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Manual changelog

Revision 2 (05/08/2026)

- Added several missing internal links.
- Added details about supercruise and high-altitude in engines section.

Revision 1 (04/08/2026)

- First version for Rafale C release.

Abbreviations

List of abbreviations commonly used throughout this manual.

Abbreviation	Meaning
AEC	Auxiliary Engine Control
AC	Alternating Current
AOA	Angle Of Attack
AP	Autopilot
APU	Auxiliary Power Unit
AT	Autothrottle
DC	Direct Current
DDM	Degrees Decimal Minutes
DH	Decision Height
DTO	Direct To
DTL	Data Link
ECM	Electronic Counter-Measures
ECS	Environmental Control System
ECU	Engine Control Unit
EM	Electromagnetic
FADEC	Full Authority Digital Engine Control
FBW	Fly-by-wire
FCS	Flight Control System
FSO	Front Sector Optronics
GPU	Ground Power Unit
HCD	Head Center Display
HOTAS	Hands On Throttle-And-Stick

Abbreviation	Meaning
HSI	Horizontal Situation Indicator
HUD	Head-Up Display
IDF	IDentiFication
IFF	Identification, Friend or Foe
IMA	Imagery
INS	Inertial Navigation System
INU	Inertial Navigation Unit
IR	Infrared
IRST	Infrared Search & Track
LD	Lateral Display
LLD	Left Lateral Display
MFK	Multi-Function Knob
RDR	Radar
RLD	Right Lateral Display
SH	Safety Height
SITAC	TACtical SItuation
TACAN	TACtical Air Navigation
TTG	Time To Goal
VVI	Vertical Velocity Indicator
WPN	WeaPoN

Introduction

Rafale overview

The Dassault Rafale is a French twin-engine, canard-delta combat aircraft developed for both the French Air Force and the French Navy.

From the beginning, the aim was to replace seven different aircraft types with a single family able to cover the full range of combat aviation missions.

The technology demonstrator, then known as ACX or Rafale A, made its maiden flight on 4 July 1986. The full Rafale program was officially launched in 1988.

The aircraft entered operational service with the French Navy in 2004 and with the French Air Force in 2006. It has since become the backbone of French tactical air power and is expected to remain in service well beyond 2060.

Combat experience in Afghanistan, Libya, Mali, Iraq and Syria confirmed the maturity of the design and the value of its broad mission set.

Omnirole philosophy

The Rafale is often described as an omnirole fighter rather than simply multi-role.

The distinction matters. The aircraft was designed not only to carry out different types of missions, but also to move from one to another with little reconfiguration and, when required, during the same mission.

In practical terms, this idea rests on several qualities:

- `Versatility`, by allowing one aircraft type to cover air-to-air, air-to-ground, reconnaissance, maritime strike, nuclear deterrence, and buddy-buddy refueling.
- `Interoperability`, by operating within joint and coalition environments.
- `Flexibility`, by allowing crews to adapt quickly to changing tactical demands.
- `Survivability`, through sensor fusion, electronic warfare, reduced signatures, and a flight-control system suited to demanding low-level and high-threat environments.

This is one of the defining features of the Rafale and helps explain much of its avionics, sensor, and cockpit logic.

Variants

The Rafale exists in three main operational variants:

- `Rafale C`: single-seat land-based version for the French Air Force and export users.
- `Rafale B`: two-seat land-based version, fully combat-capable and also used for conversion and advanced training.
- `Rafale M`: single-seat carrier-capable naval version.

Despite those differences, the three variants retain a very high level of airframe, systems, and mission-equipment commonality.

In service, the pilot still finds the same overall design philosophy across all three variants.

Standards

Rafale capability has evolved through successive standards rather than through a single fixed configuration.

- `F1` was the initial operational naval standard and focused on air-to-air missions.
- `F2`, introduced in 2006, was the first true omnirole standard, adding a credible air-to-ground capability on top of the original air-to-air core.
- `F3` marked the point at which the Rafale gained the full mission set expected by the French armed forces, including reconnaissance, maritime strike, and the French nuclear mission. `F3-R` later expanded that baseline further with important sensor and weapon improvements and became the reference standard before the transition to `F4`.
- `F4` is the current major evolution family. Its first increment, `F4.1`, was qualified by the DGA on 13 March 2023 and adopted by the French Air and Space Force in August 2023. It moves the aircraft further toward collaborative combat, improved connectivity, and wider system and weapon evolution. Further F4 increments continue in the same direction.
- `F5` is the next major step and is currently being prepared for the 2030 timeframe. It is presented as a deeper capability leap, with stronger system integration, new sensor and electronic-warfare developments, and compatibility with future French strategic requirements.

Developer notes

We are honored to have been chosen as the developer of the first officially licensed Rafale ever released for a public flight simulator, in collaboration with Jet Fighter Experience.

This initial release features the **Rafale C** in its F3-R standard. Bringing such an aircraft to Microsoft Flight Simulator has been both a privilege and a challenge that we embraced with great enthusiasm.

The development of this aircraft has spanned nearly two years. Throughout this journey, our objective was simple: to push beyond our own standards and deliver an add-on that stands among the finest military aircraft available on Microsoft Flight Simulator. Every aspect of the project has received an exceptional level of attention, from the flight model and systems simulation to the visual details and overall user experience.

To achieve this level of fidelity, we continuously explored and stretched the capabilities of Microsoft Flight Simulator 2024. Many features of this add-on required us to work at the very edge of what the platform

currently allows, developing new technologies and solutions to reproduce systems and behaviors that were never originally intended for the simulator.

We sincerely hope that our community will enjoy flying this aircraft as much as we enjoyed creating it. Your enthusiasm, feedback, and continued support have been a constant source of motivation throughout the development process.

Many thanks to Fly And Fight and to the pilots who helped us developing this aircraft.

This release is not the end of the journey. The Rafale is a living product that will continue to evolve through regular updates, improvements, refinements, and new features as we move forward.

Thank you for your trust and support.

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General description

Characteristics

General performance

The Rafale combines fighter-level agility with a payload and fuel fraction usually associated with heavier aircraft. This balance is one of the key reasons it can remain effective in both air-to-air and air-to-surface roles without changing airframe family.

Depending on the variant, empty mass remains around the 10-ton class: roughly `9,350 kg` for the `C`, `9,550 kg` for the `B`, and `9,950 kg` for the `M`. Maximum takeoff weight reaches `24.5 t`, while internal fuel reaches about `4.7 t`, with a reduction on the two-seat `B`. External fuel can add up to `4.8 t` (with three big fuel tanks), which gives the aircraft a wide range of usable mission profiles from short-range interception to long-range strike or ferry transit.

In speed terms, the aircraft can reach up to `Mach 1.8` at altitude and about `750 kt` at low level. It also retains strong acceleration and high subsonic or transonic performance even in operational loadouts, which is central to its omnirole concept.

At the other end of the envelope, handling remains unusually favorable for an aircraft of this size and mass. Approach speed is typically around `130 kt`, and low-speed controllability remains one of the defining strengths of the type. Combined with its load-factor limits and high roll performance, this gives the aircraft a broad usable envelope rather than just a high top speed.

Length	15.30 m
Wingspan	10.90 m
Height	5.30 m
Empty weight	9,350 kg
Maximum takeoff weight	24,500 kg
Internal fuel	4,700 kg
External fuel	Up to 4,800 kg

External load capacity	9,500 kg
Maximum speed (altitude)	Mach 1.8
Maximum speed (low level)	750 kts
Service ceiling	50,000 ft
Limit load factors	-3.2 G / +9 G

Airframe and aerodynamic layout

The Rafale is a twin-engine, close-coupled canard-delta aircraft. This layout is one of the defining features of the type and drives much of its handling, payload flexibility, and mission performance.

The main delta wing provides both lifting area and internal volume, while the close-coupled canards improve pitch authority and help maintain lift and controllability at high angle of attack. In broad terms, this gives the aircraft strong maneuvering capability without sacrificing range or heavy-store carriage.

Digital fly-by-wire is an essential part of the overall aerodynamic concept. It allows the aircraft to exploit the full benefit of the configuration while preserving precise handling and flight safety throughout the envelope. In practice, the pilot experiences a highly responsive aircraft rather than having to manage the raw aerodynamic compromises directly.

All three operational variants share the same core aerodynamic philosophy and a very high level of structural commonality.

The airframe is also designed with signature reduction in mind. Without turning the Rafale into a dedicated stealth aircraft, its shapes and selected materials help reduce detectability, while still preserving access, robustness, and external-store capacity.

View showing the delta wings and canards

Our approach

Developing a faithful Rafale simulation within Microsoft Flight Simulator required a number of significant technical choices.

One of the most important decisions was to completely override the default MSFS flight model. While the simulator provides a capable general-purpose flight dynamics engine, it is not sufficient to accurately reproduce the unique handling characteristics and flight control laws of the Rafale. To achieve the level of fidelity we were aiming for, we implemented our own flight control system and fly-by-wire (FBW) logic entirely in WASM.

Beyond improving flight dynamics accuracy, this custom FBW architecture also enabled us to implement advanced aircraft-specific features such as automatic terrain following and autothrottle control in angle-of-attack mode.

The aircraft's avionics are implemented using a combination of WASM and JavaScript technologies. This hybrid architecture allows us to combine high-performance systems simulation with smooth and responsive cockpit displays.

As development progressed, we increasingly leveraged the new capabilities introduced with Microsoft Flight Simulator 2024. These new APIs and systems enabled us to implement features that would have been difficult or impossible to achieve in previous versions of the simulator.

Throughout the project, we have continuously pushed the simulator beyond its original design boundaries. In many areas, we are effectively operating at the limits of what the platform currently allows. As a result, despite extensive testing, some bugs or unexpected behaviors may still be encountered. We appreciate your understanding and feedback as we continue to refine and improve the simulation.

Cockpit layout

Main panel

#	Description	#	Description
1	Head-up Display (HUD)	**26**	RLD Visualization Knob
2	Head Center Display (HCD)	**27**	Baro Setting Knob
3	Right Lateral Display (RLD)	**28**	Altimeter STD Button
4	Left Lateral Display (LLD)	**29**	IPS Test Button
5	IPS	**30**	De-Ice Button & Indicator

#	Description	#	Description
6	IMC	**31**	Terrain Following Indicator
7	PDS1	**32**	Auto Guidance Indicator
8	PDS2	**33**	EFB (Tablet) Button
9	Auxiliary Engine Control	**34**	Unused
10	***5K*** Selector / APU Button / ECS Button	**35**	Left Engine Fire Indicator
11	AC Circuit Rearm Button	**36**	APU Fire Indicator
12	DC Circuit Rearm Button	**37**	Right Engine Fire Indicator
13	Engines Calculators Rearm Button	**38**	RLD Page Selection Switch
14	Flight Control System Rearm Button	**39**	HCD Declutter Button
15	Landing Gear Handle & Indicator	**40**	HCD Map Opacity Knob
16	Tailhook Button & Indicator	**41**	HCD Brightness Knob
17	Refuel Switch	**42**	PDS 2 Brightness Knob
18	Stores Handling Mode Switch	**43**	PDS1 Brightness Knob
19	Emergency Stores Jettison Button	**44**	RLD Brightness Knob
20	Multi-Function Knob (***MFK***)	**45**	LLD Brightness Knob
21	LLD Page Selection Switch	**46**	IPS Brightness Knob
22	Master Weapons Switch	**47**	IMC Brightness Knob
23	LLD Visualization Knob	**48**	Map Lights
24	Spin Switch	**49**	Movable Armrest
25	Automatic Recovery Button		

HOTAS (stick)

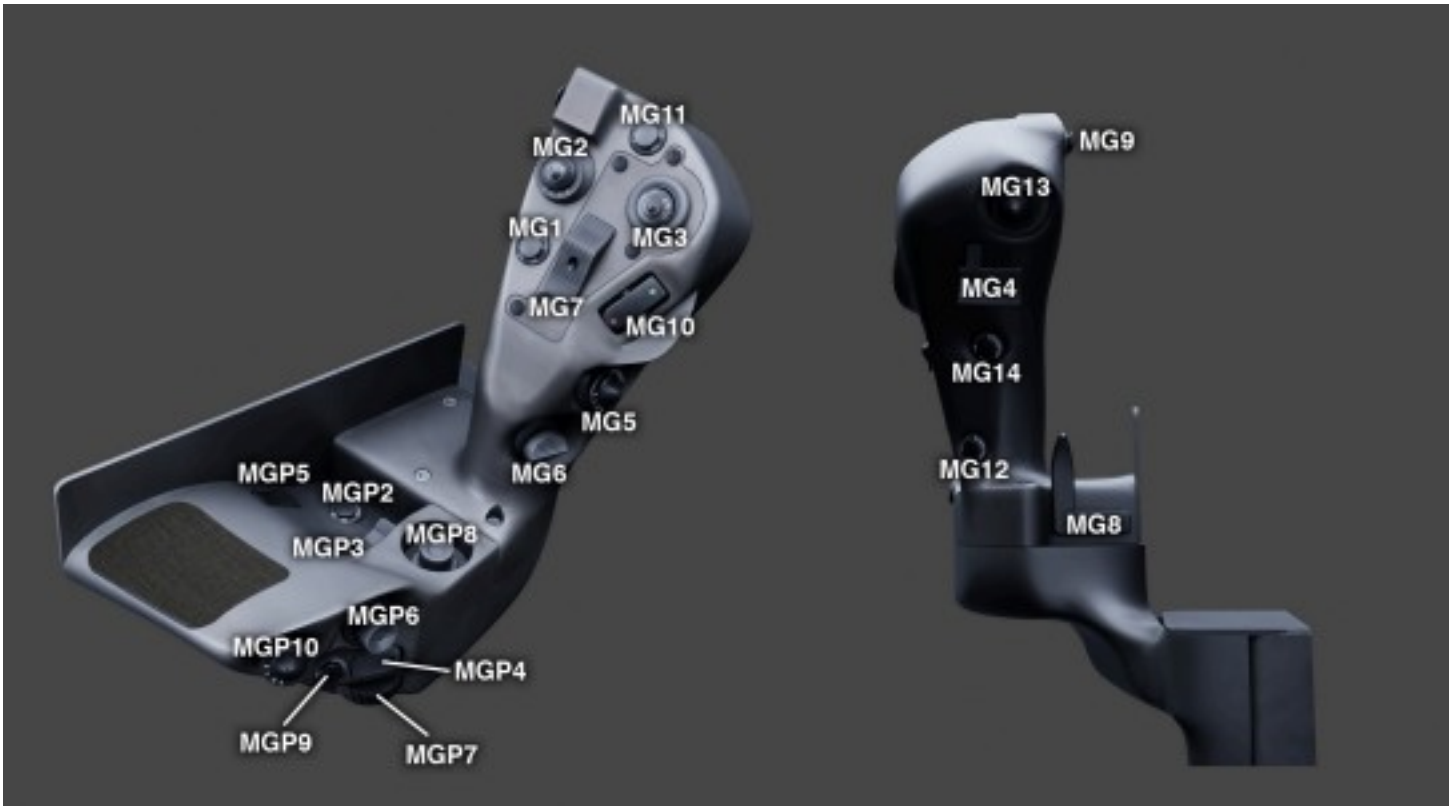
The HOTAS (Hands On Throttle And Stick) philosophy allows the pilot to perform nearly all essential flight and combat operations without removing their hands from the throttle and control stick. This significantly reduces workload and improves situational awareness, particularly during demanding phases of flight.

While we have implemented a large portion of the aircraft's HOTAS functionality, some controls are not available due to limitations or missing features within the simulator itself.

The list of available bindings is here.

#	Description	#	Description
PM1	Weapon Fire	**PM8**	Autopilot Engage / Nose Wheel Steering Toggle
PM2	*INOP*	**PM9**	Autopilot Disengage
PM3	Autopilot Attitude / Trim Hat Switch	**PM10**	LLD System Page / DAS Assign Button
PM4	*INOP*	**PM11**	LLD Autopilot Page Button
PM5	*INOP*	**PM12**	*INOP*
PM6	*INOP*	**PM13**	*INOP*
PM7	*INOP*		

HOTAS (throttle)



#	Description	#	Description
MG1	Combat Mode Selection	**MG13**	*INOP*
MG2	*INOP*	**MG14**	*INOP*
MG3	*INOP*	**MGP2**	*INOP*
MG4	Target Designation	**MGP3**	HCD Map Zoom
MG5	*INOP*	**MGP4**	Create MRK goal
MG6	Combat Mode Selection	**MGP5**	*INOP*
MG7	Spoilers Switch	**MGP6**	*INOP*
MG8	Autothrottle Toggle	**MGP7**	INOP
MG9	Flares Button	**MGP8**	*INOP*
MG10	*INOP*	**MGP9**	*INOP*
MG11	HUD Drift Cut-Out Button	**MGP10**	Taxi / Landing / Police Lights Switch
MG12	*INOP*		

Left console

The controls located in the colored panel areas are dedicated to abnormal and emergency procedures. They are protected by a cover and are generally not used during normal flight operations.

#	Description	#	Description
1	Low Pressure Crossfeed Valve Switch	**23**	FCS Gain Switch
2	External Fuel Transfer Switch	**24**	Rudder Trim Switch
3	Tailhook Emergency Switch	**25**	FCS Mode Switch
4	Emergency Battery Switch	**26**	FCS Digital Mode Indicator
5	Feed Tanks Crossfeed Valve Switch	**27**	Fire Alarms Test Switch
6	Left Generator Switch	**28**	Indicators Intensity Knob
7	Transformer Toggle Switch	**29**	*Upper*: Map Lights Knob *Lower*: Console Lights Knob
8	Right Generator Switch	**30**	*Upper*: Backlight Intensity Knob *Lower*: *INOP*
9	External Fuel Dump Button	**31**	Strobe Lights Switch
10	Left Engine Main Cock Switch	**32**	Formation Lights Switch
11	APU Main Cock Switch	**33**	Navigation Lights Switch
12	Right Engine Main Cock Switch	**34**	MDPU Reset Switch

#	Description	#	Description
13	*INOP*	**35**	LD Reset Switch
14	*INOP*	**36**	HUD / HCD Reset Switch
15	*INOP*	**37**	Selective Jettison Hood
16	*INOP*	**38**	Selective Jettison Button
17	COM1 Volume Knob	**39**	IFF Key Knob
18	COM2 Volume Knob	**40**	IFF Hold/Unhold Switch
19	DTL1 Volume Knob	**41**	IFF Ident Button
20	DTL2 Volume Knob	**42**	IFF Mode Selection Knob
21	Intercom Volume Knob		
22	Pitch / Roll Trim Switch		

Right console

#	Description	#	Description
1	Laser Switch *INOP*	**9**	Defog Valve Switch

#	Description	#	Description
2	Reset DTL Button *INOP*	**10**	Air Decontamination Switch
3	Rudder Pedals Setting Switch	**11**	Depressurization Mode Switch
4	Canopy Switch	**12**	Bleed Air Valve Mode Switch
5	Cabin Temperature Knob	**13**	FCS Test NOGO Indicator
6	Aural Alerts & Indicators Test Switch	**14**	FCS Test GO Indicator
7	General Safety Switch	**15**	FCS Test Switch
8	Radio Alt Override Switch	**16**	Parking Brake Handle

Quick start

This page is intended for pilots discovering the Rafale. It covers the minimum setup required to complete a simple first flight from a cold-and-dark aircraft.

For your first flight, select good weather, daylight conditions and a familiar airport with a long runway. Use the interactive MSFS checklist alongside this guide: it can validate each item and move the camera to the relevant control.

> **NOTE**
>
> The speeds provided in this guide are indicative. They vary with aircraft mass, external stores, wind, airfield elevation and temperature. See the full procedures section for reference values.

Essential controls

Before loading the aircraft, make sure the following standard MSFS controls are assigned:

- Pitch, roll and rudder axes.
- Throttle:
  - Assign `THROTTLE AXIS` or `THROTTLE 1 AXIS` when using an axis.
  - Assign `INCREASE THROTTLE` and `DECREASE THROTTLE` when using buttons.
- Wheel brakes and parking brake.
- Landing gear.
- `TOGGLE AFTERBURNER` if afterburner engagement is not included in the throttle axis range.

The Rafale also uses several repurposed simulator bindings for its HOTAS functions. These are not required for a first flight.

The complete binding list and the two available afterburner configurations are described in the control assignments section.

Recommended assistance

Open the EFB options page and enable the following assistance options for your first flights:

- `AUTO STORES SWITCH`: automatically keeps the flight-control limits matched to the current loadout.
- `AUTO FUEL TOTALIZER`: automatically initializes the fuel totalizer.
- `AUTO IRS ALIGN`: keeps the inertial navigation system aligned without requiring the normal alignment sequence.

These options can be disabled individually later, once you are comfortable with the corresponding systems.

Cockpit essentials

Only a few displays and controls are required for a basic flight:

- The HUD is your primary flight reference. It displays airspeed, altitude, heading, flight path and approach guidance.
- The HCD, directly below the HUD, displays the map and navigation information.
- The left and right lateral displays provide access to the aircraft system pages.
- `PDS1`, below the left lateral display, is used to select avionics pages and the active primary mode.
- The **5K** selector on the main panel controls the main electrical power and engine-start sequence.

Start the aircraft

1. Remove the external covers. Use the ladder to enter the cockpit, then remove it and close the canopy. The EFB provides a shortcut for removing all covers at once.

2. Move the **5K** selector from `OFF` to `STBY`. The left lateral display powers up and shows the `NAV` page.

3. Start the `APU` and wait until its indicator remains steadily green.

4. Move the **5K** selector to `NORM` to power the complete avionics suite.

5. If `AUTO IRS ALIGN` is disabled, open the `NAV` page and select `ALN`. A complete alignment takes approximately four minutes and requires the aircraft to remain stationary. The sequence can be interrupted after approximately two minutes, once the normal HUD indications appear.

6. Set the throttle to idle and move both auxiliary engine controls to `IDLE`.
7. Move the **5K** selector to `R` to start the right engine. Then move it to `L` to start the left engine.
8. Once both engines are running, move both auxiliary engine controls to `NORM`. The APU normally shuts down automatically unless the `ECS` remains enabled.
9. Run the short flight-control system test from the right console. Wait for the green `GO` indication before taxiing.
10. Set the General Safety Switch to `HOT`.

> **TIP**
> The complete startup procedure includes fire-warning and other system checks. Follow the interactive checklist when you want to perform the full sequence.

Taxi

1. Confirm that INS alignment is complete or that `AUTO IRS ALIGN` is enabled.
2. Remove the wheel chocks and switch on the taxi light.
3. Release the parking brake. Nosewheel steering is enabled by default in the simulation. If required, toggle it using the `INCREASE STEERING` binding. Its indicator illuminates when steering is enabled.
4. Apply thrust gently and use the rudder pedals to steer. Use differential braking for tight turns.
5. Test the wheel brakes before allowing the aircraft to gain speed. Nosewheel steering disengages automatically above 60 knots.

> **INFO**
> It is normal for the aircraft to begin moving on its own with the throttle at idle, due to residual engine thrust.

Takeoff

For a normal takeoff:

1. Line up with the runway, center the controls and hold the wheel brakes.
2. Advance the throttle to full dry thrust, release the brakes, then select full afterburner.
3. Maintain the runway centerline using small rudder inputs.
4. At approximately 130 knots in a clean or lightly loaded configuration, or 155 knots with a heavy load, apply a smooth aft-stick input and follow the fixed 13-degree pitch reference on the HUD.
5. Once a positive rate of climb is established, retract the landing gear.
6. Reduce thrust to leave the afterburner range when it is no longer required.

The aircraft does not have conventional trailing-edge flaps. Its leading-edge slats are controlled automatically by the flight-control system.

Basic handling

Climb to a safe altitude before experimenting with the aircraft.

The flight-control system commands load factor in pitch. With the stick centered during steady flight, the aircraft tends to maintain approximately 1 G.

Use smooth control inputs. Maximum roll rate and G limits vary with the selected stores configuration.

For this first flight, concentrate on:

- Performing gentle turns and altitude changes.
- Reading the flight path vector on the HUD.
- Managing airspeed without prolonged use of the afterburner.
- Returning to straight-and-level flight before preparing for the approach.

Approach and landing

1. Reduce speed early and align with the runway. The indicative approach speed for a clean aircraft is approximately 130 knots. Use the airbrake if required.
2. Extend the landing gear. This automatically selects the `APP` primary mode and changes the HUD to its approach presentation.
3. The HUD brackets represent the normal target angle of attack, set to 16 degrees by default. Adjust thrust to position the flight path vector between the brackets while keeping it over the desired runway aiming point.
4. Maintain a stable approach and make only small corrections. The 125-knot figure is a useful reference, but angle of attack is the primary approach target, and the actual airspeed varies with aircraft mass.
5. As the runway approaches, smoothly reduce the rate of descent and touch down on the main landing gear. Move the throttle to idle after touchdown.
6. Maintain directional control using the rudder and apply wheel braking progressively. Nosewheel steering becomes available below 60 knots.
7. Vacate the runway, switch off the landing light and switch on the taxi light.

Shutdown

Once parked:

1. Set the parking brake and switch off the taxi and landing lights.
2. Set the throttle to idle, then move both auxiliary engine controls to `STOP`.
3. Switch off the exterior lights and move the **5K** selector to `OFF`.
4. Open the canopy and install the ladder, covers and wheel chocks if desired.

Refer to the full checklists for the complete parking and securing sequence.

Next steps

Once you are comfortable with a basic flight, continue with:

- Autopilot, which operate differently from conventional civilian systems.
- Alarms, to understand alerts and the `NOGO` warning.
- Navigation, to create and follow a flight plan.
- Lateral display operation, to understand page selection and value editing.

Engines

Powerplant overview

Engines

The aircraft is powered by two Safran M88 afterburning turbofan engines.

Each engine is installed in a dedicated bay on either side of the rear fuselage.

The M88 is a two-spool, dual-flow turbofan engine and has the following characteristics:

Maximum dry thrust	11,200 lbf / 50 kN
Maximum afterburner thrust	16,500 lbf / 75 kN
Max Rated N2	17,650 RPM
Max Air Flow	65 kg/s
Compression Ratio	24.5
Turbine inlet temperature	1,500 °C
Engine Mass	900 kg
Time from idle to full dry	~ 4 seconds
Fuel consumption* (idle)	~ 10 kg/min
Fuel consumption* (full dry)	100-150 kg/min
Fuel consumption* (afterburner)	Up to 450 kg/min

Fuel consumption is for both engines and is indicative only as it depends on a lot of factors.

The two-engine installation provides both performance and redundancy.

Source: safran-group.com

> **TIP**
>
> Thanks to its performance, the Rafale is capable of supercruising at Mach 1.4, meaning that, at a suitable altitude and in a clean configuration, it can reach this speed without using afterburner.

Auxiliary power unit

The aircraft is equipped with an internal Rubis 3 auxiliary power unit (APU).

The APU provides two types of energy:

- Pneumatic power (bleed air) for cockpit air conditioning on the ground, and for engines starting.
- Electrical power through its connection to a generator, supplying onboard equipment before engine starting.

The APU can be used both on the ground and in flight. For engine start, it supplies the bleed air required to start the engines, with the capability to start one engine at a time only.

Engine controls

Throttle

The throttle is used for normal engine control.

It is a combined control (mono-throttle), meaning both engines receive the same thrust command in normal operation. This reduces yaw caused by asymmetric thrust.

Throttle travel is divided into two sections, separated by a physical detent:

- Dry thrust range.
- Afterburner range.

> **INFO**
>
> Do not forget to check controls assignments section, explaining how to bind your hardware.

Auxiliary engine control (AEC)

The two auxiliary controls allow each engine to be controlled independently.

Each provides four distinct functions:

- `STOP`: engine fuel shutoff valve closed, shuts the engine down.
- `IDLE`: engine idle, used during startup sequence.
- `NORM`: normal flight position, engine controlled by the mono-throttle.
- `FIX`: engine power frozen at its current value.

An indicator above each AEC illuminates red in the event of a critical engine failure or fire.

> **INFO**
>
> The `FIX` position is useful when a precise thrust setting must be maintained, for example during air-to-air refueling.

To hold one engine at a fixed setting:

- Set the desired engine RPM / power with the main throttle.
- Move the corresponding AEC to `FIX`.
- The mono-throttle will then only affect the other engine left in `NORM`.

Operation

Startup

Compared to older aircraft, the Rafale startup sequence is simplified for the pilot. Engine start is managed from the main panel using the **5K** knob.

In normal conditions, this single panel is enough to start the aircraft and both engines.

The **5K** knob positions are:

- `TEST`: test position mainly used for maintenance and for ECS and APU indicators testing.
- `OFF`: aircraft batteries are disconnected. No electricity inside the aircraft unless GPU is connected.
- `STBY`: essential battery bus is connected. Non-essential consumers are disconnected to save battery, except if an external electrical provider is connected (GPU, APU or engines generators).
- `NORM`: normal position with engines running. All electrical consumers are connected.
- `L`: left engine start position. This position is unstable.
- `R`: right engine start position. This position is unstable.

The GPU indicator is lit when GPU is connected and providing current.

APU button is used to start or stop the auxiliary power unit. The indicator is green once the APU is started and is flashing during the startup.

ECS button is used to enable air conditioning inside the cockpit while APU is running (using APU bleed air). The indicator is green when ECS is enabled and is flashing if APU is still starting.

Please note that all those functions are linked:

- If ECS is toggled with APU off, it will automatically start the APU, as APU bleed air is required.
- If **5K** knob is put on `L` or `R` positions, APU will be started automatically before starting the engines.

> **NOTE**
>
> Once both engines are started, the APU will automatically shut down except if ECS is enabled.

You can find more information about electrical circuit here.

Please refer to checklists for the complete startup procedure.

You can visualize a full startup sequence in this video:

AzurPoly - Dassault Rafale Startup - Microsoft Flight Simulator

AzurPoly

Regarder sur

Monitoring

All essential engine indications are grouped on the LD engine page.

In case of a malfunction, alerts and associated warnings are described in the alarms chapter.

> **WARNING**
>
> MSFS does not allow in-flight restart by windmilling. In case of engine shutoff in flight, you will need to start the APU first in order to restart an engine.

High altitude

The officially stated operational ceiling is 50,000 feet, although the aircraft may be able to reach altitudes slightly above 60,000 feet.

At these altitudes, the engine control system progressively restricts access to the highest power settings, starting with the afterburner. This protects the engines against operating risks such as compressor stalls.

At high altitude, the afterburner takes on a blue colour due to changes in combustion conditions and the lower air density.

Flight controls

Fly-by-wire overview

Digital flight controls were progressively introduced during the 1990s. This technology made a delta-wing aircraft much easier to exploit. It also ensures consistent control response throughout the flight envelope, reacts to the environment, compensates for center-of-gravity variations, and reduces part of the workload normally associated with conventional flight controls.

> **NOTE**
>
> Because of the unique characteristics of the Rafale's close-coupled canard-delta configuration, a fully custom FBW implementation was developed for this module. The default simulator fly-by-wire system is not used. This allows us to model the interaction between the canards, delta wing, and flight control laws, as well as the aircraft's relaxed stability characteristics, although some behaviors may still differ slightly from the real aircraft.

Stores config

As the Rafale can carry a lot of external stores, different g-force and maximum roll rates limits must be applied to eliminate any risk on the physical integrity of the aircraft.

Depending on current aircraft configuration, a different FCS mode is applied:

- `A/A`: most permissive "air-to-air" mode, with maximum 270 deg/s in roll and accelerations between -3.2 / +9G. This mode is selected if the aircraft does not have any external tank, except a single supersonic RPL701 tank with empty fuel.
- `ST1`: "stores 1" mode, with maximum 150 deg/s in roll and accelerations between -2.4 / +5.5G. This mode is selected when carrying external tanks, which is very common in most operational flights.
- `ST2`: "stores 2" mode, equivalent to a more restrictive version of `ST1`, with softer control response. This mode is selected when carrying bombs attached to the AT730 triple-bomb rack, or SCALP cruise missiles.

Current configuration is set with Stores Handling Mode Switch and must match the current aircraft configuration at any time. The aircraft throws an alarm if the selected stores mode does not correspond to the carried configuration. Flying in the wrong mode is prohibited as it could lead to aircraft damages.

An EFB option is available to manage the switch automatically according to the loadout.

Pitch handling

In pitch, the FCS behaves as a load-factor command system. Stick input sends a G command, and the computers drive the elevons to achieve the requested value. When the stick is returned to neutral, the FCS attempts to maintain a constant load factor, typically 1G, which can be approximated as a near-constant attitude in steady flight.

This behavior allows flight path to be adjusted primarily through speed changes while attitude remains nearly constant. This is also the basic principle behind angle-of-attack hold.

An angle-of-attack limiter is also present and is set to approximately 28 degrees.

Roll handling

Unlike pitch, roll behavior is closer to a conventional aircraft. The FCS provides:

- `Roll-rate limiting` : approximately 270 deg/s in `A/A` and 150 deg/s in `ST1`.

