VTOLVR Handbook[1]

Everything you need to know and more

Contents

Chapter 1

Introduction

Welcome to the Handbook, an open-source guide for VTOLVR players, new and old.

Chapter 2

Pilotable Vehicles

VTOLVR currently comes with three pilotable vehicles. They are all capable of carrier-based operation, and while they may share many operating procedures and interactions, they also have many distinct features that set each apart from the rest.

2.1 AV-42C Kestral

> *Multi-role VTOL aircraft. Features tilting jet nozzles which give it the ability to take off, fly, and land vertically or horizontally. With a large cargo bay and multiple weapon mounts, this vehicle is can perform both transport and attack missions.*

The AV-42C is the original vehicle the game launched with, and which gave it its name.

2.1.1 Distinguishing Features

- Large cargo bay to the rear of the cockpit equipped with seats for carrying up to eight passengers
- Jet turbine vectoring enabling vertical take off and landing
- Able to equip the M230 Chain Gun

2.2 F/A-26B

> *A carrier based air-superiority fighter that can be configured for ground attack roles.*

The second jet added to the game, the F/A-26B is inspired by multiple real-world aircraft, including the F-15 Eagle, the F/A-18 Hornet, and the F-22 Raptor.

2.2.1 Distinguishing Features

- The most carrying capacity of all the aircraft
- ARAD

2.3 F-45A

The F-45A is a new aircraft currently in development on the `public_testing` branch. It appears to be largely based on the F-35 Lightning II.

2.3.1 Distinguishing Features

- Stealth frame is harder for radar systems to detect
- Enclosed weapons bay that only opens for launch minimizes radar cross section
- Thrust vectoring for vertial take-off and landing
- Four touch-screen MFCDs.
- Tactual Situation Display

2.3.2 Tactical Situation Display

Unique to the F-45A, the Tactical Situation Display (TSD) is an advanced tool that combines data from multiple sources to provide a complete tactical picture.

Chapter 3

Equipment

Besides munitions, there are a number of options when it comes time to outfit your aircraft that enable you to react to and engage in different situations.

3.1 Avionics and Systems

3.1.1 Multi-Function Color Display

With at least two standard on every aircraft, the Multi-Function Color Display (MFCD) is your primary means of interaction with the aircraft's systems. While newer aircraft like the F-45A use a more intuitive touch-screen MFCD, most use a standard MFCD with hardware buttons arrayed along the sides.

Using a hardware-button MFCD is quite straightforward. The important data will be generally shown in the center of the display, and labels will be positioned adjacent to the buttons. If there is no label next to a button, pressing that button will have no effect.

3.1.1.1 Sensor of Interest

Some MFCD screens can be made the Sensor of Interest (SOI). If an MFCD screen has this capability, the upper-right-most button will be labeled SOI. Pressing this button will cause the display to be surrounded with a green rectangle to indicate that it is SOI, and any other screen that was previously SOI will no longer be (there can be only one SOI at a time). When SOI, the touchpad/thumbstick of the right controller can be used to control the sensor in a context-dependent way:

Page	Touchpad/thumbstick use
NAV	Scroll the map
TGP/EOTS	Change the camera angle
TSD, RADAR	Move the cursor and highlight targets; click to select. (RADAR: click a second time to lock)
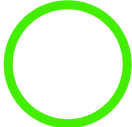
3.1.2 Radar Warning Receiver

The Radar Warning Receiver (RWR) system in your aircraft detects hostile radar signals and is used to maintain situational awareness about potential threats. While in real life the RWR will typically include allied radar sources, in VTOLVR they are omitted for simplicity and to reduce clutter.

The RWR in all aircraft is displayed in a circle, indicating position relative to your aircraft's current orientation. Distance from the center of the circle indicates *relative threat*, with higher *threat* radar sources closer to the center of the circle. *Position on the RWR does not indicate range.*

Hostile radar sources are indicated on the RWR as a combination of one or two letters/numbols/symbols surrounded by a symbol. The letters inside are an abbreviation indicating the type of threat, while the symbology around it provides more contextual information.

Table 3.2: RWR Symbology

Symbol	Meaning
◇	Primary Threat
◯	Threat is locked-on or tracking you
◠	Newest threat
⌃	Aerial (flying) threat

Symbol	Meaning
(M)	Missile lock

- The *primary threat* indicates what the system believes to be the most threatening to your aircraft at the moment.
- A *tracking threat* may fire soon, so listen for warning.
- The *newest threat* can be located in the real world via your HUD/HMCS if your aircraft has ARAD and its display is enabled on the HUD. New radar threats will be displayed as yellow diamonds on the HUD by ARAD.
- A *missle lock threat* is the only one that displays in a different color, to make sure you notice it. When you see the red M, you know a hostile missile has engaged its terminal targeting radar, which generally means it's about 10 seconds from hitting you.

