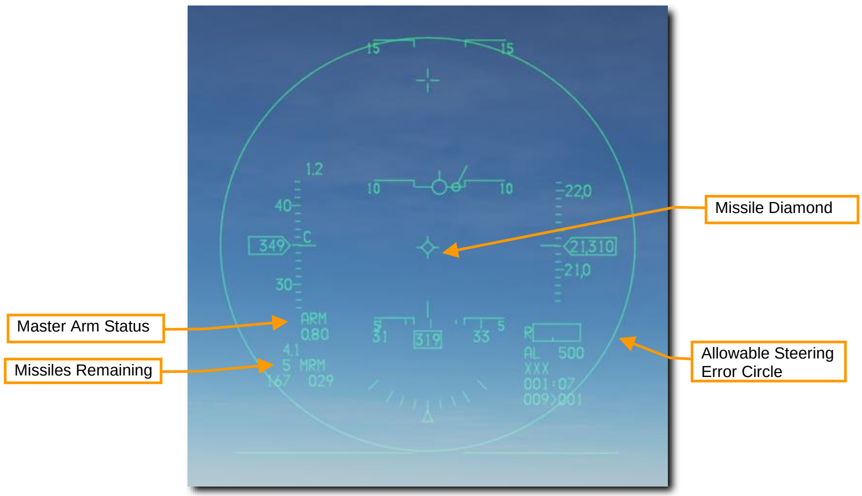
The number and type of missiles is displayed next to OSB 7. The stations with missiles loaded are displayed at the bottom and the selected station is boxed. Step through available stations with the MSL Step button on the stick or by selecting the adjacent OSB.

SLAVE/BORE commands the missile to either follow the radar line of sight (SLAVE) or keep looking straight ahead down the boresight (BORE). This may also be cycled using the CURSOR/ENABLE switch on the throttle.

- In BORE, no targeting data is received from the aircraft. The missile uses its own radar to acquire and track the target.
- In SLAVE mode, targeting data is provided via datalink until the missile is in position to track the target with its own radar.

2. Verify A-A Missile symbology is displayed in the HUD.

The air-to-air HUD provides information on the status and targeting of air to air missiles. Most of the symbology from the NAV mode is retained but several new features are added to aid in target acquisition and missile launch.



The status of the **Master Arm** switch and **Missiles Remaining** are displayed at the lower left.

The **Missile Diamond** indicates the missile line of sight. This starts at the seeker boresight position but follows the radar line of sight or track a locked target when SLAVE mode is selected, and a lock is achieved.

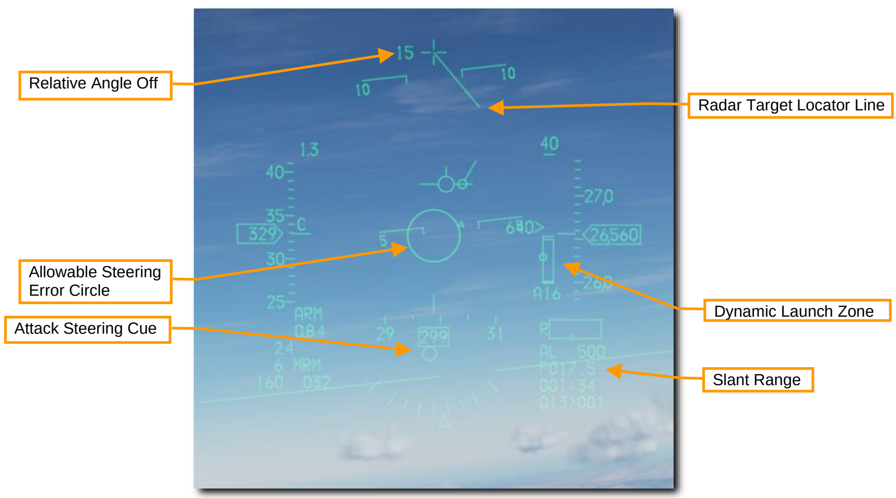
The **Allowable Steering Error Circle (ASEC)** shows the zone in which the **Attack Steering Cue (ASC)** should be located prior to launch to hit the target with a given probability kill. The ASC is displayed after radar lock. The **ASEC** shows the maximum, angular steering error probability. In other words, he circle increases in size when the distance to the target intercept point decreases, which means that as the distance decreases, the missile can be launched with greater steering error.

3. Acquire target using the radar

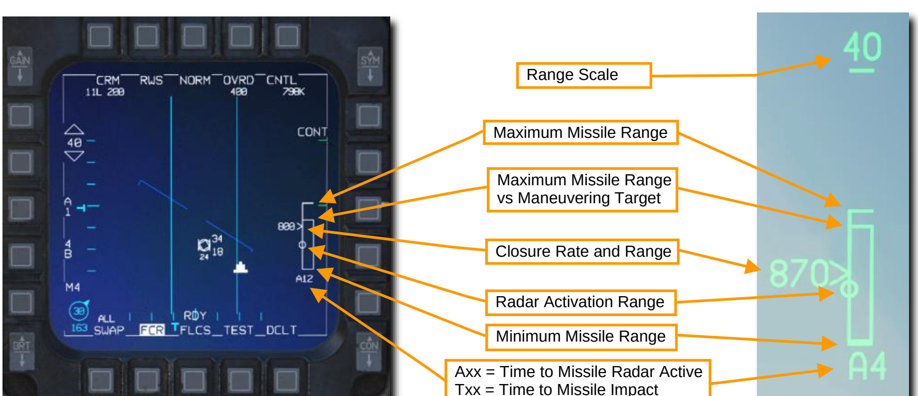
Typically, a target will be locked using RWS, TWS, or any ACM radar submode and the AIM-120 set to SLAVE.

When the locked target is outside the HUD field on view as shown below, a **Target Locator Line (TLL)** extends from the Gun Cross and points directly at the target. The **Relative Angle** is displayed next to the Gun Cross showing the number of degrees in tens between the cross and the target.

The **Allowable Steering Error Circle (ASEC)** changes size and the **Attack Steering Cue (ASC)** becomes visible. The **Slant Range** is displayed after target radar lock.



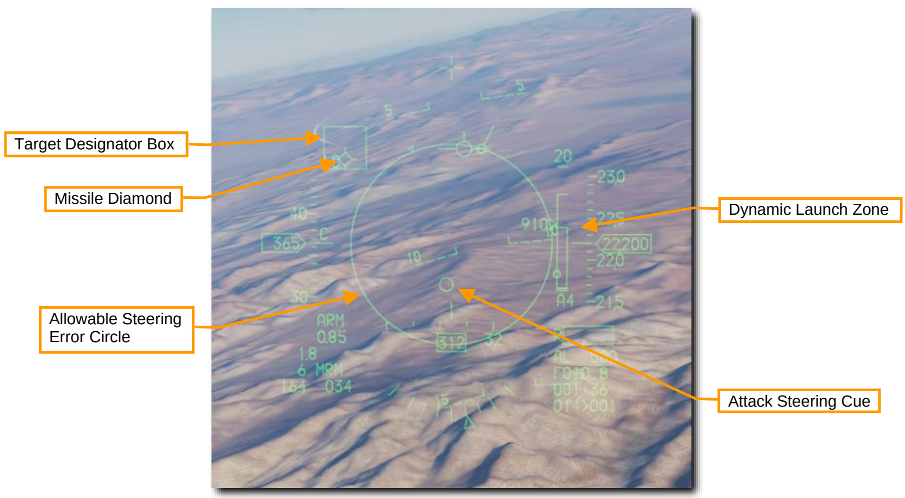
The **Dynamic Launch Zone** will be displayed on the right side of the HUD and right side of the radar display when a target is designated with the radar.



4. Maneuver until Attack Steering Cue (ASC) is inside the Allowable Steering Error Circle (ASEC)

The size of the **Allowable Steering Error Circle** will vary depending on the target range and aspect. Ensure that the **Attack Steering Cue** is located as close to the **Allowable Steering Error Circle** center as possible when firing to achieve the best performance out of the missile.

When the target enters the HUD, the **Target Designator Box** will be displayed over the target and the **Missile Diamond** will track that location.



Monitor the **Dynamic Launch Zone** and assess the threat situation to determine the optimal missile firing point.

5. Depress and hold the Weapon Release switch to fire the missile.

The missile will track the target and the next missile in sequence will be selected.

The AIM-120 may also be employed in BORE mode without a radar lock on the target. This is used when a quick shot must be taken or no radar emissions are desired. The missile radar will go active at launch and guide on the first target it detects so use this mode with care.

AIR TO GROUND EMPLOYMENT

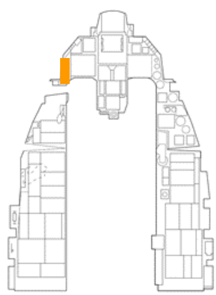
USAF Photo
by SSgt Shawn Nickel

Attack Preparation

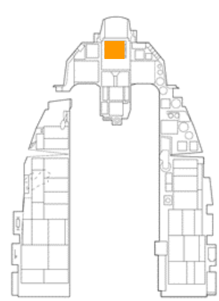
Prior to reaching the target area and conducting your attack, you will want to configure several aircraft systems ahead of time so that you can most efficiently communicate and set up your attack. When at a minimum of 40 nm from the target, you will want to take the following steps:

1. Position the Master Arm Switch to ARM. Weapons may be released normally when in the ARM position. If the Master Arm switch is placed in the SAFE position, weapon release is inhibited.

2. Position the Laser Arm Switch to ARM. This is required to enable firing of the laser designator. Laser firing is inhibited with the switch set to OFF.



2. Place the fire control system in A-G mode by pressing the A-G Master Mode Button on the ICP.



M61A1 20mm Gun Strafe

The M61A1 20MM automatic gun system provides the pilot with a formidable weapon capability. It is a six-barrel Gatling type gun mounted in the left strake of the aircraft. The system has a capacity of 512 rounds of ammunition fired at 6,000 rounds per minute.

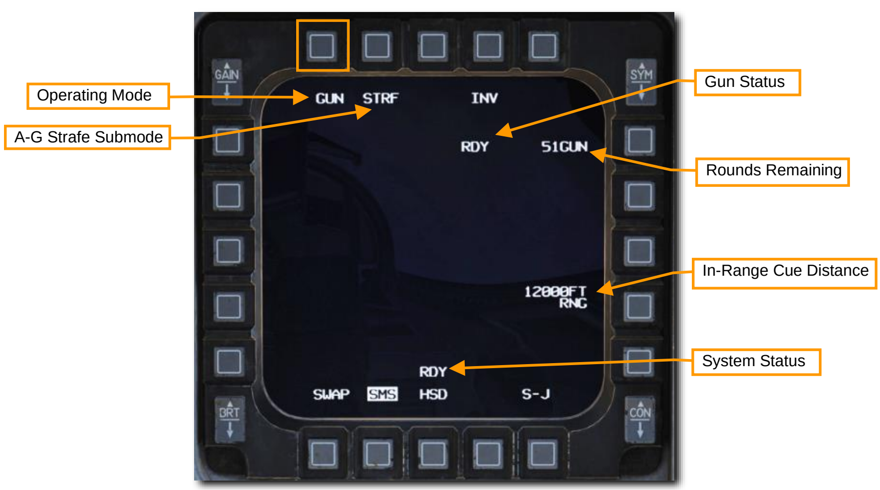
Summary

1. Select A-G Master Mode
2. Set Master Arm Switch to Arm
3. Set Laser Arm Switch to Arm if laser ranging updates are desired
4. Select STRF submode on SMS MFD
5. Fly the Pipper onto the target
6. Squeeze the Trigger to the second detent to fire the gun

Target Attack

Upon selection of the A-G master mode, the SMS Air-to-Ground (SMS A-G) page is displayed on the right MFD. Based on the priority weapon, the information on the SMS A-G page can vary. Follow these steps to achieve the correct configuration and attack ground targets with the gun:

1. Select the STRF submode on the MFD by depressing OSB 1 until GUN is displayed.



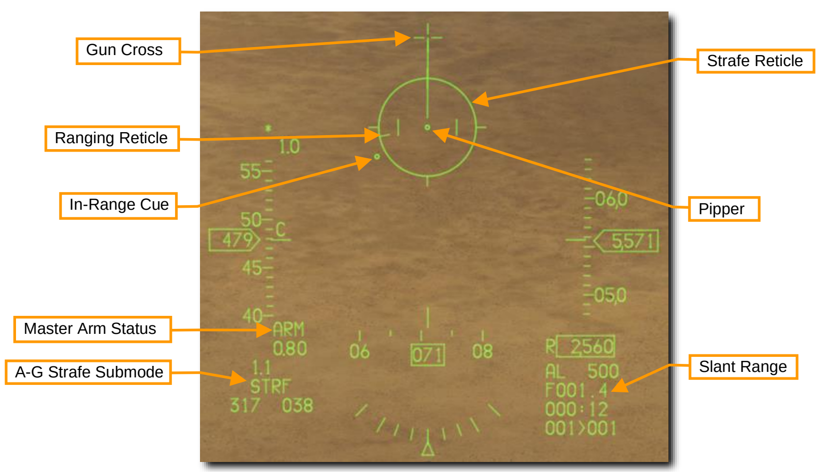
2. Verify STRF symbology is displayed in the HUD.

The Strafe Reticle is the default air to ground gunsight and provides aiming information required to fire the gun effectively. The center of the reticle is the aiming pipper and represents where the gun rounds will go assuming the target is within range. Using the pipper, it is simply a case of “putting the thing on the thing” and pulling the trigger.

Line of sight range is indicated by the digital range numeric on the bottom right of the HUD and the ranging reticle that winds or unwinds within the reticle. The position of the ranging reticle indicates the slant range to the pipper’s position on the ground. Each quarter circle tick on the strafe reticle represents 3,000 feet of slant range, so:

- 12 o’clock = 12,000 ft
- 9 o’clock = 9,000 ft
- 6 o’clock = 6,000 ft
- 3 o’clock = 3,000 ft

The in-range cue position may be set by the pilot provide an additional visual cue for the effective range against the planned target.



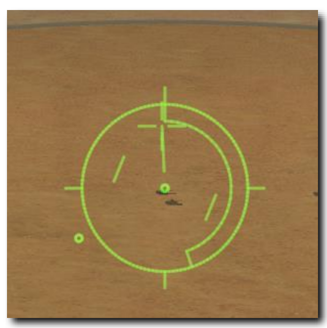
3. Maneuver your aircraft to position the pipper on target.

One technique is to place the pipper short of the target and allow it to track along the ground until it reaches the target. This will happen naturally as slant range decreases.

Laser ranging may be performed to improve the computed firing solution if a targeting pod is installed. See the Laser Ranging section for more information.

4. Squeeze the trigger all the way to the second detent to fire the gun when the pipper is over the target and you are within effective range.

In this example, the pipper is on-target at a slant range of about 5,500 feet as shown by the position on the ranging reticle.



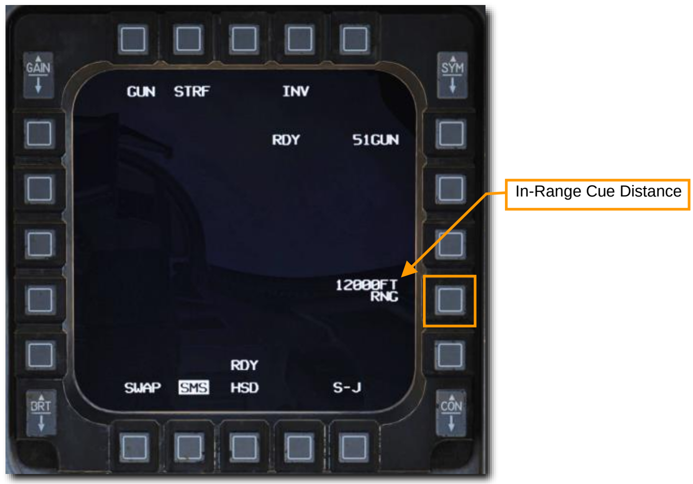
Slant range greatly affects gun effectiveness. As the rounds come out of the gun, they will gradually disperse and lose velocity. Increased dispersion and loss of velocity reduce the accuracy and effectiveness of the gun. Effective engagement range is generally from 2,500 to 7,000 feet. For armored vehicles, closer is better, and you should attack from behind the target where its armor is weakest.

When lining up a shot, be careful to avoid target fixation. Target fixation can lead to you not noticing an unseen threat or pressing the attack too close. Don’t make yourself an easy target for the machine gun on the top of that APC!

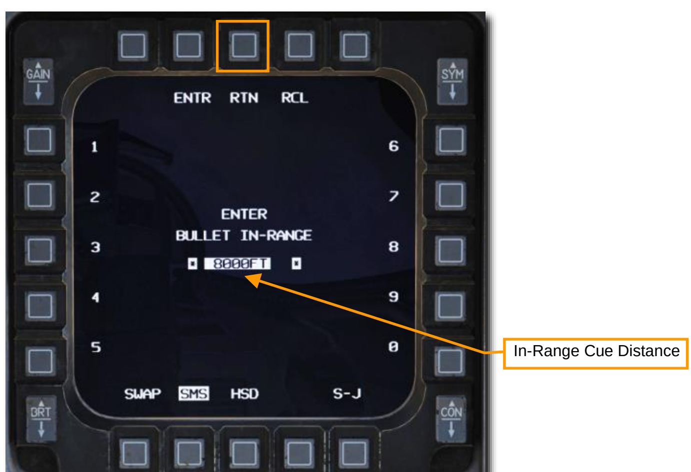
Once you have reached the minimum attack range, break off in both the horizontal and vertical to avoid hostile return fire. You may also wish to release flares in case an infrared-SAM near the enemy target has been launched at you, but you did not see it.

In-Range Cue Update

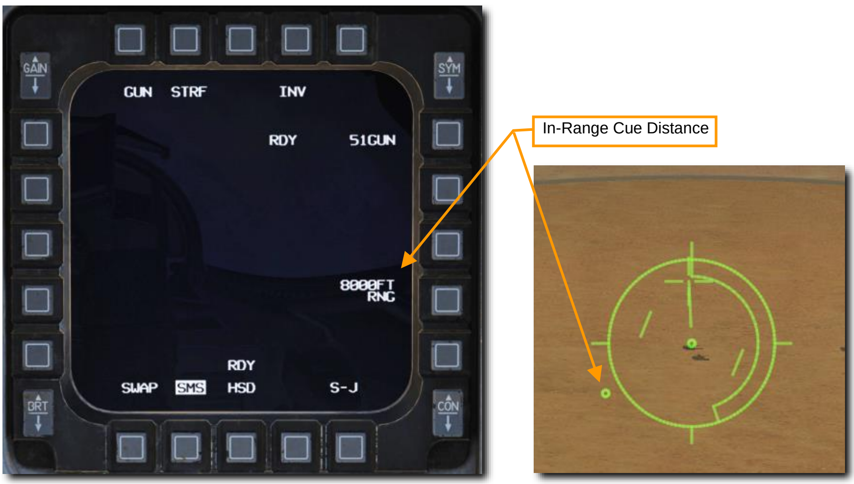
The position of the In-Range Cue on the reticle may be updated by selecting the OSB next to the In-Range Cue distance on the SMS page.