> **WARNING**
>
> Those are **maximum** roll rates values, which are different from actual roll rate that will vary based on several factors (for example, roll rate is smaller at slower speeds for aerodynamics reasons).

- `Asymmetry compensation`: When an external store is released or fuel is not centered laterraly, the resulting moment can significantly affect roll handling. This is automatically compensated by the FCS.

- `Compensation` for roll disturbances induced by the environment.

Yaw handling

In yaw, the logic is more transparent to the pilot.

However, maximum rudder angle is automatically managed depending on airspeed in order to avoid damaging the aircraft.

The rudder is electronically coupled to roll input in order to coordinate turns and to compensate for aerodynamic effects generated by the simulation environment ("yaw damper" effect).

The FCS tries to maintain wings leveled in flight when the pilot moves the rudder.

Controls

Stick

The Rafale control stick differs from that of aircraft fitted with conventional flight controls. Travel is very short, around one centimeter only, and the stick responds primarily to the force applied by the pilot rather than to displacement. Its operational role remains the same.

> **NOTE**
>
> The real aircraft includes an elastic stop allowing the pilot to override the normal envelope limits and reach up to 11G acceleration. This feature is not simulated as the existing flight controllers do not have this "elastic stop" (even force feedback joysticks).

Rudder & steering

The rudder pedals use a conventional layout. They combine yaw control, steering, and toe brakes.

Rudder pedals position can be set with a switch on right console.

Hydraulic steering can be toggled with PM8 control. It is normally disabled by default when starting the aircraft, but we decided to simplify a little bit in the simulator.

Steering is automatically disengaged above 60 knots.

Trim

In normal conditions, with FCS in digital mode, pitch trim and roll trim are disabled and managed by the system.

Rudder trim can be set in order to compensate aircraft drift.

FCS operation

Degraded modes

Under normal operation, the FCS operates in digital mode with variable gain scheduling, providing optimized handling qualities and full flight-envelope protections.

In case of digital mode failure, a dedicated switch allows the pilot to revert the flight controls to an analogue control mode. In this configuration, several aircraft systems and control functions are no longer available, resulting in a reduced level of assistance and protection:

- No autopilot.
- Canards disengaged.
- Slats retracted.
- Airbrakes not available.

In analogue mode, pitch trim and roll trim can be set manually by the pilot.

A green light indicates that the system is ready to be set to digital mode.

Selecting the emergency gain mode triggers an alarm, as some flight control protections are disabled. The pilot must therefore exercise increased caution when operating the aircraft in this degraded configuration.

> **NOTE**
>
> These degraded modes are not intended for normal operation, they have been reproduced to allow failure scenarios simulation.

Testing

After each startup, flight control system needs to be tested to check its integrity.

The test is automatic and triggered by the pilot from the right console with FCS Test Switch.

Two types of test can be conducted (short or long), the second one being longer and reserved to maintenance.

The short test will last approximately ten seconds and you can see flight surfaces pulses during the test.

Once the test is finished, a `GO` light indicates that FCS integrity is confirmed. A `NOGO` light indicates the opposite.

An alarm is displayed as long as the test is not conducted and successful. Trying to take off in those conditions will generate a NOGO alert.

Auto recovery

The auto recovery is activated by the Automatic Recovery Button.

Its purpose is to bring the aircraft back toward safe attitude and speed after a loss-of-control situation.

When pressed in flight, it commands roll back toward wings level and pitch toward a slight nose-up recovery attitude. At the same time, it forces autothrottle `IAS` mode with a 300 kts target.

The button has a green light showing that the system is currently active.

Spin mode

Spin Switch is located on main panel and is essentially used in case of handling urgency, for example if aircraft entered a spin.

Toggling the switch will disable all flight envelope protections and give full authority to the pilot input.

> **WARNING**
>
> Without flight envelope protections, you can easily exceed maximum structural limitations.

General

Circuit description

Like most modern fighter aircraft, the Rafale features a complex electrical network divided into multiple AC and DC buses to ensure redundancy and fault tolerance.

Under normal operating conditions, the pilot has virtually no actions to perform regarding the electrical system, as it is managed automatically through the **5K** selector.

The current state of the electrical system can be monitored on the LD MISC page.

Battery

The aircraft is equipped with a 24 V battery.

Although the battery can power essential systems, the aircraft is normally connected to an external power source before engine start so that onboard systems can operate without discharging the battery.

The battery can be manually forced ON or OFF in abnormal situations using the Emergency Battery Switch.

Generators

Each engine drives an electrical generator (`ACG1` and `ACG2`) rated in the 30–40 kVA power range.

The APU is also equipped with a smaller generator used to support the electrical system during autonomous starts before the main engine generators become available.

Generators are automatically connected to the electrical network when available and require no pilot action. Two emergency switches allow the pilot to disconnect `ACG1` and `ACG2` if needed.

AC circuit

The AC network is organized around three buses:

- `BUS AC1`, normally powered by `ACG1`.
- `BUS AC2`, normally powered by `ACG2`.
- `BUS AC EXT`, powered by the GPU or APU generator and acting as an interconnection bus between `BUS AC1` and `BUS AC2`.

DC circuit & shed bus

The DC network supplies power to most aircraft systems.

It is divided into two buses:

- `BUS DC NON-SHED`, which powers systems normally available whenever electrical power is present.
- `BUS DC SHED`, which powers non-essential equipment that may be automatically disconnected in specific situations to reduce electrical load and preserve battery capacity.

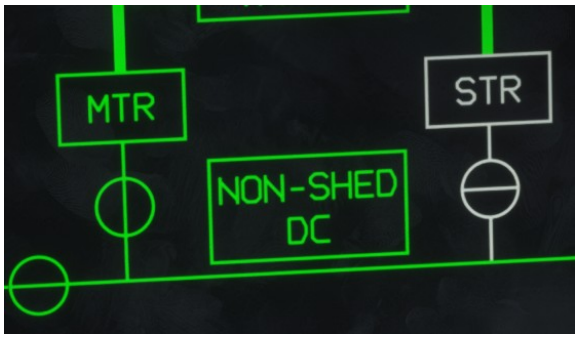
> **INFO**
>
> During an autonomous start, placing the **5K** selector in the `STBY` position keeps the `BUS DC SHED` bus disconnected. Only essential equipment remains powered. As a result, most avionics displays remain off except for the left lateral display.

Transformer rectifiers

The interface between the AC and DC networks is provided by two transformer rectifiers that convert AC power into a regulated 24 V DC supply:

- `MTR` connected to `BUS AC1` and normally used during standard operation.
- `STR` connected to `BUS AC2` and used as a backup if `MTR` becomes unavailable.

Selection between both transformer rectifiers is controlled using the Transformer Toggle Switch.



Normal operation: MTR connected

Ground power

During most ground operations, the Rafale is supplied by a Ground Power Unit (GPU), which provides external AC power.

The GPU can be connected either from the EFB tablet or during the walkaround inspection after opening the external power receptacle access panel.

Indicator confirming that GPU is providing electricity

When connected, the entire aircraft electrical network is powered, even when the **5K** selector is in the `OFF` position.


8310

Lighting

Exterior lights

Taxi and landing lights

The taxi and landing lights are mounted on the nose landing gear. The Rafale C uses two separate light units.

Those two lights can be controlled independently using the MGP10 switch:

- `UP`: landing light on.
- `DOWN`: taxi light on.
- `LEFT`: both lights off.

MGP10 switch

They turn off automatically when the landing gear is retracted.

Navigation lights

Red and green navigation lights are located on the upper and lower surfaces of each wingtip, as well as on the wing-root leading edges.

White navigation light is located at the top of the vertical tail.

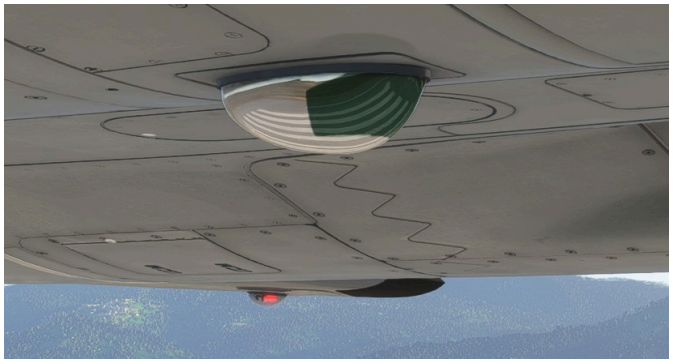
Two brightness levels are available: dimmed `DIM` and high `HIGH`.

They are selected using the Navigation Lights Switch on the left console.

Navigation lights switch

Strobe lights

The strobe lights consist of one dorsal (flashing) light and one forward ventral light on the right-hand side.



Ventral strobe light

They are controlled using the Strobe Lights Switch on the left console.

Strobe lights switch

Formation lights

The formation lights consist of three pairs of light strips located on both sides of the aircraft:

- Below the cockpit.
- Ahead of the countermeasure dispensers.
- On the vertical fin.

Two brightness levels are available: dimmed `DIM` and bright `BRT`. They are especially used for formation flying at night.

They are selected using the Formation Lights Switch on the left console.

Formation lights switch

Police light

The police light is made to illuminate an airborne target for visual identification in low luminosity conditions.

It is installed on the left side of the aircraft and projects its beam laterally.

It is controlled using the MGP10 switch (`RIGHT` position).

Interior lights

Console lights

The consoles can be illuminated with green flood lights.

Their intensity is adjusted using the Console Lights Knob.

Backlighting

Green integral lighting illuminates the markings on most instruments and panels.

Its intensity is adjusted using the Backlight Intensity Knob.

Some switches also feature phosphorescent markings, allowing them to remain identifiable in darkness without electrical illumination.

Map lights

Two white flexible-stem map lights are fitted on either side of the cockpit. Each light can be aimed as required and returns to its stowed position when moved close to it.

Their intensity is adjusted using the Map Lights Knob.

> **NOTE**
>
> Moving an object in all directions can be hard and imprecise depending on the device, due to simulator limitations.

Avionics and indicators brightness

Each avionics display has an individual brightness knob on main panel.

Display glow is projected into the cockpit, improving the visibility of nearby elements at high brightness settings. The EFB screen provides the same effect.

Indicators brightness can be set using Indicators Intensity Knob.

Indicators can be tested with the Indicators Test Switch.

Night vision

MSFS 2024 allows to partially simulate a night vision helmet.

You need to bind `NIGHT VISION` events in controllers settings in order to use it.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Fuel system

The Rafale fuel system consists of seven internal tanks distributed throughout the fuselage, wings, and vertical stabilizer. Up to three external fuel tanks can also be carried on the aircraft's centerline and inner wing stations.

Fuel system can be monitored at any time in LD FUEL screen.

Circuit description

The left engine is supplied by the left feeder tank, while the right engine is supplied by the right feeder tank.

The APU is supplied through a dedicated fuel line connected to the right-side engine supply circuit. Its fuel consumption is approximately 100 liters per hour.

When fully fueled, the aircraft has approximately 9.5 tonnes of fuel (4.7 internal and 4.8 external).

The following table shows the capacity of each internal tank:

Tank	Capacity	Fuel weight
Left feeder	1,157 L / 306 gal	928 kg / 2,046 lbs
Right feeder	1,272 L / 336 gal	1,020 kg / 2,249 lbs
Left front	944 L / 249 gal	757 kg / 1,669 lbs
Right front	864 L / 228 gal	693 kg / 1,528 lbs
Left wing	756 L / 200 gal	606 kg / 1,336 lbs
Right wing	756 L / 200 gal	606 kg / 1,336 lbs
Fin	140 L / 37 gal	112 kg / 247 lbs
TOTAL INTERNAL	**5,888 L / 1,555 gal**	**4,722 kg / 10,410 lbs**

Fuel transfer is fully automatic. The system maintains the feeder tanks at the required level while consuming fuel from the other tanks in a predefined sequence.

Under normal conditions, the tanks are emptied in the following order:

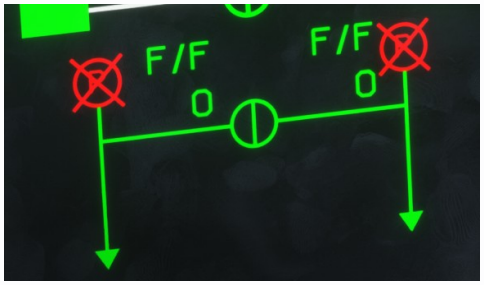
1. External wing tanks.
2. External centerline tank.
3. Internal wing tanks.
4. Fin tank.
5. Front tanks.
6. Feeder tanks.

Pumps

The fuel tanks are automatically pressurized to ensure fuel transfer throughout the system.

Each engine is supplied by a dedicated booster pump. These pumps are controlled automatically and do not normally require pilot intervention.

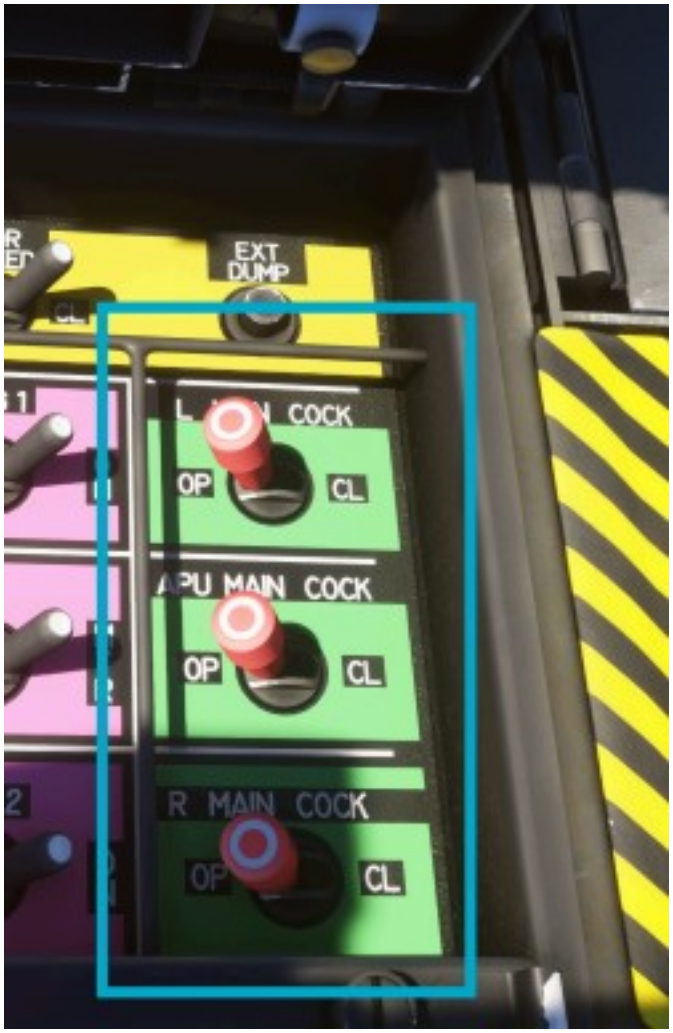
> **NOTE**
>
> When the GPU is connected, the fuel pumps are automatically electrically isolated. This does not prevent engine start, as fuel can still reach the engines by gravity and the pumps only provide additional assistance. Their status can be monitored on the LD FUEL page.



Valves

The fuel system includes several valves used to isolate components and control fuel distribution.

Each engine and the APU has a dedicated fuel shutoff valve. These valves can be manually closed by the pilot in the event of a fire, leak, or other emergency.



The fuel system is functionally divided into left and right circuits, which do not normally communicate with each other. Two crossfeed valves can be used to connect both sides when required.

- The **low-pressure crossfeed valve** connects the left and right low-pressure fuel supply lines upstream of the engines.

- The **feeder tank crossfeed valve** connects the left and right feeder tanks. It can be used to correct a fuel imbalance or maintain fuel supply following a system failure.

External fuel

The aircraft can carry up to three external fuel tanks: one on the centerline station and two on the inner wing stations.

Two external tank types are available:

- The RPL 701, commonly referred to as the supersonic tank, carries **1,250 liters** of fuel. Its aerodynamic shape allows the aircraft to retain supersonic capability while the tank is installed.
- The RPL 741 carries **2,000 liters** of fuel. When this tank is installed, the aircraft is limited to Mach 0.95.

With three RPL 741 tanks installed, the Rafale C can carry up to 6,000 liters of external fuel, extending drastically its range.

> **INFO**
>
> The Rafale airframe can accommodate two additional external fuel tanks on the outer wing stations in certain configurations. These stations are not used for external fuel tanks on the Rafale C.

Fuel monitoring

Fuel totalizer

At the beginning of the flight, the pilot must initialize the fuel totalizer from the LD FUEL page.

The totalizer calculates the remaining fuel quantity by subtracting the fuel delivered to the engines from the quantity entered during initialization. This calculated value is continuously compared with the fuel quantity measured directly in the aircraft's tanks.

If the difference between the calculated and measured quantities exceeds 300 kg, a fuel discrepancy alarm is triggered. This may indicate an incorrect totalizer initialization, an abnormal fuel transfer, or a possible leak.

For convenience, the EFB includes an option to initialize the fuel totalizer automatically using the current measured fuel quantity.

The fuel system is otherwise managed automatically and does not require specific pilot action during normal operations.

Fuel bingo

The pilot can set a BINGO fuel value. An alarm is triggered when the total remaining fuel drops below the selected value. The BINGO value can be adjusted from LD FUEL page or directly using the MFK knob.

The `time to bingo` (TTB) value shows at any time the remaining flight time before reaching BINGO, depending on current fuel consumption.

Low fuel

Because the feeder tanks are the last tanks to be consumed, a low feeder quantity indicates that the usable fuel reserve is becoming critically low.

An alarm is triggered when either feeder tank contains less than 250 liters of fuel. When this alarm appears, the pilot should land as soon as operationally practical.

Air-to-air refueling

The add-on is compatible with TouchingCloud AirshowAssistant add-on, allowing the aircraft to receive fuel during flight.

To prepare the aircraft for in-flight refueling, set the REFUEL switch to the ON position.

The switch opens the required refueling valves and allows the aircraft to accept fuel from the compatible tanker system.

Fuel jettison

The Rafale C can jettison fuel from its external tanks in an emergency. Fuel is discharged through dedicated jettison valves located beneath each external tank.

Internal fuel cannot be jettisoned on the Rafale C.

To begin the fuel jettison sequence, press the `EXT DUMP` pushbutton.

Fuel is jettisoned at an approximate rate of 8 liters per second, meaning a full RPL 741 tank is emptied in just over four minutes.

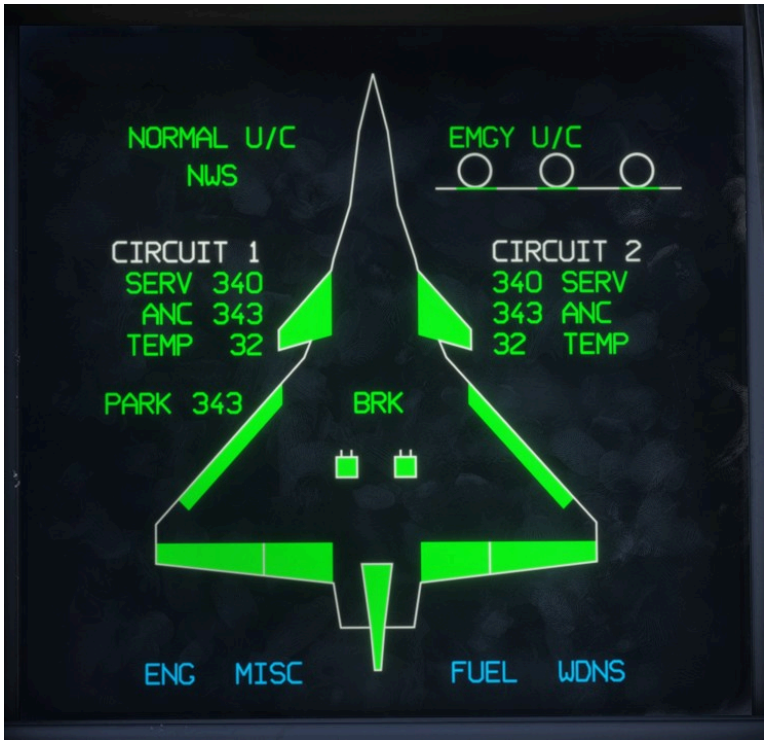
> **WARNING**
>
> Once initiated, the fuel jettison sequence cannot be stopped. All remaining external fuel will be discharged.

Hydraulic system

The hydraulic system is designed for redundancy and consists of two independent circuits operating in parallel.

This section describes the aircraft systems powered or assisted by hydraulic pressure.

The hydraulic system can be monitored at any time on the LD HYD page.



Description

Each hydraulic circuit is associated with one engine: the left circuit is powered by the left engine, while the right circuit is powered by the right engine.

The main hydraulic consumers are supplied by both circuits to maintain partial or full operation if one circuit fails. These include:

- The landing gear and nosewheel steering.
- The wheel brakes.
- The elevons.

- The canards.
- The rudder.
- The leading-edge slats.

Hydraulic pressure is generated by two engine-driven pumps, one connected to each engine. Under normal operating conditions, each circuit provides approximately 350 bar of pressure.

Hydraulic power becomes available as soon as at least one engine is running. During the engine-start sequence, the elevons and canards can be seen moving to their neutral positions as hydraulic pressure builds up.

Consumers

Flight control surfaces

The flight control surfaces can be actuated as long as sufficient hydraulic pressure is available.

The four elevons, both canards, the rudder and the leading-edge slats are controlled by the FBW system, based on pilot inputs, aircraft configuration and current flight conditions.

Landing gear

The Rafale is equipped with a hydraulically operated tricycle landing gear.

The landing gear is extended and retracted using the landing gear handle. Its current position and locking state are shown by the associated indicator.

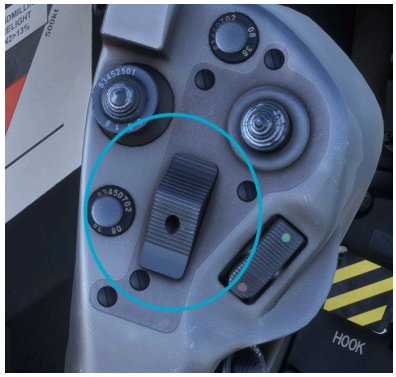
Extending the landing gear automatically enters the aircraft into `APP` mode.

The landing gear does not have a maximum extending speed, however excessive aerodynamic loads may damage it. The landing gear should therefore only be operated within its normal speed range.

Airbrake

The aircraft uses an airbrake system to increase drag and decelerate more rapidly in flight.

Unlike most aircraft, the Rafale does not use dedicated airbrake panels or spoilers. Instead, the elevons are deflected in opposite directions to generate additional drag. The canards are moved simultaneously to compensate for the resulting pitching moment and minimise changes in aircraft attitude.



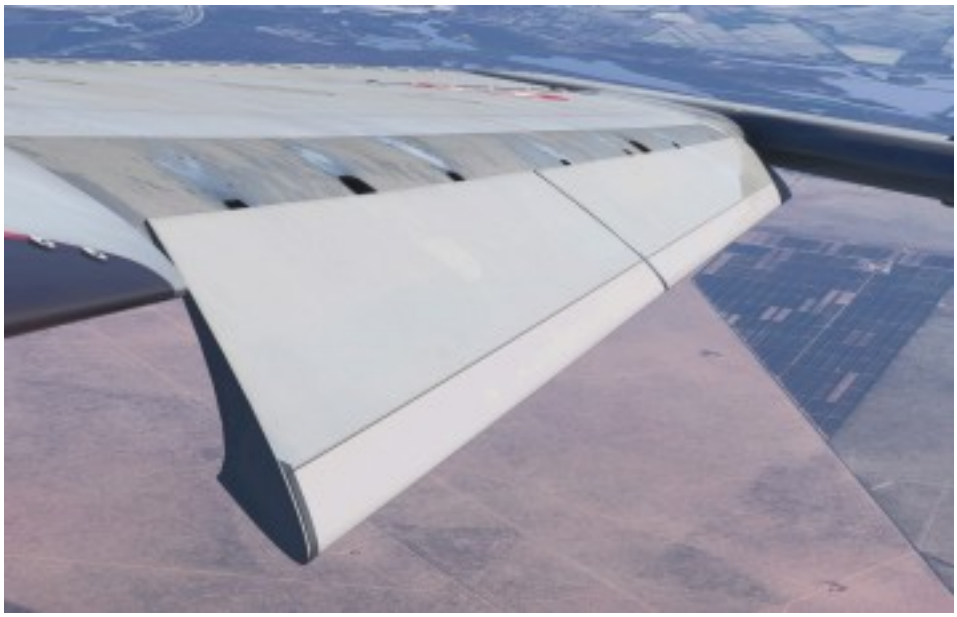
> **INFO**
>
> When the landing gear is extended, the airbrake is limited to 50% of its full deflection range.

Slats

The leading-edge slats increase lift and improve handling at low speed. The aircraft does not have conventional trailing-edge flaps.

Slat operation is fully automatic and is controlled by the FBW system:

- With the landing gear extended, the slats extend when the angle of attack exceeds 18°.
- With the landing gear retracted, the slats begin to extend progressively when the angle of attack exceeds 5.5°. Their maximum deflection depends on the aircraft speed.



Brakes

The pilot can apply differential braking using the rudder pedals.

The parking brake can be used to keep the aircraft stationary while parked or during engine start.

Nosewheel steering

The aircraft is equipped with hydraulically assisted nosewheel steering to facilitate ground manoeuvring.

Nosewheel steering can be enabled or disabled using PM8. It is automatically disabled when the indicated airspeed exceeds 60 knots to reduce the risk of excessive steering inputs or loss of directional control during take-off and landing.

An indicator illuminates when nosewheel steering is enabled.

> **NOTE**
>
> On the real aircraft, nosewheel steering is disabled by default when the aircraft is started. This behaviour is not simulated in order to provide a more convenient experience for most users.

Tailhook

Although the Rafale C is not carrier-capable, it is equipped with an arresting hook for emergency landings. The hook can engage arresting cables installed on suitably equipped military runways, particularly in the event of a braking or hydraulic system failure.

The tailhook can be lowered using the corresponding control on the left-hand console.

> **NOTE**

> On the real aircraft, the tailhook is lowered by gravity and must be manually reset after landing. For convenience in the simulator, pressing the control again will also raise it.

Failures

The loss of one hydraulic circuit does not normally prevent the aircraft from being controlled, as the main flight control actuators are supplied by both circuits.

However, hydraulic redundancy may be reduced and some systems may operate more slowly or become unavailable, depending on the failed circuit.

The LD HYD page displays the pressure available in each hydraulic circuit.

An alarm is generated when the pressure in one of the circuits falls below its normal operating range.

Pneumatics

Pneumatic power is supplied in the form of compressed air.

The pneumatic system is simulated and supplies several aircraft systems, including engine starting, air conditioning, cabin pressurisation and ice protection.

Bleed air

Both engines and the APU can provide bleed air for air conditioning and cabin pressurisation.

Before engine start, the APU supplies the bleed air required to drive the engine starter. Once the APU is running correctly, its indicator illuminates steady green, indicating that engine start can be initiated.

Bleed-air distribution is managed automatically, and the pilot does not normally need to operate the pneumatic valves manually.

Engine bleed air can be shut off using the emergency bleed-air switch if required (right console).

Cabin environment

The cockpit is pressurised to maintain an acceptable cabin altitude during high-altitude flight.

Cabin altitude approximately follows the relationship:

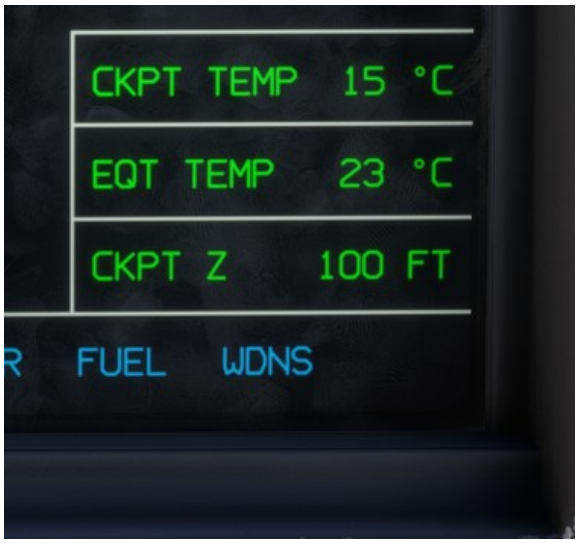
```
Cabin altitude = aircraft altitude / 2 + 3,000 ft
```

For example, at an aircraft altitude of 30,000 ft, the cabin altitude is approximately 18,000 ft.

The pilot is also equipped with an oxygen mask, which provides supplemental oxygen if cabin pressurisation becomes insufficient or is lost.

Cabin temperature can be adjusted using the temperature control knob. At least one active bleed-air source is required for the air-conditioning system to operate.

The current cabin temperature and cabin altitude are displayed on the LD MISC page.



Ice protection

Due to its usual operating speeds and flight profile, the Rafale is not normally exposed to icing for prolonged periods. However, ice may still form during low-speed flight in visible moisture and at sufficiently low temperatures.

The aircraft ice-protection system operates automatically once enabled using the associated knob-indicator.

When icing conditions are detected, the relevant sensors are heated and windshield heating is activated automatically.

Active ice protection is indicated by a blue circle on the IMC display.

If icing conditions are detected while the ice-protection system is disabled, a warning indicator illuminates on the alarm panel.

Windshield heating can also be forced using the emergency windshield de-icing switch.

Alarms

Description

The aircraft features an ergonomic warning and alert system designed to remain as unobtrusive as possible to the pilot.

Only essential information is displayed on the avionics screens, while detailed information about active alarms is available on the LD FAIL page.

Under normal conditions, the system does not generate unnecessary warnings or alarms. For example, no warning is triggered when powering the aircraft from a cold & dark state.

The system includes several categories, listed below from highest to lowest priority:

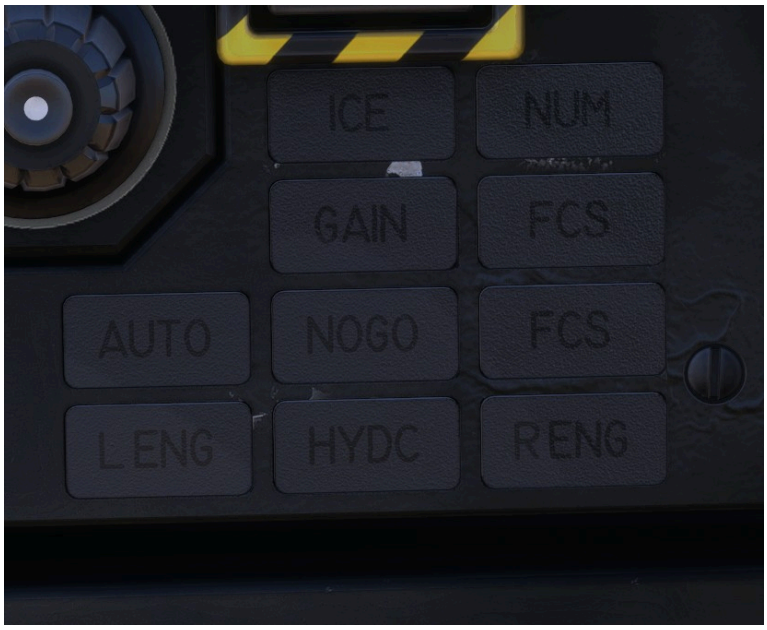
- `Alerts`, displayed on the HUD only.
- `Alarms`, divided into three categories (`red`, `amber` and `mission`) depending on severity.

The difference between an alert and an alarm is that an alarm may be acknowledged and muted by the pilot, whereas an alert remains displayed for as long as its triggering conditions are met.

Only the highest-priority alert is displayed at any given time. When multiple alarms are active simultaneously, they are automatically prioritized according to their severity.

Alarms panel

The main instrument panel includes a set of annunciator lights providing quick visual information about the aircraft status.



Each indicator may be triggered by multiple system conditions and is not necessarily associated with a single alarm.

Indicators can illuminate in three different colors depending on severity (blue for information, amber for caution, and red for failure).

	ICE	NUM
	Aircraft de-ice disabled in icing conditions	FCS digital mode failure
	GAIN	FCS
	FCS variable gain unavailable	FCS minor failure
AUTO	NOGO	FCS
Autopilot coupling failure	NOGO alert	FCS major failure
L.ENG	HYDC	R.ENG
Left engine failure	Hydraulic system failure	Right engine failure

Sound annunciations

The most critical alerts and alarms are accompanied by voice announcements generated by a female synthetic voice while the triggering conditions remain active.

Aural warnings can be tested using the Aural Alerts Switch.

For alarms, a warning tone is continuously played while the alarm remains active and has not been acknowledged. This tone may be played simultaneously with a voice announcement.