Table 3.3: RWR Abbreviations

Abbreviation	Meaning
A	Fire-control radar for Anti-Aircraft Artillery
DC	Drone Cruiser/Carrier
DF	Drone Fighter (aircraft)
DM	Drone Missile ship
DS	"Dish, SAM" The rotating-dish fire-control radar for a SAM
E4	AWACS (Airborne Warning & Control System)
F	Air-to-air Fighter (aircraft)
F+	Air superiority Fighter (aircraft)
HC	"H-Carrier," an H-shaped aircraft carrier
SA	SAAW tank ("Self-propelled Anti-Air Weapon")
SR	"SAM Radar"; phased array control

Chapter 4

Munitions

VTOLVR has a wide array of weapon systems available.

4.1 Air-to-Air

4.1.1 Employment

4.1.1.1 Heat-Seeking

Heat-seeking missiles generally have similar methods of employment. After selecting the weapon, you'll have a big circle in the middle of your HUD, and you'll hear a low growling through your headset. This represents the missile's seeker head. The basic principle is to put your target inside this circle, wait for the growl to change into a high-pitch screech, and squeeze the trigger.

Both missiles have a few different modes of target acquisition to help you get your target inside the circle. As with any other configurable weapon, this can be found by accessing the EQUIP page of the MFD, setting the mode to CONFIG, and selecting one of the lines indicating the appropriate weapon.

The different targeting modes and their descriptions are:

Mode	Description
Caged	The default mode; the targeting cue is locked to the middle of the HUD
Uncaged	The targeting cue wanders around the middle of the HUD

Mode	Description
Vertical Scan	The cue scans up and down the middle of the HUD
Head Track	The cue follows the motion of your head.

NOTE: When using Head Track mode, make sure you've enabled HMCS power and lowered your HMCS visor!

4.1.1.2 Radar-guided

TK

4.1.2 AIM-120 AMRAAM

Attribute	Value
Type	air-to-air
Guidance	active radar-guided
Fire-and-forget	Yes
Cost	$1500 / missile
Mass	187kg
Radio Call	"Fox Three"

4.1.3 AIM-9 Sidewinder

The Sidewinder is a standard, heat-seeking air-to-air missile.

Attribute	Value
Type	air-to-air
Guidance	infrared heat-seeking
Fire-and-forget	Yes
Cost	$850 / missile
Mass	120kg
Radio Call	"Fox Two"

4.1.4 IRIS-T Advanced Short Range Missile

A short range, heat-seeking missile with advanced capabilities. While nearly twice the price of a Sidewinder, if you can afford the IRIS-T it will rarely let you

down! With improved maneuverability, range, and a counter-countermeasure system, the IRIS-T is perfect for swatting pesky enemy aircraft when you've got better things to do than engage in dogfights.

Attribute	Value
Type	air-to-air
Guidance	infrared heat-seeking
Fire-and-forget	Yes
Cost	$1500 / missile
Mass	123kg
Radio Call	"Fox Two"

4.2 Air-to-Surface

The widest variety of available munitions are currently in the air-to-surface category, for taking out tanks, SAM sites, radars, ships—you name it.

4.2.1 Optically-guided

Optically guided weapons generally have a shorter range and stricter lock requirements than GPS-guided weapons, but they are also vastly better for hitting mobile targets, since they aren't simply moving towards a fixed position. Make sure to be aware of any anti-air defences when going in for a strike with an optically guided weapon!

4.2.1.1 Employment

The optically-guided missiles initially acquire their targets using the TGP. First, open the TGP page on an MFD and slew it to a target until it locks on in POINT mode—making sure the ITT reads "FOE," of course! Then, turn towards the target. Like the air-to-air missiles, when selecting an optically-guided missile you will initially get a circle in the middle of your HUD. Once you are in range and the missile has a lock, you will hear a tone. At this point, squeeze the trigger and move on to your next target

4.2.2 Laser-guided

TK

4.2.2.1   Employment

TK

4.2.3   GPS-guided

GPS-Guided weapons are a bit more complicated than other weapons, but are also very accurate and can generally be employed from much safer distances, as well.

There are currently two types of GPS-guided weapons: the bombs, and the cruise missiles.