Type in the new in-range cue distance using the OSBs on the left and right of the display and select ENTR. You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.



You will be returned to the SMS page and the new value will be displayed. The cue will be placed on the HUD Strafe Reticle at that new distance.



2.75" Rockets

Aerial rockets pack more punch than the 20mm gun but are still best used as an area suppression weapon. These come with different warhead options for different purposes including High Explosive (HE), High Explosive Anti-Tank (HEAT), and Armor Piercing (AP). White Phosphorus (WP) rounds may also be used for incendiary effect or to mark targets on the ground with their distinctive white smoke.

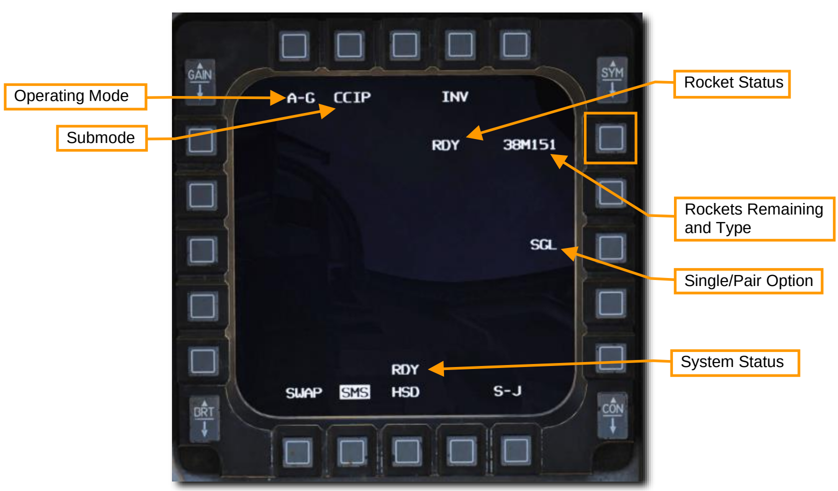
Summary

1. Select A-G Master Mode
2. Set Master Arm Switch to Arm
3. Set Laser Arm Switch to Arm if laser ranging updates are desired
4. Select Rockets and desired options on SMS MFD
5. Fly the Pipper onto the target
6. Depress the Weapons Release button to fire the rockets

Target Attack (CCIP)

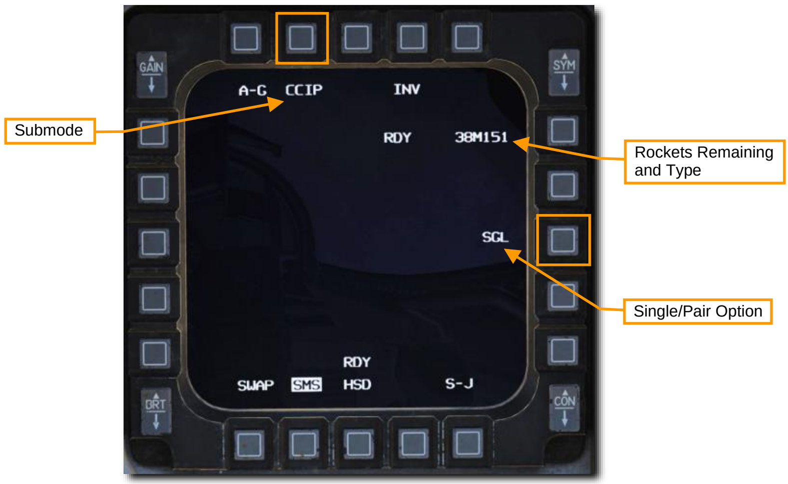
Upon selection of the A-G master mode, the SMS Air-to-Ground (SMS A-G) page is displayed on the right MFD. Based on the priority weapon, the information on the SMS A-G page can vary. Follow these steps to achieve the correct configuration and attack ground targets with rockets in CCIP mode:

1. Select the Rockets on the MFD by depressing OSB 6 until rockets are displayed.



2. Verify CCIP release mode is selected (OSB 2) and set desired Single/Pair option (OSB 8).

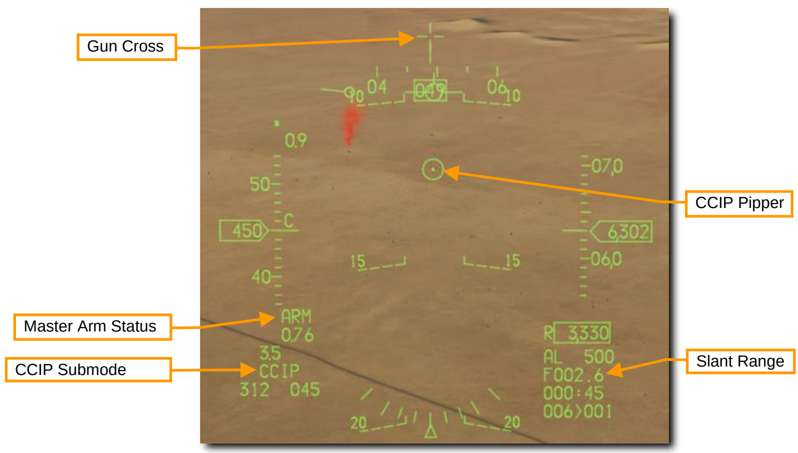
Rockets may be fired with either Single (SGL) or Pair (PAIR) selected. With SGL selected, rockets will be fired from only one launcher. With PAIR selected, rockets will be fired from each rocket launcher, assuming launchers are loaded on station 3 and 7.



3. Verify CCIP Rockets symbology is displayed in the HUD.

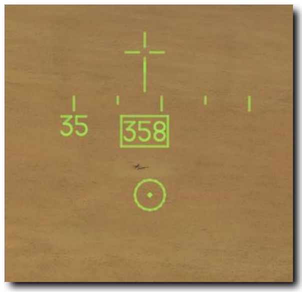
CCIP mode is perhaps the most intuitive means to put a weapon on target and mostly involves placing the “death dot” of the CCIP pipper over the target and releasing the weapon… put the thing on the thing.

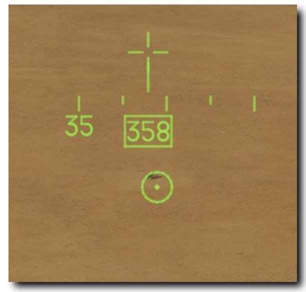
The center of the CCIP pipper represents where the rockets will go assuming the target is within range. Line of sight range is indicated by the digital range numeric on the bottom right of the HUD. An In-Range Cue will be displayed over the CCIP pipper when slant range is less than 8,000 feet and rockets are most effective.



4. Maneuver your aircraft to position the CCIP pipper on target.

One technique is to place the pipper just short of the target and allow it to track along the ground until it reaches the target. This will happen naturally as slant range decreases. Monitor slant range displayed in the bottom right of the HUD and watch for the in-range cue to appear over the pipper.

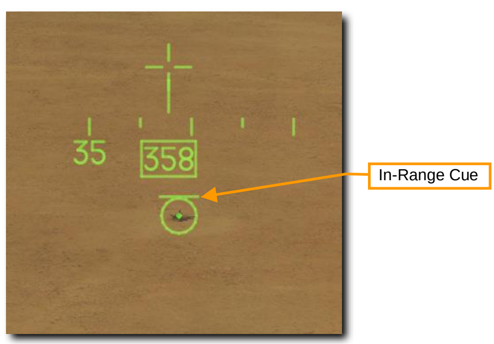




Laser ranging may be performed to improve the computed firing solution if a targeting pod is installed. See the [Laser Ranging] section for more information.

5. Depress the Weapon Release button to fire the rockets when the CCIP pipper is over the target and you are within effective range.

The In-Range Cue is a line over the CCIP pipper that is displayed when slant range is less than 8,000 feet. In this example, the pipper is on-target and the in-range cue is displayed.



When lining up a shot, be careful to avoid target fixation. Target fixation can lead to you not noticing an unseen threat or pressing the attack too close. Don't make yourself an easy target for the machine gun on the top of that APC!

Once you have reached the minimum attack range, break off in both the horizontal and vertical to avoid hostile return fire. You may also wish to release flares in case an infrared-SAM near the enemy target has been launched at you, but you did not see it.

Unguided Bombs

Unguided bombs that the F-16C can employ fall into three categories: General Purpose (GP), Cluster, and Training.

General Purpose Bombs

MK 82 LDGP. The standard MK 82 is a low drag “slick” bomb, also referred to as a Low Drag General Purpose (LDGP) bomb. The bomb is aerodynamically streamlined with four conical tail fins for flight stability. The bomb has a thin steel jacket that contributes to fragmentation effects.

The MK 82 may be carried singly on a Wing Weapons Pylon (WWP) or three may be loaded on a Triple Ejector Rack (TER)

The MK 82 serves as the basis for several other bombs including the MK 82AIR, GBU-12, and GBU-38.

MK 82 AIR. This version of the MK 82 adds the BSU-49/B high drag tail assembly, also called a “ballute”. This allows the bomb to rapidly slow down after release. By slowing down, you can release such a retarded weapon at low altitude and not be caught in the blast effect of the weapon. You can choose to release the MK 82AIR in either retarded or “slick” (no ballute deployed) modes. To drop as a slick, select only a nose fuze, and to release retarded, select nose/tail or tail fuze setting on the SMS page.

MK 82 SE. This ‘Snake Eye” version of the MK 82 pre-dates the MK 82 AIR and uses fins that deploy from the Mk-15 tail assembly to slow the bomb’s fall. You can choose to release the MK 82 SE in either retarded or “slick” modes. To drop as a slick, select only a nose fuze, and to release retarded, select nose/tail or tail fuze setting on the SMS page.

MK 84 LDGP. The MK 84 is the big brother of the MK 82 and it weighs 2,039 lbs with 945 lbs of H-6 or Tritonal high explosive. Although most effective against unarmored and lightly armored targets, the MK 84 can also be effective against armored targets when dropped in close proximity. The MK 84 can only be mounted on a WWP and cannot be loaded on a TER.

The MK 84 forms the basis for other bombs including the GBU-10 and GBU-31 that the F-16C also carries.

Cluster Bombs

CBU-87. The CBU-87 Combined Effects Munitions (CEM) weighs 950 lbs and is an all-purpose cluster bomb. The SUU-65 Tactical Munitions Dispenser that makes the body of the bomb contains 202 BLU-97/B Combined Effects Munitions (CEM) bomblets and they are effective against lightly armored and unarmored targets. The dispersal footprint of the bomblets depends on the Height of Function (HOF) and RPM spin setting set with dials on the bomb and displayed on the SMS page. However, the general bomblet footprint coverage is 200 by 400 meters.

The CBU-87 can be mounted singly on a WWP. Only two may be loaded on a TER when wing external fuel tanks are installed due to clearance constraints. This is commonly referred to as a ‘slant load’.

Each BLU-97/B CEB consists of a shaped charge, a scored steel casing, and a zirconium ring, for anti-armor and anti-personnel fragmentation and incendiary effects. Each CEB is designed to fragment into 300 fragments. Given the top attack angle of the weapon, the CEB can be effective against the generally light armor covering the top of an armored vehicle such as a tank.

CBU-97. The CBU-97 is a 1,000-pound class weapon containing sensor-fused sub-munitions in a SUU-66B Dispenser for specifically attacking armor. This Sensor Fused Weapon (SFW) contains 10 BLU-108/B sub-munitions, and 40 "hockey puck" shaped skeet infrared sensing projectiles.

As with the CBU-87, the dispersal footprint of the bomblets depends on the Height of Function (HOF) set with dials on the bomb and displayed on the SMS page. The RPM is not applicable on this dispenser. The same carriage restrictions as the CBU-87 apply: one per WWP and two per TER.

Training Bombs

BDU-33. The BDU-33 is a miniaturized training bomb that mimics the ballistics of larger general purpose bombs. The BDU-33 contains a small smoke charge to help round spotting.

Unguided/Laser Guided Bombs SMS Page

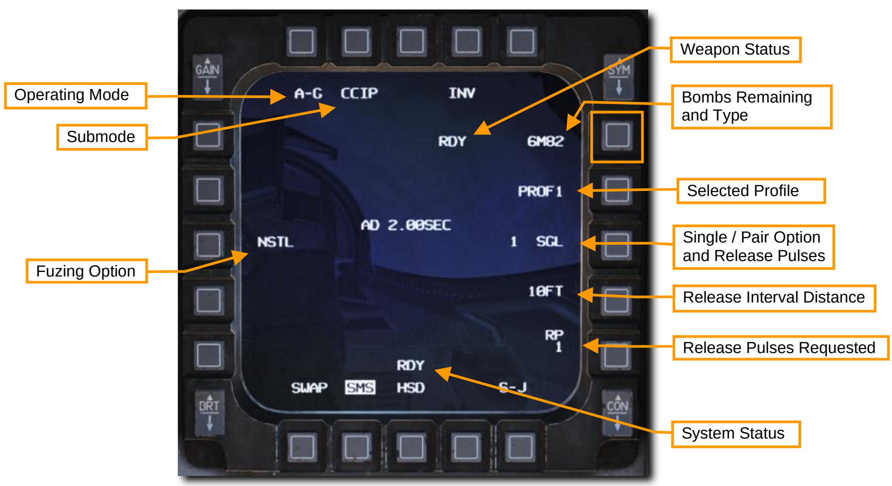
The A-G SMS display and procedure for setting up an attack with guided or unguided bombs is very similar for all types. The initial set-up will only be covered once, with differences in CCIP, CCRP submodes covered in separate sections below.

Summary

1. Select A-G Master Mode
2. Select bombs and set desired options on SMS A-G MFD

Upon selection of the A-G master mode, the SMS Air-to-Ground (SMS A-G) page is displayed on the right MFD. Based on the priority weapon, the information on the SMS A-G page can vary. Follow these steps to achieve the correct configuration and attack ground targets with GP bombs in CCIP mode:

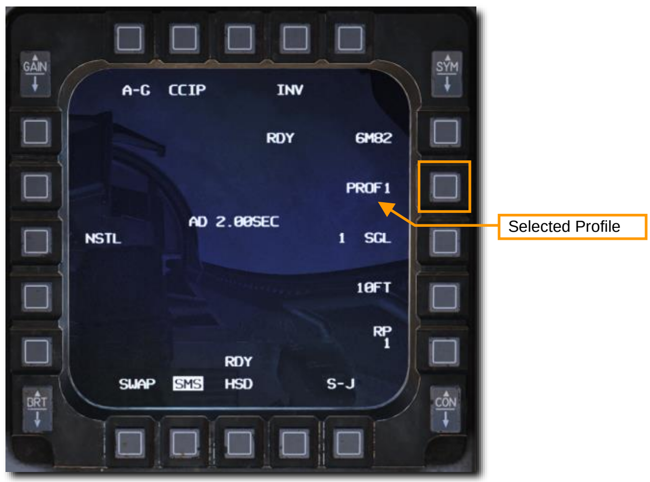
1. Select the desired weapons on the MFD by depressing OSB 6 until the weapons you want to release are displayed.



2. Select the desired profile for the selected weapons.

Two different profiles are pre-set by default. These include typical settings for delivery mode, fuze arming option, bomb impact spacing, and release quantity. If a profile already matches your planned attack profile, you are all set; no more changes are required! If not, follow the steps that follow in this section to set the profile up to your liking.

Selecting the OSB next to the current profile to cycle between the two options: PROF1 and PROF2.



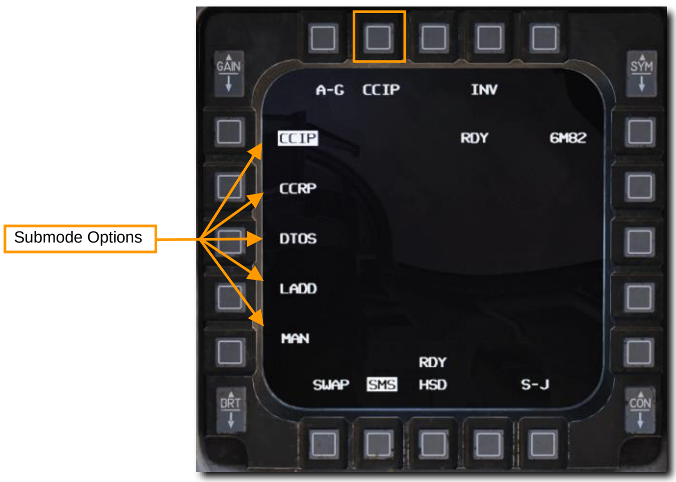
Changes to settings made while a profile is selected are saved for later use. These should typically be set or verified as part of aircraft startup, although they may be changed at any time.

3. Select your desired release submode (OSB 2).

If a submode other than the one you want is selected, you may depress OSB 2 to display the following options:

- CCIP – Continuously Computed Impact Point
- CCRP – Continuously Computed Release Point
- DTOS – Dive Toss
- LADD – Low Altitude Drogue Delivery
- MAN – Manual

Then, select the OSB next to your desired submode. That will set the new active submode and return you to the SMS A-G page.

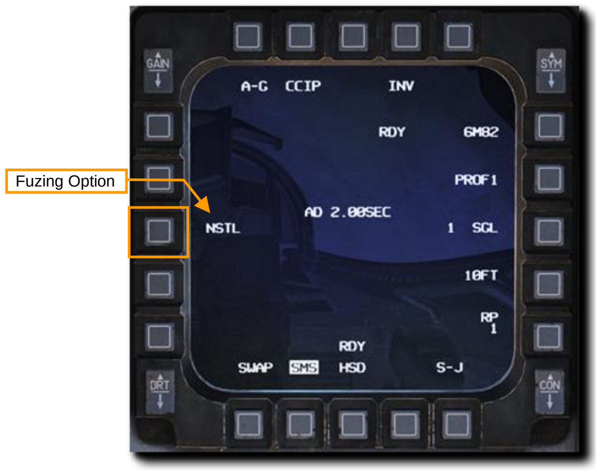


You may also cycle between submodes by depressing the Missile Step (MSL STEP) button on your stick.