Autopilot / autothrottle disconnect sound

A "dong" tone is played whenever the autopilot or autothrottle disengages unexpectedly:

- Significant control input is applied while the autopilot is engaged.
- The FCS switches to analogue mode, or the spin switch is enabled while the autopilot or autothrottle is engaged.
- Throttle reaches a physical stop while the autothrottle is engaged.

Gear down radio bip

When the landing gear is fully extended, pressing the gear status indicator emits a continuous radio beep.

This feature is traditionally used by military pilots to confirm to air traffic control that the landing gear has been successfully extended prior to landing.

Clickable landing gear indicator

Alerts

Level 1

The safety height alert is the highest-priority alert and is specific to the HUD, as it is not displayed on any other screen.

It is triggered whenever the aircraft descends below the safety height selected by the pilot (200 feet by default).

The alert is inhibited in `APP` mode and remains active until the aircraft climbs back above the selected safety height.

It is displayed as a flashing upward arrow, prompting the pilot to immediately climb above the selected safety height.

Active safety height alert displayed on HUD

Level 2

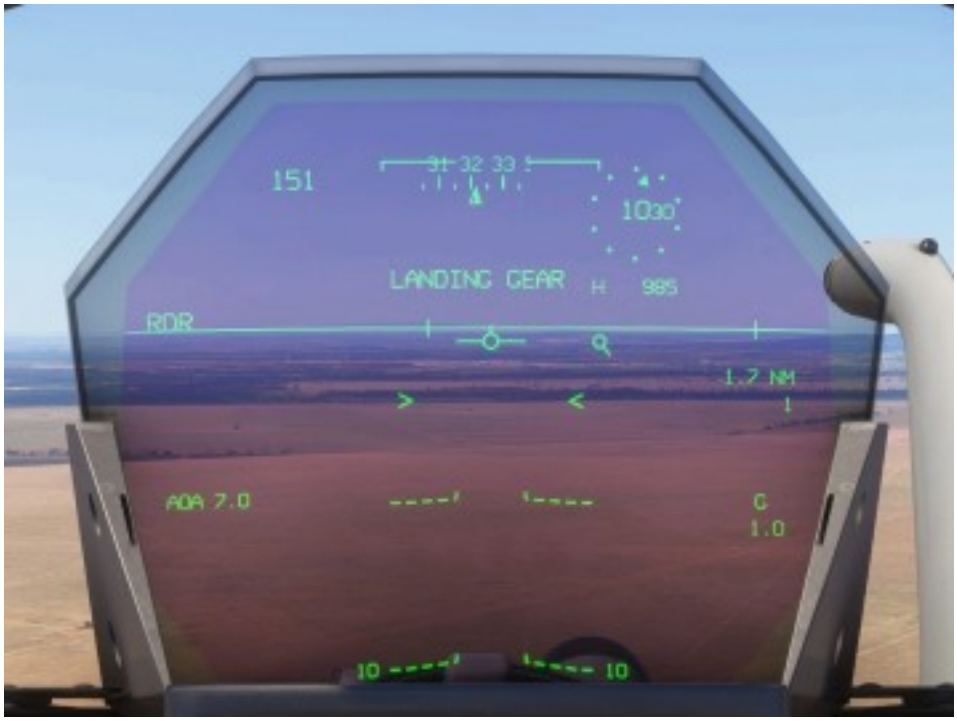
All other alerts belong to the "level 2" category.

These alerts indicate situations requiring immediate pilot attention or corrective action.

Only the highest-priority active alert is displayed.

- `RELEASE STICK`: the angle of attack exceeds 10° and the control stick is moved above elastic stop.
- `RECOVER`: the angle of attack exceeds 10°, the control stick is close to neutral, and the landing gear is not fully extended.
- `TOO SLOW`: indicated airspeed falls below 100 knots in flight, indicating an imminent stall risk.

- `TOO FAST`: indicated airspeed exceeds 750 knots at low altitude (risking structural overheating) OR Mach exceeds 0.95 with large external fuel tanks (RPL741) installed.
- `LANDING GEAR`: airspeed is below 165 kts, altitude is below 10,000 ft, at least one throttle is below 30%, and the landing gear is not fully extended.
- `MASTER ARM`: a combat mode is selected (in `A/A` or `A/S`) while the Master Weapons Switch is in the `SAFE` position.



Landing gear alert displayed on HUD

Alarms

Alarms are divided in three categories (`red`, `amber` and `mission`).

A newly triggered alarm will make a box appear on main avionics screens, and can be acknowledged by clicking on this box (in a lateral display or in center display).

Clicking on the box opens LD FAIL page.

An active alarm remains indicated at the top of the lateral displays by its corresponding severity symbol, even after it has been acknowledged, to remind the pilot that the condition is still present.

Amber alarm still active

Red alarms

Red alarms indicate major failures requiring immediate attention.

List of implemented red alarms:

- `L ENG FIRE`: left engine fire.
- `R ENG FIRE`: right engine fire.
- `APU FIRE`: APU fire.
- `HYD FAIL`: low pressure in both hydraulic circuits.

Active red alarms are displayed in a dedicated central warning box on all four main avionics displays. When multiple alarms are active, they are sorted by priority.

Red alarm displayed on main avionics screens

Amber alarms

Amber alarms indicate failures or abnormal conditions requiring pilot attention but considered less critical than red alarms.

List of implemented amber alarms:

- `HYD L`: low pressure in the left hydraulic circuit.
- `HYD R`: low pressure in the right hydraulic circuit.
- `FUEL`: at least one feeder tank contains less than 250 liters of fuel, or the discrepancy between the measured fuel quantity and the fuel totalizer exceeds 300 kg.
- `OXY`: the oxygen supply or regulator system is not operating normally.
- `BINGO`: remaining fuel quantity has fallen below the selected bingo value.
- `FCS`: both engines are running and the FCS test has not been completed successfully.
- `CONF`: the stores configuration switch is not set to the correct position.
- `GAIN`: emergency FCS gain is selected.

- `L GEN`: left generator is disconnected.
- `R GEN`: right generator is disconnected.

Amber alarms are displayed in a dedicated box located in the lower-right corner of the four main avionics displays.

This box is hidden whenever a red alarm is active and has not been acknowledged, ensuring that the pilot's attention remains focused on the highest-priority failure.

Two amber alarms displayed on main avionics screens

Mission alarms

Mission alarms are displayed on the four main avionics screens using a striped symbol.

> **NOTE**

> Only a limited number of mission alarms are currently implemented, as most are related to military systems and combat functions that are not relevant within the MSFS environment.

Currently implemented:

- `OUT OF AMMO`: gun mode is selected and no ammunition remains.

Out of ammo alarm displayed on main avionics screens

NOGO

`NOGO` is a dedicated flashing warning displayed whenever takeoff power is applied while the aircraft remains on the ground and one or more takeoff-critical conditions are not satisfied:

- Pitch, roll or yaw trim is not centered.
- The spoilers are not fully retracted.
- FCS emergency gain is selected.
- The FCS is operating in analogue mode.

- The spin switch is enabled.
- The FCS test switch is not in its normal position.
- The FCS test has not been successfully completed after startup.
- General Safety Switch is in the `SAFE` position.

It indicates that the aircraft is not in a configuration considered safe for takeoff and that corrective action is required before departure.

NOGO alert displayed on main avionics screens

Principles

The avionics are organized around four main displays and four auxiliary displays:

- The head-up display (`HUD`) is always within the pilot's field of view. It shows key flight parameters as well as mission-related information.
- The head center display (`HCD`) is collimated and positioned directly in front of the pilot. It primarily shows a map with tactical information.
- The two lateral displays (`LLD` & `RLD`) show various selectable pages.
- `PDS1` is used to select the primary mode and the pages shown on the lateral displays.
- `PDS2` displays the active autopilot modes and IFF information.
- `IPS` is a backup artificial horizon.
- `IMC` shows essential fuel and engine information.

The center display, the two lateral displays and PDS1 are touch-screens while the others are not clickable.

> **INFO**
>
> In the real aircraft, the center display is not clickable and the pilot is using a touchpad to interact with it. As this kind of interaction is not really operable in the simulator, we decided to make the screen clickable.

Primary mode

One of the key concepts in the aircraft is the primary mode. This term is used frequently throughout the documentation.

There are four primary modes, each corresponding to a different task:

- `A/A`: air-air
- `A/S`: air-surface
- `APP`: approach
- `UPD`: update

Depending on the active primary mode, the aircraft allocates its systems and sensors accordingly.

On the single-seat variant (Rafale C), only one mode can be selected at a time, meaning that selecting a mode will unselect all the other ones.

`APP` mode is specifically used during approach, and is automatically selected when the landing gear is extended.

`UPD` mode is used in flight, at regular intervals, and depending on the mission, to realign the inertial navigation system (INS).

> **NOTE**
>
> Although the INS and its initial alignment are simulated, in-flight realignment through `UPD` mode has no practical use in this add-on, as the underlying realignment process is very complex and is not simulated for now.

Multi-function knob

The **MFK** provides quick access to some of the aircraft's most frequently used settings.

The inner ring is used to select the setting, while the outer ring is used to adjust its value.

When a value is being adjusted, the selected setting and its current value are displayed in a box in the bottom-right corner of the HUD.

Press the outer ring to confirm the selected value. When using a mouse, this is performed with a right-click. If no adjustment is made for a few seconds, the box automatically disappears from the HUD.

The knob has seven positions, although only six labels are shown around it:

- `R1`: adjusts the Radio 1 (`COM 1`) frequency.
- `R2`: adjusts the Radio 2 (`COM 2`) frequency.
- `H`: adjusts the safety height, or the decision height when `APP` mode is active.
- `BULL`: changes the bullseye reference.
- `BINGO`: adjusts the BINGO fuel value.
- `DEST`: changes the active destination waypoint. See the flight plan section.
- `ALT`: adjusts the autopilot target altitude (`ALTSEL`).

When the selected altitude is changed using the **MFK**, `ALTSEL` mode is automatically engaged if the autopilot is active.

Navigation

Database and goals

One of the key concepts in the Rafale avionics is the **goal**. A goal represents a geographical point associated with a number between 1 and 999 and a name.

The avionics system includes a database containing all available goals.

At all times, the aircraft must have a **primary goal** and may also have an optional **secondary goal**. Both are displayed on the LD HSI page.

By default, the aircraft automatically creates a primary goal corresponding to the nearest airport.

Primary goal number 1 and its distance displayed on the HUD

All existing goals can be viewed and managed from the LD DB page.

LD DB page displaying airport goals

Each goal has a type among the following:

- `APT`: airport goal.
- `UPD`: update goal, used for in-flight INS realignment.
- `MRK`: marker goal, described in the section below.
- `NAV`: navigation goal, used in the flight plan.
- `A/S`: air-to-surface goal, used as a surface target.

The primary goal is closely linked to the flight plan, as explained in the next section.

`MRK` and `A/S` goals can be modified by changing their coordinates or deleting them. `APT` and `NAV` goals are managed by the navigation system and cannot be modified once created.

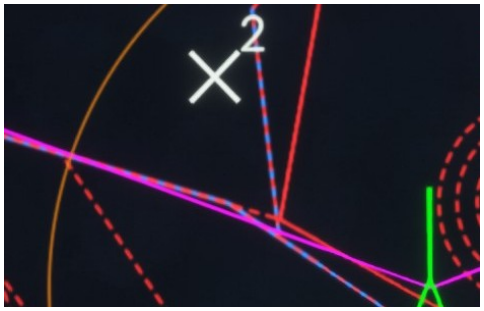
> **INFO**
>
> On the real aircraft, the database is populated with all mission-related points during mission preparation. The logic is slightly different in the simulator, where the database is populated and modified during the flight.

Marker goals

A marker goal (`MRK`) is a user-created goal stored in the aircraft database. It can be used to mark any position of interest directly from the HCD, then reused by other navigation and mission functions.

To create a marker goal:

1. Click the desired location on the `HCD` to place the cursor. The cursor information box displays the bearing and range from the aircraft to the selected position.
2. Press MGP4. A new `MRK` goal is created at the exact position of the cursor and is assigned a database number.
3. The new marker appears on the `HCD` as a cross labelled with its database number. It is also added to the `MRK` list on the LD DB page.



Marker goal displayed on HCD

Once created, a marker goal can be:

- Selected as the secondary goal on the LD HSI page.
- Used as the active bullseye.
- Inserted into the flight plan.
- Used as a surface target by selecting `TGT` on its LD DB details page.

Bullseye

A bullseye is a fixed geographical reference shared by all participants in a mission. It provides a common origin from which positions can be reported without referring to the location of a particular aircraft.

A bullseye position is conventionally expressed as a bearing and a distance. For example, `BULL 045/30` describes a position located 30 nm from the bullseye on a bearing of 45 degrees. This allows aircraft, targets or other points of interest to be located quickly using the same reference.

In the avionics, the bullseye is assigned to an existing goal in the aircraft database. Any suitable goal can be used, including a marker goal created specifically for this purpose.

To select the bullseye, use the MFK in `BULL` position.

Goal 3 selected as the active bullseye

Inertial navigation system

The Rafale uses two inertial navigation units (`INU`) for navigation. Both units must be aligned before each flight.

When electrical power is first supplied to the aircraft, the LD NAV page is displayed on the `LLD`. It shows the number and coordinates of the nearest goal, which the system uses as the reference position for alignment.

LD NAV page before alignment

The center display is initially centred on the goal used as the alignment reference.

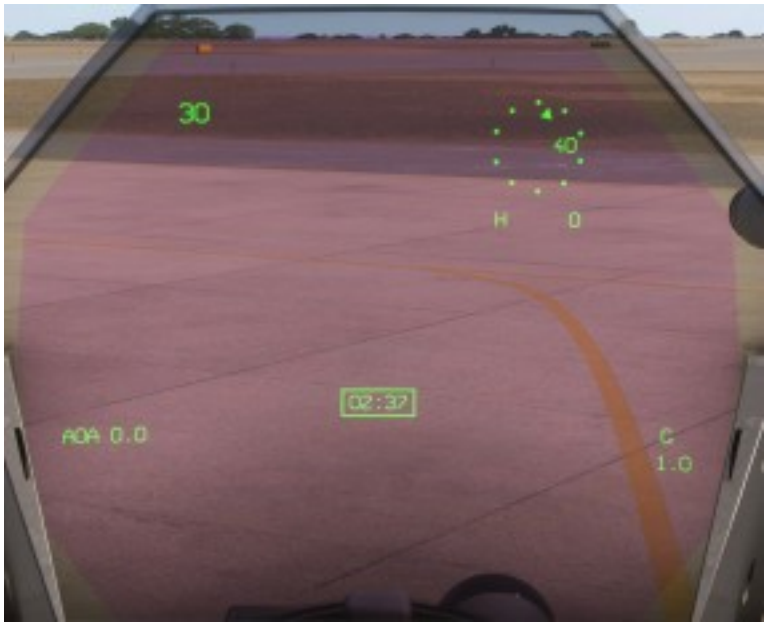
Center display before alignment

Select **ALN** to start the alignment sequence.

LD NAV page during alignment

The complete alignment process takes approximately four minutes and requires the aircraft to remain stationary.

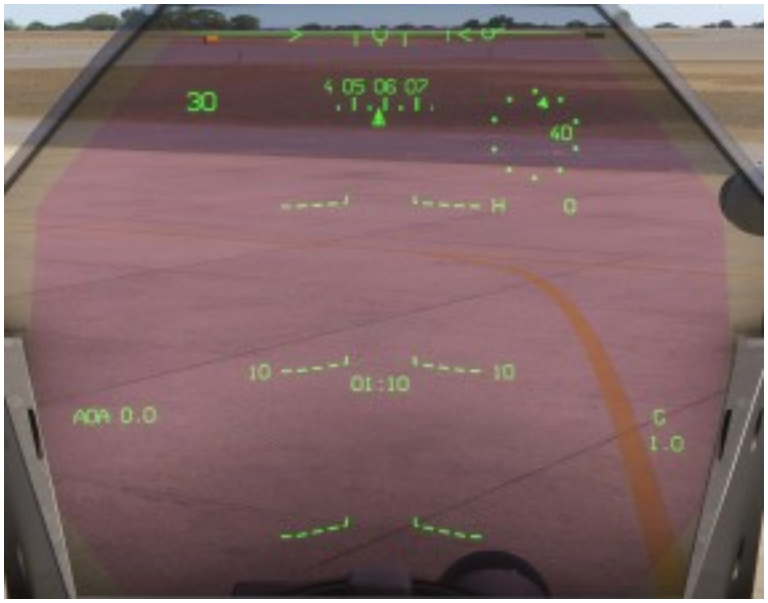
The remaining alignment time is displayed on both the LD NAV page and the HUD.



> **WARNING**
>
> You have to ensure parking brake is set during the whole alignment sequence, otherwise the sequence will be paused.

The alignment sequence can also be paused manually by selecting **ALN** again.

After approximately two minutes, the system has reached a sufficient level of alignment for normal operation, and the sequence may be interrupted if necessary. From this point onwards, all standard HUD indications are displayed and the remaining alignment time flashes.



The horizontal and vertical offsets between the two INUs can be monitored at any time on the LD POS page. These offsets progressively decrease during alignment.

LD POS page

> **INFO**
>
> The INS alignment sequence can be skipped using an EFB assistance option. When this option is enabled, both INUs are automatically kept aligned.

Flight plan

The aircraft avionics can import and manage a flight plan, which can then be followed by the autopilot.

> **INFO**
>
> On the real aircraft, the database and flight plan are generally loaded into the avionics before the flight. As this workflow cannot be reproduced directly within the simulator, the MSFS EFB is used to create the flight plan and transfer its waypoints to the aircraft systems.

The LD FPL page displays the current flight plan and each of its legs:

LD FPL page

Each leg displays its target speed, as configured on the preparation page, and its associated altitude. Cruise legs use the selected cruise altitude, while specific departure and arrival legs may display an altitude constraint.

The estimated time and fuel remaining are displayed for each leg, with the final fuel reserve at the bottom.

The flight plan is represented by an orange line on the center display. The active waypoint, which is also the primary goal, is identified by a thicker circle.

Flight plan displayed on the center display

> **NOTE**
>
> Each waypoint in the flight plan always has a corresponding goal in the aircraft database.

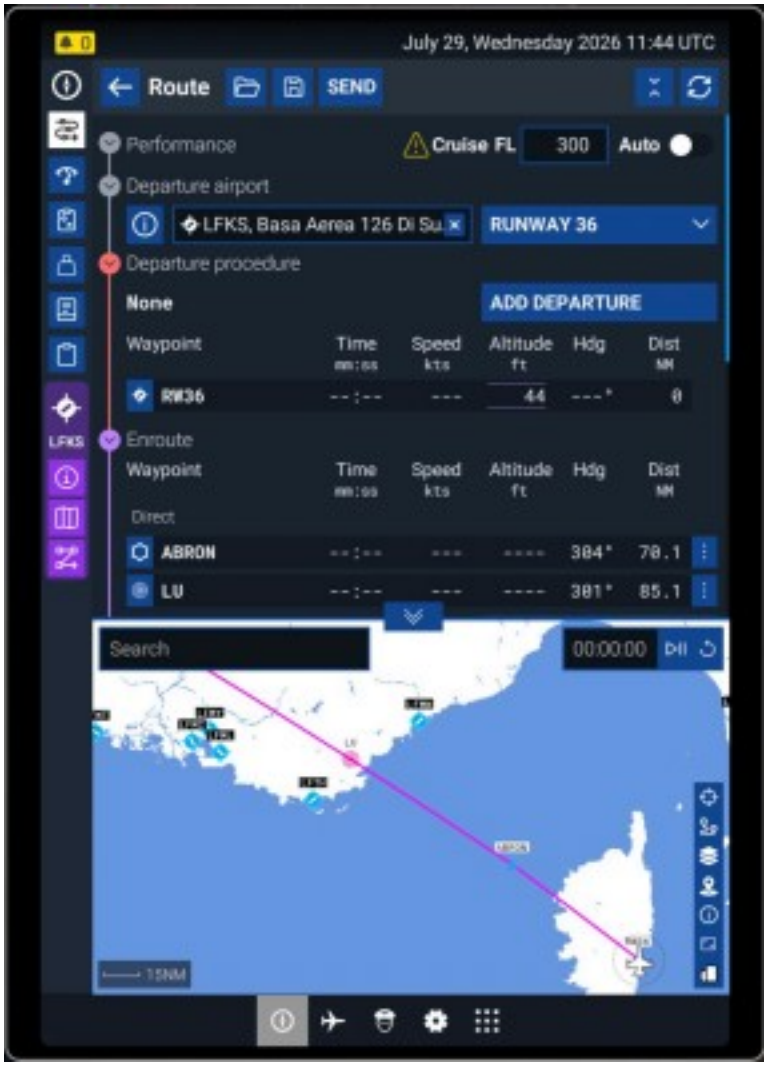
The LD PRP page allows you to configure the cruise altitude and cruise speed before importing the flight plan:

LD PRP page

> **NOTE**
>
> The cruise speed is provided for reference only, as the aircraft does not include a vertical navigation (`VNAV`) function.

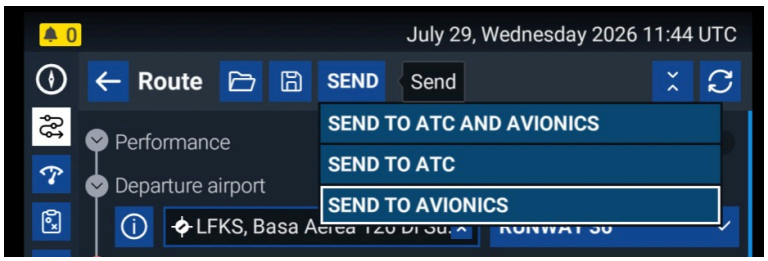
Creation

To create a flight plan, open the MSFS EFB and configure the departure, arrival and any desired intermediate waypoints. SIDs, STARs and approaches are supported by the system.



Flight plan creation in the MSFS EFB

Once the flight plan has been created, select `SEND TO AVIONICS` to transfer it to the aircraft avionics.



The flight plan is then imported into the aircraft, together with the corresponding database goals, which are numbered automatically.

The flight plan is now available for navigation, with its first waypoint automatically selected as the primary goal.

A flight plan created in the MSFS EFB can also be imported directly from the LD PRP page.

> **WARNING**
>
> Once a flight plan has been imported into the aircraft, it becomes independent of the MSFS EFB. Any subsequent changes made in the EFB will not be reflected in the avionics unless the flight plan is sent again.

Editing

Once imported, the flight plan can be modified during the flight in several ways.

The LD FM page is used to edit the flight plan, while LD FPL is intended for consultation only. The two pages have a similar layout, but editable items are displayed in magenta on LD FM.

LD FM (flight plan modification) page

Insert waypoint

A marker goal can be inserted into the flight plan after it has been created from the center display. Its coordinates can be modified beforehand if required.

On the center display, select the marker goal that you want to insert to place the cursor over it.

On the LD FM page, open the waypoint immediately before or after the desired insertion position and select `INSERT`. You can then choose whether to insert the marker before or after that waypoint.

The flight plan is immediately updated with the new waypoint.

> **NOTE**
>
> The system does not support inserting other types of goals, such as navdata points, into an existing flight plan. To use these points, they must already be included in the flight plan imported from the MSFS EFB.

Remove waypoint

On the LD FM page, open the waypoint that you want to remove and select `DELETE`.

Delete plan

The complete flight plan can be deleted from the avionics using the LD PRP page.

Direct-to

To bypass one or more flight plan legs, you can create a direct-to leg towards the desired goal. This goal then becomes the new primary goal.

A direct-to can be created in either of the following ways:

- From the LD FM page, open the desired waypoint details and select `DTO`.
- Set the MFK knob to the `DEST` position and select the desired goal.

The direct-to leg is displayed as a dashed line on the center display.

> **WARNING**
>
> Once a flight plan waypoint has been passed, it cannot be selected as the primary goal again. This limitation follows the MSFS flight plan logic.

SimBrief

A flight plan prepared using a Navigraph® SimBrief account can be imported into the Rafale avionics.

To use this feature, download *SimBrief Dispatch for MSFS 2024* from your SimBrief account.

Once installed, the flight plan can be managed directly from the MSFS EFB and imported into the aircraft avionics using the same procedure described above.

INFO

You must select another aircraft type or create a custom aircraft profile, as no dedicated Rafale profile is currently available in SimBrief.

Autopilot

The automatic flight-control system is divided into two independent parts:

- The main autopilot, which manages vertical and lateral guidance.
- The autothrottle, which manages aircraft speed by controlling engine thrust.

The active autopilot and autothrottle modes are displayed on the PDS2 screen.

> **NOTE**
>
> The Rafale autopilot operates differently from the systems found in most conventional aircraft. We strongly recommend reading this section carefully before using it.

> **WARNING**
>
> A significant amount of custom logic is used to reproduce the aircraft's specific autopilot operation. Avoid using the default MSFS bindings for individual autopilot modes, such as altitude hold, as they may interfere with this custom logic and cause unexpected behaviour.

Autopilot

The main autopilot provides several vertical and lateral guidance modes.

The available vertical modes are:

- Pitch hold, which is the default vertical mode.
- Altitude hold (`ALT`).
- Altitude selection (`ALTSEL`).
- Terrain following (`TF`).

The available lateral modes are:

- Bank hold, which is the default lateral mode.
- Heading hold (`HDG`).

- Homing (`HOM`).
- Flight plan following (`FPL`).

The ILS approach mode provides both vertical and lateral guidance.

The autopilot is managed from the LD AP page.

Operation

The autopilot can be engaged using the PM8 switch and disengaged using PM9.

It can also be engaged by selecting the amber vertical and lateral mode containers on the lateral display autopilot page. Both containers turn green when the autopilot is active.

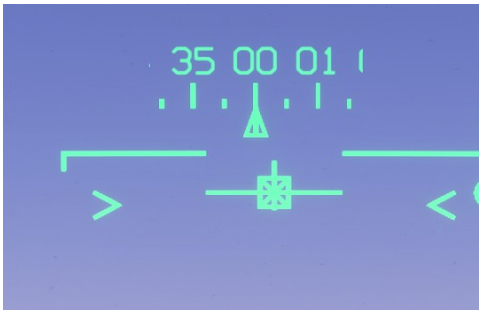
The main autopilot can only be engaged when all the following conditions are met:

- The aircraft is airborne.
- The bank angle is below 50°.
- The pitch angle is below 40°.
- The spin switch is not enabled.
- The FCS is operating in digital mode.

The autopilot disconnects automatically if the aircraft returns to the ground or if the pilot makes a significant stick input. An aural warning is played when the system disconnects.

Autopilot submodes can only be selected once the main autopilot is active.

When the autopilot is engaged, the HUD vertical velocity indicator (`VVI`) is displayed inside a square.



Base mode

Base mode is selected by default when the autopilot is engaged. It maintains the aircraft's current pitch and bank attitude.

If the aircraft pitch is close to level when the autopilot is engaged, altitude hold is selected automatically.

If the bank angle is below 10° when the autopilot is engaged, the commanded bank angle is automatically set to zero.

The PM3/trim switch can be used at any time to adjust the commanded pitch or bank angle.

On the HUD, the flight director asterisk represents the current guidance command. When the asterisk is superimposed on the VVI, the aircraft is following the trajectory commanded by the flight director.

Asterisk indicating a pitch-down trajectory commanded by the flight director

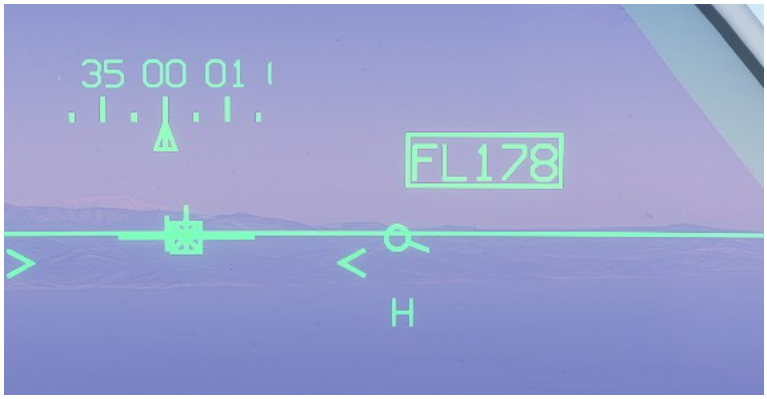
Altitude hold

`ALT` mode captures and maintains the aircraft's current altitude.

It can only be engaged when the aircraft pitch angle is below 20 degrees.

Moving the PM3/trim switch disengages `ALT` mode and returns the autopilot to base mode.

Once the selected altitude has been captured and is being maintained, the HUD altimeter is replaced by the target altitude displayed inside a square.



Altitude captured and maintained

> **NOTE**
>
> Altitudes above 10,000 ft are displayed using flight-level (`FL`) notation, regardless of the selected barometric setting. For example, a target altitude of 15,300 ft is displayed as `FL153`.

Altitude selection

`ALTSEL` mode is used to capture an altitude selected on the LD AP page or with the MFK.

After engaging the mode, the pilot must set the desired climb or descent attitude manually using the PM3/trim switch.

As the aircraft captures the selected altitude, the target value flashes three times on the HUD. `ALTSEL` then disengages automatically and `ALT` mode becomes active.

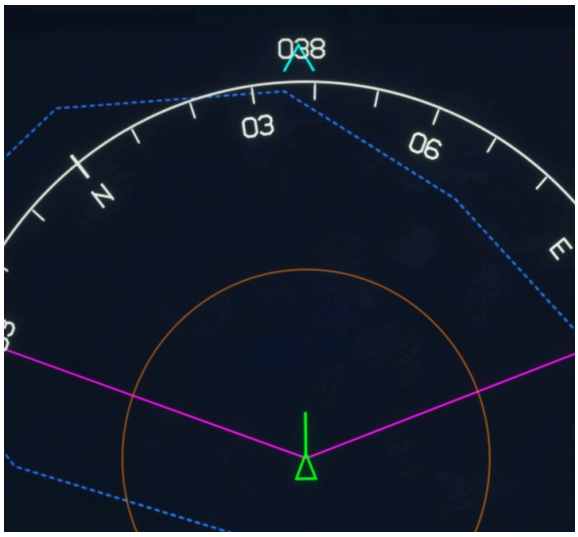
ALTSEL mode active while the aircraft climbs towards FL250

> **WARNING**
>
> Engaging `ALTSEL` does not automatically initiate a climb or descent. The required pitch attitude must be commanded manually.

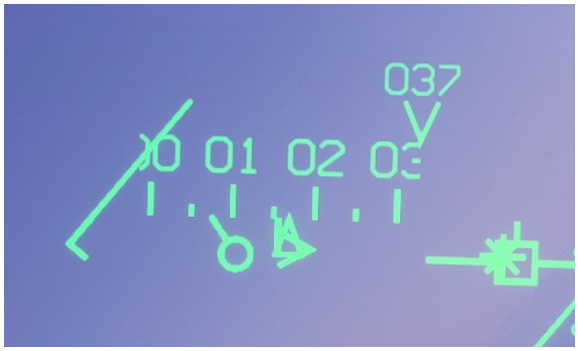
Heading

Heading hold mode (`HDG`) is entered by pressing both toe brakes while the autopilot is active. The mode initially captures the aircraft's current ground track.

`HDG` mode is not represented by a dedicated container on the autopilot page. Its activation is instead indicated by an arrow on the HUD and the center display.



Center display showing heading hold mode active



HUD showing heading hold mode active with a target of 37°

As on the real aircraft, once the mode is active, the left and right toe brakes are used to decrease or increase the selected target. Greater pedal travel produces a larger change.

This behaviour can be enabled or disabled using an EFB assistance option.

If your hardware does not support differential braking, the `INCREASE HEADING BUG` and `DECREASE HEADING BUG` bindings can be used to adjust the target instead.

> **NOTE**
>
> The value initially captured by this mode is the aircraft's current ground track, regardless of whether the display is configured to use magnetic or true reference.

Moving the PM3/trim switch disengages heading hold and returns the lateral autopilot to base mode.

Flight plan

Flight plan mode (`FPL`) automatically follows the active flight plan laterally. It does not manage the aircraft's altitude.

The system automatically adjusts the aircraft's bank angle to remain on the planned route.

FPL mode active and following the flight plan route

> **⚠ WARNING**
>
> Aircraft speed must be monitored carefully while using `FPL` mode. At excessive speeds, the autopilot may be unable to follow tight turns, particularly during departure or arrival procedures.

Homing

In homing mode (`HOM`), the aircraft flies directly towards the primary goal without attempting to intercept or remain on the planned route.

This is equivalent to flying directly towards each active waypoint in a straight line.