4.2.3.1   Employment: GPS-guided Bombs

Selecting a GPS-guided bomb will put two concentric rings on your HUD, with the outer and inner rings representing the max radius the bomb can steer to and the optimal steering radius, respectively. Any GPS targets from the current GPS group will appear on the hud, which a diamond around the current target. Simply maneuver until the target is in one of the rings (preferably the "optimal" inner ring, especially if you're not very high up) and squeeze the trigger.

Creating GPS targets can seem a bit daunting, but is easy enough once you get used to it. Currently, you can create GPS targets from either the MAP or the TGP. In either place, slew onto the target and press the `GPS-S` (GPS "Send") MFD button. This will add the location to the current GPS *group*, creating a new group if there is none.

You can manage GPS targets and groups from the GPS page of the MFD, as you might expect.

GPS-guided bombs also have a couple configuration options:

- Targeting Mode:
    - Manual: The default mode
    - Auto: After each trigger pull, the next target in the GPS group will be selected
    - Dumb: The bomb acts like an unguided bomb using CCRP or CCIP.
- Deploy Rate: TK?

    NOTE: If you want a bit more accuracy from your MAP-created GPS targets, you can use the `GPS-A` (GPS "Acquire") MFD button on the TGP to slew the TGP onto the GPS target you created from the MAP, then manually slew the TGP until it locks, and use `GPS-S` one more time to create a new, more accurate, target.

4.2.3.2 Employment: GPS-guided Cruise Missiles

Cruise Missiles are designed to follow a *path* of GPS points. To use them, you generally create a new GPS group, switch to PATH mode, and add GPS points as for normal GPS-guided bombs. You may also use it in non-PATH mode, however, and the missile will cruise directly to the GPS point and search for a target nearby.

Note that the terminal (last) GPS point, either in the path or when in non-PATH mode, *must not be on the target*. Cruise Missiles use the GPS to navigate to their attack area, then use onboard systems to autonomously seek its target, so if the GPS point is *on* the target you want it to find, the missile will likely fly right over it.

4.2.3.2.1 Cruise Missile Attack Modes You can change the terminal attack mode for Cruise Missiles from the `EQUIP` or `SMS` screen:

- *SSEvasive*: Short for Sea-Skim Evasive, the missile will fly as low to the surface of the water as possible and perform snaking maneuvers to avoid detection
- *Direct*: The missile flies directly to the terminal waypoint and, as normal, searches for a target there
- *Popup*: The missile flies as per *SSEvasive* mode. At the terminal GPS point, however, the missile will pitch up into the air and gain altitude, enabling a wider area for target acquisition and a top-down attack vector.

4.2.4 ARAD (Anti-radiation)

TK

4.2.4.1 Employment

TK

4.2.5 AGM-114 Hellfire

Attribute	Value
Type	air-to-surface
Guidance	laser-guided
Fire-and-forget	*no*
Cost	$1200 / 4x rack
Mass	392kg / 4x rack
Radio Call	"Rifle"

4.2.6 AGM-126 SideARM II

Attribute	Value
Type	air-to-surface
Guidance	ARAD
Fire-and-forget	Yes
Cost	?
Mass	?
Radio Call	"Magnum"

4.2.7 AGM-161

A cruise missile, similar to the AGM-89 Anti-ship Cruise Missile but intended for ground targets rather than water targets.

Attribute	Value
Type	air-to-surface
Guidance	GPS/optical Cruise
Fire-and-forget	Yes
Cost	?
Mass	?

4.2.8 AGM-188 MARM

Long range Anti-Radiation Missile with a unique top down attack angle.

Attribute	Value
Type	air-to-surface
Guidance	ARAD
Fire-and-forget	Yes
Cost	$5000 / missile
Mass	375kg
Radio Call	"Magnum"

4.2.9 AGM-65D Maverick

It is a medium range laser/optically guided anti-tank missile

Attribute	Value
Type	air-to-surface
Guidance	Laser/Optical
Fire-and-forget	Yes
Cost	$800 / missile
Mass	325kg
Radio Call	"Rifle"

4.2.10 AGM-88 HARM

Attribute	Value
Type	air-to-surface
Guidance	ARAD
Fire-and-forget	Yes
Cost	$5000 / missile
Mass	395kg
Radio Call	"Magnum"

4.2.11 AGM-89 Anti-Ship Cruise Missile

Air-launched anti-ship cruise missile. Equipped with waypoint following, radar target acquisition, and terminal maneuvering technology.

The AGM-161 can be used against ground-targets.