4. Set desired bomb fuzing option (OSB 18).

Bombs are typically equipped with two fuzes, one in the nose and one in the tail. These are sometimes set with different impact delay settings to provide the pilot with the choice of how the fuze functions and when the bomb detonates after impact. Sometimes an instantaneous detonation is desired for fragmentation effects and sometimes a delayed detonation is desired to allow target penetration or cratering.

Selecting OSB 18 cycles between three fuze arming options: NOSE, TAIL and NSTL (Nose/Tail). This is typically set to NSTL (Nose/Tail) for redundancy unless a specific effect is desired when the weapon detonates.



There are also some special cases where the fuze option changes how the weapon behaves after release:

MK 82 AIR/SE:

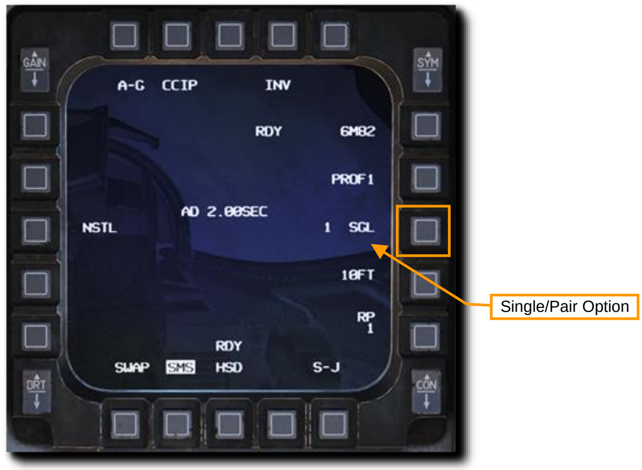
- NSTL – High Drag
- NOSE – Low Drag
- TAIL – High Drag

CBU-87/97:

- NSTL – Bomblets dispense using settings displayed on SMS page
- NOSE – Bomblets dispense immediately after release
- TAIL – Dud

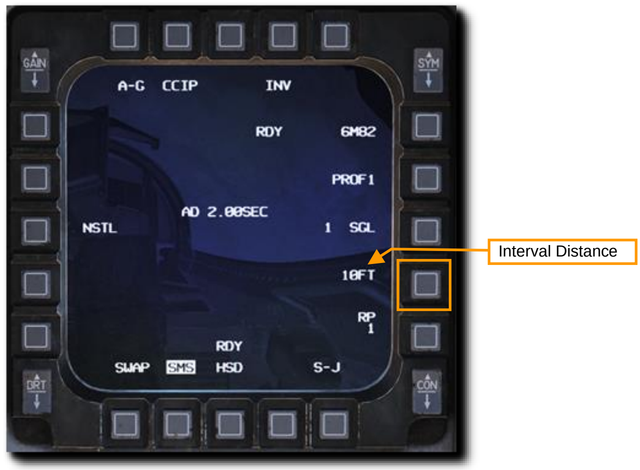
5. Set desired Single/Pair option (OSB 8).

Bombs may be released with either Single (SGL) or Pair (PAIR) selected. With SGL selected, bombs will be released from only one station. With PAIR selected, bombs will be released from both opposite stations, assuming identical bombs are loaded on stations 4 and 6 or 3 and 7.

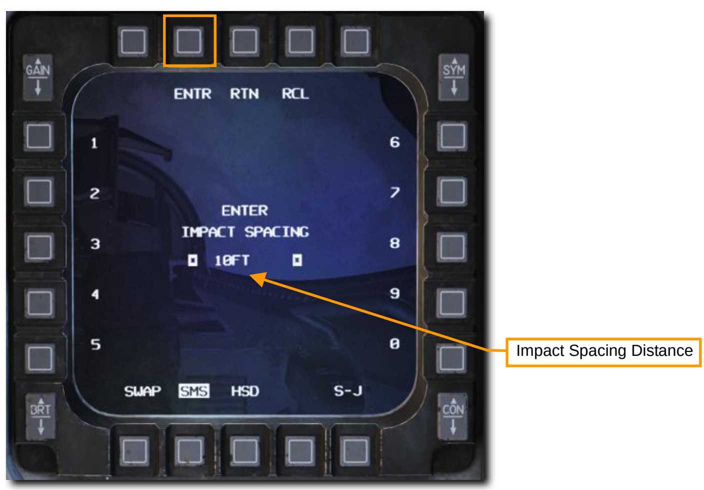


6. Set the desired release interval distance if more than one bomb is to be released. (OSB 9).

The timing between release pulses is computed by the aircraft to space multiple weapons in a ‘stick’ along the ground at the specified distance. Valid distances range from 10-999 feet. This setting has no effect if only one bomb or one pair of bombs is released.

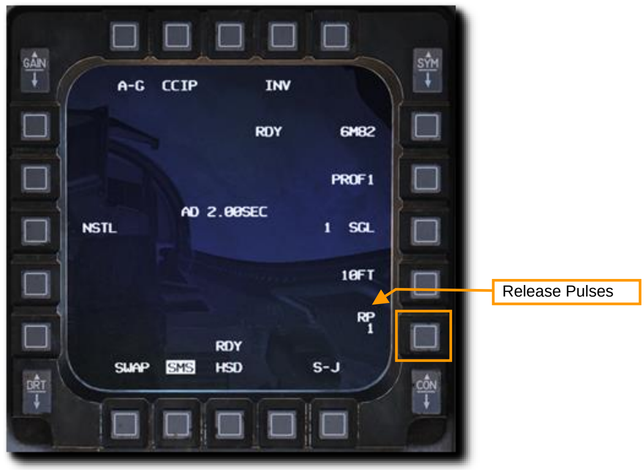


Type in the new impact spacing distance using the OSBs on the left and right of the display and select ENTR. You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.

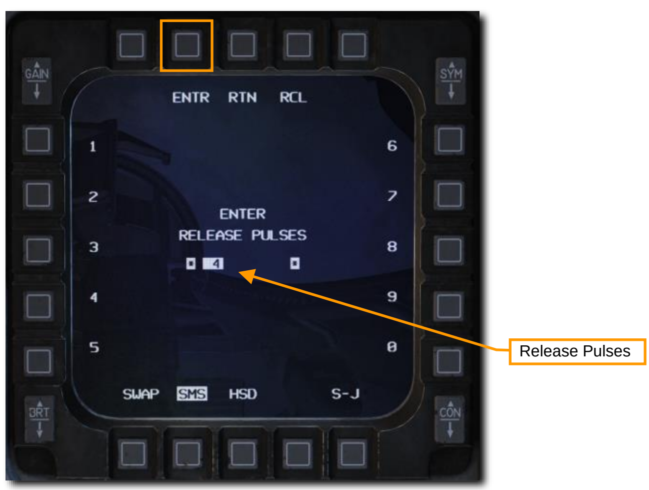


7. Set the number of release pulses if more than one bomb is to be released. (OSB 10).

This sets the number of release pulses sent to the weapons stations when the Weapon Release button is depressed. For example, a setting of 1 releases only one bomb or pair of bombs at a time while a setting of 4 releases four bombs or pairs of bombs at a time. This is commonly known as a 'ripple release'.



Type in the desired number of release pulses using the OSBs on the left and right of the display and select ENTR. You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.



Unguided Bombs CCIP Attack

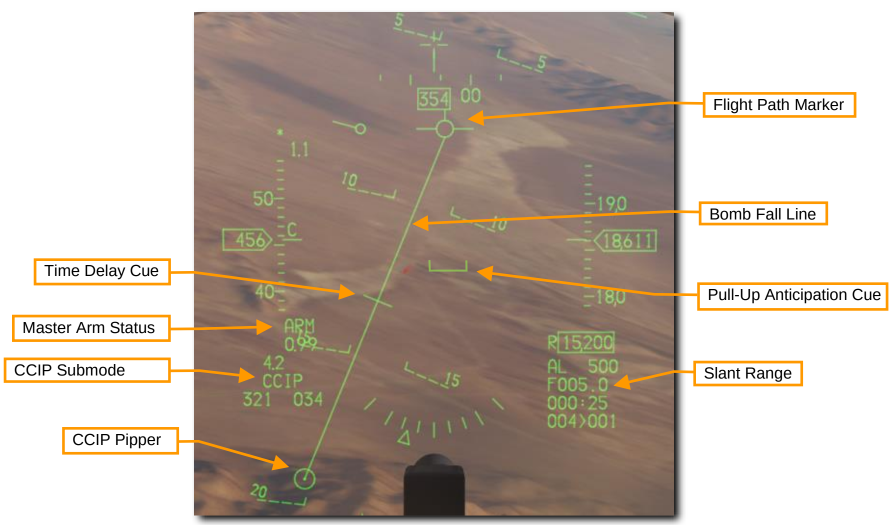
The Continuously Computed Impact Point (CCIP) mode is a computed visual delivery mode with manual weapon release. This mode allows a high degree of flexibility since the point on the ground at which the weapon will impact is continuously indicated by a CCIP Pipper on the HUD. No target designation is required. Place the thing on the thing and drop the bomb.

Summary

1. Select A-G Master Mode
2. Set Master Arm Switch to Arm
3. Set Laser Arm Switch to Arm if laser ranging updates are desired
4. Select Bombs and desired options on SMS MFD
5. Fly the Pipper onto the target
6. Depress the Weapons Release button to expend weapons

1. Verify CCIP symbology is displayed in the HUD.

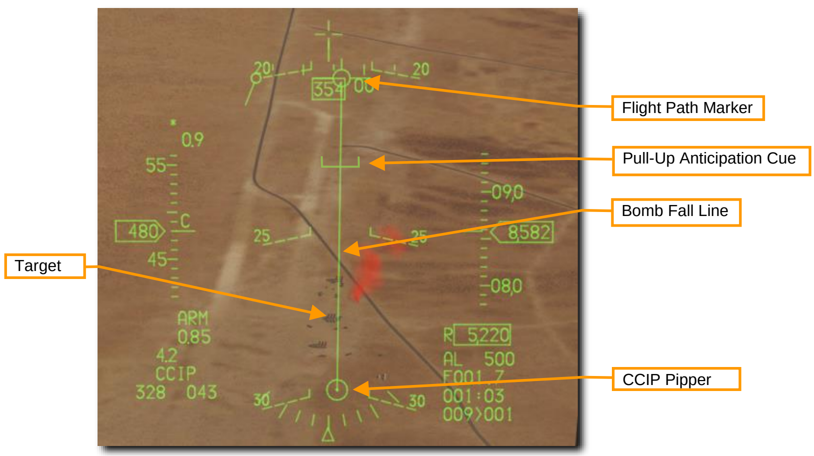
If the CCIP impact point does not lay within the HUD field of view, the Time Delay Cue (TDC) is shown as a short, horizonal line on the Bomb Fall Line. The CCIP Pipper is outside the HUD field of view when this is displayed. A second, 'post-designate CCIP' technique may be used in this situation but that will be covered in the next section.



2. Maneuver your aircraft to position the CCIP Pipper on target.

When the TDC is no longer displayed on the Bomb Fall Line, the pipper is in the HUD field of view. That will be the impact point if the bombs are released immediately.

One technique is to place the FPM ahead of the target and the pipper just short of the target. Fly the Bomb Fall Line over the target and allow the pipper to track straight up the line. This will happen naturally as slant range decreases.

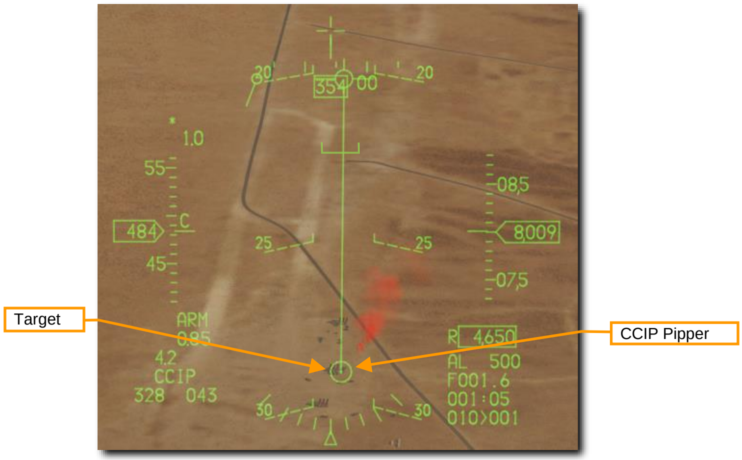


Monitor the Pull-Up Anticipation Cue to ensure it does not go above the Flight Path Marker. The Pull-Up Anticipation Cue (PUAC) provides a visual representation of the altitude required for the bomb fuze to arm or altitude to initiate a pull-up to avoid impacting the ground, whichever is more immediate. It moves up toward the Flight Path Marker (FPM) as the aircraft loses altitude. Releasing a bomb with the FPM below the PUAC will not give the bomb time to arm and result in a dud.

Laser ranging may be performed to improve the computed firing solution if a targeting pod is installed. See the Laser Ranging section for more information.

3. Depress the Weapon Release button to release the bombs when the CCIP pipper is over the target.

The pipper will be at the center of the 'stick' if more than one bomb is released in a ripple delivery. Hold the Weapons Release button long enough to ensure all weapons come off. The FPM flashes after weapons are released.



Pull up immediately and take evasive action to avoid flying into bomb fragments and to avoid enemy fire.

Unguided Bombs CCIP Attack (Post-Designate)

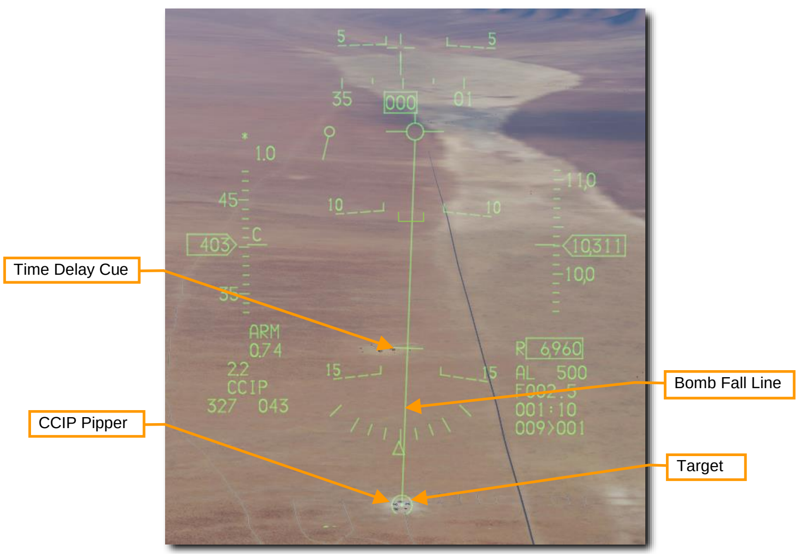
An additional option for CCIP bombs delivery is available for situations where the target cannot be within the HUD field of view at release. This can sometimes happen on attacks from a shallow dive angle or high altitude.

The steps to enter CCIP mode are the same as described above. The difference is in when you depress and hold the Weapons Release button.

1. Maneuver your aircraft to position the CCIP Pipper on target.

When the Time Delay Cue is displayed on the Bomb Fall Line, the pipper is not in the HUD field of view, however you will still place the pipper over the intended target.

You will designate that location as the target by depressing and holding the Weapons Release button. The fire control computer will do the rest.

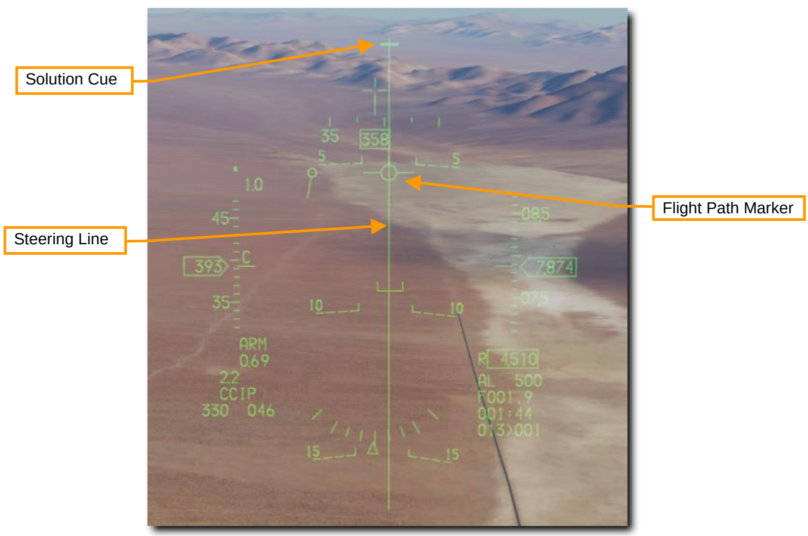


Laser ranging may be performed to improve the computed firing solution if a targeting pod is installed. See the Laser Ranging section for more information.

2. Depress and HOLD the Weapons Release button.

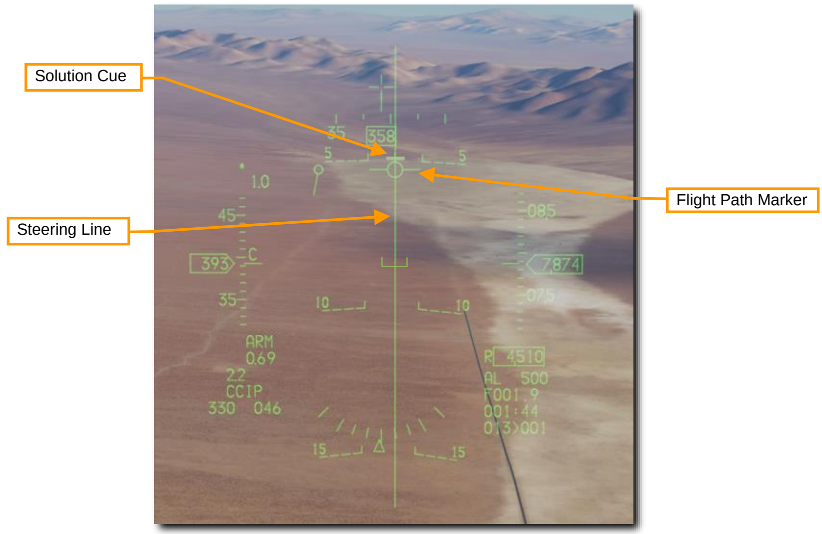
The HUD symbology displayed is identical to that used for a CCRP delivery. Keep the Flight Path Marker aligned with the Steering Line. This will align your aircraft with the target even though the target will be out of sight.