HOM mode active and guiding the aircraft towards goal 3

ILS

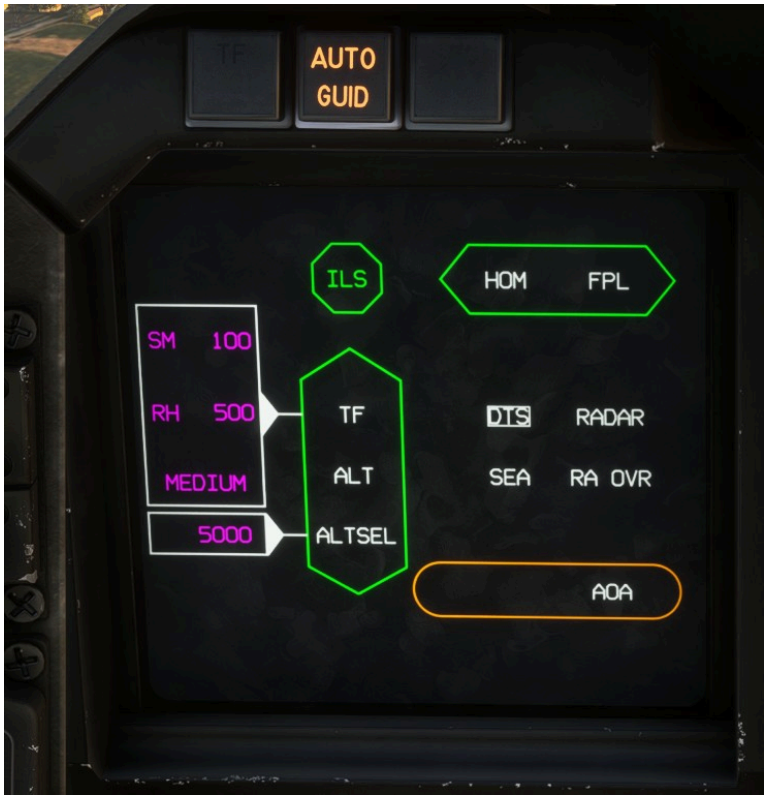
When a valid ILS approach is included in the flight plan, the autopilot can provide automatic localizer and glideslope guidance. This mode is particularly useful in low-visibility conditions.

When valid localizer and glideslope signals are received, the LD HSI page displays the corresponding lateral and vertical deviations.

LD HSI page displaying ILS deviations

Once `APP` primary mode is active, an `ILS` button becomes available on the autopilot page. Select it to arm the automatic approach mode.

The button and its label turn green once both the localizer and glideslope have been captured. The AUTO GUID indicator also illuminates.



LD AP page with ILS approach mode active, as confirmed by the AUTO GUID indicator

Before engaging the approach mode, ensure that the aircraft is stabilized at an appropriate approach speed and is reasonably aligned with both the localizer and glideslope. Otherwise, the autopilot may struggle to establish the correct trajectory.

> **NOTE**
>
> If the ILS box is not displayed on the HUD and no ILS information appears on the LD HSI page, the flight plan may not contain a valid ILS approach, or the aircraft may not yet be within the area where the ILS signals can be received. In this situation, selecting `ILS` on the LD AP page has no effect.

> **INFO**
>
> The current automatic approach mode relies on the default MSFS approach guidance, which may produce oscillations at the relatively high angles of attack used during approach. A custom approach mode is planned for a future update.

Terrain following

Terrain following (`TF`) is a specialised guidance mode designed to reduce pilot workload during low-level flight, particularly in low-visibility conditions.

In our implementation, the system samples the terrain ahead of the aircraft, builds a terrain profile, generates a suitable vertical flight path and commands the flight-control system to follow it. This broadly reproduces the operating principle of a terrain-following system within the limitations of Microsoft Flight Simulator.

The terrain-following system can use two selectable terrain-data sources:

- `RADAR`: represents terrain data obtained through active radar scanning.
- `DTS`: represents topographic data stored in the aircraft's database, allowing `TF` guidance to be used without radar emissions.

In our implementation, both options use the same underlying simulator terrain data.

`TF` can be selected on the LD AP page without engaging the autopilot. In this configuration, the calculated terrain data is displayed on the HUD and can be followed manually.

Terrain following selected but not controlled by the autopilot

> **NOTE**
>
> Terrain following is implemented natively in this add-on and is designed to remain usable across a wide range of environments. However, edge cases may still occur because of terrain-data resolution and simulator limitations. The system may be refined in future updates.

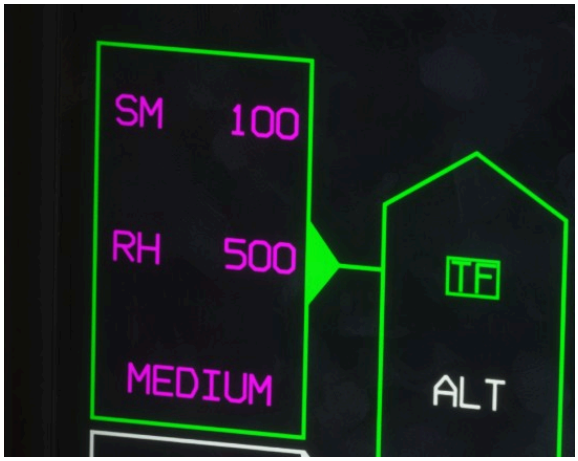
Settings

Terrain-following behaviour is configured using three settings:

- Requested height (`RH`): the desired clearance above the terrain. It can be set between 200 and 2,000 ft.
- Safety margin (`SM`): an additional clearance added to the requested height to account for obstacles such as power lines and other narrow vertical structures that may not be represented reliably in the ter-

rain data. It can be set between 0 and 1,000 ft.

- Ride law: controls how aggressively the system reacts to changes in the terrain profile. Three settings are available:
  - `SOFT`: reduced responsiveness, suitable for smooth terrain or greater clearances.
  - `MEDIUM`: balanced responsiveness for most situations.
  - `HARD`: increased responsiveness for steep terrain or low requested heights, resulting in higher-G manoeuvres.



Terrain-following settings on the autopilot page

Operation

`TF` can be selected from the LD AP page or by clicking the terrain-following indicator.

Once armed, the mode can activate only when all the following conditions are met:

- Indicated airspeed is between 400 and 600 kts.
- Bank angle is below 60°.
- Nose-down pitch angle is below 50°.

While `TF` is armed but not yet active, the HUD displays a double hexagon representing the interception cue. When the VVI crosses this cue, `TF` becomes active and the symbol changes to a double circle around the VVI.

Terrain following active and displayed in green on the autopilot page

The commanded clearance is not calculated from a single terrain point. The system analyses several terrain zones ahead of the aircraft, gives greater weight to the nearest terrain and increases its margin when terrain variation or bank angle becomes greater.

Over particularly uneven terrain, the aircraft may not maintain the exact requested height at all times.

Terrain following controls only the vertical component of the flight. Lateral modes such as bank or heading hold, `HOM` and `FPL` can therefore remain active at the same time.

> **WARNING**

> If any of the terrain-following activation conditions are no longer met, the mode disengages immediately. For example, `TF` disengages if indicated airspeed falls below 400 kts. These parameters must therefore be monitored throughout the flight.

Autothrottle

The autothrottle operates independently from the main autopilot.

It controls engine thrust within the dry-thrust range only, from idle to maximum dry thrust.

Only engines whose AEC is set to `NORM` are controlled by the autothrottle.

Speed hold

A selected speed can be maintained using either of the following modes:

- `KT`: maintains a selected indicated airspeed.
- `M`: maintains a selected Mach number.

The pilot can switch freely between `KT` and `M` modes.

Above 20,000 ft, `M` mode is selected by default.

Autothrottle active in KT mode with a target of 490 kts

When the autothrottle is active, the selected speed is displayed inside a box on the HUD.

When the aircraft is within ±10 kts or ±0.05 Mach of the selected target, the target indication merges with the current speed indication.

If the aircraft speed subsequently moves outside this tolerance, the target indication flashes three times.

Angle of attack hold

`AOA` mode maintains a selected angle of attack instead of a speed target.

This mode is primarily intended for approach operations. When the landing gear is extended, the autothrottle automatically selects `AOA` mode.

The default target angle of attack is 16°, which is the usual approach angle, but it can be adjusted as required between 10° and 20°.

Autothrottle enabled in AOA mode with a target of 12 degrees

The target angle of attack is displayed on the HUD above the indicated airspeed.

Operation

The autothrottle can be toggled by selecting its amber container on the LD AP page or by using MG8 on the throttle.

When `KT` or `M` mode is first selected, the aircraft's current speed is used as the initial target. The target can then be adjusted from the LD AP page using the value adjustment knob.

Selecting `KT` or `M` switches between the two speed-reference modes.

When the landing gear is extended, only `AOA` mode is available.

The autothrottle disengages automatically when any of the following conditions occur:

- The aircraft is on the ground.
- The throttle reaches either physical stop, at idle or full power.
- The spin switch is enabled.
- The FCS enters analogue mode.

An aural warning is played when the autothrottle disconnects.

PDS1

Description

PDS1 is an auxiliary display used to select the primary mode and the page shown on the LLD.

Its lower section provides clock and timing functions.

It is located on the main panel, and its brightness is adjusted using the PDS1 Brightness Knob.

The available buttons are distributed across two pages. Use the arrow button in the lower-right corner to switch between them.

Primary mode

Four buttons on the first page are used to select the primary mode: `A/A`, `A/S`, `APP` or `UPD`.

The active mode is highlighted with a green background. Pressing the active mode button again deselects it.

Lateral display pages

The remaining buttons open the corresponding page on the `LLD`. The button associated with the page currently displayed on the LLD is highlighted.

First page:

- `FPL`
- `COM`
- `IFF`

Second page:

- `DB`
- `NAV`
- `FM`
- `DAS`
- `POS`
- `PRP`

Time functions

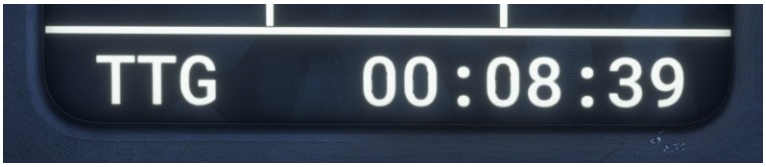
The lower section contains a time display. Click its left-hand side to cycle through the three available functions.

Current time

Displays the current time in UTC.

Time to goal

Time to goal (`TTG`) is the estimated time remaining before the aircraft reaches the primary goal.

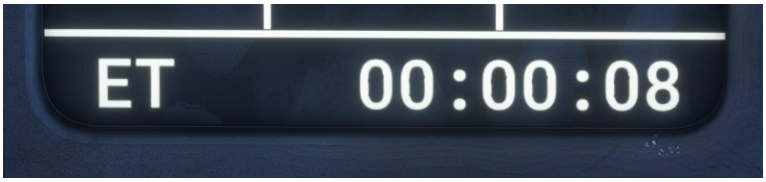


Stopwatch

The stopwatch, also referred to as elapsed time (`ET`), is used to measure a duration.

Its operation is straightforward:

- Click the displayed time once to start the stopwatch.
- Click it again to pause it.
- Click it a third time to reset it.



PDS2

Description

PDS2 is an auxiliary display that summarises the active autopilot modes and IFF settings.

It is located on the main panel, and its brightness is adjusted using the PDS2 Brightness Knob.

Autopilot modes

The active autopilot modes are displayed inside three shapes, allowing the pilot to check their status at a glance.

The vertical polygon, which represents vertical guidance, remains empty when the default pitch-hold mode is active.

The horizontal polygon, which represents lateral guidance, remains empty when the default bank-hold mode is active.

Shape	Type	Label
Vertical polygon	Vertical guidance	`ALT` — Altitude hold `ALTSEL` — Altitude selection `TF` — Terrain following `ILS` — Approach
Horizontal polygon	Horizontal guidance	`HDG` — Heading hold `HOM` — Homing `FPL` — Flight plan `ILS` — Approach
Circle	Autothrottle	`KT` — Speed hold `M` — Mach hold `AOA` — Angle-of-attack hold

These modes are described in detail in the autopilot section.

Both polygons are displayed while the main autopilot is engaged, while the circle is displayed when the autothrottle is engaged.

Active ALTSEL mode, HOM and autothrottle in KT mode

An armed mode is displayed with a black background until it becomes active.

Terrain following armed but not yet active

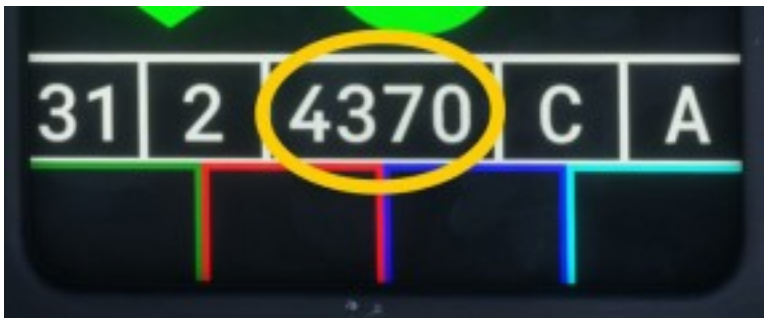
IFF

The lower section displays information related to IFF and the data link.

Most of these settings have no practical effect in Microsoft Flight Simulator. The main exception is IFF Mode 3, which corresponds to the aircraft transponder code.

The IFF information is displayed from left to right as follows:

- IFF Mode 1 code.
- `2` when IFF Mode 2 is active.
- IFF Mode 3 code.
- `C` when Mode C is active.
- IFF Mode 4 key (`A` or `B`).



Transponder code set to 4370

IPS

Description

The IPS is the aircraft's standby flight display.

It is built around an attitude indicator and displays airspeed, altitude, barometric pressure setting and magnetic heading. These essential flight parameters remain available in the event of a failure affecting the main displays.

It is located on the main panel and is powered by its own electrical circuit, independently of the main displays. Brightness is adjusted using the IPS Brightness Knob.

Attitude indicator

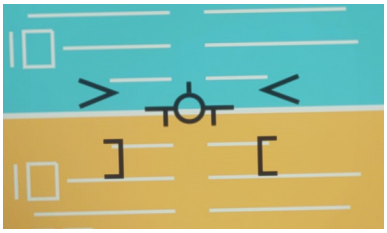
The pitch ladder is graduated up to 80 degrees in both nose-up and nose-down attitudes. The upper blue section represents the sky, while the lower brown section represents the ground.

A bank-angle scale is marked around the edge of the display and graduated up to 90 degrees.

Flight path vector

The VVI, represented by a winged circle, indicates the aircraft's flight path. Unlike the HUD VVI, it moves vertically only and does not indicate lateral drift.

Two short vertical lines appear below the symbol when the landing gear is down and locked.



The two chevrons indicate the aircraft's pitch attitude. When the VVI and the chevrons are vertically aligned, the angle of attack is zero.

Approach brackets

In approach mode, two brackets, `] [`, appear as shown above and indicate the emergency approach angle-of-attack reference, fixed at 12 degrees.

Unlike the adjustable target displayed on the HUD, the IPS brackets are fixed and appear only while approach mode is selected.

Airspeed and Mach

Indicated airspeed is displayed in knots in the upper-left corner, while the Mach number is shown in the lower-left corner.

Below 30 knots indicated, both indications are replaced by dashes (`---`).

Altitude

Indicated altitude is displayed in the upper-right corner, with the tens digit shown in a smaller font.

Barometric setting

The active barometric pressure setting is displayed below the altitude in hectopascals.

The Baro Setting Knob adjusts the pressure setting used by all aircraft instruments.

The Altimeter STD Button provides quick access to the standard pressure setting of 1013.25 hPa. When standard pressure is selected, `STD` is displayed in lieu of the pressure value.

Compass

The compass scale runs along the top of the display.

It is graduated every 5 degrees and labelled every 10 degrees. It always indicates magnetic heading.

Instrument test

Pressing the IPS Test Button runs a display test:

- Airspeed, Mach, altitude and barometric pressure fields are filled with nines.
- The compass indicates north.
- The attitude indicator shows a 10-degree left bank and a 10-degree pitch attitude.


999
35 36 01
99999
50
30
10
10
9.99
9999

IMC

Description

The IMC monitors the main engine parameters and the fuel supply status.

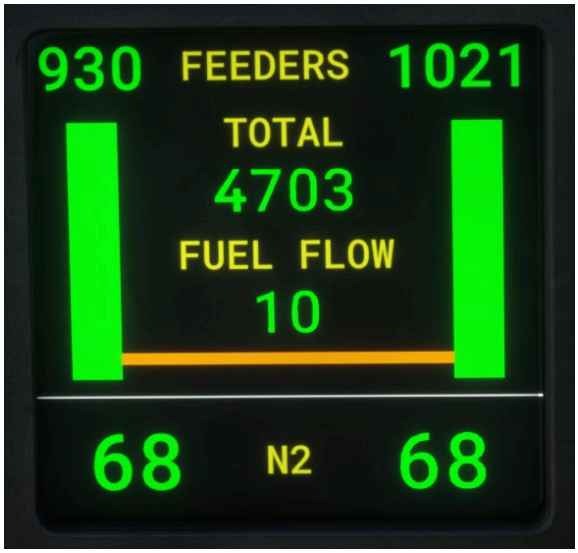
It is located on the main panel, and its brightness is adjusted using the IMC Brightness Knob.

Fuel

The upper section displays fuel-related information:

- `FEEDERS`: the quantity of fuel, in kilograms, remaining in the left and right feeder tanks. Each value is displayed beside a vertical gauge indicating the corresponding tank level.
- `TOTAL`: the total fuel quantity, in kilograms.
- `FUEL FLOW`: the combined fuel flow of both engines, in kilograms per minute.

A line between the two feeder tank gauges indicates whether the Feed Tanks Crossfeed Valve is open or closed.



Feed tanks crossfeed valve open

When the fuel quantity in either feeder tank falls below 250 litres, its readout and gauge are highlighted to warn the pilot of the low fuel level.

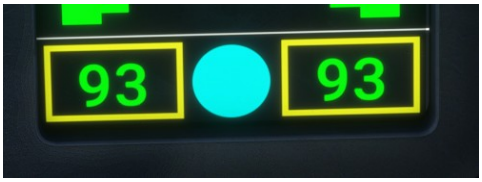
Engine and de-icing

The lower section displays the **N2** rotational speed of each engine as a percentage. The value is replaced by dashes when the corresponding engine is stopped.

The display also indicates specific engine conditions:

- A yellow border appears around the N2 value when the afterburner is active.
- The value turns red if the turbine temperature exceeds its limit of approximately 1,180 K.

A blue circle appears in the centre of the display when the ice protection system is active.



Head-up display

Description

The head-up display centralises the information required to fly the aircraft in all operating conditions.

It is the pilot's primary visual reference, as it remains within the forward field of view.

Common display

Essential flight information remains visible regardless of the selected mode.

Pitch ladder

The pitch ladder is organised around a continuous line aligned with the horizon.

Pitch is graduated every five degrees in both directions, with numerical labels every ten degrees.

Negative pitch lines are dashed and become progressively more vertical as the nose-down attitude increases, helping the pilot recognise an increasing descent angle towards the ground.

VVI

The velocity vector indicator (`VVI`) represents the aircraft's current flight path.

It can be interpreted as the projected point towards which the aircraft is moving.

On the Rafale HUD, the VVI remains horizontally centred relative to the pitch ladder. The ladder moves laterally to indicate aircraft drift.

Drift indication can be disabled using the drift cut-out function on the MG11 button. This may be useful during approaches in strong crosswinds.

The VVI uses a specific symbol when the landing gear is down and locked.

VVI with the landing gear retracted

VVI with the landing gear down and locked

Speed

Indicated airspeed is displayed in the upper-left corner, with a minimum displayed value of 30 knots.

The Mach number is displayed immediately below and appears only from Mach 0.4 onwards.

Altimeter

Aircraft altitude is displayed in feet inside a circular scale graduated in 100-foot increments.

The barometric setting appears below the altitude value while it is being adjusted using the Baro Setting Knob.

The `STD` indication remains displayed when standard pressure is selected.

Radio height

Radio height is displayed below the altimeter next to an `H`.

It disappears above 13,000 feet or when the aircraft pitch or bank angle becomes excessive, preventing the system from calculating a reliable value.

Longitudinal acceleration

The longitudinal acceleration brackets `> <` are displayed on either side of the VVI and move vertically according to the aircraft's acceleration or deceleration.

When the brackets are below the VVI, the aircraft is losing speed.

Their movement is limited to the visible area of the HUD.

When an engine is operating in afterburner, a second bracket appears on the corresponding side, changing `> <` into `>> <<`.

Acceleration brackets indicating a loss of speed

AOA and G-meter

The angle of attack, expressed in degrees, is continuously displayed on the left and identified by `AOA`.

The current load factor is displayed on the right and identified by `G`.

Heading indication

A heading ribbon is displayed along the top of the HUD. It shows the aircraft heading and track using either magnetic or true references, depending on the LD HSI setting.

A vertical line indicates the heading, while the triangle indicates the track.

Heading ribbon showing a five-degree deviation

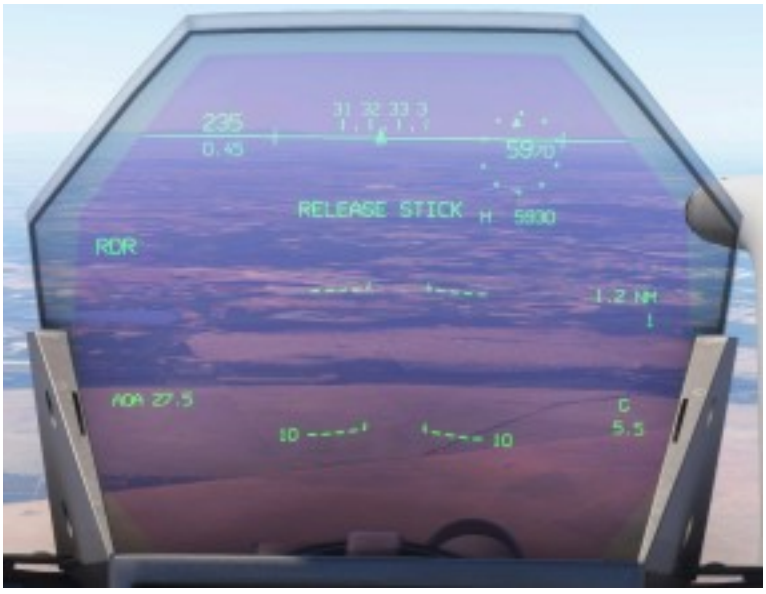
The horizon line is also graduated every ten degrees.

Alerts & alarms

The HUD repeats any active alerts or alarms, as described in the alarms section.

The only alert specific to the HUD, and therefore not shown on the other displays, is the safety height alert.

Level 2 alerts are displayed as flashing text in the upper-centre area of the HUD.

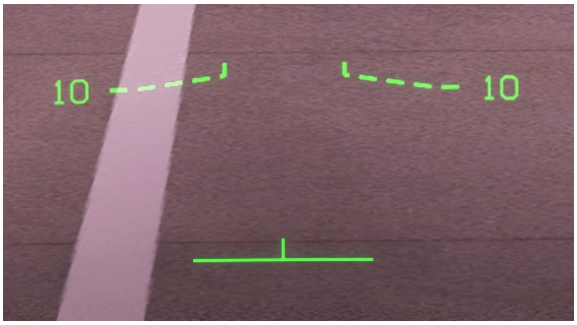


Alarms are displayed inside a box in the lower-right corner.

Takeoff display

The takeoff display supplements the standard flight information with dedicated references for the ground roll and initial climb.

A fixed pitch reference is displayed at 13 degrees to indicate the target pitch attitude during rotation.



Longitudinal acceleration is displayed in a box near the upper centre of the HUD. The value is expressed in `g` and allows the pilot to monitor acceleration during the takeoff roll. For reference, in a clean configuration and at full afterburner, the displayed value may reach approximately 0.8.

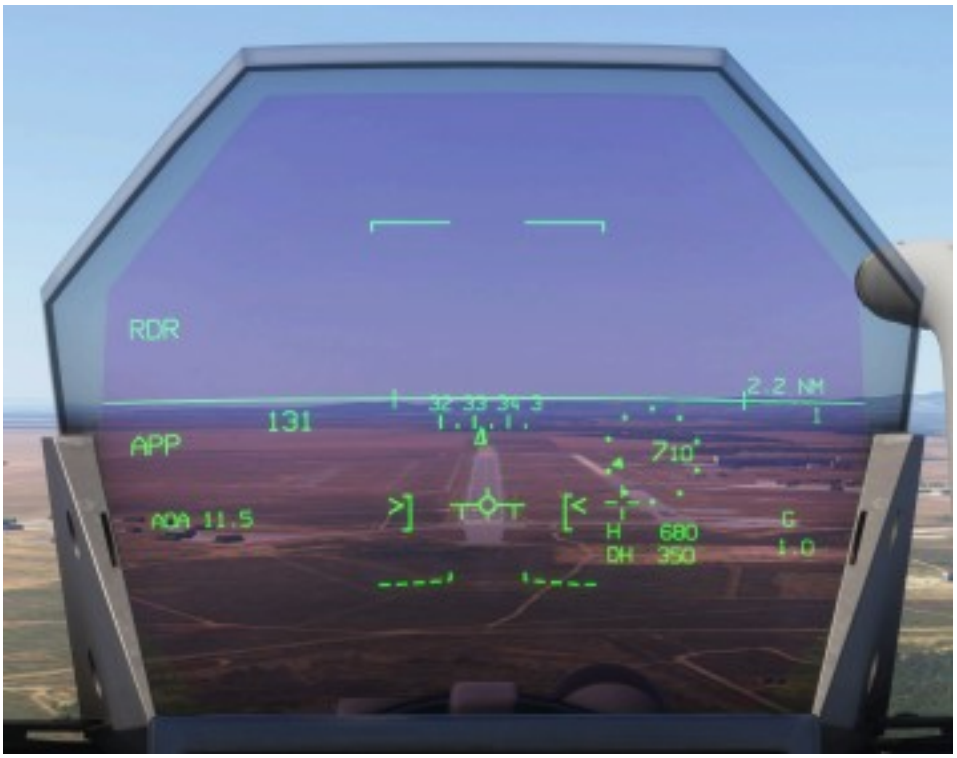
A vertical bar on the left indicates the aircraft's kinetic energy during the takeoff roll.

Approach display

This display is used when `APP` mode is active.

Approach mode reorganises the standard symbology so that the essential information is concentrated in the lower part of the HUD, closer to the pilot's view of the runway.

The airspeed, altitude and heading indications move to the lower part of the HUD.



Two brackets, `] [`, indicate the target angle of attack. This target uses the same setting as the autothrottle AOA hold mode.

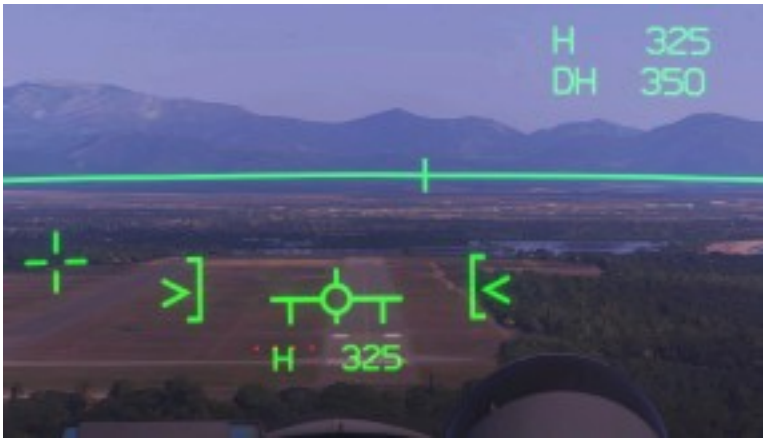
Aircraft aligned with the runway at the standard 16° AOA target and a stable speed

> **INFO**
>
> During an approach at a high angle of attack, you may need to raise the cockpit viewpoint to keep all HUD information clearly visible. Select the `Landing` camera from the cockpit views.

Decision height

The selected decision height (`DH`) is displayed below the radio-height indication.

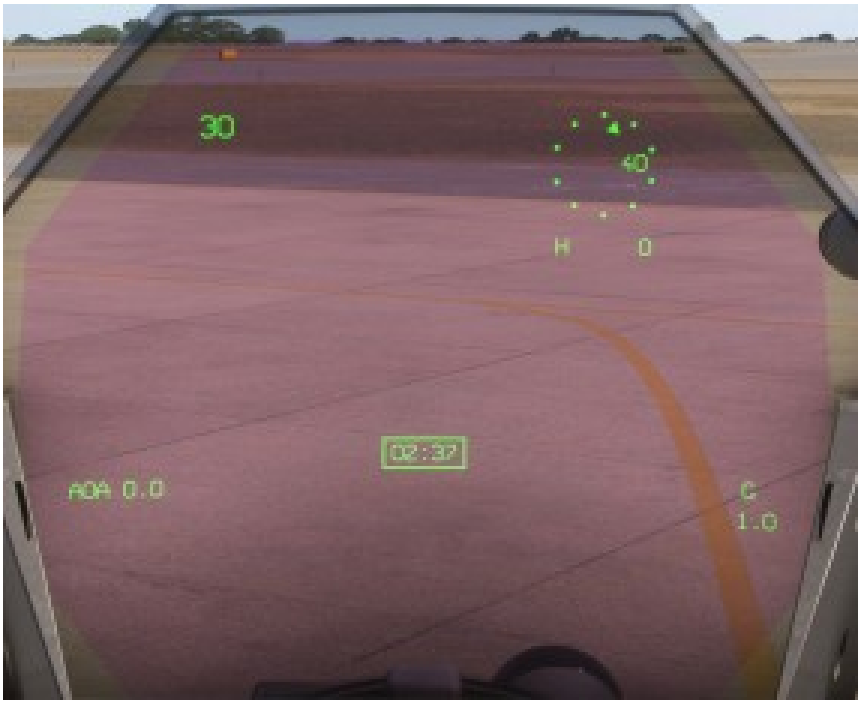
A second radio-height indication appears below the VVI and initially flashes when the aircraft descends below the selected decision height (either aircraft indicated altitude or radio height).



INS-related display

During INS alignment, the pitch and heading indications remain hidden until the system has reached a sufficient level of alignment.

A boxed countdown shows the remaining alignment time.



Navigation-related display

Primary goal

The primary goal number and its distance are displayed continuously on the right-hand side of the HUD.

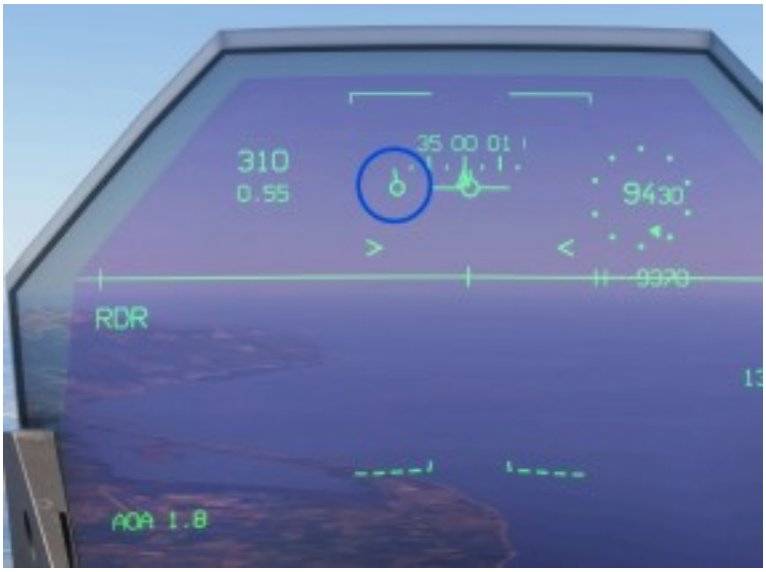
Primary goal number 1 and its distance

When the goal is less than 10 nm away, a cross indicates its position. The symbol is projected in three dimensions to improve spatial orientation.

Airport goal cross displayed on the HUD

> **NOTE**
>
> As explained in the flight plan section, some goals do not have an associated altitude constraint and are therefore projected at an altitude of zero.

A reticle consisting of a circle and a short line indicates the direction of the goal. Unlike the projected cross, this is a two-dimensional indication.



Route deviation

When a flight plan is active, route deviation is represented by two vertical lines forming a guidance corridor.

Placing the VVI inside this corridor guides the aircraft back towards the planned route and reduces cross-track error.

Guidance indicating a slight turn to the left to rejoin the planned route

ILS

ILS guidance and synthetic runway symbology assist the pilot during approaches in reduced visibility.

A flight plan containing a valid ILS approach must be configured for this symbology to appear.

Synthetic runway display

When the aircraft is within 20 nm of the airport, the approach is correctly configured and a valid ILS signal is available, the HUD projects a rectangle matching the runway dimensions onto the ground. A dashed line extends the runway centreline beyond the threshold.