Attribute	Value
Type	air-to-surface
Guidance	GPS/radar Cruise
Fire-and-forget	Yes
Cost	?
Mass	?

4.2.12 CAGM-6 Cluster Missile

An optically guided 'fire and forget' missile. Deploys 6 sub-munitions that independently seek targets in the field of view.

Attribute	Value
Type	air-to-surface
Guidance	optical

Attribute	Value
Fire-and-forget	Yes
Cost	$3000
Mass	200kg

4.2.13 CBU-97 Bomb

A smart cluster bomb that fires 40 explosively shaped armor penetrators at targets

Attribute	Value
Type	air-to-surface
Guidance	?
Fire-and-forget	?
Cost	$1600
Mass	620kg

4.2.14 GBU-12 Bomb

Attribute	Value
Type	air-to-surface
Guidance	Laser
Fire-and-forget	*no*
Cost	?
Mass	?

4.2.15 GBU-38 Bomb

500lb GPS guided direct attack munition. It's a Mk.82 bomb with a guidance package strapped on.

Attribute	Value
Type	air-to-surface
Guidance	GPS
Fire-and-forget	Yes
Cost	$1250
Mass	502kg

4.2.16 GBU-39 Bomb

Lightweight and cheap, a rack of GBU-39 is effective against small, soft, stationary targets.

Attribute	Value
Type	air-to-surface
Guidance	GPS
Fire-and-forget	Yes
Cost	$7500 / 4x rack
Mass	716kg / 4x rack

4.3 Unguided

Unguided weapons are perfect for when you don't have the time—or money—to nicely paint a target the way you need for the more complicated guided weapons!

4.3.1 Employment: CCRP

Continuously computed release point

TK

4.3.2 Employment: CCIP

Continuously computed impact point

TK

4.3.3 GAU-8 Cannon

TK

4.3.4 Hydra 70 Rockets

Cheap and plentiful, Hydras are your friend when you need something blown up quick. To use, just put whatever you want to blow up inside the little circle and keep squeezing the trigger until it's gone!

4.3.5   M230 Chain Gun

TK

4.3.6   M62 Vulcan

TK

4.3.7   Mk-82 Bomb

Standard un-guided 500lb bomb.

Attribute	Value
Type	air-to-surface
Guidance	*None*
Cost	$400 / 3x rack
Mass	645kg

4.3.8   Mk-82AIR High Drag Bomb

Standard un-guided 500lb bombs. Deploys and inflatable drag chute to slow descent for low altitude bombing

To elaborate on the in-game description, the addition of the drag chute to the standard Mk-82 Bomb provides the pilot time to distance themselves from the target before detonation when low-level bombing.

Attribute	Value
Type	air-to-surface
Guidance	*None*
Cost	$100
Mass	429kg

4.3.9   Mk-83 Bomb

Standard un-guided 1000lb bomb.

Attribute	Value
Type	air-to-surface
Guidance	*None*

Attribute	Value
Cost	$100
Mass	659kg

Chapter 5

Tactics

In this section, you'll learn how to accomplish your goals and make it safely back to base.

5.1 Munition Selection

As more and more munitions get added to the game, it can be difficult to keep track of which does what, and when to use which—even for veteran pilots. This section aims to offer guidance based on mission type.

TK

5.2 Defensive

5.2.1 Avoiding Missiles

We've all been there. You're cruising along, minding your own business, when suddenly the missile launch warning goes off. The key to surviving these encounters is to stay calm and analyze the situation.

When you get the "missile launched" notification, the things you need to pay attention to are:

1. The orange "MISSILE" warning light
2. "Fox Two" or "Fox Three" calls on the radio (if flying with wingmen)

"MISSILE"	"Fox"	Situation
no	"Fox Two"	*Probably*, an ally has launched an IR missile

"MISSILE"	"Fox"	Situation
Yes	*none*	You've been targetted by an active radar-guided missile
no	*none*	You've been targetted by a heat-seeking missile

If a call such as "Fox 2" (infrared-guided) or "Fox 3" (active radar-guided) is accompanied by a missile launch notification, and you don't see the orange warning light, as indicated above this missile is *probably* an ally's aimed at somebody else, but you should still be wary. A red `M` on the RWR is also a good indication that you've been targetted by an active radar-guided missile.

Properly identifying the type of threat is crucial to survival, as some evasion techniques are mutually exclusive, as you will see.