A Solution Cue is displayed at the top of the Steering Line. It will fall down the line as the range decreases and the weapon is about to be released.



3. Keep the Weapons Release button held until after the Solution Cue passes the Flight Path Marker.

Keep flying the Flight Path Marker over the Steering Line as the Sulution Cue continues to track downward. The bombs are released when the Steering Cue passes the Flight Path Marker.



Hold the Weapons Release button long enough to ensure all weapons come off. The FPM flashes after weapons are released. Pull up immediately and take evasive action to avoid flying into bomb fragments and to avoid enemy fire.

Unguided Bombs CCRP Attack

The Continuously Computed Release Point (CCRP) mode provides computed, automatic release of bombs. This can be done from a dive, but also from wings-level or a nose-high attitude.

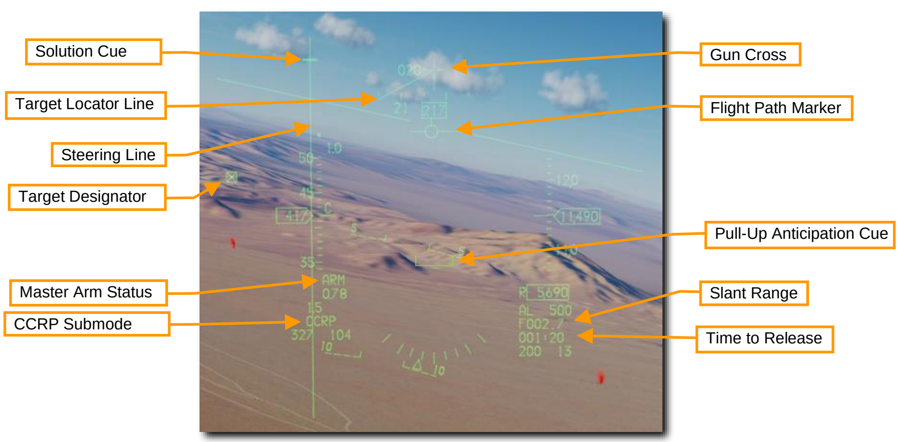
This mode requires a target designation point from which to build the bombing solution. Command steering is provided to the appropriate weapon release point and the weapon will release automatically at the proper time such that the weapons hit the target.

Summary

1. Select A-G Master Mode
2. Set Master Arm Switch to Arm
3. Set Laser Arm Switch to Arm if laser ranging updates are desired
4. Select Bombs and desired options on SMS MFD
5. Set desired steerpoint number or designate target with TGP
6. Center FPM on Steering Line
7. Depress and hold Weapons Release button to expend weapons at computed point

1. Verify CCRP symbology is displayed in the HUD.

The fire control system provides a Steering Line (SL) to provide steering to the designated target. By placing the Flight Path Marker (FPM) on the SL and holding down the Weapon Release Button, the weapon will release at the proper time and account for wind.



A Solution Cue is displayed at the top of the SL. It will fall down the line as the range decreases and the weapons are about to be released.

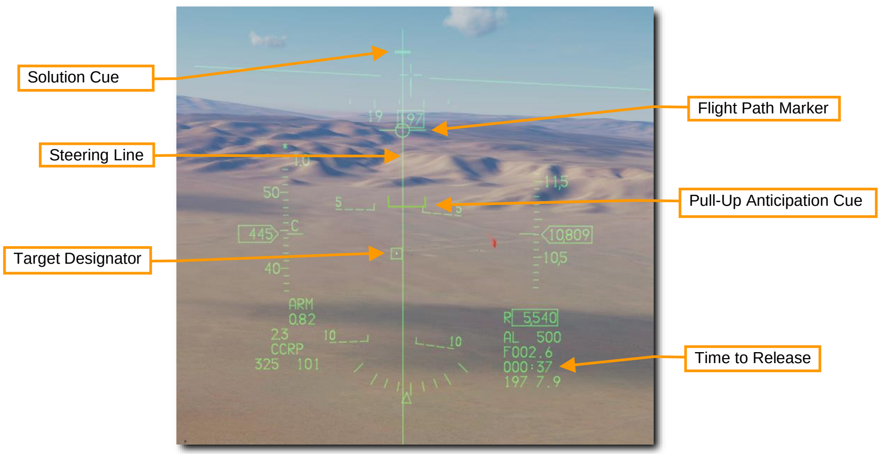
When the Target Designator (TD) is outside the HUD field on view as shown above, a Target Locator Line (TLL) extends from the Gun Cross pointing directly at the target. The relative angle is displayed next to the Gun Cross showing the number of degrees in tens between the cross and the target.

2. Designate the desired target.

In order to calculate a bombing solution in CCRP mode, a target first must be designated. This can be done by:

- Selecting a Steerpoint that was placed at the target location
- Designating a target with the Targeting Pod (if installed)

Updates to the target location may be made by slewing the TD Box in the HUD or slewing the TGP cursors onto a new position with the Cursor/Enable Control on the Throttle.



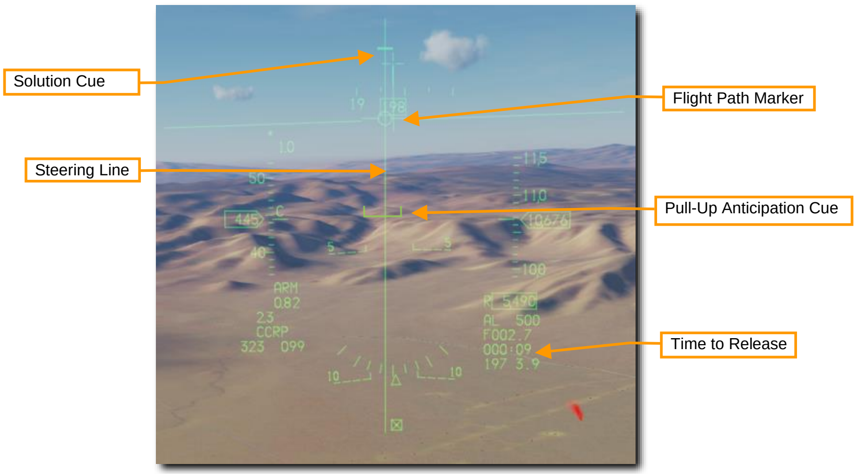
Monitor the Pull-Up Anticipation Cue to ensure it does not go above the Flight Path Marker. The Pull-Up Anticipation Cue (PUAC) provides a visual representation of the altitude required for the bomb fuze to arm or altitude to initiate a pull-up to avoid impacting the ground, whichever is more immediate. It moves up toward the Flight Path Marker (FPM) as the aircraft loses altitude. Releasing a bomb with the FPM below the PUAC will not give the bomb time to arm and result in a dud.

Laser ranging may be performed to improve the computed firing solution if a targeting pod is installed. See the Laser Ranging section for more information.

3. Depress and HOLD the Weapon Release button.

Keep the Flight Path Marker aligned with the Steering Line. This will align your aircraft with the target even though the target will be out of sight.

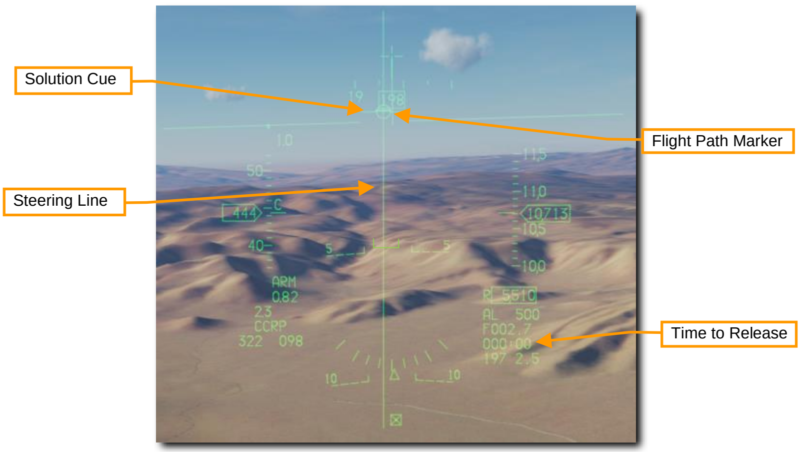
Time to release counts down at the lower right of the HUD.



When the Solution Cue begins to move down the Steering Line, about 10 seconds prior to release, depress and hold the Weapon Release button on the stick. This provides the fire control computer consent to release the weapons.

4. Keep the Weapons Release button held until after the Solution Cue passes the Flight Path Marker.

Keep flying the Flight Path Marker over the Steering Line as the Sulution Cue continues to track downward. The bombs are released when the Steering Cue passes the Flight Path Marker.



Hold the Weapons Release button long enough to ensure all weapons come off. The FPM flashes after weapons are released.

Laser Guided Bombs

The development of laser guided weapons has dramatically improved the accuracy of weapon guidance and delivery. With the assistance of build-up guidance kits, general GP bombs are turned into laser-guided bombs (LGBs). The kits consist of a computer- control group (CCG), guidance canards attached to the front of the warhead to provide steering commands, and a wing assembly attached to the aft end to provide lift. LGBs are maneuverable, free-fall weapons requiring no electronic interconnect to the aircraft. They have an internal semi-active guidance system that detects laser energy and guides the weapon to a target illuminated by an external laser source. The designator can be located in the delivery aircraft, another aircraft, or a ground source.

All LGB weapons have a Computer Control Group (CCG), a warhead (bomb body with fuze), and an airfoil group. The computer section transmits directional command signals to the appropriate pair of canards. The guidance canards are attached to each quadrant of the control unit to change the flight path of the weapon. The canard deflections are always full scale (referred to as "bang, bang" guidance).

The LGB flight path is divided into three phases: ballistic, transition, and terminal guidance. During the ballistic phase, the weapon continues on the unguided trajectory established by the flight path of the delivery aircraft at the moment of release. In the ballistic phase, the delivery attitude takes on additional importance since maneuverability of the LGB is related to the weapon velocity during terminal guidance. Therefore, airspeed lost during the ballistic phase equates to a proportional loss of maneuverability. The transition phase begins at acquisition. During the transition phase, the weapon attempts to align its velocity vector with the line-of-sight vector to the target. During terminal guidance, the LGB attempts to keep its velocity vector aligned with the instantaneous line-of-sight. At the instant alignment occurs, the reflected laser energy centers on the detector and commands the canards to a trail position, which causes the weapon to fly ballistically with gravity biasing towards the target.

GBU-10 Paveway II. This Guided Bomb Unit (GBU) weighs 2,562 lbs and is basically a laser-guided version of the Mk-84 unguided bomb with a general purpose warhead. The laser detector on the nose of the seeker detects the reflected energy of the designating laser at the set laser code. Once dropped, the wing-like airfoil surfaces at the rear of the bomb extend and are used to maneuver the bomb to the laser designation point. Rather than smooth and constant input of course-corrections to reach the target, the bomb uses a series of discreet input corrections and this is often referred to as “bang bang” guidance mode.

GBU-10 can only be hung from a MAU-12 ejector rack on stations 3, 4, 6, and 7.

Suitable targets for the GBU-10 are large and/or hardened targets that require an accurate and powerful strike. Such targets often include bridges, bunkers, and hardened command posts.

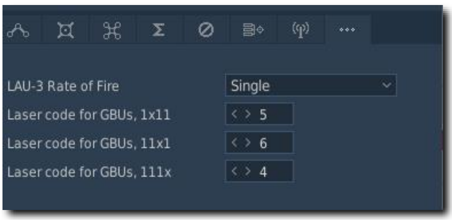
GBU-12 Paveway II. This GBU is the laser-guided version of the Mk-82 unguided, general purpose bomb. The GBU-12 guides using the same principles as the GBU-10, the only difference being the bomb the LGB is based on.

The GBU-12 can be mounted singly on a MAU-12 ejector rack at stations 3, 4, 6, and 7. Only two may be loaded on a TER when wing external fuel tanks are installed due to clearance constraints. This is commonly referred to as a ‘slant load’.

Bomb Seeker Laser Code

The seeker head on each laser guided bomb is set to track only a specific laser pulse rate frequency (PRF) code. These are manually set by the weapons load crew during ground operations and may not be set from the cockpit during flight.

To replicate this, the laser code may be set using the mission editor. In this example, the laser code on each bomb seeker head is 1564.



An additional method to set the bomb seeker laser code is included on the in-game kneeboard. You may access this using keyboard command RSHFT+K, then use the [ ] (bracket) keys to access the page. Use the keyboard commands listed to the right of each digit to change the laser code.

Bomb seeker laser codes can only be changed using this method on the ground prior to engine start and with the STA POWER switch on the right console OFF.

The laser designator on the Targeting Pod must be set to match the code on the bomb. See the section on the LASR DED Page for procedures.

SMS Page

The A-G SMS display and procedures for setting up an attack with guided or unguided bombs are identical. See the section on the Bombs A-G SMS Page for procedures.

Laser Guided Bomb CCRP Attack

The Continuously Computed Release Point (CCRP) mode provides computed, automatic release of bombs. This can be done from a dive, but also from wings-level or a nose-high attitude. The laser guided bomb attack is identical to unguided bombs with the addition of laser designation with the Targeting Pod (TGP)

This mode requires a target designation point from which to build the bombing solution. Command steering is provided to the appropriate weapon release point and the weapon will release automatically at the proper time such that the weapons hit the target.

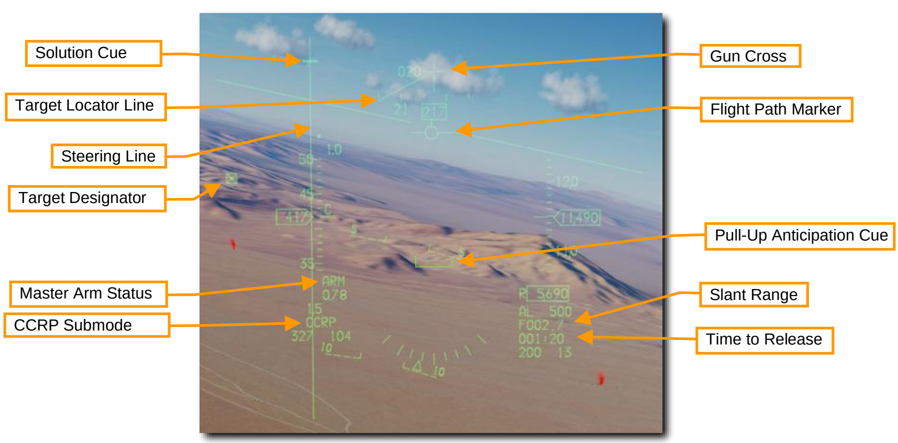
The bomb laser code must match the TGP laser designator laser code. See the sections on Bomb Seeker Laser Code and Laser Designator Code for procedures.

Summary

1. Select A-G Master Mode
2. Set Master Arm Switch to Arm
3. Set Laser Arm Switch to Arm
4. Select Bombs and desired options on SMS MFD
5. Set desired steerpoint number or designate target with TGP
6. Center FPM on Steering Line
7. Depress and hold Weapons Release button to expend weapons at computed point
8. Lase target at least 8-12 seconds prior to impact

1. Verify CCRP symbology is displayed in the HUD.

The fire control system provides a Steering Line (SL) to provide steering to the designated target. By placing the Flight Path Marker (FPM) on the SL and holding down the Weapon Release Button, the weapon will release at the proper time and account for wind.



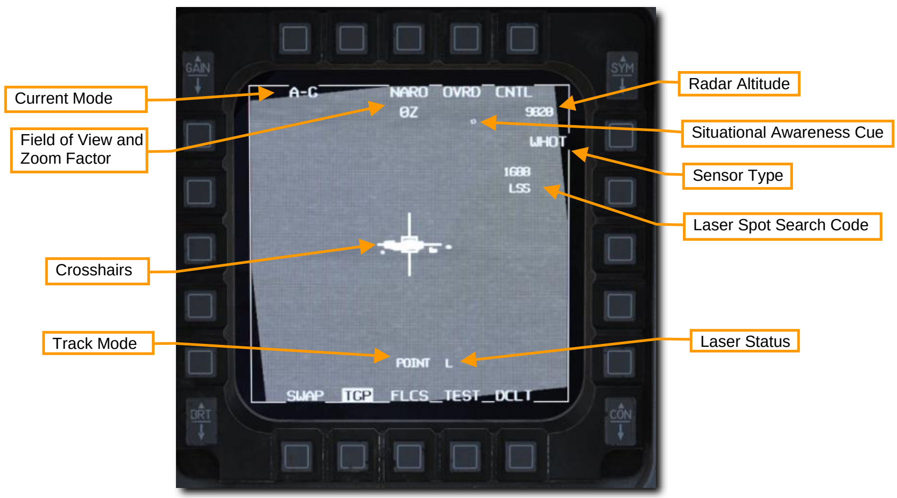
A Solution Cue is displayed at the top of the SL. It will fall down the line as the range decreases and the weapons are about to be released.

When the Target Designator (TD) is outside the HUD field on view as shown above, a Target Locator Line (TLL) extends from the Gun Cross pointing directly at the target. The relative angle is displayed next to the Gun Cross showing the number of degrees in tens between the cross and the target.

2. Verify TGP is configured for target search and laser fire.

Select A-G mode on the TGP to configure it for target acquisition and weapon guidance. The line of sight will slave to the current steerpoint when CCRP delivery mode is selected.

The TGP display may be made the sensor of interest (SOI) by positioning the Display Management Switch (DMS) Down on the stick. The current SOI can be identified by the box surrounding the display.



The TGP crosshairs may then be slewed to a new position using the Cursor/Enable Control on the Throttle. Slewing the Target Designator with the HUD as SOI will also slew the TGP crosshairs.

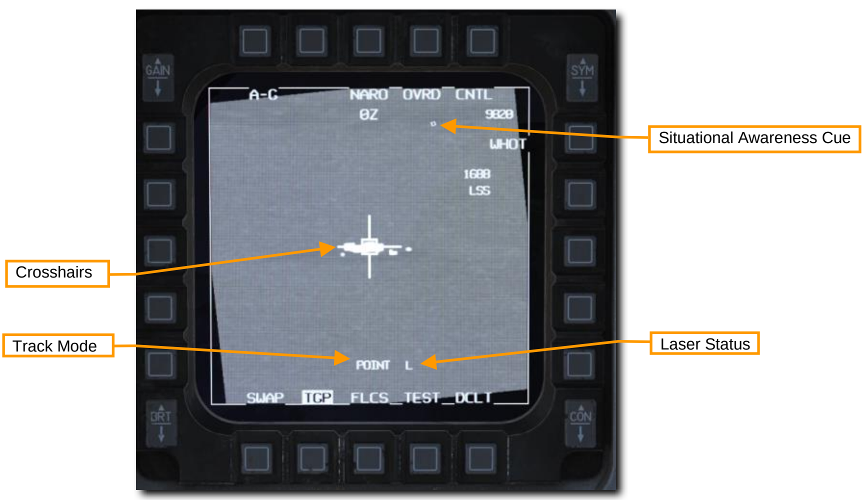
3. Locate and designate the desired target.