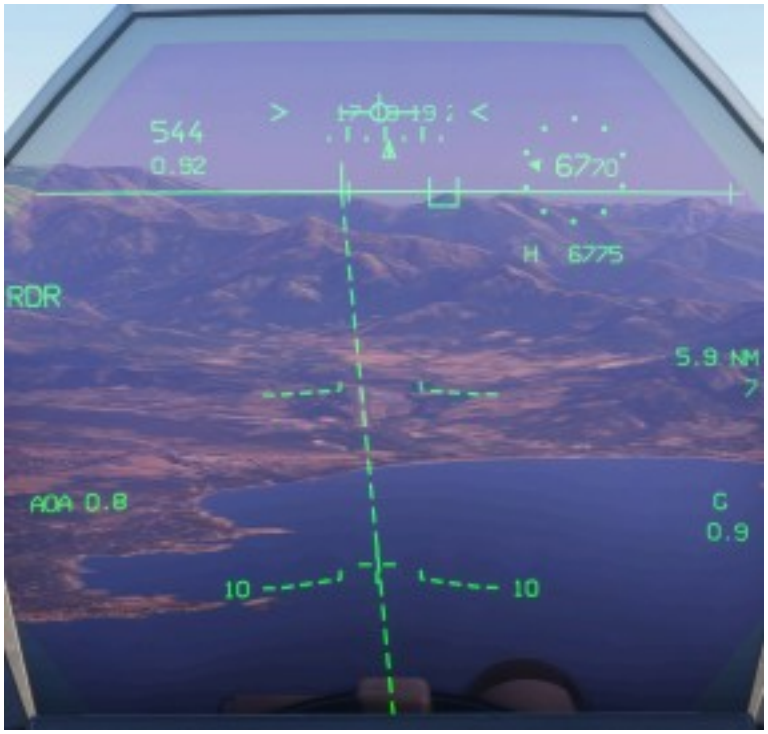
The projection disappears on short final.

> **WARNING**
>
> The synthetic runway depends on data supplied by the simulator. For some runways, this data may be inaccurate and contain lateral or longitudinal offsets of several metres, causing the projected runway to appear displaced from the actual runway.

Guidance

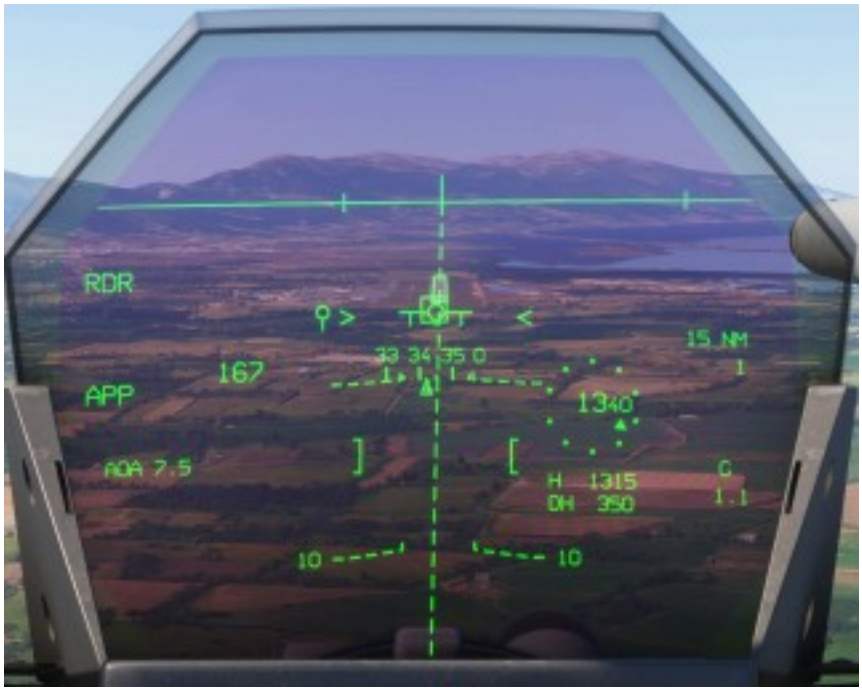
When a valid localizer signal is received, a U-shaped symbol appears on the horizon line and indicates lateral deviation from the localizer course.

Steering towards this symbol helps the pilot intercept and follow the correct lateral path.



Aircraft positioned to the left of the desired localizer course

When a glideslope signal is also available, the U-shaped symbol becomes a complete square and additionally indicates vertical deviation from the glideslope. It therefore provides combined lateral and vertical guidance towards the runway.



Aircraft established on the correct ILS approach path

When the deviation becomes too large, an arrow indicates the direction in which the pilot must manoeuvre to recover the ILS path.

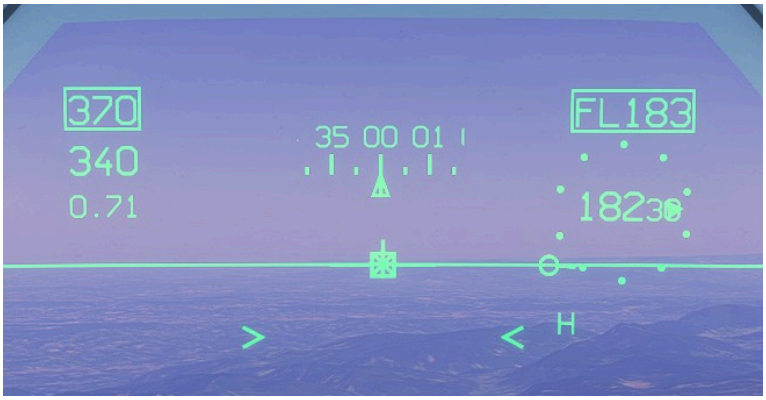
Guidance indicating a climb and a correction to the right to rejoin the approach path

Autopilot-related display

Autopilot-specific symbology is described in greater detail in the autopilot section.

Altitude and speed target

When the autopilot or autothrottle is active, the selected altitude and speed, or Mach number, are displayed inside boxes.



Flight director

The flight director is represented by an asterisk indicating the horizontal and vertical guidance commands required to reach the selected flight parameters.

When no correction is required, the VVI and the asterisk are superimposed.

Terrain following display

When terrain following is selected, an additional symbology layer appears on the HUD.

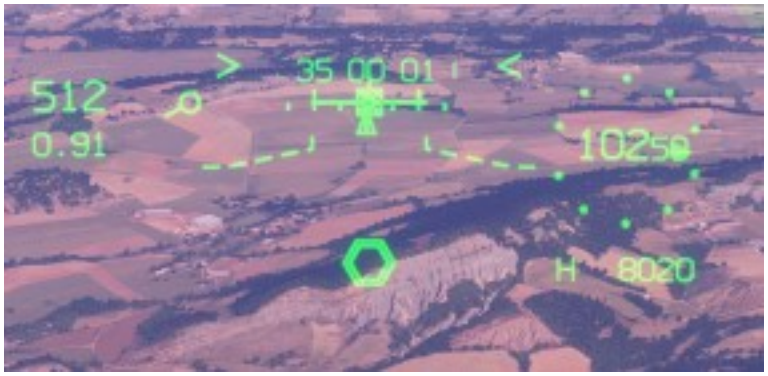
At the bottom of the HUD, a stepped pattern represents the relative elevation of the terrain ahead of the aircraft across nine scanning zones.

A raised section in the centre of the pattern indicates higher terrain directly ahead of the aircraft.

On the right, `RDR` or `DTS` indicates the data source used by the terrain-following system. The requested height (`RH`) is displayed immediately before it and is enclosed in a box when the autopilot is actively controlling the aircraft in `TF` mode.

Before terrain interception, a double hexagon indicates the flight-path reference required to engage terrain following. When the VVI crosses the double hexagon, the interception begins.

Once the terrain-following path has been captured, the double hexagon changes into a double circle superimposed on the VVI, indicating that automatic terrain following is active.



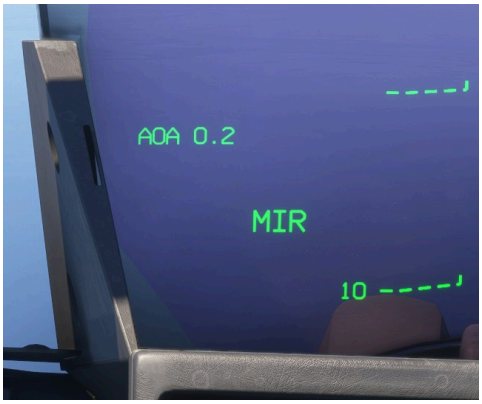
VVI approaching the double hexagon, terrain interception imminent

Air-to-air display

`A/A` mode is divided into several sub-modes: `IDF`, `MIR`, `MIF` and `GUN`.

Cycle through these modes using MG6.

The active mode is displayed in the lower-left corner of the HUD.



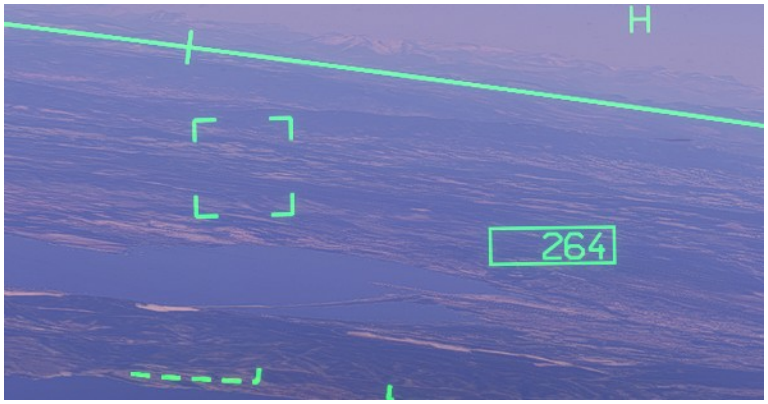
Target designation is performed on the center display, as explained in the weapons section.

> **NOTE**
>
> The symbology has been deliberately simplified to remain consistent with the intended simulation scope while retaining the information required to use the system.

Common symbology

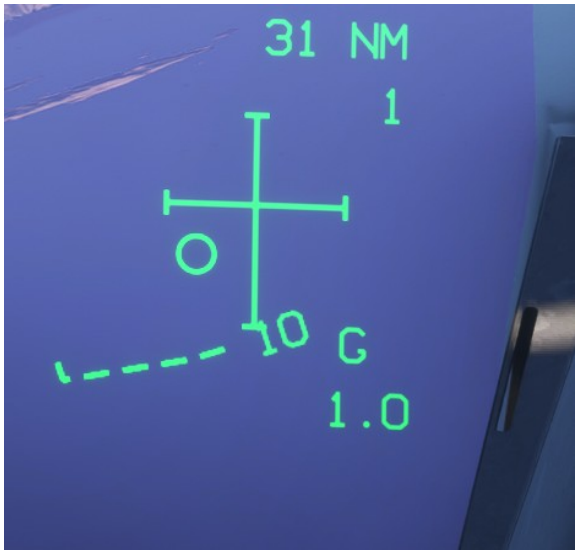
Some symbols are shared by several sub-modes.

When a target is selected, its relative speed is displayed in knots inside a box on the center-right side of the HUD. A positive value indicates that the distance between the aircraft and the target is decreasing.



Target closing at a relative speed of 264 knots

A large cross indicates the direction of the selected target relative to the aircraft. The target itself is represented by a small circle.



Target located below and to the left of the aircraft

IDF mode

Identification mode is used to track targets without arming a weapon. It is primarily intended for air-policing and identification scenarios.

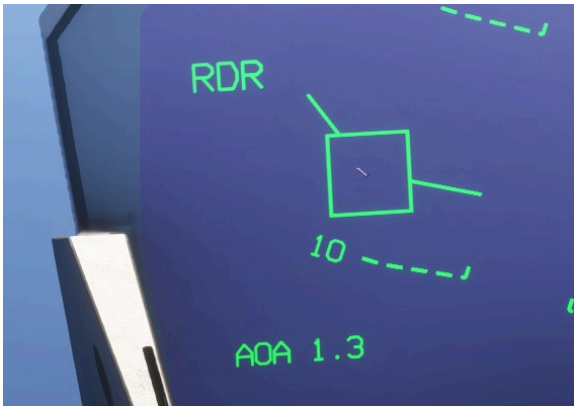
The tracked target is represented by a square.

MIR mode

This mode is used for MICA IR employment.

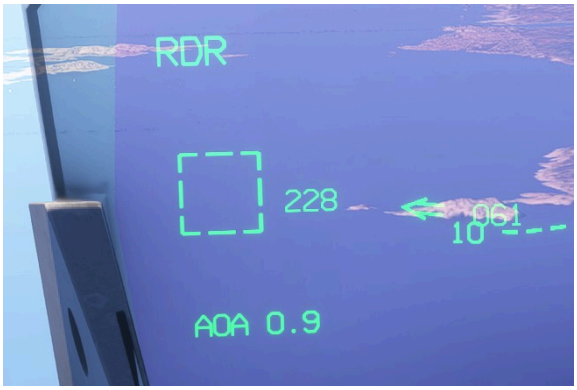
When the target is tracked by the radar, it is represented by a square with two additional lines:

- One represents the target's velocity vector.
- The other represents the line of sight between the aircraft and the target.



When the target is outside the HUD field of view, the square becomes dashed and the following indications are displayed:

- The target's computed track, in degrees.
- An arrow indicating the direction of the target.
- The heading difference between the aircraft and the target.



In addition to the common symbology, a range scale with a moving cursor indicates the distance to the target in nautical miles. The scale also represents the simulated weapon engagement envelope and helps determine an appropriate launch point.

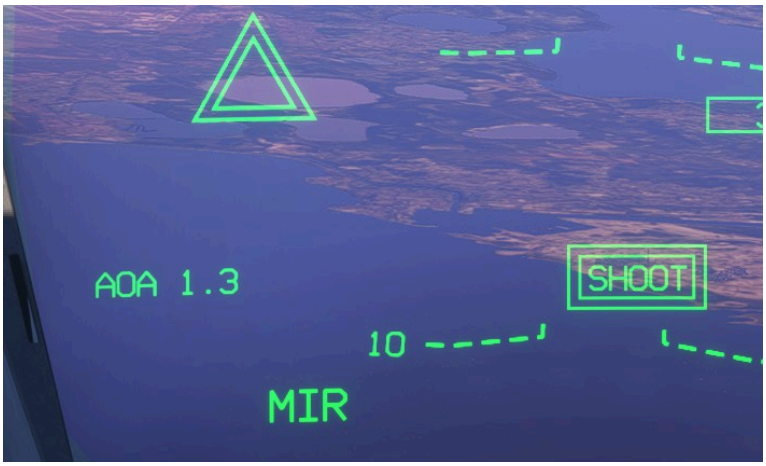
At the bottom of the HUD, the letters `L` and `R` represent the two MICA IR missiles that can be carried on the wingtip stations. A circle appears around a letter when the corresponding missile is ready.

When the target is tracked by both the radar and the missile's infrared seeker, a circle appears inside the target square.

When the system determines that the target is within the simulated engagement envelope and the launch conditions are suitable, a `SHOOT` cue appears on the HUD.

Target tracked by the radar and missile seeker, with the left MICA IR ready to fire

Once the missile has been fired, the `SHOOT` cue is enclosed by two rectangles.



MIF mode

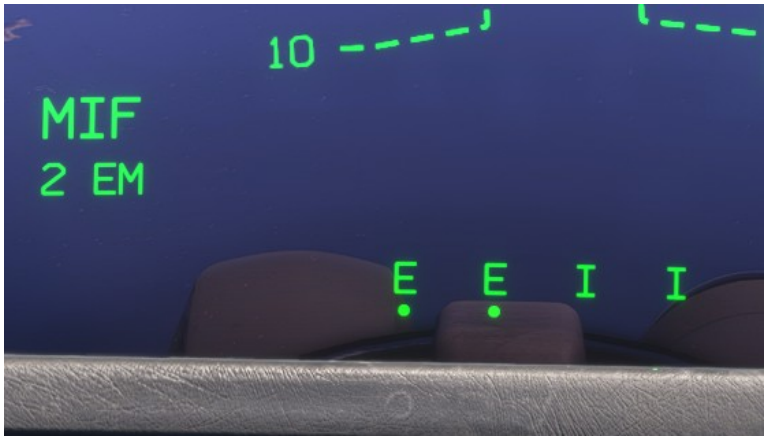
This mode is used for radar-guided missile employment. Its symbology is similar to `MIR` mode, with several differences.

Each available missile is represented at the bottom of the HUD:

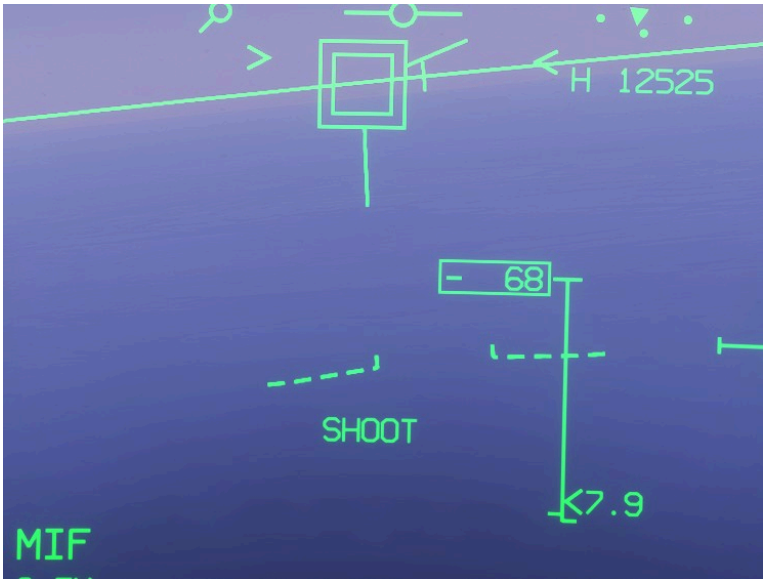
- `E` represents an electromagnetic-guidance missile, either a MICA EM or a Meteor.
- `I` represents an infrared-guided MICA IR.

- A small dot above the letter indicates that the missile is carried on a ventral station.

The number of available electromagnetic-guidance missiles is displayed below the `MIF` indication.



When the target is tracked by both the radar and the selected missile, it is represented by a double square.



GUN mode

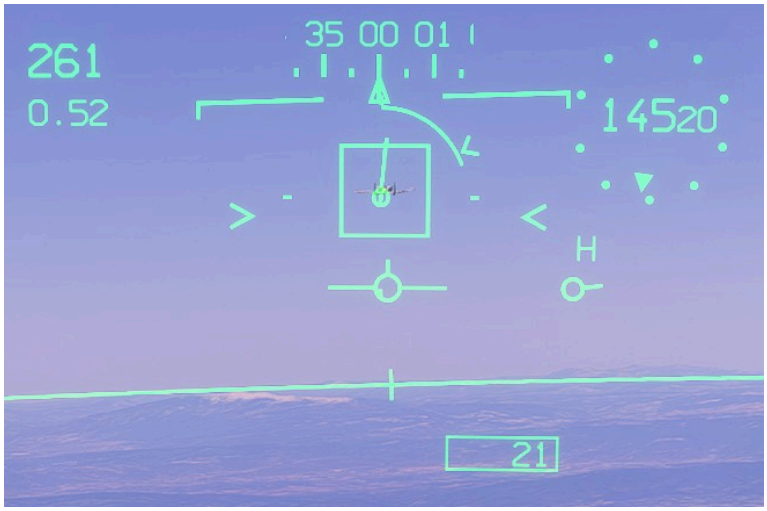
The gun display adds the following elements:

- A predicted shell-trajectory line showing where rounds would travel if the gun were fired immediately.
- When the target is less than 1 nm away, a gunsight moves along this line according to the target range. It includes:
  - A target-tracking square when the target is radar-tracked.
  - A range circle indicating the distance to the target, with each quarter representing 0.25 nm.

    - A `>` marker showing the predicted target range in five seconds. When the marker is outside the range circle, the target is moving away; when it is inside, the target is closing.

- The remaining ammunition count, which disappears when no rounds remain.

If the predicted shell-trajectory line intersects the target, firing at that moment should result in a hit within the limits of the simulation.



Air-to-surface display

`A/S` mode is divided into several sub-modes: `AGB`, `AGM` and `GUN`.

Cycle through these modes using MG6.

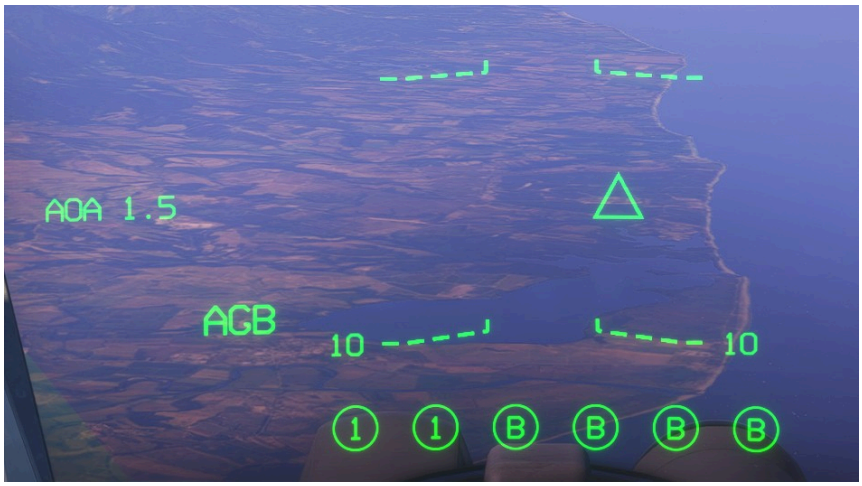
The active mode is displayed in the lower-left corner of the HUD.

AGB mode

This mode is used for GBU-12 and AASM employment.

The bombs carried by the aircraft are listed at the bottom of the HUD. When a bomb is ready and a surface target has been designated, its `B` indication changes to `1`.

The designated target is represented by a projected triangle.

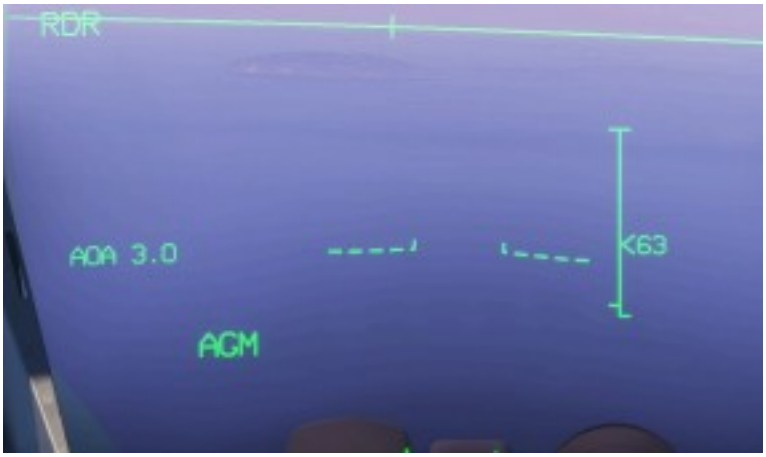


Six bombs carried, with two prepared for release

AGM mode

This mode is used for SCALP cruise missile employment.

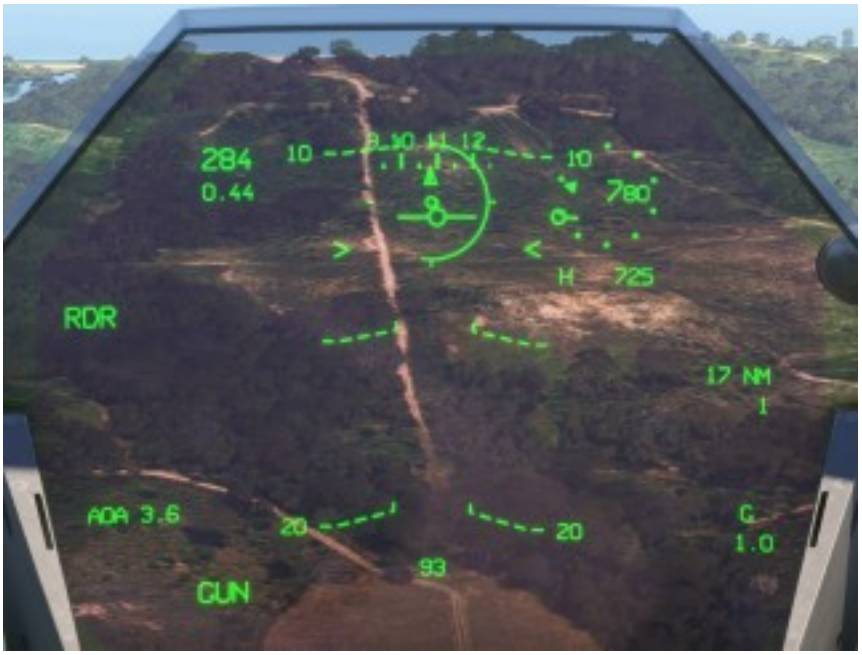
Once a target has been designated, a range scale indicates the simulated optimal missile launch envelope.



GUN mode

The symbology is similar to the `A/A` gun display, except that no target is tracked.

The range circle indicates the calculated distance to the ground impact point.


284
0.44
10
8 10 11 12
10
780
H 725
RDR
17 NM
1
AOA 3.6
20
20
G
1.0
93
GUN

Head center display

Description

The center display is positioned directly below the HUD and close to the pilot's normal line of sight.

It is built around a map that presents navigation data and the tactical situation.

Its brightness is adjusted using the HCD Brightness Knob.

The upper-right corner displays the current safety height, the selected map range in nautical miles and the aircraft's ground speed.

Own aircraft

The aircraft is represented by a green triangle with a line indicating its current direction of travel.

The length of the line varies according to the aircraft's ground speed.

Compass

The display is surrounded by a compass rose graduated every 10 degrees and labelled with the four cardinal directions (`N`, `E`, `S` and `W`).

The rose rotates according to the aircraft heading, which may be magnetic or true depending on the LD HSI setting. The current heading value is displayed above the rose.

The distance between the center of the display and the compass rose corresponds to the selected range shown in the upper-right corner. The available range settings are 2, 5, 10, 20, 40, 60, 80 and 120 nm. The thin brown circle represents half of the selected range.

The appearance and position of the compass rose vary depending on whether the centered view mode is active.

Compass rose in the second display mode

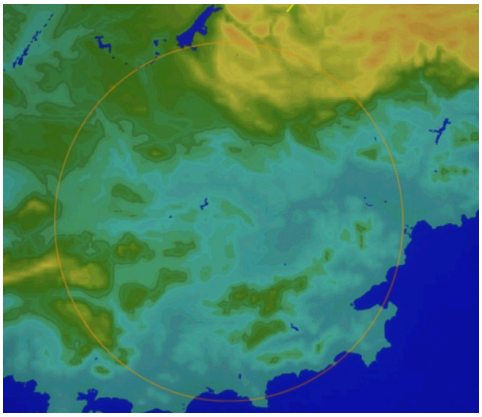
Map

Four different map backgrounds are available. Airspace zones can be superimposed on any of them.

The default background is entirely black and does not display any topographic information.

The second background is black, with bodies of water shown in blue.

The third background is a topographic map that uses colour variations to represent terrain elevation.



A fourth option is available specifically for metropolitan France: the DIRCAM CAM chart, which is used for military air traffic circulation.

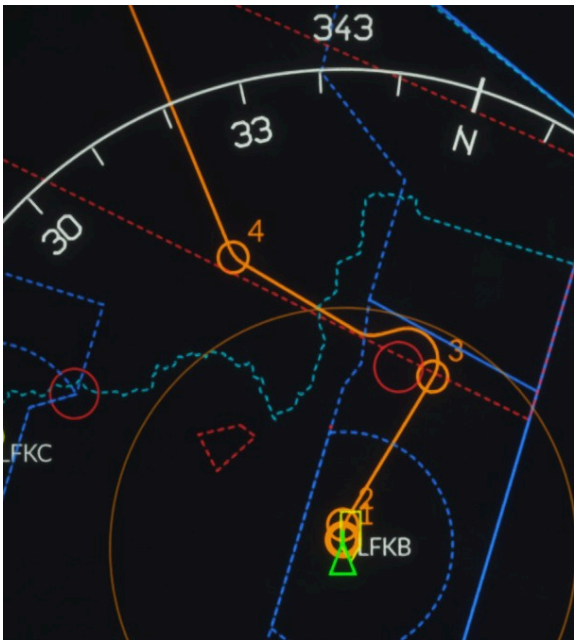
> **NOTE**
>
> The military CAM map (France) integrated in the avionics is courtesy of DIRCAM (Direction de la circulation aérienne militaire) and is used with authorization.

Map opacity can be adjusted using the HCD Map Opacity Knob.

Navigation data

Airports with paved runways are displayed on the `HCD`. A yellow symbol represents the orientation of the longest runway.

The flight plan is represented by an orange line, with each waypoint shown as a circle and labelled with its corresponding database number. The primary goal, which is the active waypoint, is represented by a thicker circle.



Marker goals are represented by a cross together with their database number. They are created at the current HCD cursor position using `MGP4`.

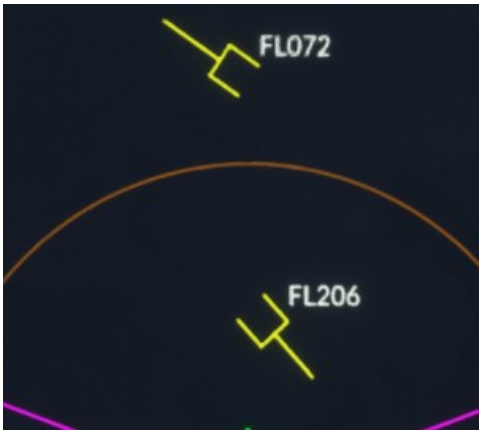
The active bullseye is represented by two concentric green circles with a cross at the center.

Goals 2 and 3 are marker goals, with goal 3 selected as the bullseye

Traffic

As explained in the radar section, traffic detected by the radar is displayed on the `HCD` together with its calculated altitude.

Traffic callsigns can also be displayed as an option.



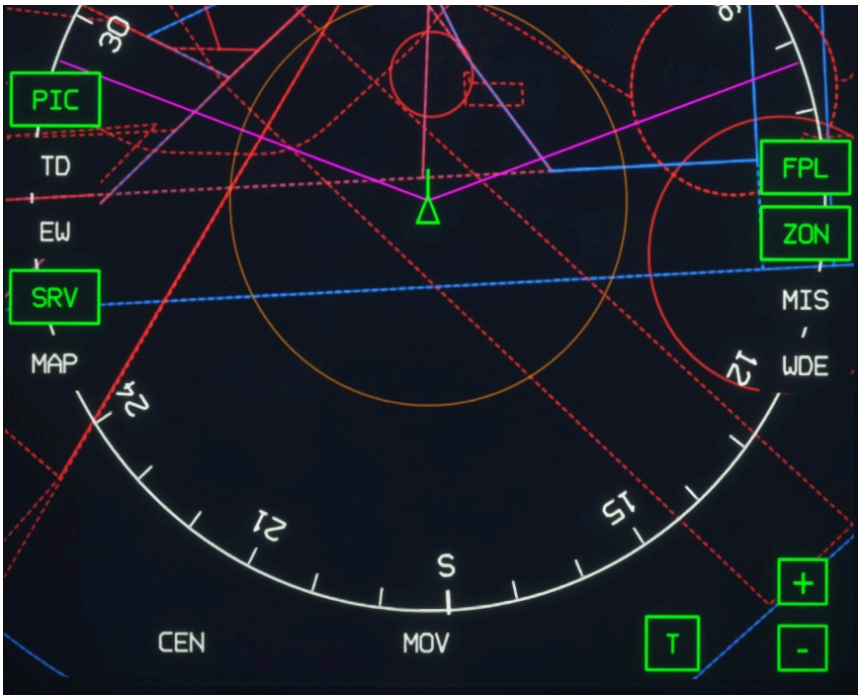
Settings

When the pointer is moved over the display, several buttons appear and provide access to the display settings.

Some buttons have active and inactive states. Active buttons are outlined in green.

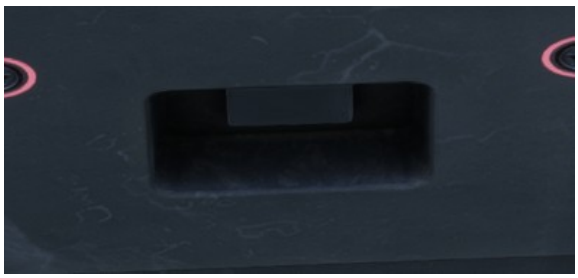
- `PIC`: toggles the display of callsigns above traffic symbols.
- `TD`: activates target designation mode.
- `SRV`: toggles surveillance mode and the display of detected traffic.
- `MAP`: cycles through the available map backgrounds.
- `FPL`: toggles the flight plan display.
- `ZON`: toggles the display of airspace zones.
- `CEN`: toggles the centered view mode.
- `MOV`: activates moving-map mode.
- `T`: toggles between track-up and north-up orientation.
- `+/-`: zooms the map in or out. This provides the same function as MGP3.