5.2.1.1 General Strategies

Situational awareness is crucial to survival. As soon as you get a "missile launched" notification, you have a potentially very short window of time before the missile locks onto you. In that window, it may be possible to confuse the missile's tracking systems by launching countermeasures, but it becomes much harder to do so once it has a lock (indicated by the orange "MISSILE" warning light).

For radar-guided missiles, it may still be possible to confuse the missile (see Beaming below) but in general at this point your best bet is to avoid it. Here, the things to remember are that:

1. The missile is trying to go where it thinks you *will be*, not where you are.
2. The missile has a finite amount of fuel and energy that it can use to reach you.

With that in mind, here are some general strategies:

- Don't run away from the missile—it will have the advantage in a direct chase. Instead, prefer flying perpendicular to it, if you can, or at an angle towards it, so it has to waste its energy maneuvering.
- Dive toward the ground, or a mountain, and fly low, to try to trick the missile into crashing into the ground.
- Alternatively, if you have enough speed, climb into the air to try to make the missile waste its energy following you, keeping in mind your angle with the missile.

5.2.1.2 Active radar-guided missiles

Flares will generally not help too much against these, and chaff is situational. The general strategies of forcing the incoming missile to expend all of its energy

before it can reach you, as described above, are very relevant. Two common maneuvers for accomplishing this are covered below.

5.2.1.2.1 F-Pole Maneuver F-Pole refers to the distance between the launching aircraft and its target at the moment of missile impact[1]. An F-Pole maneuver is a BVR[2] strategy designed to maximize this distance, with the idea that by engaging bandits[3] at a longer range you are more likely to stay out of their engagement zone and, consequently, more likely to survive the encounter.[4]

The prototypical example of the F-Pole maneuver involves an enemy aircraft on a head-on trajectory towards your aircraft. In this situation, it is recommended to "crank" left or right of the aircraft so that your flight path is about a level 40-50 degrees away from theirs (you probably want to turn in the direction of the shorter angle, to conserve energy. As they continue to approach, even if they adjust course to try to intercept, any radar-guided missile they launch will have to make a hard turn to try to intercept you.

If they do launch a missile, you can then abuse its guidance systems by turning in towards the enemy aircraft, probably about a 90-100 degree turn in the opposite direction of your original turn. At this point, you will be in a good position to launch a missile of your own, as you will have closed more distance and, by keeping the enemy within 50 degrees of you, you should still have a radar lock on them. This sharp turn will force the incoming missile to waste even more energy on a second turn, hopefully making it easy for you to avoid (if it's fully active, or if it's semi-active but your missile doesn't take out the enemy aircraft before the missile gets close enough to intercept you).

For further reference on the F-Pole, see this Youtube video.

5.2.1.2.2 Beaming The way doppler radar tracking works, if you are moving toward or away from the radar site it will very easily be able to detect you against the open sky. When beaming, you maintain a perpendicular flight path to the line of site from the radar site, so that you are neither moving towards nor away from it, making it harder for the missile to distinguish you from the landscape.

If the missile is launched at you from above (IE another aircraft) then beaming the missile may be sufficient to make it unable to distinguish you from the terrain. If it was launched from below you, however, such as from a surface-mounted missile launcher, you will need to make use of chaff.

While maintaining a perpendicular flight path to the radar site, particularly as the missile approaches your aircraft, begin launching a slow but steady stream

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[1] https://en.wikipedia.org/wiki/Air-to-air_missile#Performance
[2] **BVR**: Beyond Visual Range
[3] **Bandit**: An identified enemy aircraft
[4] https://forums.eagle.ru/showpost.php?p=244917&postcount=9

of chaff. Hopefully this will confuse the missile and it will break off. If it does not, you may need to switch strategies.

It is important to remember that once you have established a perpendicular flight path, you will need to bank slightly towards the radar site so that you are orbiting it, in order to maintain the perpendicular path; otherwise, you will start to flight away from the radar site, and you will no longer be beaming.

5.2.1.3 Heat-seeking missiles

Infrared/Heat-seeking missiles like the AIM-9 are sometimes simpler to avoid than active radar-guided. Using the techniques above cannot hurt, of course— dogfighting tends to be about correct energy management—however the fact that IR missiles can be confused by appropriate use of Flares tends to make them somewhat easier to evade.

It is important to remember, however, that *flares are not magic.* They can draw away IR-seeking missiles by providing a hotter-looking target for the seeker head, but if your engines are still in full afterburner then they won't be enough to distract the missile. If you are hoping to use Flares to evade an IR-seeking missile, you *must* lower your throttle to put out a smaller IR signature than your flares!