In order to calculate a bombing solution in CCRP mode, a target first must be designated. This can be done in two ways:

- **Select a Steerpoint that was placed at the target location.** The Target Designator box on the HUD will be placed at the steerpoint. The TGP will slave to that location when CCRP mode is selected.
- **Locate a target with the Targeting Pod.** With the TGP SOI, position the TMS Down on the stick to undesignate. The TGP will return to the boresight position near the center of the HUD. Fly or slew the TGP line of sight to the desired target location. TMS Up to designate. The Target Designator box on the HUD will be placed at that location.

Updates to the target location may be made by slewing the TD Box in the HUD or slewing the TGP cursors onto a new position with the Cursor/Enable Control on the Throttle. The Targeting Pod line of sight is used to calculate the bombing solution regardless of the track mode used.

Command an area track with TMS Up to stabilize the crosshairs over the target. A Point Track may also be commanded using TMS Up on the stick to aid in targeting if desired.



Laser ranging may be performed prior to weapon release to improve the computed firing solution. See the Laser Ranging section for more information.

The laser designator may be fired with any sensor type selected and from any track mode. The Laser status is displayed as an L near the bottom of the display when the Laser Arm switch is set to arm.

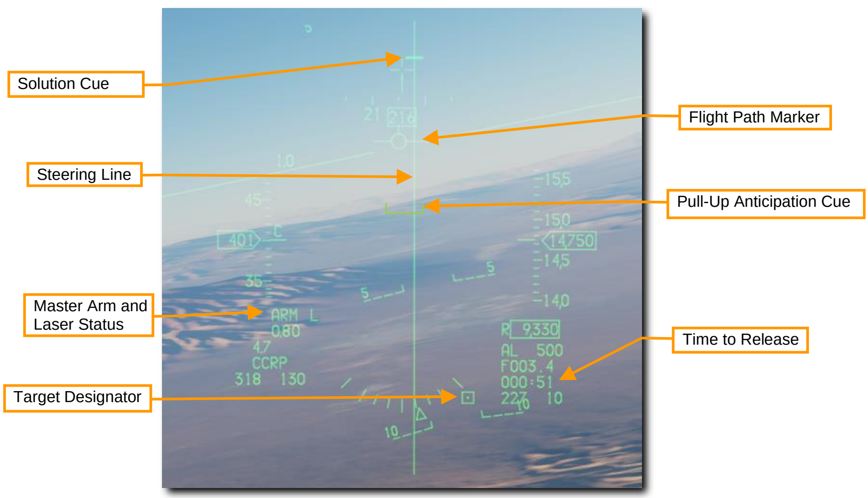
The laser is fired by squeezing the trigger on the stick to the first detent. The L flashes when the laser designator is firing.

4. Execute a CCRP bombing delivery.

Weapons delivery for laser guided bombs is identical to unguided bomb CCRP delivery.

Keep the Flight Path Marker aligned with the Steering Line. This will align your aircraft with the target even though the target will be out of sight.

The Steering Cue will fall down the Steering Line as the range decreases and the weapon is about to be released. Time to release counts down at the lower right of the HUD.

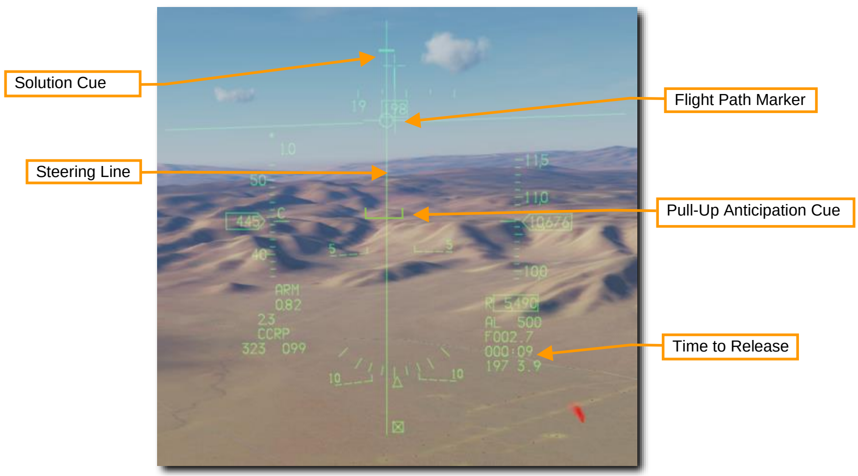


Monitor the Pull-Up Anticipation Cue to ensure it does not go above the Flight Path Marker. The Pull-Up Anticipation Cue (PUAC) provides a visual representation of the altitude required for the bomb fuze to arm or altitude to initiate a pull-up to avoid impacting the ground, whichever is more immediate. It moves up toward the Flight Path Marker (FPM) as the aircraft loses altitude. Releasing a bomb with the FPM below the PUAC will not give the bomb time to arm and result in a dud.

5. Depress and HOLD the Weapon Release button.

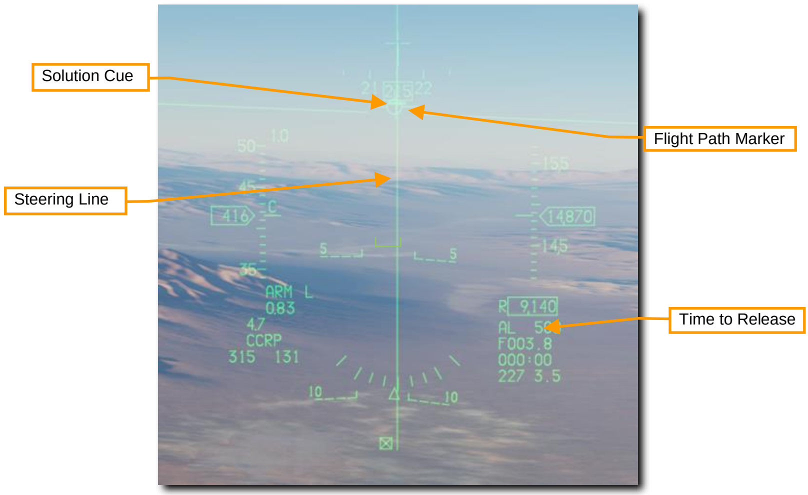
When the Solution Cue begins to move down the Steering Line, about 10 seconds prior to release, depress and hold the Weapon Release button on the stick. This provides the fire control computer consent to release the weapon.

Keep the Flight Path Marker aligned with the Steering Line. This will align your aircraft with the target even though the target will be out of sight.



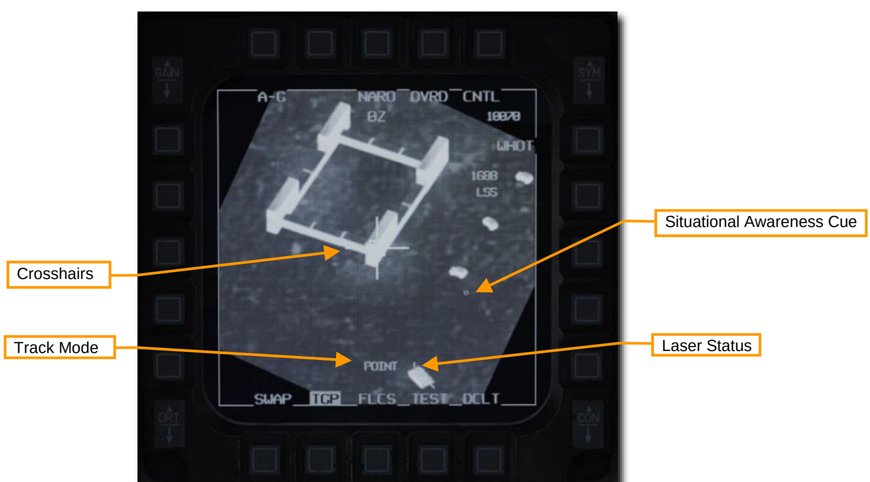
6. Keep the Weapons Release button held until after the Solution Cue passes the Flight Path Marker.

Keep flying the Flight Path Marker over the Steering Line as the Sulution Cue continues to track downward. The bombs are released when the Steering Cue passes the Flight Path Marker.



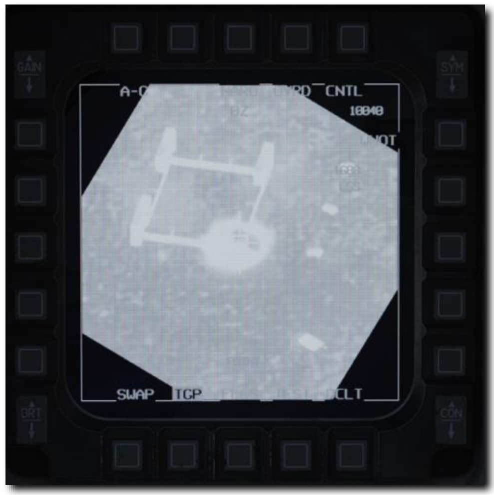
Hold the Weapons Release button long enough to ensure all weapons come off. The FPM flashes after weapons are released.

Execute a 30-45 degree check turn to the left or right to avoid overflight of the target and possible TGP gimbal roll. Continue to track the target in the TGP and update the crosshair aimpoint if necessary.

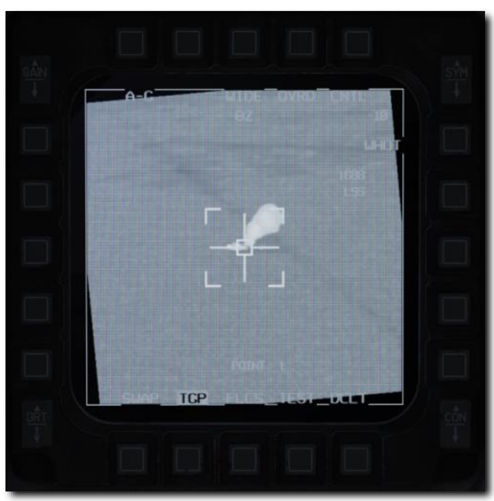


7. Lase the target with the TGP.

Squeeze the Trigger on the stick to lase the target no later than 8-12 seconds prior to impact. The L flashes when the laser designator is firing. At impact, the screen will wash out from the IR energy of the explosion.



Switch to a wide field of view for an assessment and documentation of target damage. Set up for a re-attack if necessary or exit the area.



AGM-88 HARM

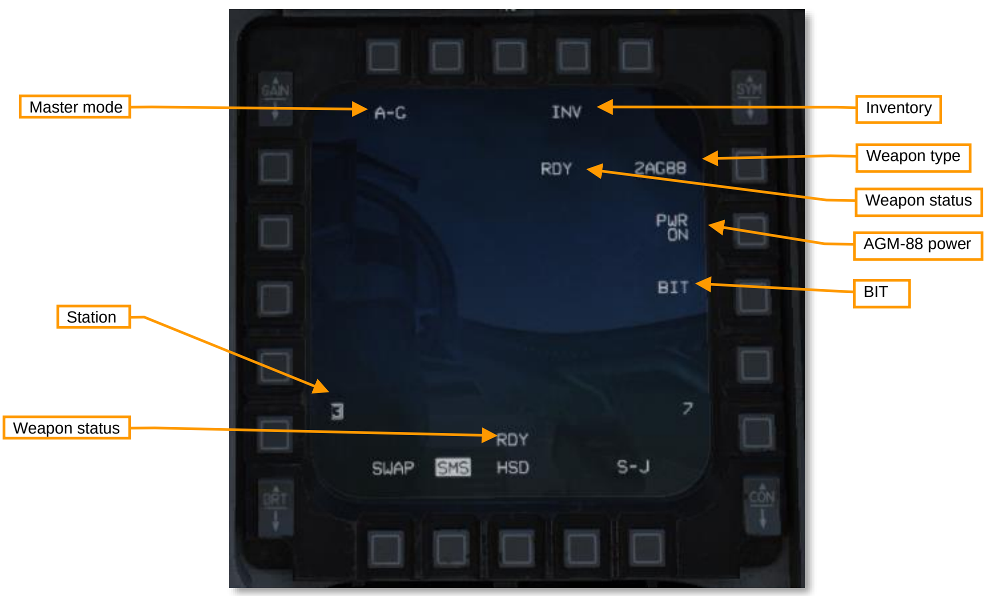
The AGM-88 High-speed Anti-Radiation Missile (HARM) is a supersonic, passive radar-guided air-to-ground missile intended to strike air defense radar sites and vehicles. The missile has an onboard radar receiver that homes in on radar energy emitted by ground-based radars, making it fire-and-forget. The pilot can designate targets using the missile's onboard radar receiver, or using the separate HARM Targeting System (HTS) pod (not yet implemented). The HARM may be loaded on stations 3, 4, 6, or 7, but is only flight-certified for stations 3 and 7.

The HARM can be targeted using its onboard radar receiver in one of three modes: position known (POS), HARM-as-sensor (HAS), or datalink (DL). Currently, DL is not implemented in DCS.

Communication with the HARM missile is managed by the aircraft launcher interface computer (ALIC) onboard the LAU-118 pylon. The ALIC provides HARM sensor video to the SMS, and allows the SMS to hand off threat types to the AGM-88. The AGM-88 will home in on threats matching the handed-off threat type after launch.

Symbology

SMS Format



Master mode: Toggles between A-G and STRF (gun strafe) air-to-ground modes.

Inventory: Pressing this OSB displays the Inventory page.

Weapon type: Displays "AG88" for AGM-88 HARM, and the number of missiles loaded.

Weapon status: Displays "RDY" when the AGM-88 is ready for launch.

AGM-88 power: Displays "PWR ON" or "PWR OFF". Pressing commands spin-up or spin-down to all loaded AGM-88 missiles.

BIT: Commands execution of a built-in test. The status of each station will be updated following completion of the BIT.

Station: Displays the stations on which HARMs are loaded. The station selected for launch is boxed. Above the station number is a character indicating the missile degrade state for that station: “D” for degraded or “F” for failed. No character above the station number indicates a functioning missile.

WPN Format

The AGM-88 HARM can be targeted using its onboard sensor in one of three modes: position known (POS), HARM-as-sensor (HAS), or datalink (DL). (Currently DL is not supported in DCS.) Each mode has its own WPN format.

POS Mode

Sub-mode: Displays “POS” in Position Known sub-mode.

Threat table: Displays the current threat table (TBL1, TBL2, or TBL3). Pressing cycles through the three tables. Pressing the TMS switch left when the WPN page is SOI also cycles through threat tables.

HARM UFC: Pressing this OSB displays the HARM page on the DED, where threat tables can be modified.

POS mode: Selects the attack profile to use: EOM (equations of motion), PB (pre-briefed), or RUK (range unknown). Currently only RUK is available in DCS.

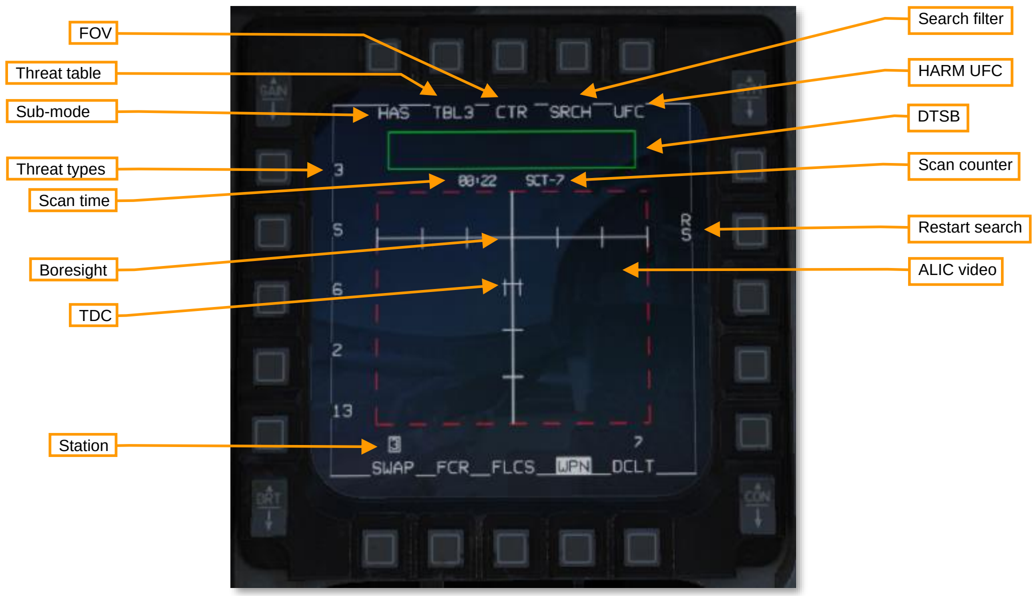
Threat types: Lists the threats in the current table. Pressing the OSB adjacent to a threat hands off that threat type to the ALIC.

In-flight missile data: Information about the missile currently in-flight. Not displayed if no missile has been launched. In RUK (range unknown) mode, the first line is the target steerpoint, and the second line is the handed-off threat type.

Next missile data: Information about the next missile to be launched. In RUK (range unknown) mode, the first line is the handed-off threat type, and the second line is the target steerpoint.

Launch status divider line (LSDL): Divides in-flight missile information from next missile information.

HAS Mode



Sub-mode: Displays "HAS" in HARM-as-Sensor sub-mode.

Threat table: Displays the current threat table (TBL1, TBL2, or TBL3). Pressing cycles through the three tables. Pressing the TMS switch left when the WPN page is SOI also cycles through threat tables.

FOV: Displays the missile field of view: "CTR" for center, "LT" for left, "RT" for right, and "WIDE" for wide. Pressing cycles through FOV settings. The FOV setting controls which portion of the missile's forward hemisphere it searches. Pressing the FLCS pinky switch also cycles FOV settings.

Search filter: Pressing this OSB allows the pilot to toggle on and off threats within the current threat table. Reducing the number of threats that the ALIC is searching for reduces the time for each scan cycle.

HARM UFC: Pressing this OSB displays the HARM page on the DED, where threat tables can be modified.

DTSB: The detected target status box lists detected threat types. When a new threat is detected, its type (e.g., "2" for SA-2) is added to the DTSB.

Scan counter: This counter increments after each successive scan made by the AGM-88.