The remaining buttons are not functional in the current implementation.



Declutter

Pressing the button located below the `HCD` declutters the display by hiding airport symbols.



Declutter button

Cursor

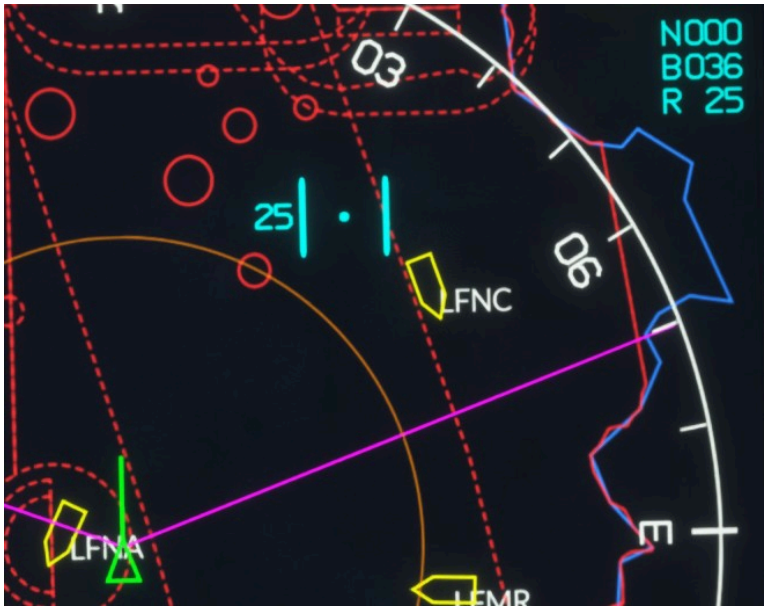
Clicking on the map places a cursor represented by a blue dot and two blue lines.

The cursor is used to designate elements on the display.

The distance from the aircraft to the cursor is shown in nautical miles to the left of the cursor.

The upper-right corner of the display shows:

- `B`: bearing from the aircraft to the cursor.
- `R`: range from the aircraft to the cursor.



Cursor located 25 nm away on a bearing of 36°

When a bullseye is active, the information box in the upper-right corner displays:

- `N`: database number of the goal used as the bullseye.
- `B`: bearing from the aircraft to the bullseye.
- `R`: range from the aircraft to the bullseye.

Bullseye assigned to goal number 2

A2D view

The LD DAS page allows two additional views to be displayed at the bottom of the screen:

- The expanded view, which provides a magnified view centered on the aircraft.
- The `A2D` view, which displays the vertical tactical situation. It shows radar-detected traffic and their vertical movement using the same range scale as the main map. The radar coverage limits are represented by magenta lines.

HCD with the expanded view and A2D view displayed

Lateral display

The aircraft has two lateral displays, one on each side of the main panel: the left lateral display (`LLD`) and the right lateral display (`RLD`). The two displays operate independently.

Each display shows one page at a time. A page is dedicated to a specific system or function, such as engines, fuel, hydraulics, navigation, communications, weapons, autopilot or failures, and provides the information and controls required to monitor and operate it.

When the DC shed bus is isolated and only the left lateral display remains powered, the page previously shown on the `RLD` is automatically transferred to the `LLD`. Under normal conditions, some pages can only be displayed on the right lateral display, including the engine and fuel pages.

Color logic

All lateral display pages use the same colors and visual conventions:

- A selected function or item is surrounded by an outline.
- Amber indicates that a function or item is inactive or unavailable.
- Green indicates that a function or item is active.
- Red indicates a failure.
- Magenta indicates data that can be modified.

Page selection

As explained in the PDS1 section, PDS1 provides access to several pages displayed on the `LLD`.

In addition, two multidirectional switches provide quick access to the most commonly used pages.

The LLD Page Selection Switch provides access to:

- `WPN`: opens the weapons page.
- `AP`: opens the autopilot page.
- `FAIL`: opens the failures page.

- `INFO`: opens the database details page when the HCD cursor is positioned over a database goal on the map.

LLD page selection switch

The RLD Page Selection Switch provides access to:

- `HSI`: opens the HSI page.
- `ECM`: opens the ECM page.
- `FUEL`: opens the FUEL page, which also provides access to the engine, hydraulic and other system pages.
- `SA`: opens the SITAC page.

RLD page selection switch

> **TIP**
>
> The right selection switch is hidden behind the control stick. You can temporarily hide the stick by clicking its base.

> As multidirectional switches can be difficult to operate in MSFS, the interaction is not performed by clicking and moving the switch itself. Instead, click directly on the label corresponding to the page you want to open.

Visualization knobs

Adjustable values shown on the lateral displays can be modified using the LLD Visualization Knob or the RLD Visualization Knob.

This knob is also used to scroll through different items in the page.

Left visualization knob

Adjustable values are displayed in magenta, as described in the color logic section.

To modify a value:

1. Click the value. A blue circular arrow appears around it.

2. Turn the visualization knob located beside the display being used. You can click and drag the knob, or use the mouse wheel to adjust the value more quickly.

3. Press the knob to confirm the new value. The change is not applied until the knob is pressed. To cancel the adjustment, click the selected value again before confirming.

Pages

Select any page below to view its complete description and operating details.

AP

Autopilot

COM

Communication

DAS

Display settings

DB

Database

ECM

Electronic counter-measures

ENG

Engine

FAIL

FM

Flight plan modification

FPL

Flight plan

FUEL

Fuel

HSI

Horizontal situation indicator

HYD

Hydraulic

IFF

IFF

IMA

Imagery

MISC

Miscellaneous

NAV

Navigation

POS

Position

PRP

Preparation

SITAC

Tactical situation

SYS

WDNS

Aircraft systems state

WPN

Weapons

AP

Description

The autopilot page is used to manage the autopilot, autothrottle and terrain-following system, while displaying their current status.

Detailed information about autopilot operation is available in the autopilot section.

To display this page, move the LLD Page Selection Switch to the `AP` position. You can also use PM11.

Autopilot

A mode is selected by clicking its shape or label.

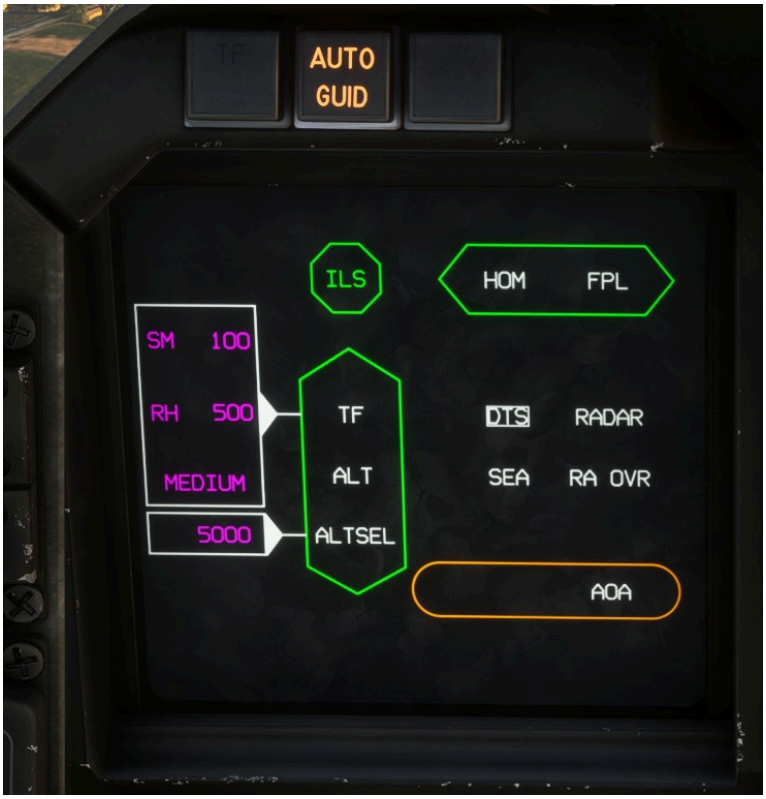
An active mode is highlighted in green, while a mode that is armed but not yet active is outlined.

Engagement

The main autopilot controls both vertical and lateral guidance. Clicking either the vertical or lateral shape engages or disengages the autopilot.

Clicking the autothrottle shape engages or disengages the autothrottle.

When `APP` mode is active, an `ILS` octagon appears. Clicking it engages the approach mode if a valid ILS signal is available.



Vertical modes

`ALT`, `ALTSEL` and `TF` can be toggled by clicking their respective labels.

Lateral modes

`HOM` and `FPL` can be toggled by clicking their respective labels.

Autothrottle

The autothrottle shape displays the active autothrottle mode: `KT`, `M` or `AOA`.

Clicking the mode label switches between `KT` and `M`.

When the landing gear is down, only `AOA` mode is available.

Terrain following

The terrain-following settings are located on the center-right side of the page:

- `DTS`: uses the aircraft's internal topographic data as the terrain source.
- `RADAR`: uses radar-derived terrain data.
- `SEA`: enables terrain following over the sea.
- `RA OVR`: a special radio-altitude-related option that is not implemented in the simulator.

Terrain following using the DTS source

COM

Description

The communication page is used to manage the aircraft's two radios, `R1` and `R2`, and their associated frequencies.

This page is displayed from the PDS1.

Radio

Each radio, `R1` and `R2`, has an active frequency and a standby frequency. They correspond to `COM 1` and `COM 2` in the simulator.

The active frequency is displayed at the top and enclosed in a rectangle. The standby frequency is displayed below it.

Both frequencies can be adjusted using the visualization knob.

Click the arrow to swap the active and standby frequencies.

Data link

`DTL1` and `DTL2` each contain a channel number between 1 and 99.

These values have no effect in the simulator, as the data link is not simulated.

DAS

Description

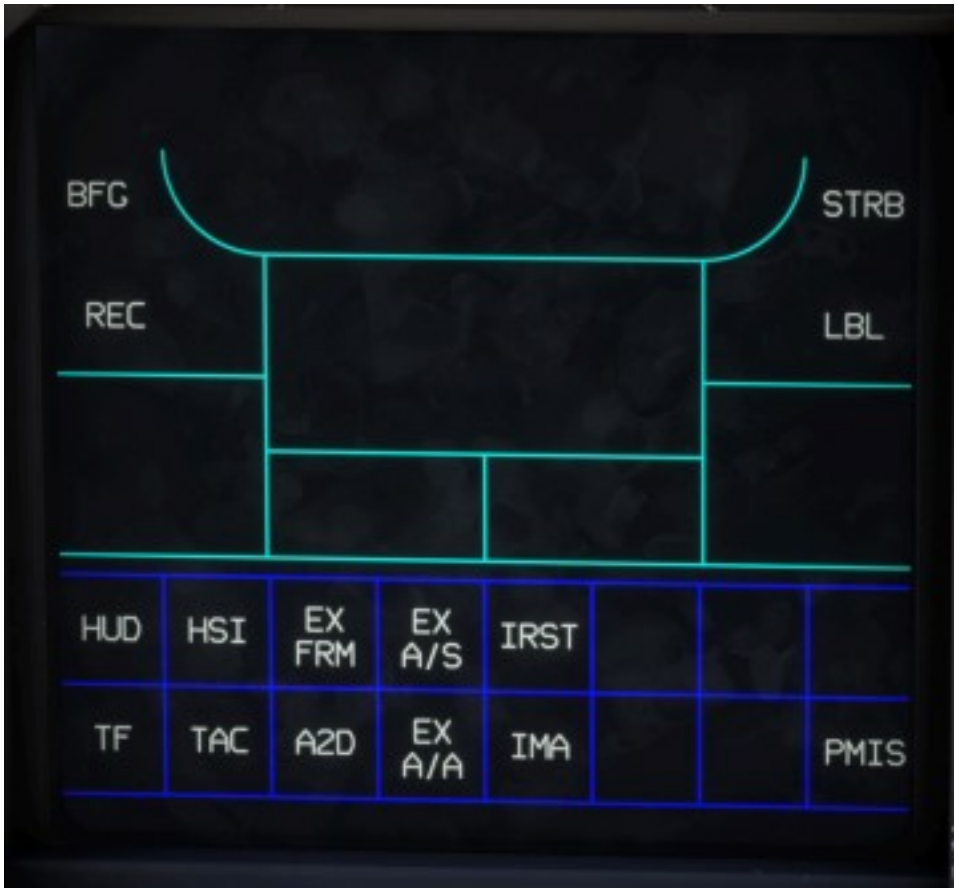
The DAS page provides access to specific display options for the `HCD` and the lateral displays.

This page is displayed from the PDS1.

The cyan diagram represents the avionics display layout:

- `HUD` at the top.
- `HCD` below it, divided into three areas.
- `LLD` and `RLD` on either side.

The table at the bottom contains the display options that can be assigned to specific areas of the layout.



The other options (`BFG`, `REC`, `STRB` and `LBL`) are not functional in the current implementation.

Operation

To assign an option to a display area:

1. Select the desired option. The areas to which it can be assigned are highlighted with a dashed magenta outline.

2. Select the area to which you want to assign the option. Green text confirms that the option has been assigned successfully.

In this example, the A2D view has been assigned to the lower section of the center display.

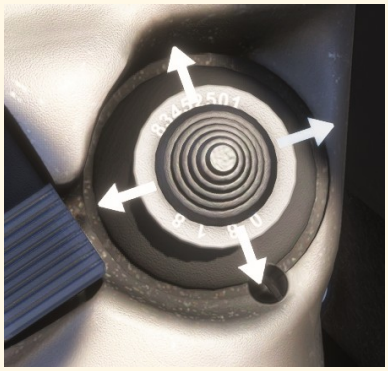
To remove an option from an area, select the option again and then select the area to which it is currently assigned.

⚠ WARNING

When an option is assigned to a lateral display, it is not displayed immediately, as this would cause the DAS page to disappear.

Use PM10 to display the assigned page:

- Move it to the left to display the option assigned to the `LLD`.
- Move it to the right to display the option assigned to the `RLD`.



The available options are:

- `HSI`: assigns the HSI page to a lateral display.
- `TAC`: assigns the SITAC page to a lateral display.
- `IMA`: assigns the IMA page to a lateral display.
- `A2D`: displays the A2D window on the center display.
- `EX FRM`: displays the expanded formation view on the center display, providing a magnified view centered on the aircraft.
- `EX A/S`: displays the expanded air-to-surface view on the center display. In the current implementation, it is identical to `EX FRM`.

- `EX A/A`: displays the expanded air-to-air view on the center display. In the current implementation, it is identical to `EX FRM`.

The remaining options are not currently implemented.

DB

Description

The database page allows you to view all goals stored in the avionics database.

This page can be opened from PDS1.

As described in the navigation section, each goal belongs to one of the following types:

- `APT`: airport goal.
- `UPD`: update goal.
- `MRK`: marker goal.
- `NAV`: navigation goal.
- `A/S`: air-to-surface goal.

Click a goal type to display the list of corresponding goals. The currently selected type is highlighted in green.

Each goal entry displays:

- `WPT`, or `DEST` if the goal is currently the primary goal.
- The goal number, between 1 and 999.
- The goal name.

Details page

Click a goal to open its details page.

The top of the page displays the goal number, name and type.

The following information is also displayed:

- Goal latitude in DDM format.
- Goal longitude in DDM format.
- Goal altitude in feet, only when the goal is an airport.

The `TGT` button assigns the goal as the current surface target for weapon delivery.

The `LIST` button returns to the main database page.

Editing

Only `MRK` and `A/S` goals can be edited.

On the details page, editable coordinates are displayed in magenta.

The goal can also be deleted by clicking `DELETE`.

To edit a coordinate, click it. The selected coordinate is enclosed in a magenta rectangle, and a keypad appears.

Three buttons are available:

- `RET`: cancels the operation and retains the existing coordinate.
- `DEL`: deletes the last character entered.
- `ENT`: validates and applies the entered coordinate.

The cardinal direction letter can be entered before, during or after the numerical value.

If an invalid coordinate is entered, the border turns red when validation is attempted.

ECM

Description

This page is dedicated to the countermeasures managed by the aircraft's self-defense system.

It is displayed with RLD Page Selection Switch.

Most of its functions are intentionally non-functional, as not possible in MSFS, which is not a military simulator.

The only functional setting is the flare dispensing program.

Nine different programs are available, each producing a different flare release sequence.


MAN

ENG

Description

The engine page is often displayed, as it provides the main operating parameters for both engines.

To access it, move the RLD Page Selection Switch to the `FUEL` position, then select the ENG page.

Shortcuts at the bottom of the page provide access to the MISC, HYDR, FUEL and WDNS pages.

The engines are described in greater detail in the engines section.

The gauges display `**` until the engine control units (ECU) receive electrical power. This occurs when the aircraft is powered by the GPU or when the engines are running.

Display with the engine control units unpowered

Engine parameters

The following parameters are displayed for each engine.

N1

Low-pressure spool speed, expressed as a percentage.

The value turns amber at 103% and red at 105% to indicate an overspeed condition.

T49

Turbine temperature measured between the high-pressure and low-pressure turbines, expressed in Kelvin.

The value turns red above 1184 K, or above 1198 K when the afterburner is active.

N2

High-pressure spool speed, expressed as a percentage.

The value turns amber at 103% and red at 105% to indicate an overspeed condition.

A8

Exhaust nozzle opening, expressed as a percentage of its maximum area.

An inner ring inside the gauge provides a visual representation of the nozzle position and expands as the nozzle opens.

The indication turns magenta when the afterburner is active.

At idle, the nozzle is approximately 90% open. It progressively closes as thrust increases in dry power, then opens fully when the afterburner is engaged.

F/F

The fuel flow of each engine, expressed in kilograms per minute and labelled `F/F`.

TT

Total temperature, expressed in degrees Celsius and labelled `TT`.

FAIL

Description

The failure page, also referred to as the alarm page, lists the alarms currently active on the aircraft.

To display this page, move the LLD Page Selection Switch to the `FAIL` position.

When no alarm is active, the page displays `OK`.

For each alarm, the page provides a description of the failure, the procedure to follow and any applicable flight limitations.

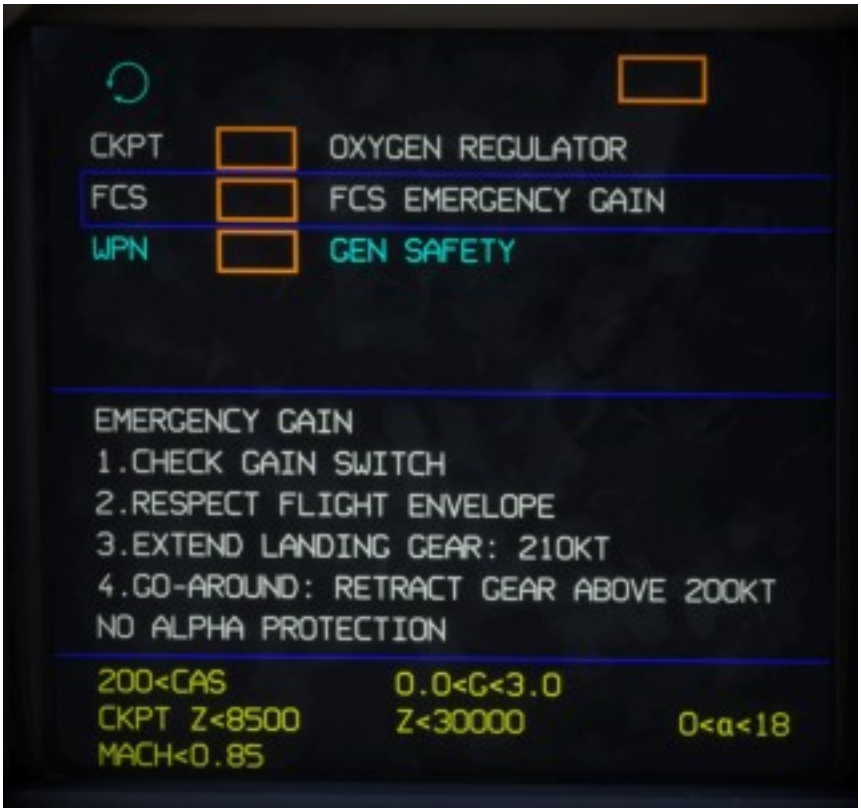
The alarm system is described in greater detail in the alarms chapter.

Alarm list

Each active alarm is displayed on a separate line, together with the affected system, its severity symbol and a short description of the failure.

Turn the visualization knob to scroll through the list and display more information about each alarm. Up to five alarms are visible at a time. A circular arrow appears when additional alarms are available.

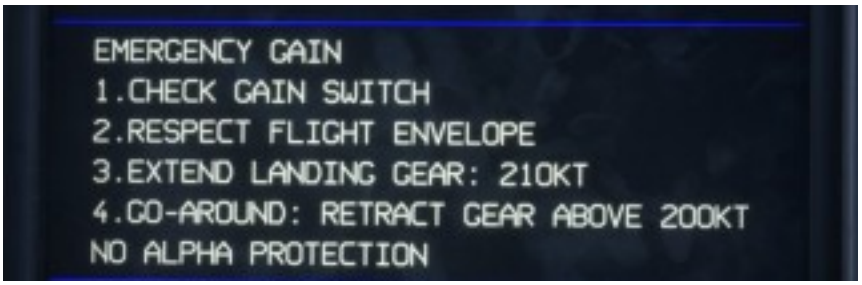
A newly triggered alarm is displayed in white. It can be archived by clicking the procedure area. The alarm then moves to the end of the list and its text changes to cyan.



Procedures

The procedure associated with the selected alarm is displayed below the list.

It provides immediate corrective actions and guidance for continuing the flight safely.



Flight limitations

The lower section displays the flight limitations imposed by the currently active alarms.

These limitations are calculated from all active alarms to prevent the aircraft from operating outside its permitted flight envelope.

The following parameters may be subject to limitations:

- Indicated airspeed.
- Mach number.
- Altitude.
- Cabin altitude.
- Load factor.
- Angle of attack.

FM

Description

The flight plan modification page is similar to the FPL page, but it also provides flight plan editing functions.

This page can be opened from PDS1.

Most of the information displayed is identical to the FPL page. A shortcut labelled `FPL` is available at the bottom of the page to return to it.

RQST page

Clicking any flight plan leg opens its RQST page.

This page displays the following information for the selected waypoint:

- Estimated time of arrival.

- Estimated fuel remaining on arrival.
- Leg altitude.
- Leg ground speed.

Several buttons are available for editing the flight plan:

- `DTO`: creates a direct-to leg to the selected waypoint.
- `INSERT`: inserts a waypoint before or after the selected waypoint.
- `DELETE`: removes the selected waypoint from the flight plan.

Flight plan operations, including inserting and deleting waypoints, are described in the navigation section.

The `FPL` button returns to the main FM page.

FPL

Description

The flight plan page displays the active flight plan and provides information about each leg.

This page can be opened from PDS1.

The flight plan cannot be modified from this page. Editing functions are available on the VTL FM page.

Further information about flight plan management is available in the navigation section.

Leg information

The page displays all flight plan legs. Up to four legs are visible at a time, and the list can be scrolled using the visualization knob.

The active leg, whose destination is the current primary goal, is displayed in green.

Each leg displays its target speed, as configured on the preparation page.

The displayed altitude is based on the cruise altitude entered on the preparation page, while also accounting for any altitude constraints associated with specific waypoints, such as those included in some departure procedures. Non-cruise waypoints without an altitude constraint do not display an altitude.

> **NOTE**
>
> As a reminder, the aircraft does not provide vertical navigation guidance.

For each upcoming leg, the page displays the estimated fuel remaining, in kilograms, calculated using the current fuel flow and ground speed. The estimated time of arrival is also displayed.

At the bottom of the page, `RESERVE` indicates the estimated amount of fuel that would remain upon reaching the end of the flight plan.

`REF TIME` displays the current time used as the calculation reference.

FUEL

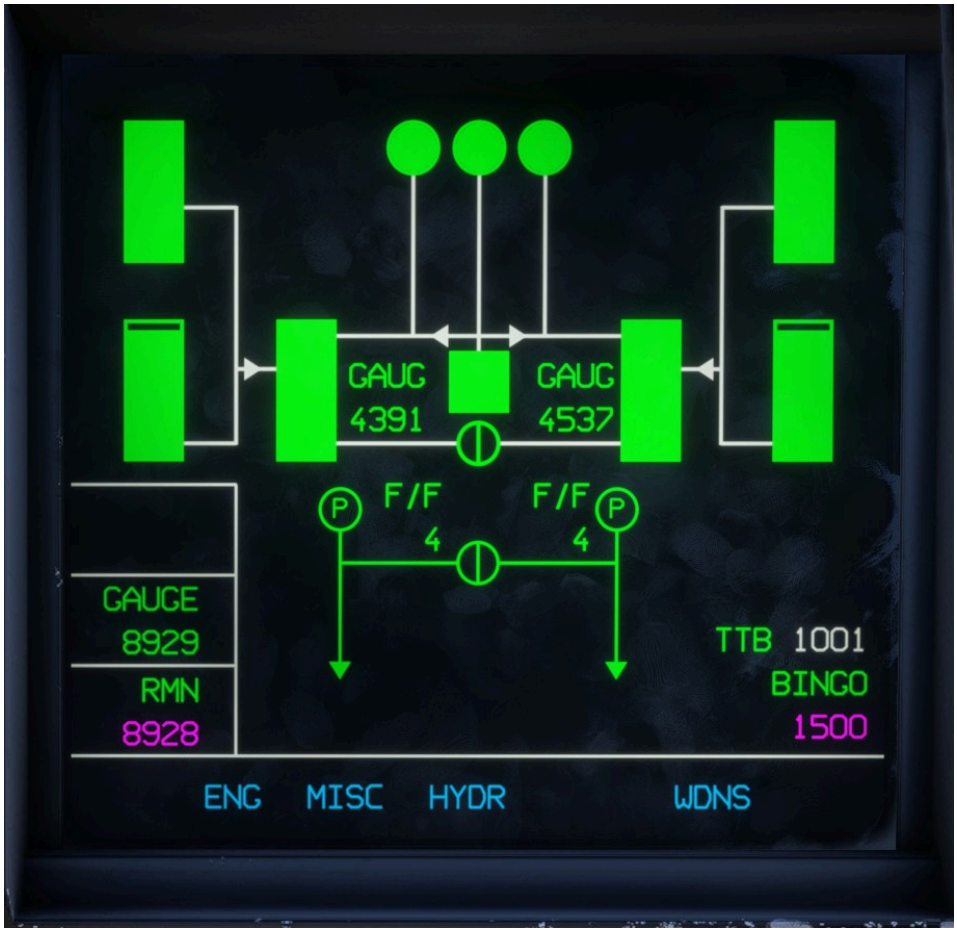
Description

The fuel page provides a synoptic view of the aircraft's fuel system. It displays the quantity of fuel in each tank, pump and valve status, engine fuel flow and fuel-management information.

To access it, move the RLD Page Selection Switch to the `FUEL` position.

Shortcuts at the bottom of the page provide access to the ENG, MISC, HYDR and WDNS pages.

The fuel system itself is described in detail in the fuel system chapter.



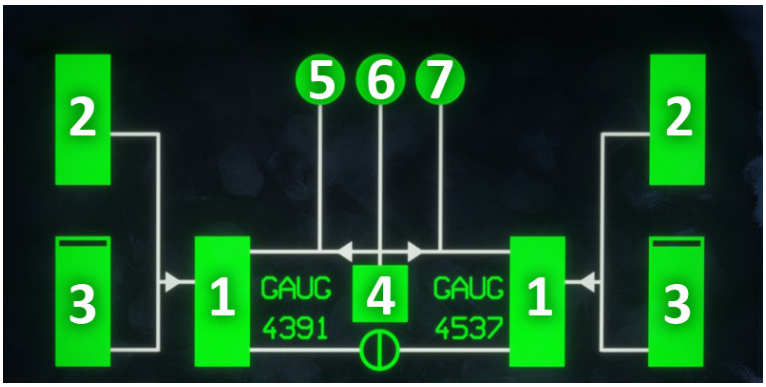
Fuel tank schematic

The seven internal fuel tanks are represented by rectangular gauges.

Up to three external tanks are represented by circular gauges at the top of the page, one for each of the left, center and right stations. The same gauge is used whether an `RPL 701` or `RPL 741` is fitted to the corresponding station.

Each gauge shows the quantity of fuel remaining in the corresponding tank. The green fill decreases as fuel is consumed, with the gauge appearing completely black when the tank is empty.

Two `GAUG` readouts display the total fuel quantity, in kilograms, on the left and right sides of the aircraft. They allow significant fuel imbalances to be identified quickly.



1	Feed tanks
2	Front tanks
3	Wing tanks
4	Fin tank
5	Left external tank
6	Center external tank
7	Right external tank

Fuel transfer is automatic, and the tanks are emptied in the sequence described in the fuel system section. The arrows on the synoptic indicate the direction of fuel transfer towards the feed tanks and engines.

`F/F` indicates the fuel flow supplied to each engine, in kilograms per minute.

Pumps and valves

The two engine booster pumps are represented by circles labelled `P`. The symbol turns green when the corresponding pump is operating.

Booster pump operating

Each valve is represented by a circle containing a bar. The bar is aligned with the fuel line when the valve is open and perpendicular to it when the valve is closed.

The line connecting the two feed tanks turns green when the feed tank crossfeed valve is open.

Feed tank crossfeed valve open, low-pressure crossfeed valve closed

Total fuel

The total quantity of fuel on board is displayed below the `GAUGE` label, in kilograms.

`RMN` corresponds to the value calculated by the fuel totalizer.

Bingo fuel

The lower-right section displays information related to the BINGO fuel setting.

The default BINGO fuel value is 1,500 kilograms.

HSI

Description

The horizontal situation indicator is the aircraft's primary navigation display.

It can be accessed using the RLD Page Selection Switch or assigned to a lateral display from the VTL DAS page.

The page is divided vertically into two sections. The left section displays information related to the primary goal, while the right section displays information related to the secondary goal.

The compass rose indicates the aircraft heading, using either a true or magnetic reference depending on the selected heading mode. Reference markers are displayed every 45 degrees.

The lower section displays the aircraft's ground speed and fuel consumption per nautical mile flown, expressed in kilograms per nautical mile.

The center of the compass rose displays the calculated wind direction and speed in knots.

Primary goal

The primary goal is displayed in green, together with its database number, name and current distance from the aircraft.

The double green needle points towards the primary goal.

`TTG` displays the estimated time to the goal in minutes and seconds, calculated using the current ground speed.

`XTK` indicates the cross-track deviation from the active flight plan route. In the example above, `XTK 0.33R` indicates that the aircraft is 0.33 nm to the right (`R`) of the route.

The lower section displays:

- `ETA`: estimated time of arrival.
- `EFA`: estimated fuel remaining on arrival.

Secondary goal

The secondary goal is displayed in magenta.

When no secondary goal is selected, all associated fields are dashed.

Click the secondary goal field and use the visualization knob to select any available goal from the database.

Secondary goal being selected

Once a secondary goal has been selected, the following information is displayed:

- Database number and name.
- Distance in nautical miles.
- Estimated time of arrival.
- Estimated fuel remaining on arrival.

The single magenta needle points towards the secondary goal.

MAG/TRUE setting

The HSI page is used to switch between true and magnetic heading references.

Select `MAG` to use magnetic headings. When magnetic mode is active, the label is displayed in green with a green outline.

This setting affects the heading indications shown on the `HUD`, `HCD` and both lateral displays. The `IPS` always displays magnetic heading, regardless of this setting.

The angular difference between the filled triangle and the outlined triangle represents the local magnetic variation.

Heading reference set to magnetic

TACAN

The secondary-goal section can be switched to TACAN mode by selecting `TAC`. When TACAN mode is active, the label is displayed in green with a green outline.

The TACAN settings can then be adjusted using the vizualisation knob:

- Station channel (1 to 127).
- Channel mode (`X` or `Y`).
- TACAN operating mode:
  - `T/R`: transmit and receive, providing both bearing and distance information.
  - `R`: receive only, providing bearing information without station distance.
  - `A/A`: air-to-air TACAN mode, which is not supported in MSFS.

When a valid TACAN signal is received, the distance to the station is displayed and the magenta needle indicates the bearing to the station.

`ETA` and `EFA` are dashed in TACAN mode, as these values are not calculated for TACAN stations.

HSI tuned to TACAN channel 87X

> **NOTE**
>
> The Rafale HSI does not support tuning VOR stations. Only TACAN navigation is available.

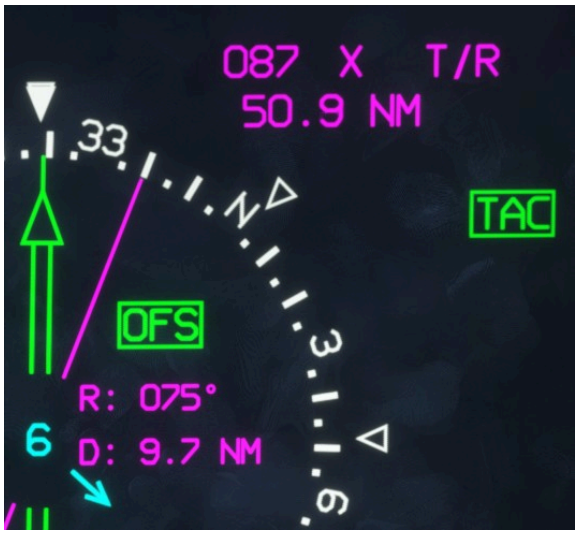
Offset

The `OFS` function allows a virtual navigation point to be defined at a specified bearing and distance from a TACAN station.

Select `OFS` to enable the function. When active, the label is displayed in green with a green outline.

The offset bearing (`R`) and distance (`D`) can then be adjusted using the vizualisation knob.

The magenta needle points towards the resulting virtual point, and the displayed distance takes the selected offset into account.



Offset point located 9.7 nm from the station at a bearing of 75°

ILS display

When a valid ILS approach is configured and the aircraft enters the approach phase, the HSI display changes to provide dedicated ILS guidance.

The primary and secondary goal information is replaced by horizontal and vertical deviation indicators.

`CRS` displays the runway course in degrees.

HYD

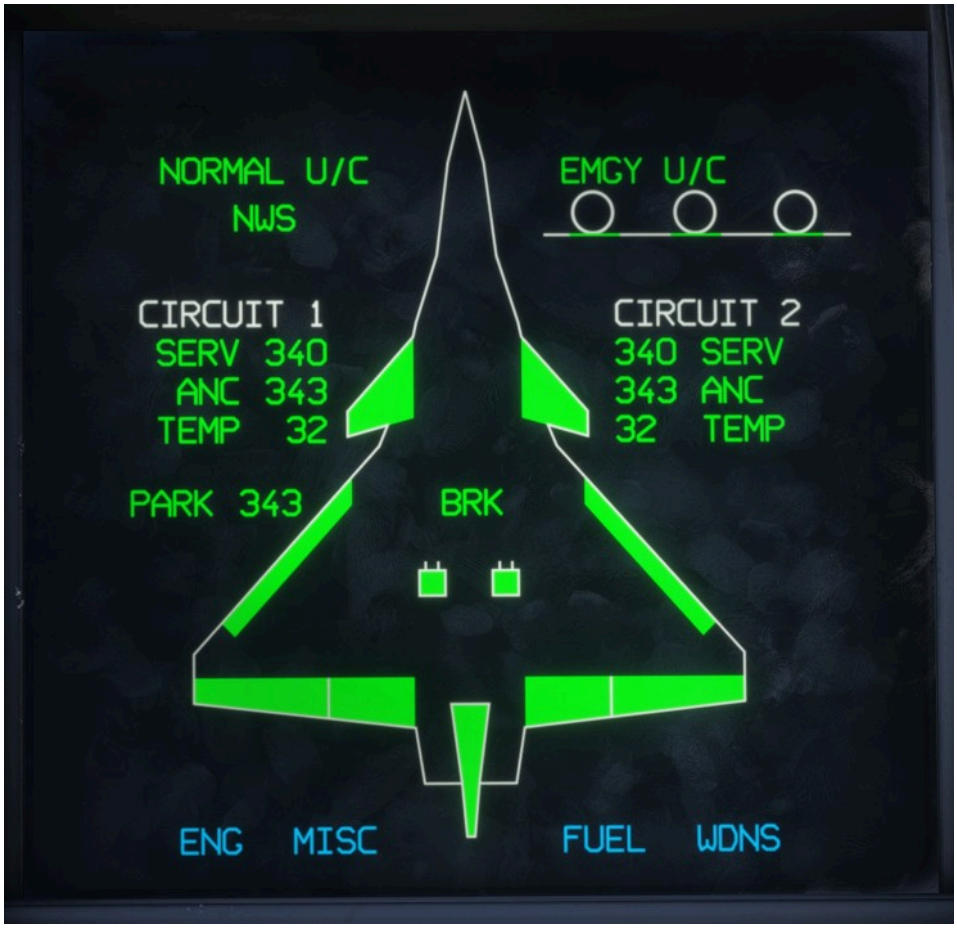
Description

The hydraulic page provides a synoptic view of the hydraulic system, represented over a top view of the aircraft.

To access it, move the RLD Page Selection Switch to the `FUEL` position, then select the HYDR page.

Shortcuts at the bottom of the page provide access to the MISC, ENG, FUEL and WDNS pages.

The hydraulic system itself is described in the hydraulic system section.



Circuits

The two main hydraulic circuits are displayed as `CIRCUIT 1` and `CIRCUIT 2`. The following information is shown for each circuit:

- `SERV`: servo pressure, in bar.
- `ANC`: accumulator pressure, in bar.
- `TEMP`: hydraulic fluid temperature, in degrees Celsius.

Each indication changes colour when it moves outside its normal operating range:

Reading	Amber	Red
Pressure	< 150 bar	< 100 bar
Temperature	> 90 °C	> 120 °C

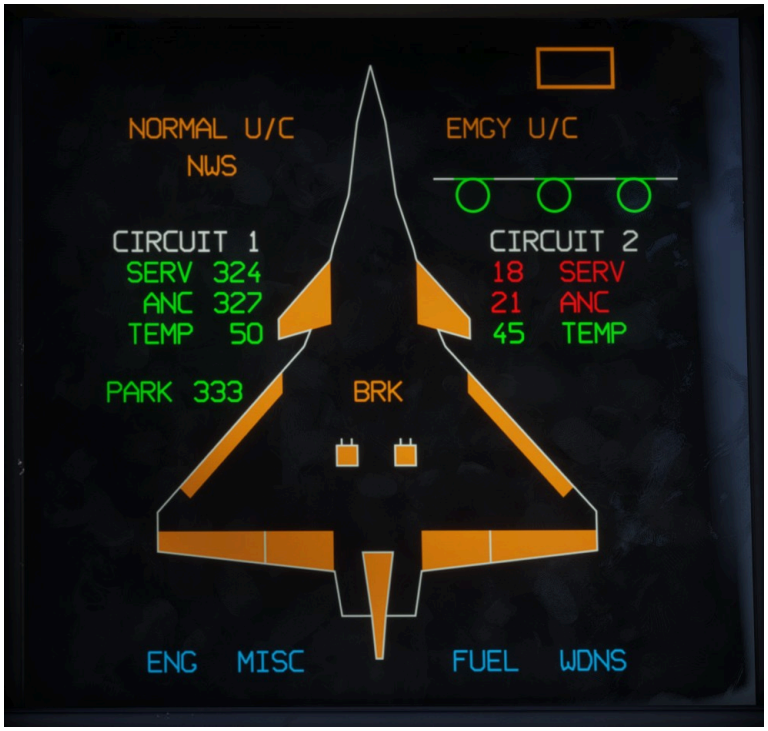
`BRK` indicates the availability of the braking system and is displayed in green when available.

`PARK` indicates the parking brake accumulator pressure. This dedicated accumulator maintains braking pressure when the main hydraulic system is unavailable.

Flight control surfaces

The aircraft silhouette indicates the hydraulic status of each flight control surface: elevons, canards, rudder and slats.

Each surface is powered by both hydraulic circuits. Its indication turns amber when one circuit is unavailable and red when both circuits are unavailable.



Page display with circuit 2 unavailable

Landing gear

`NORMAL U/C`, `NWS` and `EMGY U/C` respectively indicate the availability of the normal landing gear system, nose-wheel steering and emergency landing gear extension system.

In the upper-right corner, each landing gear leg is represented by a circle, which turns green when the gear is down and locked. Each landing gear door is represented according to its current position and turns green when fully closed.

Landing gear retracted with the gear doors open

IFF

Description

This page is used to configure the IFF system and its various settings.

It can be opened from PDS1.

The current IFF settings are also repeated on PDS2.

Settings

The transponder status is displayed as either `ON` or `STDY` (standby). Click the status to switch between the two states.

The available settings are summarised below:

`MOD1`	Two-digit identification code
`MOD2`	Four-digit identification code
`MOD3`	Four-digit transponder code
`MODC`	Altitude reporting, toggled by clicking
`MOD4`	Key `A` or `B`, selected by clicking

To change a numerical value, select `MOD1`, `MOD2` or `MOD3`, then enter the required digits using the keypad. Only digits from `0` to `7` are accepted.

The code is applied automatically once the required number of digits has been entered.

> **INFO**
>
> As a reminder, only Mode 3 has a functional purpose in the simulator, as it corresponds to the transponder code.

The selected Mode 3 code can be overridden by the IFF Mode Selection Knob when it is set to one of the following positions:

- `7600`: sets transponder code 7600, used in the event of a radio communication failure.
- `EMGY`: sets transponder code 7700, used in an emergency.

IMA

Description

This page displays imagery provided by the front sector optronics (`FSO`) or, when installed, the Damocles targeting pod.

The page must be assigned to a lateral display from the VTL DAS page.

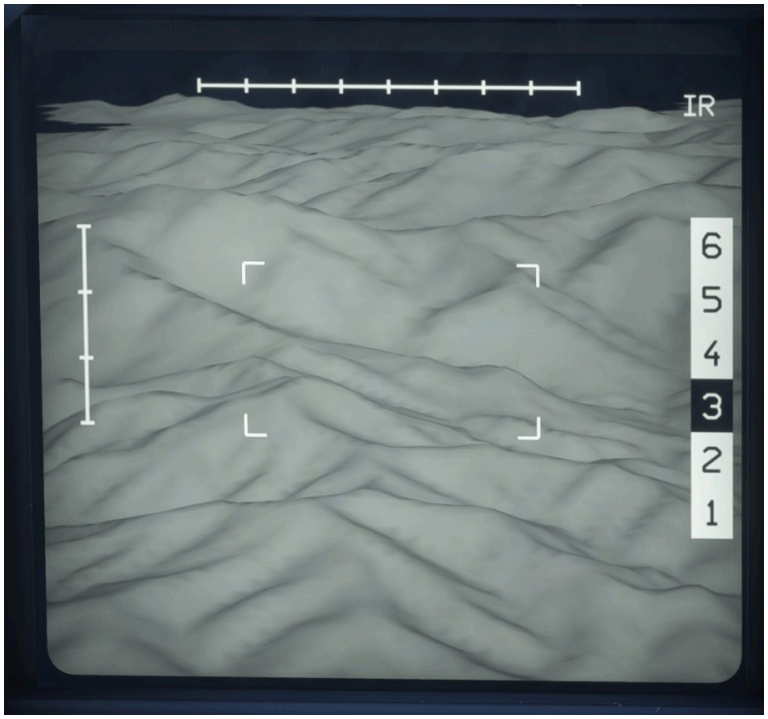
> **NOTE**
>
> Microsoft Flight Simulator does not allow a live camera view to be rendered directly on an avionics display. The imagery shown on this page is therefore generated using external imagery services and does not reproduce every element of the simulator environment.
>
> Other aircraft, buildings and weapon effects are not visible in the displayed imagery.

Display modes

Two display modes are available:

- `TV` provides a color image in the visible spectrum.
- `IR` provides an infrared image and is the only mode suitable for night operations.

Six zoom levels are available to adjust the displayed field of view.



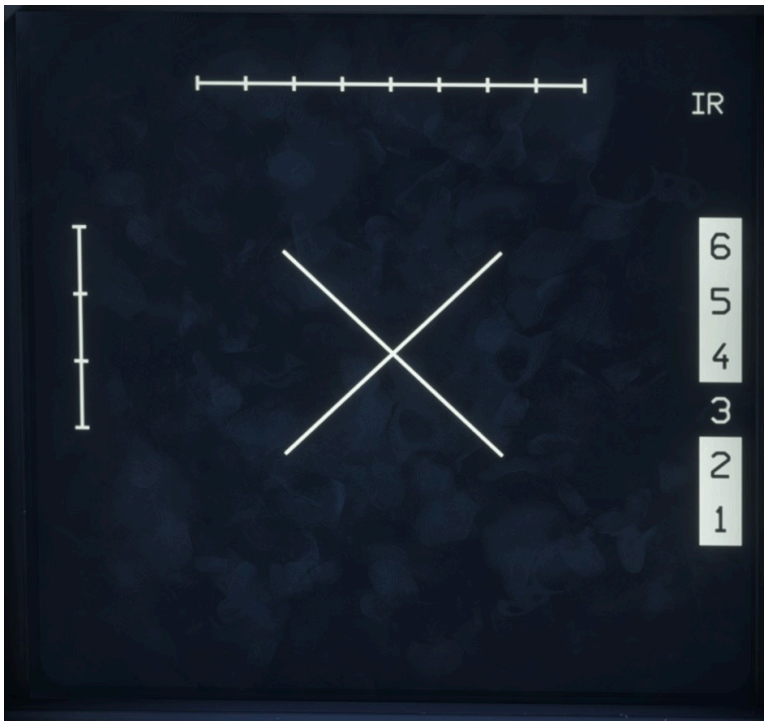
IMA page displaying the infrared view

Operation

Imagery is unavailable unless either `A/A` or `A/S` primary mode is active.

The `IMA` must be selected and available on LD SYS, depending on the active mode.

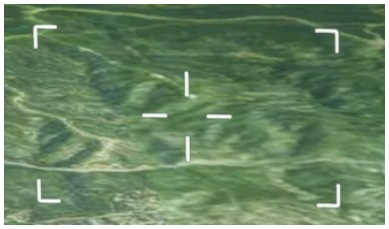
Select the zoom level directly on the screen. Click the `TV` or `IR` label to switch between the two display modes.



IMA page with no imagery available

Once a target has been designated (an air target in `A/A` mode or a surface target in `A/S` mode), the available sensors attempt to track it and display the corresponding imagery on the page.

The `FSO` has a more restricted field of regard than the Damocles targeting pod. When the target is within the field of regard of the active sensor, a central cross is displayed.



View centered on the designated target

If the target moves outside the sensor's field of regard, the image may continue to move as the system attempts to reacquire and track it.

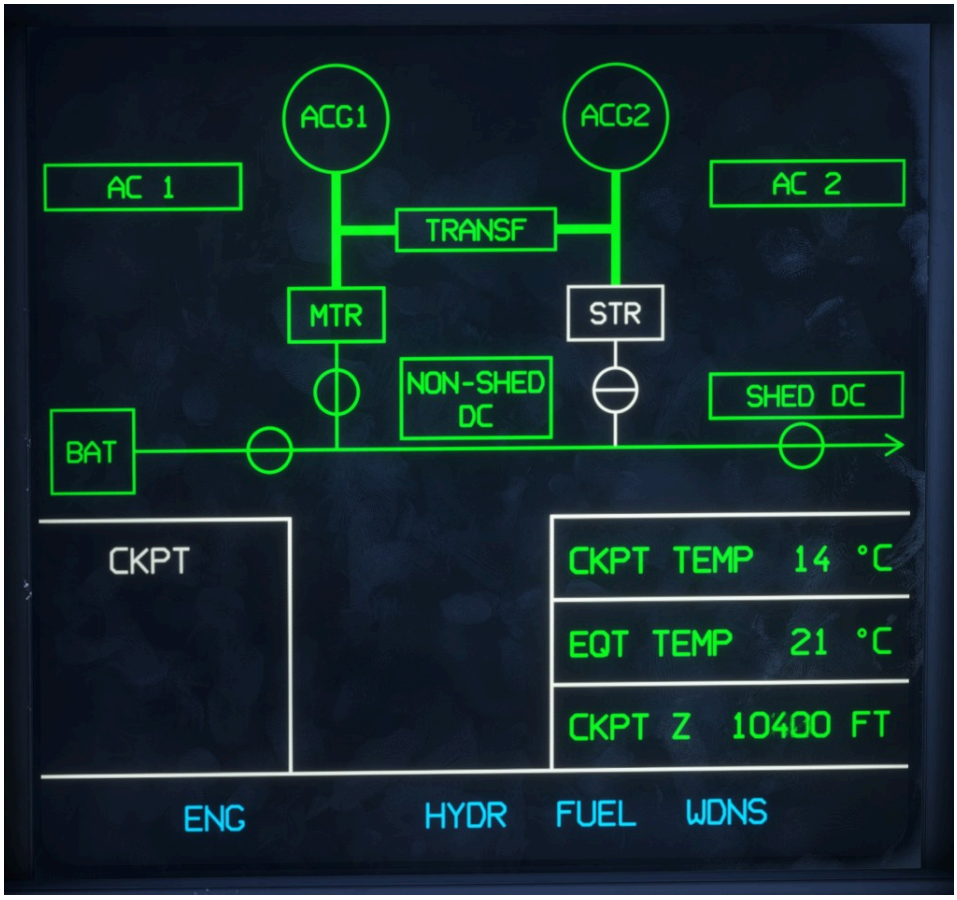
MISC

Description

This page displays miscellaneous information about the aircraft systems, with a primary focus on the electrical system.

To access it, move the RLD Page Selection Switch to the `FUEL` position, then select the MISC page.

Shortcuts at the bottom of the page provide access to the ENG, HYDR, FUEL and WDNS pages.



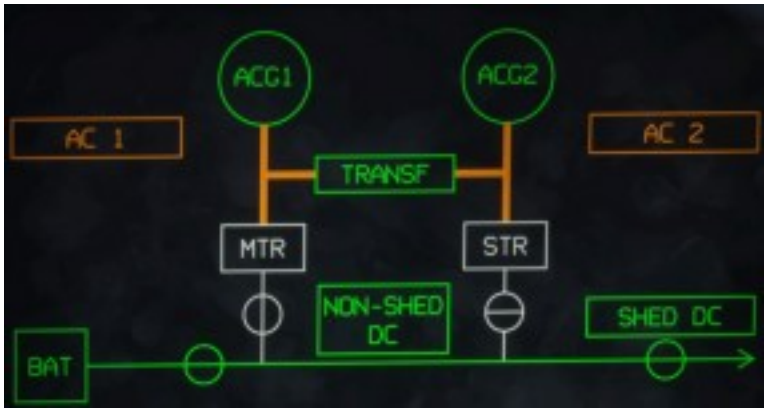
Electrical system

The upper section provides a schematic view of the aircraft's electrical system.

The electrical system is described in greater detail in the electrical system section.

Components operating normally are displayed in green. They turn amber when they are unavailable or inoperative.

Energized electrical lines are displayed in green, while white lines indicate sections that are not powered.



DC buses energized, both AC buses unpowered

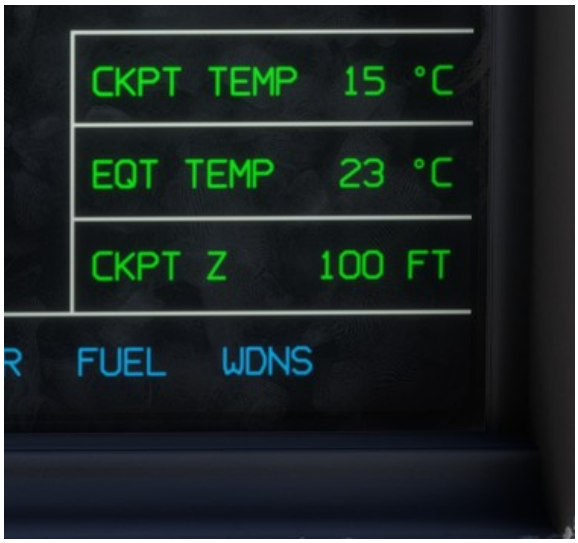
Circles containing a transverse line represent electrical contactors:

- Battery connection to `BUS DC NON-SHED`.
- Connection between `BUS DC SHED` and `BUS DC NON-SHED`.
- `MTR` transformer connection to `BUS DC NON-SHED`.
- `STR` transformer connection to `BUS DC NON-SHED`.

Cockpit environment

The lower-right section displays the following cockpit environment parameters:

- Cockpit temperature, in degrees Celsius.
- Equipment compartment temperature, in degrees Celsius.
- Equivalent cockpit altitude, in feet.



The box on the left displays warnings related to the cockpit environment and associated equipment.

Anti-G suit unavailable

NAV

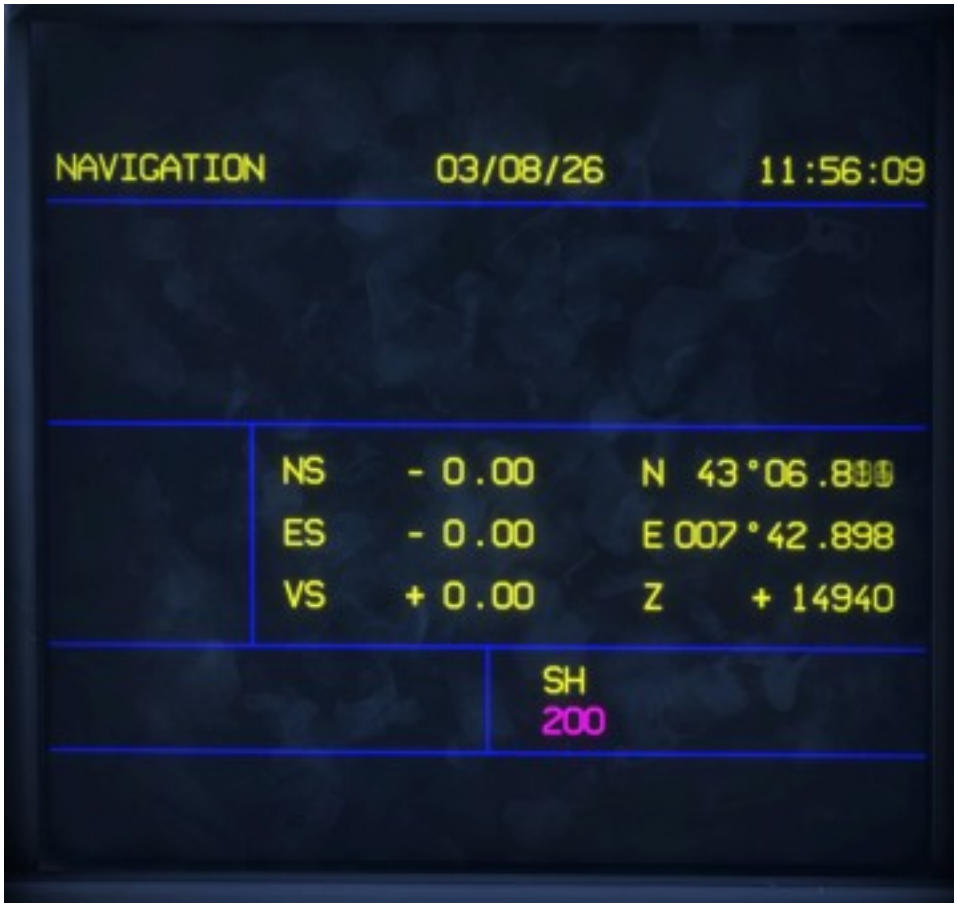
Description

The navigation page displays information related to the INS and the aircraft's calculated position.

This page can be opened from PDS1.

The upper section displays the current reference date and time.

The safety height can be adjusted at the bottom of the page.



INS alignment

Before alignment begins, the page displays the coordinates of the primary goal used as the alignment reference. Select `ALN` to start the alignment sequence.

NAV page before alignment

During alignment, the remaining alignment time is displayed below each corresponding `INU`.

NAV page during alignment

Once alignment is complete, the page displays the aircraft's current coordinates and altitude as calculated by the inertial navigation system, together with the current positional deviation between the two `INUs`.

NAV page after alignment

POS

Description

The position page is closely linked to the NAV page and displays information related to the INS.

This page can be opened from PDS1.

In the upper-right corner, you can select whether the display is referenced to `INU1` or `INU2`.

A compass rose, with north indicated, shows the horizontal positional difference between the two inertial navigation units. The displayed distance value indicates the full scale of the circle, in meters.

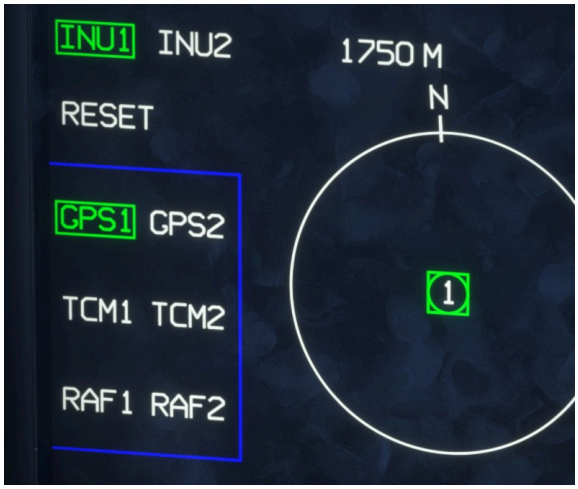
A vertical scale shows the altitude difference between the two units. The value displayed in feet indicates the full range of the scale.

The settings for both INUs can be configured on the left side of the page.

For example, selecting `GPS1` means that the corresponding INU is hybridized with the GPS system, allowing faster alignment.

The schematic representation of an INU changes from a square to a circle when it is hybridized.

`TCM` and `RAF` correspond to alternative positioning modes that are not simulated in the current implementation.



INU1 hybridized with GPS

PRP

Description

The preparation page is used to configure flight plan parameters and has been adapted to the simulator environment.

This page can be opened from PDS1.

The page allows you to:

- Set the cruise speed.
- Set the cruise altitude or flight level.
- Import a flight plan created in the MSFS EFB.
- Delete the active flight plan from the avionics.

SITAC

Description

The SITAC page displays the tactical situation in a format similar to the HCD, with which it shares most of its display elements and settings.

To access it, move the RLD Page Selection Switch to the `SA` position.

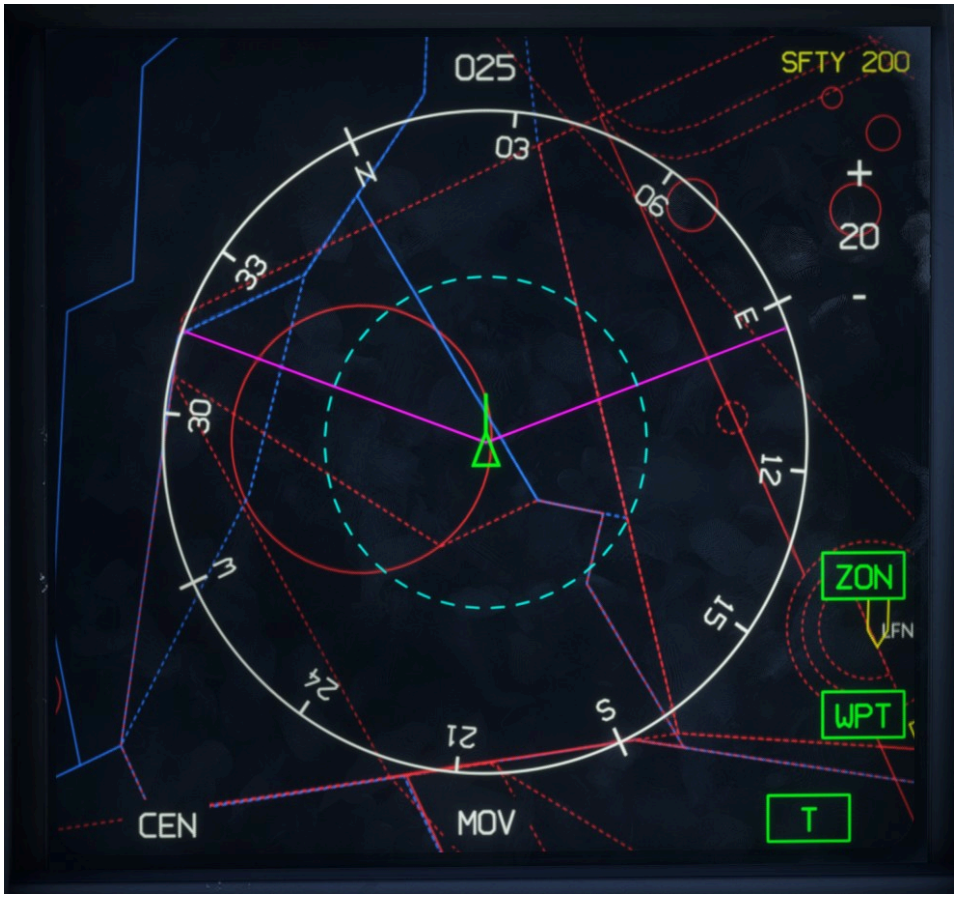
The page can also be assigned to either lateral display from the VTL DAS page.

The display is centered on a compass rose showing the current heading, using either a magnetic or true reference depending on the LD HSI setting. A blue dashed circle represents half of the selected range.

The aircraft is represented by a green symbol, together with the radar coverage sector in magenta.

The current safety height is displayed in the upper-right corner.

Other elements, including the flight plan and detected traffic, are displayed in the same way as on the `HCD`.



Settings

The following settings are available on the SITAC page:

- `ZON`: toggles the display of airspace zones.
- `WPT`: toggles the flight plan display.
- `CEN`: toggles the centered view mode.
- `MOV`: activates moving-map mode.
- `T`: toggles between track-up and north-up orientation.
- `+/-`: zooms the map in or out.

SYS

Description

The system page is used to configure the aircraft's various sensors independently for each primary mode.

The page is accessed by pressing the center of PM10.

A selected item is outlined. The outline is amber when the item is unavailable and green when it is active.

The currently selected terrain-following data source, `DTS` or `RDR`, is displayed in the upper-left corner.

The following sensors can be assigned independently to each primary mode:

- `RDR`: radar.
- `IRST`: infrared sensors.
- `IMA`: imagery.

- `IRS`: MICA IR seekers.

Enabling or disabling these sensors determines which functions and data are available, including target detection and imagery display.

The primary mode can also be changed directly from this page.

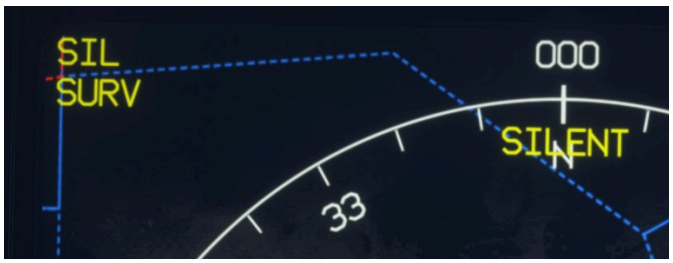
The `NAVIGATION` row assigns radar and imagery functions to navigation.

The upper-right section provides quick access to the following configurations:

- `SIL`: prevents all active sensors from emitting. Passive sensors remain available.
- `FREE`: allows all sensors to operate normally.
- `DIS`: configurable discreet mode. In the current implementation, it operates in the same way as `FREE`.

Silent mode, RDR and IRST unavailable

When silent mode is active, a status message is displayed on the `HCD`.



The ranging options (`TAS`, `LAS` and `RA`) have no effect in the simulator.

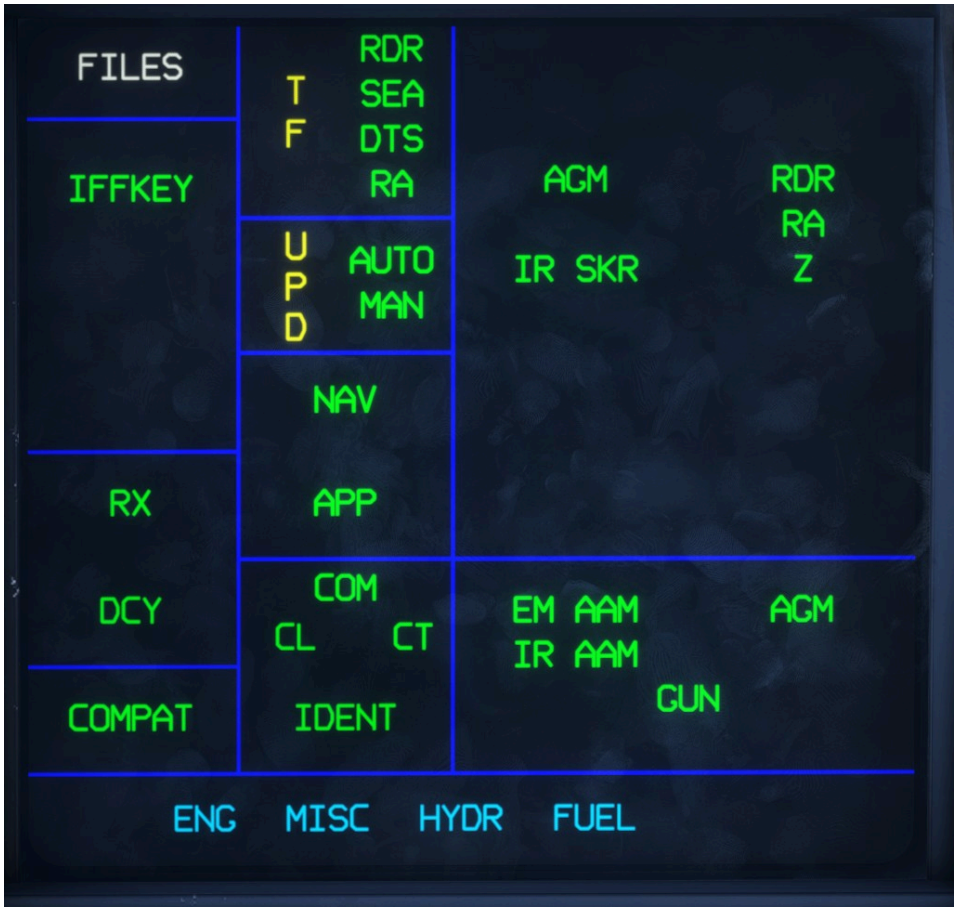
WDNS

Description

The WDNS page displays the status of several aircraft systems.