Restart search: Pressing this OSB cancels the current scan cycle and begins a new one.

ALIC video: Detected threats are displayed in this area. Only threats from the active threat table are displayed. ALIC video is ground stabilized and referenced to missile boresight line. Threats displayed as characters representing their type (e.g., "2" for SA-2). If the threat is active (radiating), the letter "A" follows the threat type. If the threat is tracking (guiding an in-flight missile), the letter "T" follows the threat type. If the threat is not radiating (memory threat), or multiple threats of the same time are co-located, no "A" or "T" is shown.

Pressing TMS forward commands designation of the threat under the TDC. The ALIC video display will switch to a non-ground-stabilized display of the targeted threat, with crosshairs indicating missile boresight.

Station: Shows which stations have AGM-88s loaded. The station selected for next launch is boxed. A “D” or “F” is displayed over the station number to indicate a degraded or failed missile.

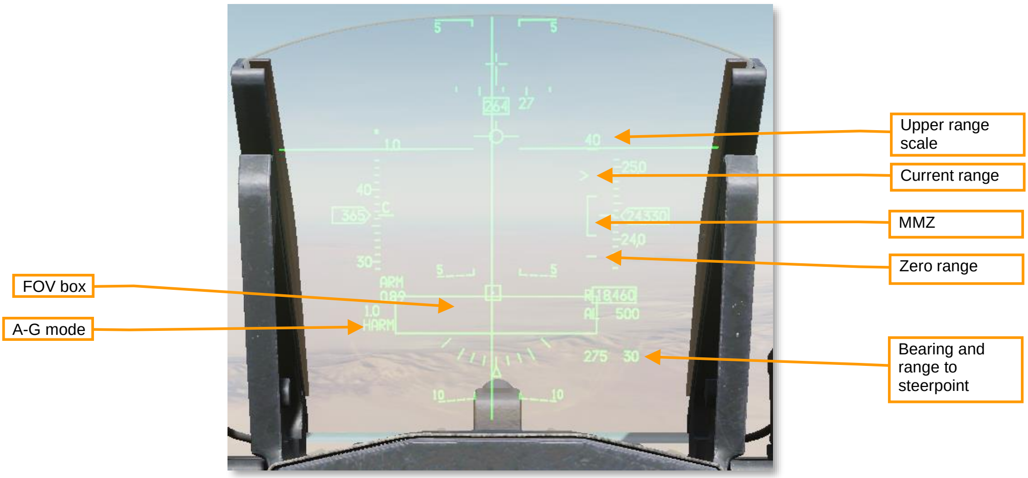
TDC: The target designator cursor is slewed over a target the pilot wishes to designate, using the cursor control on the TQS. Pressing TMS forward commands designation of the threat under the TDC, and hands off the threat type to the AGM-88.

Boresight: Indicates the missile boresight axis.

Scan time: Shows worst-case scan time. The ALIC will repeatedly scan for threats according to the chosen parameters. Reducing the number of threats to be scanned using the SRCH OBS, or reducing the FOV, will reduce the scan time and therefore decrease the amount of time before a threat is detected.

Threat types: The five threat types for the current threat table (TBL1, TBL2, or TBL3) are shown along the left side. If a threat is designated, its type is highlighted. The adjacent OSBs have no function in the HAS sub-mode.

HUD



On the right side is the HARM Launch Scale (HLS), which indicates the range potential of the missile to reach the current target. The target is assumed to be at the current steerpoint. The SMS estimates both the aircraft maneuver zone (AMZ), and the missile maneuver zone (MMZ). The AMZ is the zone where the missile can reach the target if the launching aircraft lofts or turns towards the target first. The MMZ is the zone where the missile can reach the target by doing entirely its own maneuvering.

FOV box: Indicates the end-game field-of-view of the HARM. The FOV box flashes when the aircraft is within the missile maneuver zone, target handoff is completed, and the missile is ready to be fired.

Upper range scale: Will be either 40 or 80 NM, whichever is sufficient to cover the distance to the target.

Current range: The caret represents the current aircraft range to target along the HLS range scale.

Missile maneuver zone (MMZ): The "staple" represents the range where the missile can reach the target steerpoint with no required maneuvering by the pilot.

Zero range: The bottom end of the HLS is a target distance of zero.

Bearing and range to steerpoint: The bearing and range to the target steerpoint is shown below the FOV box.

HARM DED Page

The HARM DED page is accessed by pressing the LIST button on the UFC, then the 0/M-SEL button to select MISC, and then the 0/M-SEL button again to select HARM. Note that the HARM option is only displayed when AGM-88 is the selected on the SMS.

Pressing INC/DEC cycles through the three threat tables (TBL1, TBL2, and TBL3). Each threat table can store up to five numeric threat IDs. Pressing the dobber switch up or down moves the cursors between slots. Use the numeric buttons on the UFC to enter a new threat ID. Threat IDs supported in DCS are:

ID	Radar	Type	Platform
101	1L13	EWR	
102	55Zh6 “TALL RACK”	EWR	
103	5N66M “CLAM SHELL”	SR	S-300PS / SA-10D “GRUMBLE”
104	64N6E “BIG BIRD”	SR	S-300PMU / SA-20 “GARGOYLE”
107	9S18M1 “SNOW DRIFT	TAR	Buk / SA-11 “GADFLY”
108	1S91 “STRAIGHT FLUSH”	STR	2K12 “Kub” / SA-6 “GAINFUL”
109	9S80M1 Skorba / “DOG EAR”	MRCC	
110	30-N6 “FLAP LID”	FCR	S-300P / SA-10 “GRUMBLE”
115	9A310M1	TELAR	Buk / SA-11 “GADFLY”
117	9A33	TELAR	9K33 Osa / SA-8 “GECKO”
118	9A35M3	TELAR	9K35 Strela-10M3 / SA-13 “GOPHER”
119	9A331	TELAR	Tor / SA-15 “GAUNTLET”
120	1RL144 “HOT SHOT”	TAR	2S6 Tunguska / SA-19 “GRISON”
121	RPK-2 “GUN DISH”	STR	ZSU-23-4 Shilka
122	P-19 “Danube” / “FLAT FACE B”	SR	S-125 “Neva” / SA-3 “GOA”
123	SNR-125 “LOW BLOW”	TR	S-125 “Neva” / SA-3 “GOA”
124	Marconi DN 181 “Blindfire”	TR	Rapier FSA
125	Rapier FSA Launcher	STR	Rapier FSA
126	SNR-75 “FAN SONG”	TR	S-75 Dvina / SA-2 “GUIDELINE”
201	Thales Domino	TR	Roland
202	AN/MPQ-53	STR	MIM-104 Patriot
203	AN/MPQ-50	SR	MIM-23 Hawk
204	AN/MPQ-46	TR	MIM-23 Hawk
205	Siemens MPDR 16	SR	Roland
206	AN/MPQ-55	CWAR	MIM-23 Hawk
207	Gepard radar	STR	*Flakpanzer* Gepard
208	AN/VPS-2	RR	M163 Vulcan ADS
301			*Admiral Kuznetsov*-class CV / Project 11435
302			*Admiral Kuznetsov*-class CV (2017 overhaul)
303			*Moskva*-class CG / Project 1164

306	*Grisha*-class FL / Project 1124.4
309	*Rezky*-class FF / Project 1135M
312	*Molniya*-class FSG / 1241.1MP
313	*Piotr Velikiy*-class CGN / Project 1144.2
315	*Ticonderoga*-class CG
319	*Neutrashimy*-class FFG / Project 11540
401	*Oliver Hazard Perry*-class FFG-7
402	USS *Carl Vinson* CVN-70
403	USS *Theodore Roosevelt* CVN-71
404	USS *Abraham Lincoln* CVN-72
405	USS *George Washington* CVN-73
406	USS *John C. Stennis* CVN-74
407	USS *Tarawa* LHA-1

(“EWR” means early-warning radar, “SR” means surveillance radar, “TR” means tracking radar, “TAR” means target acquisition radar, “STR” means search and tracking radar, “MRCC” means mobile air target reconnaissance and command center, “FCR” means fire control radar, “TELAR” means transporter erector launcher and radar, “CWAR” means continuous-wave acquisition radar, and “RR” means ranging radar.)

Preparation

Prior to departure, set up your threat tables as necessary. The threats you expect to fire against must be present on at least one threat table for the HARM to detect them. Most of the time, you will be able to use one of the default threat tables:

TBL1 (modern SAMs)	TBL2 (AAA, SHORAD)	TBL3 (older SAMs)
10 (SA-10 FCR)	19 (SA-19 TAR)	3 (SA-3 TR)
BB (SA-20 SR)	15 (SA-15 TELAR)	S (SA-3 SR)
CS (SA-10 SR)	8 (SA-8 TELAR)	6 (SA-6 STR)
11 (SA-11 TELAR)	A (ZSU-23-4 STR)	2 (SA-2 TR)
SD (SA-11 TAR)	DE (DOG EAR MRCC)	13 (SA-13 TELAR)

If your expected threat does not appear on any of these tables, you will need to add it to one of the tables. You will also improve your ability to efficiently employ HARMs if you consolidate expected threats onto a single table.

To edit threat tables, first select air-to-ground master mode by pressing the A-G button on the ICP. Then, on the SMS format, select AG88 as the active weapon type. Display the HARM page on the DED by pressing the LIST button on the ICP, then the 0/M-SEL button to select MISC, and the 0/M-SEL button again to select HARM.

Use the INC/DEC buttons on the ICP to select a threat table, then use the dobber to place the cursor over a threat you wish to edit. Use the ICP to enter a new threat number, then press the ENTR button.

Prior to employing HARMs, press the A-G button on the ICP to select air-to-ground master mode. Ensure that the SMS and WPN formats are visible on an MFD. From the SMS format, power on the HARMs:

Prior to firing a HARM, ensure the MASTER ARM switch is in ARM.

Employment using Position Known (POS) mode

Summary

1. Select A-G Master Mode.
2. Set MASTER ARM switch to ARM.
3. Select AG88 on SMS page (OSB6).
4. Select POS sub-mode on the WPN page (OSB1).
5. Select the attack profile on the WPN page (OSB3).
6. Select the desired threat table and threat on the WPN page (OSB2).
7. Select the target steerpoint.
8. Fly to the AMZ, follow the loft cue, and wait until the FOV box on the HUD is flashing.
9. Fire the missile using the weapon release button.

Position Known (POS) mode is a pre-planned employment mode that relies on a steerpoint being placed at or near the target radar. The radar type will be downloaded to the ALIC, and the HARM will fly towards the target steerpoint until the radar is detected, at which point it will home on the radar signal.

In POS mode, the pilot selects one of three attack profiles: Equations of Motion (EOM), Pre-Briefed (PB), or Range Unknown (RUK). Each of these profiles makes different assumptions about the aircraft maneuver zone (AMZ) and missile maneuver zone (MMZ). The AMZ is the zone where the missile can reach the target, assuming the aircraft maneuvers to an ideal loft angle first. The MMZ is the zone where the missile can reach the target without requiring the aircraft to loft first.

Equations of Motion (EOM) mode is the most effective profile for off-boresight launches, but requires the most accurate target steerpoint data. To launch with EOM selected, the pilot must first fly to the AMZ, then loft and launch once within the MMZ. EOM is useful when attacking threats that require high off-boresight (HOBS) defensive tactics.

Pre-Briefed (PB) mode is the most effective profile at longer ranges, but requires an on-bearing attack. To launch with PB selected, the pilot must first turn the aircraft to point at the target, then fly to the AMZ, then loft and launch once within the MMZ. PB is most effective at longer ranges but requires the aircraft to fly directly at the target.

Range Unknown (RUK) mode is the most versatile profile when working with degraded target data. To launch with RUK selected, the pilot must fly the aircraft into the MMZ, where the missile can make all required maneuvering to reach the target. RUK is much more tolerant of inaccurate target steerpoints, or when fighting threats where only bearing information is available.

Currently, only the RUK attack profile is available in DCS.

1. Select POS sub-mode on the WPN page.

Press OSB1 if necessary to change to POS sub-mode. You will see the launch status divider line (LSDL) and next-launch information below the LSDL.

2. Select the attack profile.

On the WPN page, press OSB3 until the desired attack profile is shown. (Currently, only RUK is available.)

3. Select the threat table and threat.

On the WPN page. press OSB2 until the desired threat table is shown, and then press the OSB adjacent to the threat you wish to attack from the list on the left side. This will hand off the threat to the ALIC.

4. Select the target steerpoint.

Activate the steerpoint co-located with the threat you are attacking.

5. Fly to the AMZ, follow the loft cue, and wait until the FOV box on the HUD is flashing.

The attack profile you will fly is dependent on whether you have selected EOM, PB, or RUK. Currently, only RUK is available in DCS.

RUK Attacks

In RUK mode, you must fly the aircraft all the way to the MMZ. Follow the azimuth steering line (ASL) on the HUD towards the target until the FOV box on the HUD is flashing. Once it is flashing, you are within the MMZ and the weapon release button will be hot. For RUK attacks, the HARM will loft, but the loft angle will be limited to the maximum the missile can achieve while still keeping the threat within its field of view.

Because range information is degraded or unavailable for RUK attacks, no time-until-intercept or time-to-impact data is shown on the WPN page, and the HARM Launch Scale (HLS) and solution cues are suppressed on the HUD.

Employment using HARM-as-sensor (HAS) mode

Summary

1. Select A-G Master Mode.
2. Set MASTER ARM switch to ARM.
3. Select AG88 on SMS page (OSB6).
4. Select HAS sub-mode on the WPN page (OSB1).
5. Make the WPN page SOI.
6. Select the desired threat table on the WPN page (OSB2).
7. Wait until your threat appears in the ALIC video display on the WPN page.
8. Move the TQS cursor over the threat and designate with TMS forward.
9. Fire the missile using the weapon release button.

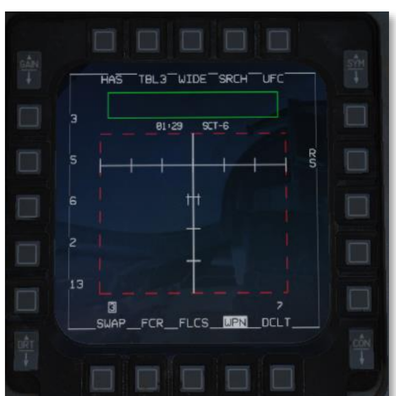
HARM-as-sensor (HAS) mode is a target-of-opportunity employment mode using the HARM's onboard radar receiver. The HARM detects air defense radar signals and transmits that information to the aircraft. The pilot can then select a radar to attack, and launch a HARM against it. With this mode, distance to the target is not known, only bearing, so the HARM does not loft, which decreases its effective range.

In HAS mode, the HARM repeatedly scans for threats that match the current active threat table. The HARM begins with a full scan of its FOV, once for each of the selected threat types. If any targets are found, a detailed scan is performed to determine the target coordinates. The HARM then steps to the next threat type. In all, this results in a worst-case scan cycle time of 22 seconds.

The ALIC is in HAS mode when the master mode is A-G, AG88 is the selected weapon on the SMS page, and "HAS" is displayed as the active sub-mode on the WPN page.

1. Select HAS mode and make WPN page SOI.

Press OSB1 if necessary to change to HAS sub-mode. Ensure that the WPN page is SOI; if not, press DMS aft to change SOI to the WPN page.



2. Select the appropriate threat table.

Press OSB2 or TMS left until the desired threat table is selected.

3. Reduce the scan time by selecting only the threats you wish to scan for (optional).

If you want to reduce scan time, press SRCH (OSB4), then leave highlighted only the threats you are interested in searching for.

Press HAS (OSB1) to return to the HAS page.

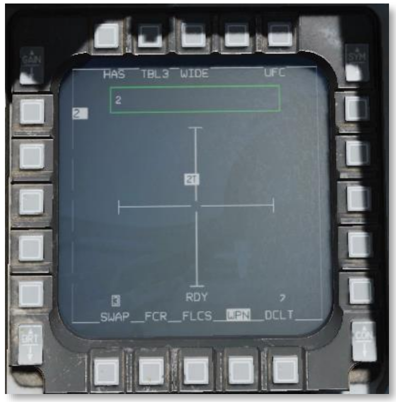
4. Select an FOV (optional).

You can further reduce scan time by using the pinky switch (or OSB3) to cycle through FOV options until you find an appropriate FOV.

5. Locate and designate your target.

Point your aircraft (and the missile seeker) in the direction of your expected threat. As each scan cycle completes, detected threats will be shown in the ALIC video area and placed into the DTSB.

Slew the cursor over the detected threat, then press TMS forward to designate it. The HAS display will change to indicate the designated threat.



Note that you can designate and fire against any threat that appears on the HAS display, but many radar operators will cycle their radars on and off, or track different targets. This will result in the HARM being unable to continue tracking the target, and the missile will become ineffective.

To increase probability of kill, you may wish to wait until the threat radar is guiding a missile at you (“T” appears next to threat type on HAS display) before firing, since a radar operator is less likely to cease tracking you while guiding a missile. However, this strategy comes with its own obvious risks!

6. Fire the missile.

Verify the proper threat is highlighted, “RDY” is displayed in the SMS and WPN pages, and the FOV box in the HUD is flashing, then press and hold the pickle button to fire the missile.

AGM-65 Maverick

The AGM-65 Maverick is an optically-guided air-to-ground missile intended for the close air support (CAS) mission. It uses an onboard electro-optical (E/O) or infrared imager that tracks the target, giving it “fire and forget” capability. The pilot locks the target using the image from the onboard seeker head, and fires the missile. The missile tracks to the target using the image from its seeker head.

The AGM-65 was developed by Hughes Missile Systems Division in 1966, and entered service in 1972.

Operation

The AGM-65 must be warmed up before it can be used. During the warm-up period, onboard image-stabilizing gyroscopes spin up to operating speed. The missile’s video can be used before the gyroscopes have spun up, but the image will not be ground-stabilized.

Missile video will become available on the WPN page once the gyroscopes are spun up. If you wish to shorten the warm-up period, pressing the Uncage button while the WPN page is SOI will activate missile video once the gyroscopes have reached 90% of operating speed.

The pilot can locate and designate targets using the fire control radar (FCR) or heads-up display (HUD), using the AGM-65’s own seeker head, or the pilot can handoff targets designated from the Sniper Advanced Targeting Pod (TGP).

When handing off targets from the TGP, the missile boresight correlator (MBC) compares the image from the targeting pod with the image from the missile seeker head, and slews the missile seeker head until the images match. The MBC is only active when in A/G mode with an AGM-65 selected, and the TGP is sensor of interest (SOI).

When the Maverick is fired, its onboard imager continues to track the target until the target grows to fill about 75% of the seeker head field of view (FOV). At this point, to continue to impact, the AGM-65A and -65B use last rate memory, and the AGM-65D uses forced correlation.

The AGM-65 has a ground-configurable fuzing delay and a ground-selectable LAND/SHIP selector that changes the tracking algorithm to be more suitable for vehicles or ships.

Limitations

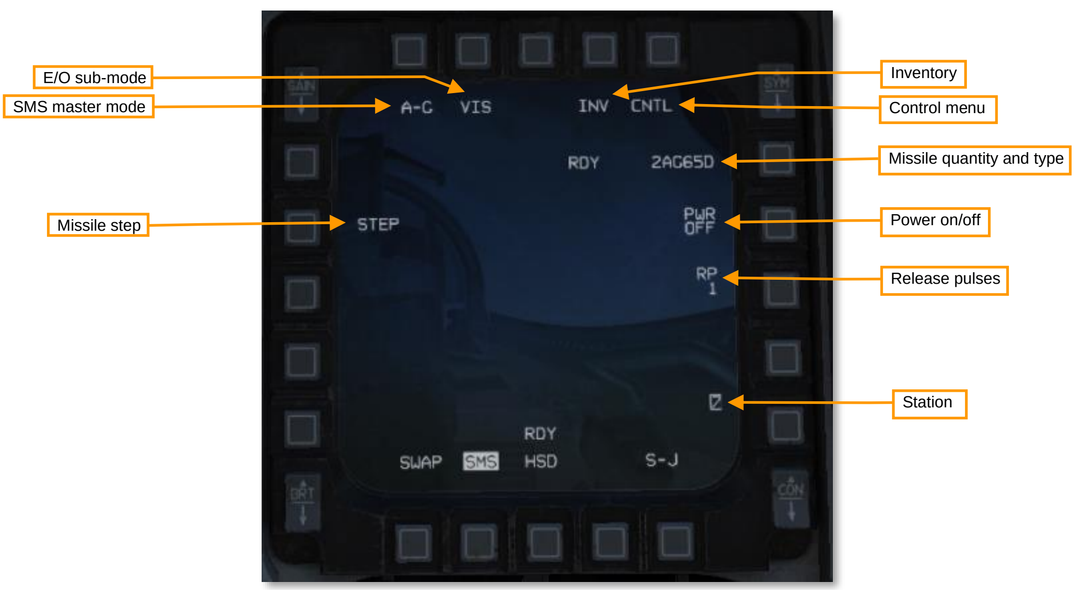
Standby time 1 hour

Video time 30 minutes

Seeker gimbal limits

AGM-65A	±60°
AGM-65B	±50°
AGM-65D	±42° horizontally ±30-54° vertically

SMS Page



SMS master mode: Toggles between A-G and STRF (gun strafe) master modes.

E/O sub-mode: Cycles between PRE, VIS, or BORE E/O sub-modes. See the Employment sections, below, for more information on the different sub-modes. You can also toggle sub-modes using the cursor enable button on the throttle quadrant system (TQS).

Inventory page: Press to show the Inventory page.

Control page: Press to show the Control page.

Missile quantity and type: Cycles between different types of loaded AGM-65s.

Auto power toggle: Toggles on or off the auto-power feature (see Automatic Power-On, below).

Release pulses: Controls the number of missiles released per press of the weapon release button. Only available for AGM-65D and -65G.

Stations: Shows the stations loaded with AGM-65s. The next station to fire is highlighted.

Missile step: Cycles the next station to fire between loaded stations.

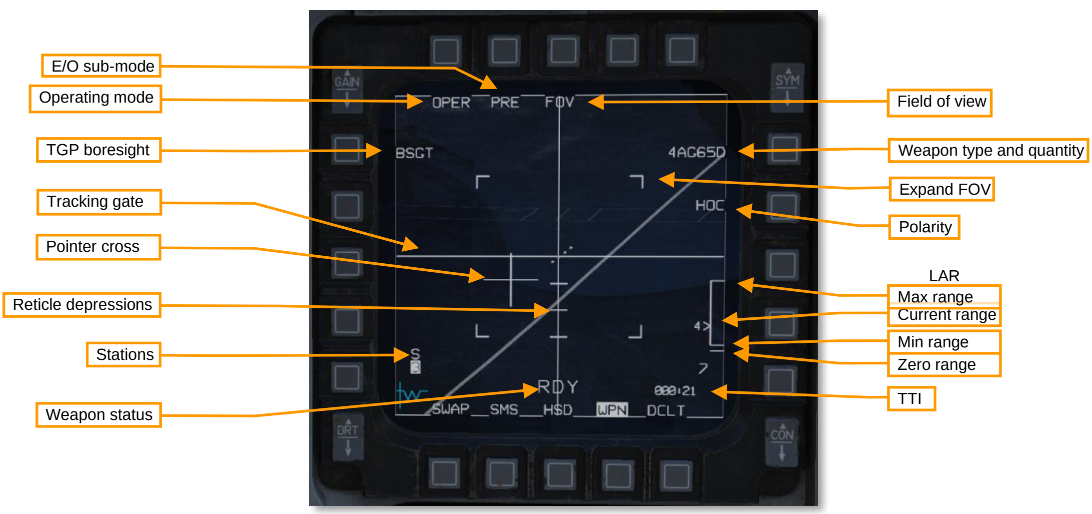
SMS Page, CNTL Sub-Page

Auto power toggle: Turns on or off the auto power-on feature.

Auto power steerpoint: Sets the steerpoint where the Maverick will automatically turn on.

Auto power direction: Sets the general direction the airplane must be going when it crosses that steerpoint in order to automatically power on the Mavericks. Cycles between north/east/south/west.

WPN Page



Operating mode: Cycles between STBY (standby) and OPER (operating) modes.

E/O sub-mode: Cycles between PRE, VIS, or BORE E/O sub-modes. See the Employment sections, below, for more information on the different sub-modes. You can also toggle sub-modes using the Cursor Enable button on the TQS.

TGP boresight: Press to mark this Maverick station as boresighted to the targeting pod. This should be done after confirming that the targeting pod and Maverick seeker head are pointing at the same target. See Missile Boresighting, below, for more information.

Tracking gate: Indicates the missile track target. The crosshairs will expand to indicate the boundaries of the target being tracked.

Pointer cross: Indicates the seeker head direction relative to boresight (center of the screen). The AGM-65A seeker head is capable of rotating ±60° horizontally and vertically, the AGM-65B ±50° horizontally and vertically, and the AGM-65D ±42° horizontally, and +30-54° vertically.

The pointer cross will flash when any of the following launch criteria are not met:

- Seeker head must be within 10° horizontally and vertically of boresight.
- Target image must be large enough to maintain continuous track.

Reticle depressions: Indicates 5°, 10°, and 15° of reticle depression.

Stations: Shows the stations loaded with AGM-65s. The next station to fire is highlighted. Above the station number will be a character indicating the status of the MBC:

- S: Slave (MBC has not been commanded to slew missile)
- 1: Slew 1 (MBC is slewing to match missile LOS to TGP LOS)
- 2: Slew 2 (MBC is slewing to match missile video to TGP video)
- T: Track (MBC has commanded missile to track)
- C: Complete (MBC has finished correlating)
- I: Impossible (MBC was unable to complete handoff)

Weapon status: One of the following:

- REL: Release signal being transmitted to weapon.
- RDY: Weapon is armed and ready for release.
- MAL: Weapon cannot be released due to malfunction.
- SIM: Weapon is unarmed and will not be released, but release symbology is being displayed.
- (blank): MASTER ARM is in OFF position.

Field of view: Toggles between wide and narrow FOV. You can also toggle FOV using the pinky switch on the flight control stick (FCS) when the WPN format is SOI, or using the Uncage button on the TQS regardless of SOI. Not shown when AGM-65A is selected.

Weapon type: Cycles between the different types of loaded AGM-65s. Shows the quantity and type of AGM-65 loaded and active.

Expand FOV: Outlines the boundaries of the expanded field of view. Not shown when AGM-65A is selected.

Polarity: Toggles between hot-on-cold (HOC) and cold-on-hot (COH) polarity. You can also press TMS right to toggle between polarities. The AGM-65G and -H additionally have an AREA mode for forced correlation mode (see Force Correlate, below).

LAR: The launch acceptable region for the next missile, showing the acceptable launch range and current range adjacent to the caret. Accurate range data is only available if the SPI is in proximity to the missile LOS.

Time to impact (TTI): The time until the next missile impacts its target, if launched now.

Preparation

The AGM-65 has a duty cycle of one hour in standby, and 30 minutes when active. After powering the AGM-65s, the missiles will begin their 3-minute warm-up period. Once three minutes has passed, the missiles are in standby mode and ready for employment. In standby mode, the missiles have one hour of available duty time. Once a missile's video is activated, it has 30 minutes of available duty time. When a missile's duty time has expired, it must be powered off for one hour (AGM-65A/B) or two hours (AGM-65C/D).

Automatic Power-On

The SMS can be configured to automatically power on the Mavericks when crossing a configured steerpoint, so that the pilot does not need to remember to power them on at least three minutes prior to employment.

Summary

1. On the SMS format, select Mavericks.
2. Display the Control page.
3. Choose the steerpoint.
4. Choose the direction and enable auto power-on.

1. On the SMS format, select Mavericks.

On the SMS format, press OSB6 until AG65 is shown as the active weapon.

2. Display the Control page.

Press the CNTL (OSB5) to display the Control page.

Choose the steerpoint.

Press OSB19, labeled STPT *X*.

Using the OSBs, enter the steerpoint number, then press the OSB labeled ENTR. The Mavericks will be powered on upon crossing this steerpoint. You can press RCL to undo an errant digit, or RTN to return to the Control page without changing the steerpoint number.

3. Choose the direction and enable auto power-on.

Press OSB20 (NORTH OF) to cycle between different direction options. The Maverick will not be powered on until the aircraft crosses the configured steerpoint traveling in generally this direction.

Press AUTO PWR (OSB7) to turn on the automatic power-on feature.

You can leave the Control page by pressing the CNTL (OSB5) again.

Missile Boresighting

Missile boresighting should be done prior to employing Mavericks using TGP handoff. It can be done either on the ground or in the air while en route.

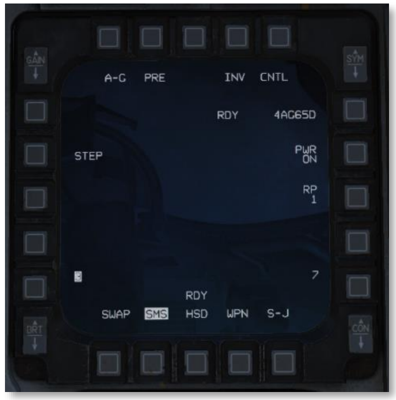
Summary

1. Power on the Mavericks and TGP.
2. Set GND JETT ENABLE ON, MASTER ARM SIM, A-G master mode, and A/G TGP mode.
3. On the SMS format, select AG65 and set E/O sub-mode to PRE or VIS.
4. On the TGP format, slew the seeker head to the boresight target.
5. On the WPN format, slew the seeker head to the same target and designate.
6. Press the BSGT button (OSB20).
7. Repeat steps 4–6 for for each station.
8. Power off the Mavericks and reset all switches.

1. Power on the Mavericks and TGP.

Place the TGP format on one MFD, and the SMS format on another.

If the Mavericks are not already powered on: On the SMS format, press the PWR OFF (OSB7) to power on the Mavericks.



If the TGP is not already powered on: Set the RIGHT HDPT power switch to on, on the SENSOR panel.

2. Set GND JETT ENABLE ON, MASTER ARM SIM, A-G master mode, and A/G TGP mode.

If on the ground, set GND JETT ENABLE to ON. Press the A-G button on the ICP to switch to air-to-ground master mode. Set the MASTER ARM switch to SIM.

If the TGP is not already in air-to-ground mode, then on the TGP format, press the OSB labeled STBY, then the OSB labeled A-G to put the targeting pod in A/G mode.

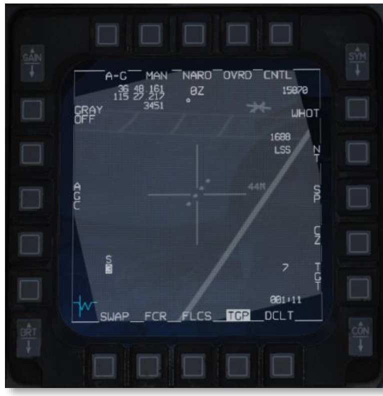
3. On the SMS format, select AG65 and set E/O sub-mode to PRE or VIS.

On the SMS format, press OSB2 until PRE or VIS is shown as the Maverick sub-mode. (You can also use the cursor enable button on the TQS to cycle between delivery modes.) Use PRE if your boresight target is co-located with a steerpoint; use VIS if you are visually locating your boresight target. Confirm that AGM-65 PRE or VIS symbology is shown on the HUD. Choosing a target further away will reduce parallax errors.

Change the MFD displaying the SMS format to the WPN format. On the WPN format, verify that NOT TIMED OUT is no longer displayed, indicating the missiles have completed their three-minute warm-up. The WPN page should begin displaying video from the missile seeker head.

On the TGP format, slew the seeker head to the boresight target.

Use DMS aft to move SOI to the TGP. Using the TQS cursor, slew the TGP pointing cross over the boresight target.



4. On the WPN format, slew the seeker head to the same target and designate.

Press DMS aft until SOI moves to the WPN format. Use the TQS cursor to slew the Maverick tracking gate over that same boresight target, then press TMS forward to designate. Verify that the tracking gate closes and the correct target is being tracked.

5. Press the BSGT button (OSB20).

Press OSB20, labeled BSGT, to boresight the missiles.

Press TMS aft to break missile track, then verify the missile LOS follows the TGP LOS.

6. Repeat steps 4–6 for for each station.

Press MSL STEP to move to the next pylon. Repeat this procedure for each pylon loaded with AGM-65s.

7. Power off the Mavericks and reset all switches.

When you are finished boresighting your missiles, go back to the SMS format and press the OSB labeled PWR ON. This will prevent your Mavericks from running through their duty time before you enter the combat area.

Be sure to reset the positions of the MASTER ARM and GND JETT ENABLE switches, as well as the master mode.

Employment using PRE mode

The PRE (pre-planned) delivery mode allows you to lock targets in the vicinity of a sensor point of interest (SPI), such as a steerpoint. PRE uses CCRP-style HUD symbology, and the Maverick seeker head will be slaved to the SPI.

Summary

1. On the WPN format, set E/O sub-mode to PRE. Make sure WPN page is SOI.
2. Slew the tracking gate over the target and designate.
3. Fire the missile.

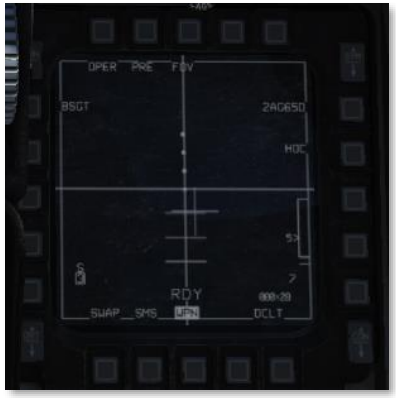
1. On the WPN format, set E/O sub-mode to PRE. Make sure WPN page is SOI.

On the WPN format, set the delivery mode to PRE using Cursor Enable or OSB2. The Maverick seeker head will be slaved to the SPI (typically the current steerpoint). Confirm that seeker head video is available.

Press DMS aft until the WPN page is SOI.

2. Slew the tracking gate over the target and designate.

Use the TQS cursor to slew the tracking gate over the target, then press TMS forward to designate. The tracking gate will close on the target. Confirm that the missile is tracking the correct target, the pointer cross is not flashing, and that the target is in range.



3. Fire the missile.

Fire the missile with the weapon release button.

Employment using VIS mode

The VIS (visual) delivery mode allows you to lock targets that you can see in front of you, by using the HUD to slew a TD box onto the target. VIS uses DTOS-style sighting. VIS mode is unavailable if the Mavericks are loaded onto an LAU-88/A rack.

Summary

1. On the WPN format, set E/O sub-mode to PRE.
2. On the HUD, slew the TD box over the target and designate.
3. On the WPN format, slew the tracking gate over the target and designate.
4. Fire the missile.

1. On the WPN format, set E/O sub-mode to PRE.

On the WPN format, set the delivery mode to VIS using cursor enable or OSB2. SOI will move to the HUD, and a TD box will appear, initially caged to the flight path marker (FPM). Confirm that seeker head video is available on the WPN page.

2. On the HUD, slew the TD box over the target and designate.

Uncage the TD box and slew it over the target using the TQS cursor.

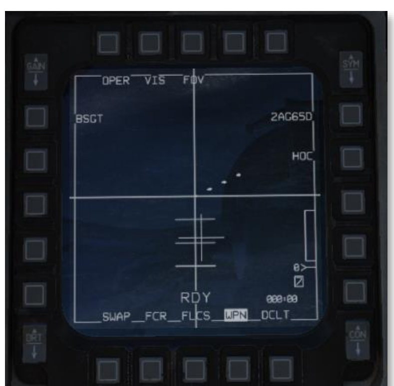
Press TMS forward to designate the target in the TD box. The TD box will ground-stabilize and SOI will move to the WPN format.

If the wrong target is designated, reject the designation by setting HUD as SOI using DMS forward, and then undesignate with TMS aft.

3. On the WPN format, slew the tracking gate over the target and designate.

Use TMS left or OSB7 to change video polarity, if desired.

Use the TQS cursor to place the target within the crosshairs on the WPN format, then press TMS forward to designate the target. The crosshairs will close on the target. Confirm that the missile is tracking the correct target, the pointer cross is not flashing, and that the target is in range.



4. Fire the missile.

Fire the missile with the weapon release button.

Employment using BORE mode

BORE (boresight) delivery mode is intended for quick reactive or target-of-opportunity shots. Missiles can be launched against any target in BORE mode without having to change the SPI. In BORE mode, the Maverick seeker head is slaved to the pointer cross on the HUD.

Summary

1. On the WPN format, set E/O sub-mode to BORE.
2. On the HUD, fly the boresight cross over the target and designate.
3. Fire the missile.

1. On the WPN format, set E/O sub-mode to BORE.

On the WPN format, set the delivery mode to BORE using cursor enable or OSB2. SOI will move to the WPN format. Confirm that seeker head video is available. SOI will move to the WPN page and missile seeker head position will be displayed on the HUD as a cross. Seeker head position will initially be boresight.

2. On the HUD, fly the boresight cross over the target and designate.

Fly the pointer cross near your target, then use the TQS cursor to slew the pointer cross over the target. Reference both the HUD and the WPN format to correctly place the pointer cross, then press TMS forward to designate.

Confirm that the missile is tracking the correct target, the pointer cross is not flashing, and that the target is in range.

3. Fire the missile.

Fire the missile with the weapon release button.

Employment using TGP handoff

The TGP can hand-off targets to the MBC, which will correlate the seeker head video with the TGP video and attempt to automatically track the TGP target. To improve the likelihood of a successful handoff, perform the steps listed in Missile Boresighting, above, prior to entering the target area.

You should have the TGP format active on one MFD and the WPN format active on the other.

Summary

1. On the WPN format, set the delivery mode to PRE or VIS using cursor enable or OSB2. Confirm that seeker head video is available.
2. Using the DMS, move SOI to the TGP format.
3. Using the TQS cursor, slew to the target. For a moving target, use TMS forward to switch to POINT track. (For more information, see Air-to-Ground (A-G) Mode.)

While the TGP is slewed, the MBC will command the seeker head to match slew and automatically attempt a track. During the attempt, HANDOFF IN PROGRESS will be displayed on the WPN format. The amount of time to complete correlation is reduced if the missile boresight procedure was completed prior to weapon employment.

If handoff succeeds, a “C” (correlated) will be displayed over the active pylon number. There is no need to switch SOI away from the TGP format. Confirm that the missile is tracking the correct target, the pointer cross is not flashing, and that the target is in range, then press the weapon release button to fire.

If the handoff cannot succeed, “I” (impossible) is displayed above the pylon number instead.

Ripple Fire

Up to two Mavericks can be queued with separate targets for a ripple fire (a.k.a. “quick-draw”) attack. When more than one Maverick is tracking a target, two 10-mr LOS circles will appear on the HUD, labeled “1” and “2”. The AGM-65s must be loaded on LAU-117 pylons for ripple fire to be available.

Summary

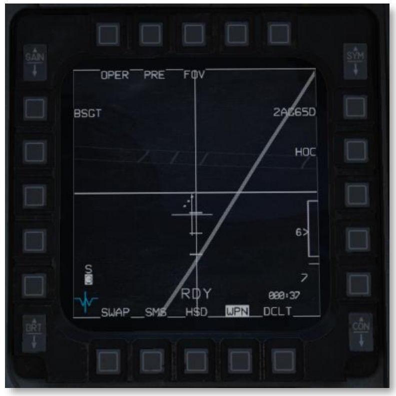
1. On the SMS format, set RP to 2 (optional).
2. Using one of the delivery modes above, designate a target for the first Maverick.
3. Press the MSL STEP button to step to the next missile.
4. Designate a target for the second Maverick.
5. Fire both missiles.

1. On the SMS format, set RP to 2 (optional).

Optionally, set the release pulses to two. To do this, from the SMS page, press OSB8 (labeled RP). Use the MFD to set the releases pulses to 2, then press ENTR (OSB2).

2. Using one of the delivery modes above, designate a target for the first Maverick.

Using one of the delivery modes above, locate and designate a target for the first Maverick. Confirm that the missile is tracking the correct target. Do not fire the missile.

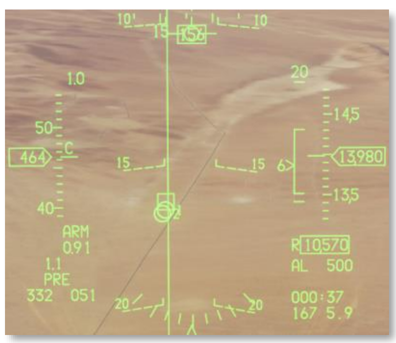


3. Step to the next missile.

Press the MSL STEP button to step to the next missile.

4. Designate a target for the second Maverick.

Using the same procedure, locate and designate a target for the second missile. Confirm that the missile is tracking the correct target, the pointer cross is not flashing, and that the target is in range. On the HUD, LOS circles labeled “1” and “2” will indicate missile LOS and the order the missiles will fire in.



5. Fire both missiles.

If you set releases pulses to two, press and hold the weapon release button until both missiles have come off the rail. If not, press and hold the weapon release button once for each missile (twice total).

Force Correlate

The AGM-65G and -H models can be launched in force-correlate mode. This mode does not use the normal centroid tracking algorithm suitable for targeting vehicles, instead using an image-correlation algorithm suitable for tracking elements within a picture. Force-correlate mode is useful when launching Mavericks against static targets such as buildings and structures, when it is desired that the Maverick impact a specific part of that structure. Instead of tracking the target centroid, the Maverick will strive to impact the exact part of the image that was targeted (e.g., the base of an antenna).

Summary

1. Using one of the delivery modes above, locate a target.
2. Set the polarity mode to AREA.
3. Designate the image feature you wish to target.
4. Fire the missile.

1. Using one of the delivery modes above, locate a target.

Select either PRE, VIS, or BORE mode and locate your target.

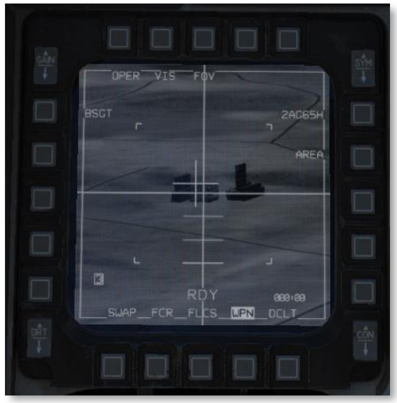
2. Set the polarity mode to AREA.

Press OSB6, use the cursor enable button, or (if the WPN page is SOI) press TMS right to cycle between polarity modes until AREA is shown next to OSB6.

3. Designate the image feature you wish to target.

Press DMS aft until the WPN page is SOI.

Using the TQS cursor, slew the targeting gate to the image feature you wish to target, then press TMS forward to designate it. Confirm that the missile is tracking the correct portion of the image, the pointer cross is not flashing, and the target is in range.



4. Fire the missile.

Fire the missile with the weapon release button.

Using Visual Reference Points, Visual Initial Points, and Pull-Up Points

The F-16 has the capability of displaying visual indicators to assist in making attacks from locations relative to the target. These indicators can assist the pilot in knowing where the target is relative to a prominent visual reference, where to commence the attack, and when to begin a pop-up attack. These visual indicators are programmed using the Data Entry Display (DED), and are displayed on the HUD in pre-planned air-to-ground submodes (e.g., CCRP).

A **visual initial point** (VIP) is used when the location of the target is not known precisely, but is known relative to a visually prominent object. For example, the target may be known to be five miles northwest of an identifiable bridge. A **visual reference point** (VRP) is used when the pilot desires a visual indication of a location to begin an attack (or otherwise reference relative to a known target position). A **pull-up point** is a location where a pop-up attack commences.

Note that a single steerpoint cannot have both a VIP and a VRP active.

Using Visual Initial Points

When a visual initial point is specified for a steerpoint, the steerpoint is treated as the initial point, and a target indication is automatically shown relative to that steerpoint on the HUD. Navigation steering is provided to the initial point, the idea being that the pilot flies to and visually acquires the initial point, and then performs an INS update using an overfly or HUD designation. (At this time, INS updates are not implemented.) Once the initial point location has been updated, the target designation should be directly on top of the actual target position. While navigation steering is to the initial point, weapon release steering (e.g., the azimuth fall line [ASL]) references the target position.

In the screenshot above, the location of the target is known relative to the intersection of two dirt roads, marked as steerpoint 1 and depicted as a diamond. The target is shown as a TD box.

To define a VIP, first ensure that you are in air-to-ground mode, then press LIST on the ICP, then “3”, to show the VIP page. The VIP-TO-TGT page is then shown.

Dobber down to the VIP line, and select the steerpoint located at the visual initial point. Dobber down to each successive line and enter the bearing from the VIP to the target, then the range from the VIP to the target, and finally the elevation difference from the VIP to the target. (To enter a negative number, first press “0” twice.) Dobber back up to the VIP-TO-TGT line, then press M-SEL (“0”) to activate VIP mode for this steerpoint.

On the HUD, a TD box will appear at the target location when in air-to-ground mode and when the VIP steerpoint is active. Navigation steering will be to the VIP, and the ASL will reference the target.

Using Visual Reference Points

A visual reference point (VRP) is used when a target location is known, and the pilot wishes to mark a reference point relative to the target. This could be a location to commence the attack from, the location of friendly forces, etc. With a VRP, the steerpoint is the target point, and the reference point is defined relative to the target steerpoint. (A VIP works the opposite way; the steerpoint is the reference point, and the target is defined relative to the reference point).

In the screenshot above, steerpoint 2 is over the target (TD box), and a visual reference point (diamond) is defined relative to it.

To define a VRP, first ensure that you are in air-to-ground mode, then press LIST on the ICP, then “3”, to show the VRP page. The TGT-TO-VRP page is then shown.

Dobber down to the TGT line, and select the target steerpoint. Dobber down to each successive line and enter the bearing from the target to the VRP, then the range from the target to the VRP, and finally the elevation difference from the target to the VRP. (To enter a negative number, first press “0” twice.) Dobber back up to the TGT-TO-VRP line, then press M-SEL (“0”) to activate VRP mode for this steerpoint.

On the HUD, a diamond will appear over the VRP when in air-to-ground mode with the target steerpoint selected. Both navigation and weapon release steering will be to the target, just as if no VRP were defined.

Using Pull-Up-Points

A pull-up-point (PUP) is a location where a pop-up attack begins. Pull-up locations are typically precomputed to allow an aircraft to make a preplanned pop-up attack with sufficient altitude and time to release weapons and perform a safe-escape maneuver prior to reaching minimum safe altitude. Once these calculations are completed, the pull-up point configured in the DED the aircraft and displayed on the HUD.

In the screenshot above, a pull-up point is defined relative to the target steerpoint. The target is depicted as a TD box and the pull-up point is shown as a circle. If the pull-up point is outside the HUD FOV, the circle is clamped to the edge of the HUD and drawn inscribed with an “X”.

To define a pull-up point relative to the target steerpoint, first ensure that you are in air-to-ground mode, then press LIST on the ICP, then “9”, to show the VRP page. The TGT-TO-VRP page is then shown. Press DCS Sequence to move to the TGT-TO-PUP page.

Dobber down to the TGT line, and select the target steerpoint. Dobber down to each successive line and enter the bearing from the target to the pull-up point, then the range from the target to the pull-up point, and finally the elevation difference from the target to the pull-up point. (To enter a negative number, first press “0” twice.) Dobber back up to the TGT-TO-PUP line, then press M-SEL (“0”) to activate the PUP for this steerpoint.

If you are using VIP sighting for a target, you can define the pull-up point relative to the VIP rather than the target. To do this, first ensure that you are in air-to-ground mode, then press LIST on the ICP, then “3”, to show the VIP page. The VIP-TO-TGT page is then shown. Press DCS Sequence to move to the VIP-TO-PUP page.

Dobber down to the VIP line, and select the visual initial steerpoint. Dobber down to each successive line and enter the bearing from the VIP to the pull-up point, then the range from the VIP to the pull-up point, and finally the elevation difference from the VIP to the pull-up point. (To enter a negative number, first press “0” twice.) Dobber back up to the VIP-TO-PUP line, then press M-SEL (“0”) to activate the PUP for this steerpoint.

DEFENSIVE SYSTEMS

USAF Photo
by MSgt Cecilio Ricardo

Overview

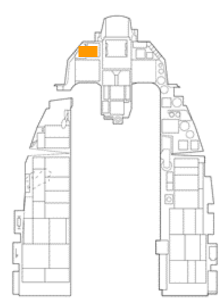
You will often find yourself as the target of enemy weapon systems. The aircraft includes several defensive systems to assist you in your fight to keep alive that includes expendable countermeasures of chaff and flares and Electronic Countermeasures (ECM).

Azimuth Indicator (RWR)

Detected radars are displayed on the Azimuth Indicator (aka Radar Warning Receiver).

The Azimuth Indicator is a circular-shaped display on the left of the front dash that provides you a visual representation of radar emitters around your aircraft. The display is in plan view with your aircraft in the center. As threats are displayed around the center of the display, the icons represent the azimuth direction to the threat. For example: an icon of the left side of the display would indicate an emitter located off your left. In addition to the icons, an audio system will alert you to the status of the radars detected (search, track, and launch).

The locations of radar emitters on the display do not necessarily correlate to emitter range from your aircraft. The distance of the threat icon from the center of the display indicates radar signal strength. The closer the icon is to the center of the display generally indicates the closer the radar is to you. Any time a new emitter symbol is displayed on the azimuth indicator status change tone is generated by the system. Special tones are also generated for specific threats or critical threat modes of operation.



A symbol can have three states on the display:

- If a symbol is displayed with no circle around it, it indicates that the radar is in acquisition/search mode. When a new emitter is detected, a new threat tone will be heard.
- If a symbol has a steady circle around it, it indicates that the radar is tracking/locked on to your aircraft. When being tracked by an engagement radar, you will be provided a radar lock tone.
- If a symbol has a flashing circle around it, it indicates that the radar is supporting a missile that has been launched at you. When being launched on by a radar-guided missile, you will hear a missile launch tone and the LAUNCH light to the left will illuminate.

Indicator lights and buttons are located just to the left of the display.

HANDOFF. Not applicable.

LAUNCH. Illuminates when a missile launch is detected.

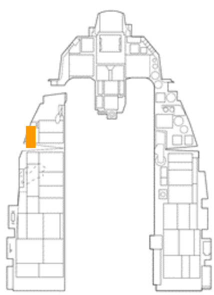
MODE. This button toggles between OPEN that can display the 16 highest priority threats or PRI that will only show the five highest threats.

UNKNOWN SHIP. Toggles display of emitter symbols of unknown weapon systems on and off.

SYS TEST. Initiates the system self-test.

T (TGT SEP). Separates symbols that cover each other on the azimuth indicator; the symbol with the highest threat priority remains in the right place.

The Threat Warning Aux panel on the left auxiliary console is used to power the RWR on and off.



SEARCH. Not used.

ACT/PWR. Not used.

ALTITUDE. Not used.

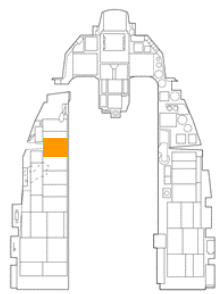
POWER. Toggles RWR system power on and off.

Countermeasures Dispensing Set (CMDS)

Selection and release of countermeasures (chaff and flare) is accomplished through a cockpit panel, HOTAS controls, and a Data Entry Display (DED) page.

CMDS Control Panel

The left auxiliary console is dominated by the countermeasures dispensing system. This system provides protection against tracking radar, air-to-air and surface-to-air missiles. Protection is provided by ejecting chaff or flare.



Status Display. The left side displays the status of the CMDS, GO or NO GO. The right side displays DISPENSE READY when manual consent is required to dispense countermeasures in the SEMI or AUTO mode.

RWR and JMR Source Switch. These do not control power to the RWR or ECM (Jammer) but rather enable their data to be used by the CMDS for dispensing in the SEMI or AUTO modes.

MWS Switch. The missile warning system is not applicable to the block 50 f-16C.

JETT Switch. This enables jettisoning of countermeasures when positioned up to JETT. This switch functions even when the CMDS is turned off.

Quantity Indicators. The quantity remaining of each countermeasures type is displayed. LO is displayed when the bingo level set on the DED is reached. System failure messages are also displayed in these fields when applicable.

CH (Chaff) and FL (Flare) Switch. These switches must be enabled to allow dispensing of chaff or flare countermeasures.

PRGM Knob. This selects one of four pre-set countermeasures programs to be dispensed by HOTAS command CMS forward on the stick.

MODE Knob. This selects the CMS operating mode.

- MAN – The selected manual program may be dispensed by positioning the CMS forward on the stick.

- SEMI – The aircraft systems determine the program to be dispensed based on the threat. Consent to dispense must be given by positioning the CMS aft on the stick.
- AUTO – The aircraft systems determine the program to be dispensed based on the threat. Countermeasures are dispensed automatically. This mode must also be enabled by positioning the CMS aft on the stick. It may be disabled by selecting CMS right.
- BYPASS – This is selected to allow manual dispensing of countermeasures when failures prevent the other modes from working.

HOTAS

On the stick, there is a four-place switch for countermeasures.

Center. This is the OFF position and no dispense action is taken.

Forward. This dispenses the manual program selected on the CMDS Panel with the PRGM knob.

Aft. This gives consent to dispense the requested program when the MODE knob is in SEMI. This also enables the AUTO mode when the MODE knob is in AUTO.

Left. No function.

Right. This disables the AUTO dispense mode.

CMDS DED Pages

The CMDS upfront controls are accessed from the LIST page by pressing 7 on the ICP. Pages may be cycled through by positioning the DCS switch right to SEQ.

The default bingo quantities for CH (chaff) and FL (flare) are listed on the first page. These quantities may be changed by placing the CMDS Mode knob in STBY and entering the new bingo quantity in each field.

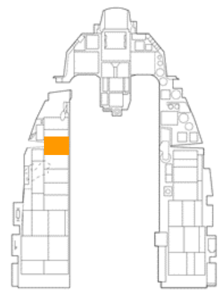
Three voice message options may also be toggled on or off from this page.

Feedback (FDBK). This enables or disables the 'Chaff Flare' audio message that plays when a countermeasures program has been initiated.

Request Countermeasures (REQCTR). This enables or disables the 'Counter' audio message that plays when consent to release countermeasures is requested in the SEMI or AUTO mode.

BINGO. This enables or disables the 'Low' or 'Out' audio message that plays when the bingo quantity is reached, or all countermeasures have been expended.

The next DED pages display the number of countermeasures and interval between release for each countermeasure type. The values may be changed by manually inputting new quantities and intervals. The CMDS Mode knob should be set to STBY before changing the programs using the DED pages.



The values shown are for the program displayed at the top right of the page. Any of the four programs may be changed using the Increment/Decrement switch on the ICP to select each in sequence. The pages for chaff and flare are identical so only the flare page is shown below.

Burst Quantity. The number of countermeasures released per burst.

Burst Interval. The interval in seconds between countermeasures per burst. This is usually a very small value.

Salvo Quantity. The number of bursts commanded when release consent is given.

Salvo Interval. The time in seconds between each burst.

In the example above, two flare will be released every second for 10 seconds.

Good hunting!

The Eagle Dynamics SA team

USAF Photo
by SSgt Deana Heitzman