To access it, move the RLD Page Selection Switch to the `FUEL` position, then select the WDNS page.

As it covers complex systems that are only partially simulated in the current implementation, this page is not described in further detail.



WPN

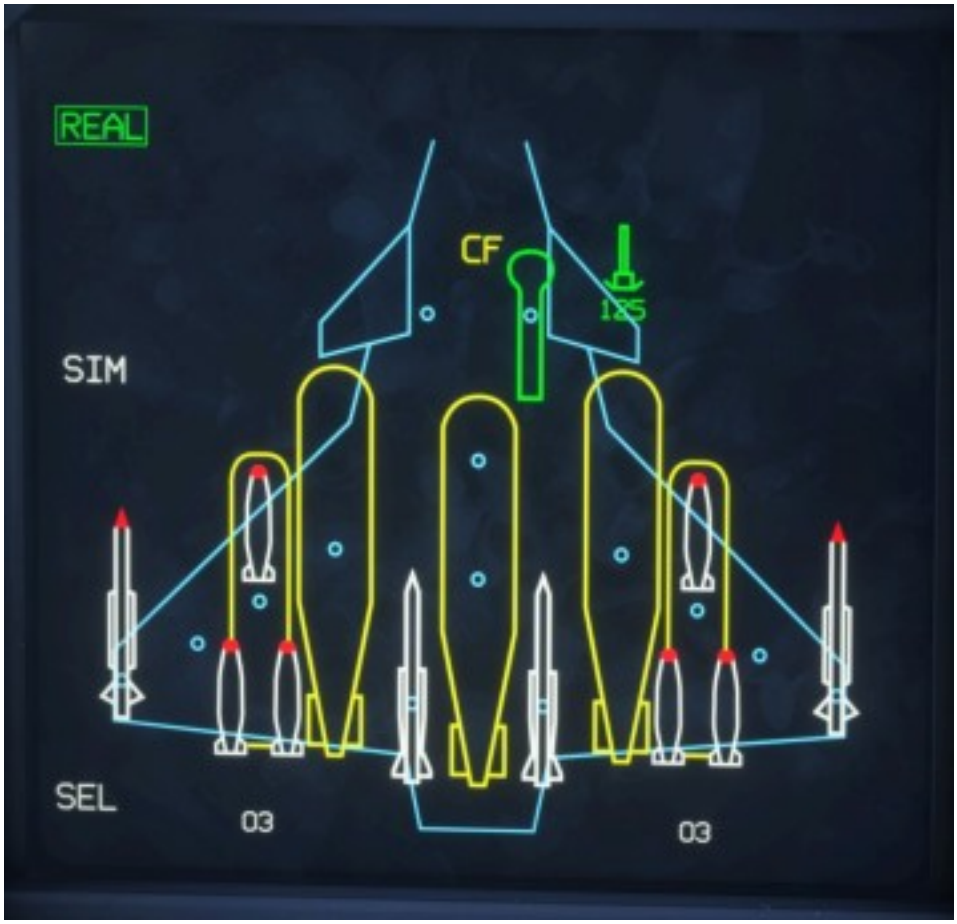
Description

The weapons page displays the aircraft's current loadout configuration and the status of each store.

To display this page, move the LLD Page Selection Switch to the `WPN` position.

The available weapons, pods and external fuel tanks are described in the payload section.

`REAL` indicates that the page is operating in live weapon mode. The `SIM` training mode is not implemented (we are already in a simulator, after all).



Loadout display

The aircraft is shown from above, with its 14 store stations arranged around its outline. Each fitted store is displayed at its corresponding station.

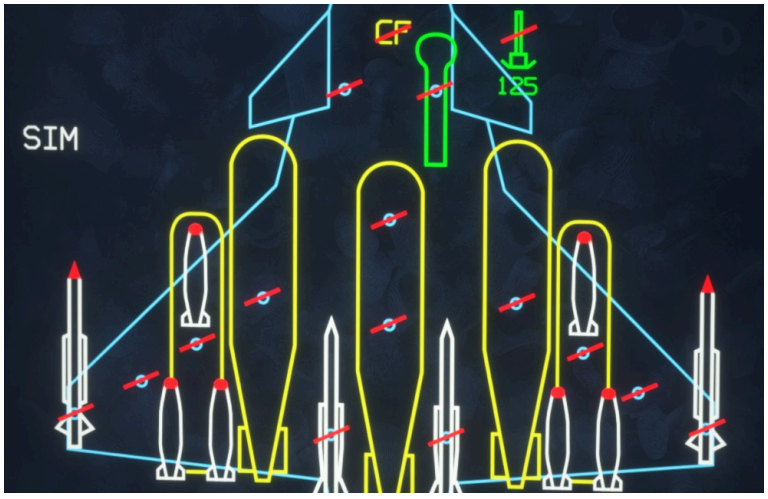
Triple-bomb racks are represented on stations 3 and 12. The two-digit values displayed below them indicate the number of `AASM` or `GBU-12` bombs carried on each side.

The color of each store indicates its current status:

Color	Status
White	Not ready
Purple	Preparation in progress
Green	Ready
Red	Failure
Magenta	Selected for jettison

External fuel tanks and their pylons do not have a preparation status and remain yellow.

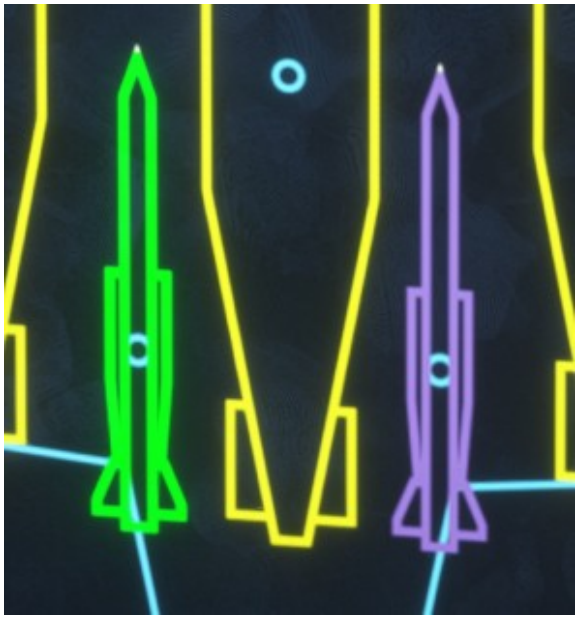
Red diagonal lines appear across the store stations when the General Safety Switch is set to `SAFE`, indicating that electrical store release and jettison commands are inhibited.



Display with the GEN SAFETY switch set to SAFE

Click a weapon to start its preparation sequence. It turns purple while preparation is in progress, then green when ready.

Only ready weapons can be included in a firing sequence. Clicking a weapon again while it is being prepared or is already ready cancels its preparation and returns it to the not-ready state.



Left METEOR ready, right METEOR in preparation

Selective jettison

The `SEL` indication in the lower-left corner shows the current selective jettison status:

- In the normal state, `SEL` is displayed in white.
- While store selection is active, a white rectangular border appears around `SEL`, and releasable stores are displayed in either magenta or yellow.
- When the Selective Jettison Hood is open, `SEL` turns yellow, its border disappears and the displayed selection is locked.

The selective jettison procedure is described in detail in the payload section.

Active selection for selective jettison

Cannon

The cannon symbol is followed by the number of rounds remaining. Both are displayed in green while ammunition is available and turn amber when the cannon is empty.

Cannon with 125 rounds remaining

Sensors & Reconnaissance

> **WARNING**
>
> The radar and sensor systems described on this page should not be considered representative of the real aircraft or its capabilities. These systems are highly simplified to operate within the MSFS environment, and the figures provided below are specific to this add-on. They are not based on real-world performance data.

Radar

To use the radar, ensure that it is enabled on the LD SYS page for the currently active primary mode.

LD SYS page with radar selected and active in A/A mode

A `RDR` indication is displayed on the HUD while the radar is active.

> **INFO**
>
> The radar is automatically disabled while the aircraft is on the ground.

Our simulated radar has the following characteristics:

- Maximum detection range of approximately 150 km / 80 nm.
- Maximum horizontal scan angle (azimuth) of 70 degrees.
- Maximum vertical scan angle (elevation) of 60 degrees.

The radar is primarily used to detect other aircraft in the simulator, including both AI-controlled and multi-player traffic.

Detected aircraft can be displayed on the center display in `SURV` surveillance mode.

Each detected aircraft is represented by a yellow symbol comprising a square and a velocity vector pointing in its direction of travel. The length of the vector varies according to the aircraft's speed, allowing it to be compared with your own speed. The aircraft's estimated altitude is also displayed.

The magenta outline indicates the limits of the simulated radar scan volume.

Center display showing three detected aircraft

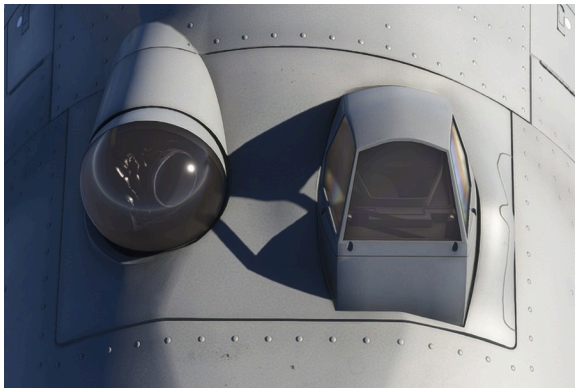
When an aircraft leaves the radar detection volume, its position continues to be estimated for a few seconds before the track disappears from the display.

> **NOTE**
>
> Traffic may occasionally disappear or flicker on the center display. This is caused by a simulator issue that can make AI traffic unstable. Using traffic injected through the custom spawner avoids this issue.

Front sector optronics

The Rafale is equipped with a front sector optronics (`FSO`) system integrated above the nose. It combines visible-spectrum and infrared optronic channels for passive detection, identification and tracking.

Both `IRST` and `IMA` must be selected on the LD SYS page to use these functions.



The system can be used to track a designated air or surface target and display infrared or TV imagery on the LD IMA page.

When not in use, the `FSO` optical heads are stowed in a protected position.

Targeting pod

The Damocles targeting pod implemented in our Rafale extends the aircraft's electro-optical targeting capabilities. It provides imagery and laser designation for surface targets across a wide field of regard beneath the aircraft.

The pod's head rotates according to the aircraft's movement and the position of the designated target in order to maintain its line of sight.


ADP192 n 155

Payload & Weapons

Our Rafale supports a wide selection of stores commonly associated with the aircraft.

The aircraft loadout can be configured and displayed from the EFB payload page.

All users, on both PC and console, can display the different stores on the aircraft. However, **the functional weapon system is only available on compatible PC versions**, as explained below.

Implementing a functional weapon system required a significant amount of research and development. Microsoft Flight Simulator was not originally designed to support this type of feature, which made its implementation considerably more complex. The final result goes well beyond the scope initially planned for the product.

Nevertheless, several technical compromises were required to keep the system efficient, stable and accessible to the widest possible range of users.

> **INFO**
>
> Microsoft Marketplace policies do not allow products distributed through the Marketplace to include functional weapons.
>
> The Microsoft Marketplace version therefore does not include the functional weapon system by default. To enable it on PC, download the weapons manager patch from our website and install it in your `Community` folder.
>
> **The patch cannot be installed on Xbox or PS5, so the functional weapon system is not available on these platforms.**
>
> For versions purchased from compatible third-party stores, the functional weapon system is included by default.

> **WARNING**
>
> Although we have made every effort to deliver a realistic experience, this implementation is based on free interpretations and should not be considered representative of the real Rafale weapon system, its capabilities, or its operational use.

> The simulated weapon performance figures do not reproduce or disclose real-world performance data.

Payload overview

The weapons and store selection offered in our version focuses on the main items associated with the Rafale F3-R weapons set. Some stores are not included for various reasons.

The Rafale C has 14 hardpoints, numbered as follows:

> **NOTE**
>
> The two ventral hardpoints generally cannot be used simultaneously, as most centreline stores occupy or interfere with both stations.

MICA (EM & IR)

The MICA family gives the Rafale a common missile body for short-range self-defense and beyond-visual-range interception. The two versions mainly differ by seeker type:

- `MICA EM` uses an active radar seeker and is intended for all-weather radar-guided engagements.
- `MICA IR` uses an imaging infrared seeker and can support more discreet passive interceptions.

In practical terms, the pair gives the aircraft tactical flexibility rather than two completely different missile concepts.

Meteor

`Meteor` is the Rafale's very-long-range air-to-air missile. Its defining characteristic is its ramjet propulsion, which sustains energy deep into the intercept and gives it a particularly large no-escape zone compared with more conventional rocket-powered missiles.

Within the Rafale inventory, it serves as the primary long-range air-superiority weapon.

AASM

`AASM`, also known as `HAMMER`, is a modular precision-guided air-to-surface weapon.

It combines a bomb body with a guidance kit at the front and a range-extension kit at the rear.

The weapon family is available with several guidance configurations, including:

- `INS/GPS`
- `INS/GPS/IR`
- `INS/GPS/laser`

Our version currently reproduces the `INS/GPS` variant.

The AASM provides the Rafale with an all-weather stand-off weapon suitable for precision strikes at both short and extended ranges.

GBU-12

The `GBU-12` is a 500 lb laser-guided bomb based on the `Mk 82` general-purpose bomb body.

Unlike propelled stand-off weapons, it is an unpowered weapon whose range depends heavily on the aircraft's altitude, speed and attitude at release.

The target must remain illuminated by a compatible laser designator during the terminal phase of the attack. On the Rafale, this function can be provided by a targeting pod such as `Damocles`.

SCALP

`SCALP` is a conventionally armed, long-range stand-off cruise missile intended for pre-planned strikes against high-value fixed or stationary targets.

It is designed for day, night and all-weather operation. Its navigation system combines `INS`, `GPS` and terrain referencing, while an imaging infrared seeker is used during the terminal phase.

Within the Rafale inventory, it provides a deep-strike capability against distant targets.

Cannon

The Rafale is equipped with an internal `Nexter 30M791` 30 mm cannon on both single-seat and two-seat variants.

The cannon can be used for close air combat and air-to-surface strafing. It has a firing rate of approximately 2,500 rounds per minute and carries 125 rounds.

Damocles pod

`Damocles` is a targeting and laser-designation pod used for target acquisition and laser-guided weapon employment.

It allows the aircraft to observe, identify, track and designate surface targets during day and night precision-strike missions.

External tanks

The Rafale can carry external fuel tanks to increase its range, endurance and available loiter time.

In the configurations represented by this add-on, the aircraft can carry up to approximately `4.8 tonnes` of external fuel. Three wet stations can be used to carry external tanks.

Subsonic RPL741

The `RPL 741` is the larger subsonic external tank.

It maximises fuel capacity for missions where transit range, endurance or loiter time is more important than high-speed performance.

Supersonic RPL701

The `RPL 701` is the supersonic-compatible external tank.

Compared with the larger `RPL 741`, it carries less fuel but provides a more favourable aerodynamic profile for high-speed flight.

Smokewinders

For air displays, the aircraft can carry a smoke pod on each wingtip station.

The smoke system can be controlled using the bindings described in the controls section.

Weapons operation

This section explains how to operate the functional weapon system on compatible PC versions.

> **WARNING**
>
> Microsoft Flight Simulator was not designed to support functional weapon systems. This implementation therefore operates within the technical limitations of the simulator. For instance, you cannot see the weapons fired by other multiplayer users.
>
> Weapon rendering, collision detection, visual effects and target behaviour may vary, particularly on lower-end hardware or in complex scenarios.
>
> The system may be improved through future updates as new simulator features become available.

Air-to-air

Air targets can be engaged using `MICA` or `METEOR` missiles. Each missile has a different intended use and a simulated maximum range of approximately:

- `MICA IR`: 60 km / 32 nm
- `MICA EM`: 80 km / 43 nm
- `METEOR`: 170 km / 90 nm

`MICA IR` is primarily suited to close-range engagements, while `MICA EM` and `METEOR` cover progressively longer engagement ranges.

Operation

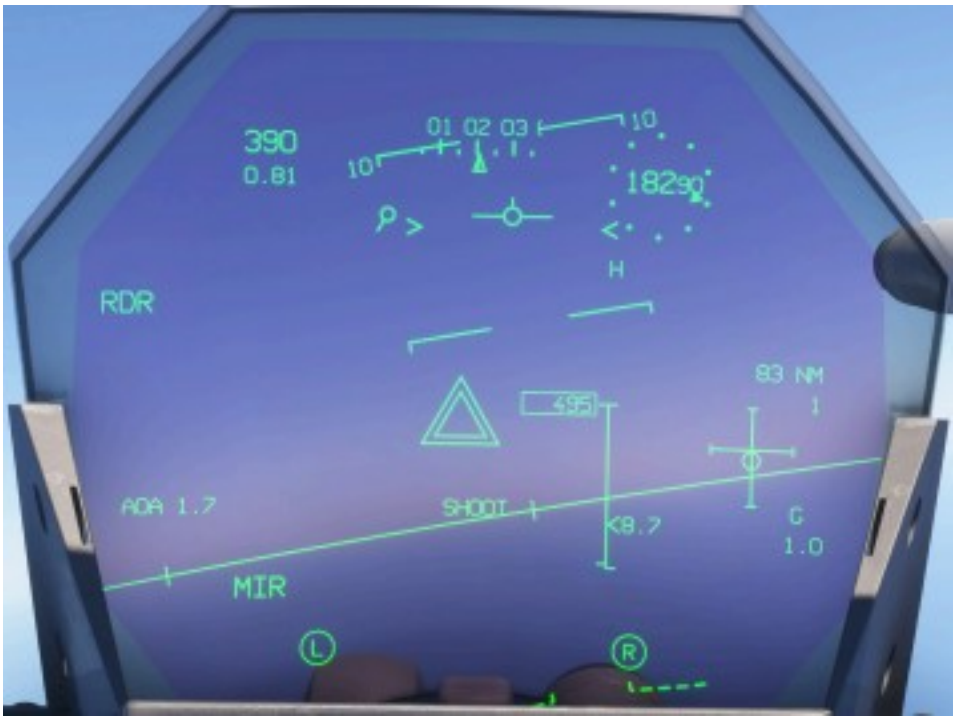
Follow these steps to fire a missile at an air target:

1. Ensure that at least one compatible missile is included in the current loadout.
2. Switch to `A/A` mode.
3. Designate an air target on the center display using MG4 or the `TD` button.
4. Select the desired combat mode using MG6:

- Select `MIR` to use `MICA IR` in close air combat.
- Select `MIF` to use `MICA EM` or `METEOR`.

5. Open LD WPN and prepare the selected missiles for launch.
6. Set both the `GEN SAFETY` and `MASTER ARM` switches to `HOT`.
7. Press PM1 to fire.

When the firing conditions are suitable, based on factors such as range, aircraft speed and target trajectory, a shoot cue is displayed on the HUD.



The complete associated symbology is described on the HUD page.

> **NOTE**
>
> On our add-on, only one target can be designated at a time, and missiles are launched individually. A second missile can be launched a few seconds after the first. If several missiles are ready, the system will choose which one to fire first.

Impact and miss

Following a successful hit, the system takes control of the target aircraft and places it into an uncontrolled descent. Smoke and fire effects can be used to identify the approximate crash area.

Microsoft Flight Simulator does not currently allow us to hide the original traffic model or replace it with a custom damaged model. As a result, the target aircraft may remain visible and stationary after reaching the impact point.

If the missile misses its target or is unable to reach it, it automatically self-destructs after a short delay.

Air-to-surface

Surface targets can be engaged using the following air-to-surface weapons:

- `GBU-12`: an unpowered laser-guided bomb. Its achievable range and impact point depend directly on the aircraft's altitude, speed and attitude at the time of release. Within the simulation, the bomb attempts to maintain an efficient glide profile to preserve as much speed and range as possible.
- `AASM`: a rocket-assisted precision-guided bomb. After release, it accelerates towards its cruise speed and altitude. Once an appropriate terminal-attack geometry has been reached, it turns towards the target and begins its final descent. Its simulated maximum powered range is approximately 50 km, with a cruise speed of approximately Mach 0.9.
- `SCALP`: a long-range cruise missile intended for strikes against distant targets. Its simulated maximum range is approximately 300 km, with a cruise speed of approximately Mach 0.8.

> **NOTE**
>
> Our current SCALP implementation is highly simplified and does not include terrain-avoidance logic. The missile cannot automatically detect or avoid terrain along its route.

Operation

Follow these steps to release an air-to-surface weapon:

1. Ensure that at least one compatible air-to-surface weapon is included in the current loadout.
2. Switch to `A/S` mode.
3. Designate a surface target on the center display using MG4 or the `TD` button. A target can also be designated from a database point on the LD page.
4. Select the desired combat mode using MG6:

- Select `AGB` to use a bomb (`GBU-12` or `AASM`).
- Select `AGM` to use a missile (`SCALP`).

5. Open LD WPN and prepare the selected weapons for release.
6. Set both the `GEN SAFETY` and `MASTER ARM` switches to `HOT`.
7. Press PM1 to release the weapon.

Two AASMs ready for release

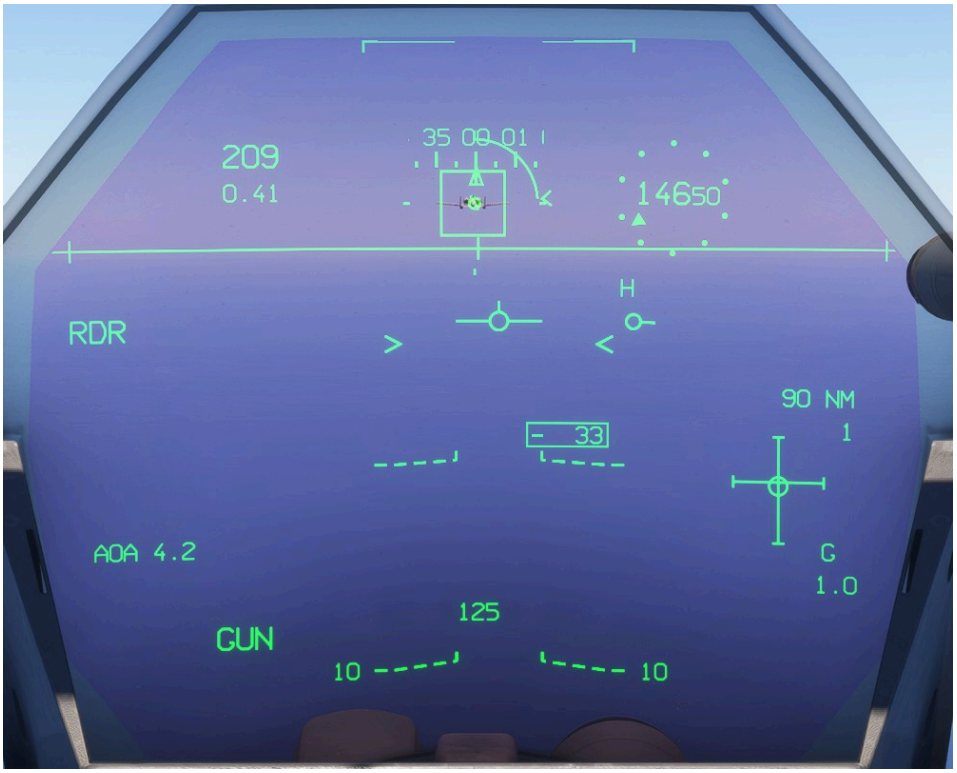
The complete associated symbology is described on the HUD page.

> **NOTE**
>
> All prepared bombs are released sequentially, with a short delay between each weapon.

Cannon

The cannon can be used against both air and surface targets. The `GUN` combat mode can be selected while in either `A/A` or `A/S` primary mode.

To engage an aircraft, first designate it on the center display. When the target is successfully hit, the same target-response behaviour used for missile impacts is applied.



> **NOTE**
>
> Firing the cannon at ground targets produces the associated visual effects, but will not damage any object as this is not possible in the simulator.
>
> Air targets must be radar-locked in order to be hit by the cannon.

Cannon ammunition can be quickly replenished from the EFB payload page.

Jettison

The aircraft provides several ways to jettison external stores in an emergency, such as following a loss of engine power or in other situations requiring a rapid reduction in weight or drag.

Compatible weapons and external fuel tanks can be jettisoned independently.

> **NOTE**
>
> On the real aircraft, the triple-bomb rack can also be jettisoned. This is not currently implemented in our add-on.

Emergency jettison

A yellow-and-black-striped button located on the left side of the cockpit jettisons all compatible external stores simultaneously, except for the wingtip MICA missiles.

Selective jettison

When only specific stores need to be jettisoned, the selective jettison procedure can be used.

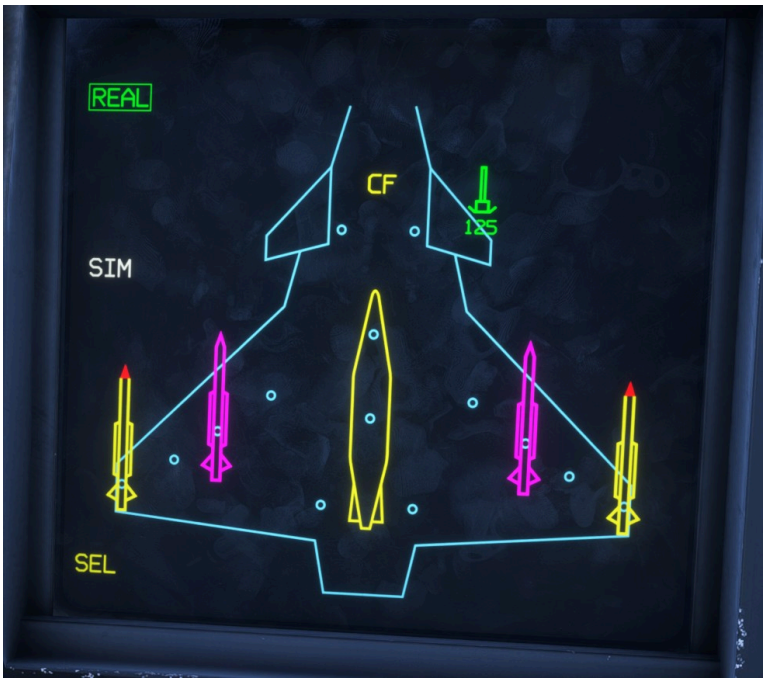
The procedure is as follows:

1. Open the LD WPN page and select `SEL`. By default, all jettisonable stores are selected and displayed in magenta.

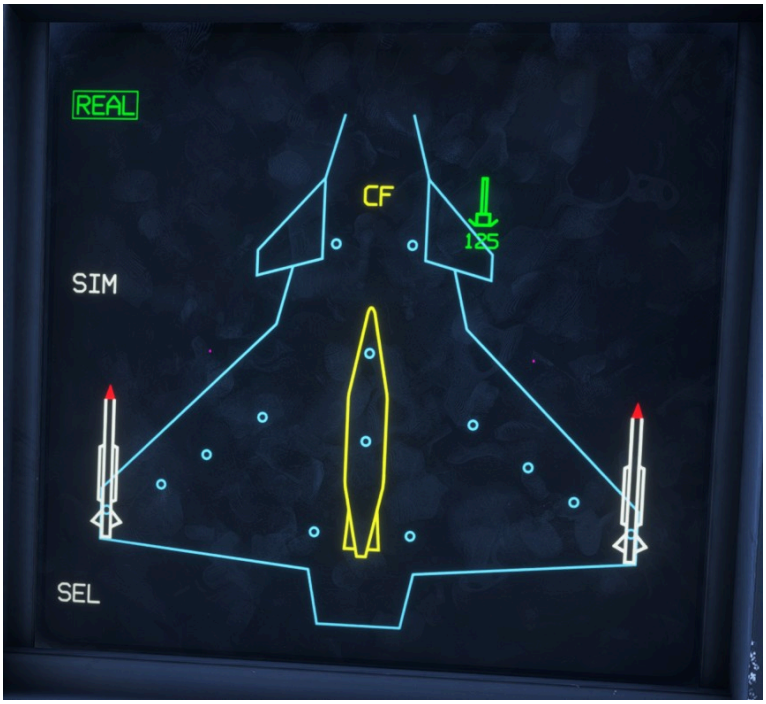
2. Select each store that you want to **exclude** from the jettison sequence. Excluded stores are displayed in yellow.

3. Translate the protective cover over the selective jettison button to arm the sequence.

4. On the LD WPN page, `SEL` changes to yellow. Press the selective jettison button to execute the sequence.



5. All stores that remain selected are jettisoned from the aircraft.



NOTE

On the real aircraft, the wingtip MICA missiles are launched under their own power to ensure safe separation rather than being conventionally jettisoned. This behaviour is not simulated in our current version.

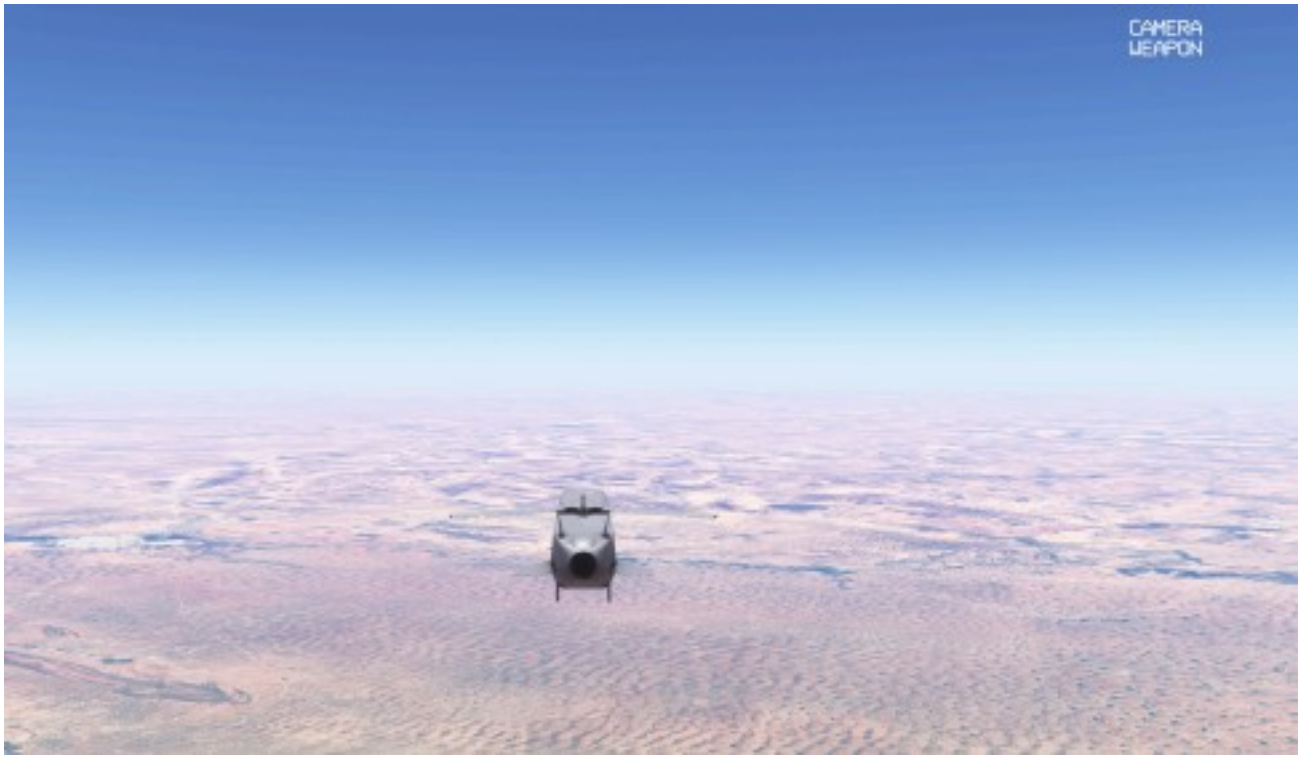
Custom cameras

To make mission scenarios more immersive, we have implemented a custom camera system that can be controlled using the custom bindings.

The available camera views depend on the active primary mode (`A/A` or `A/S`).

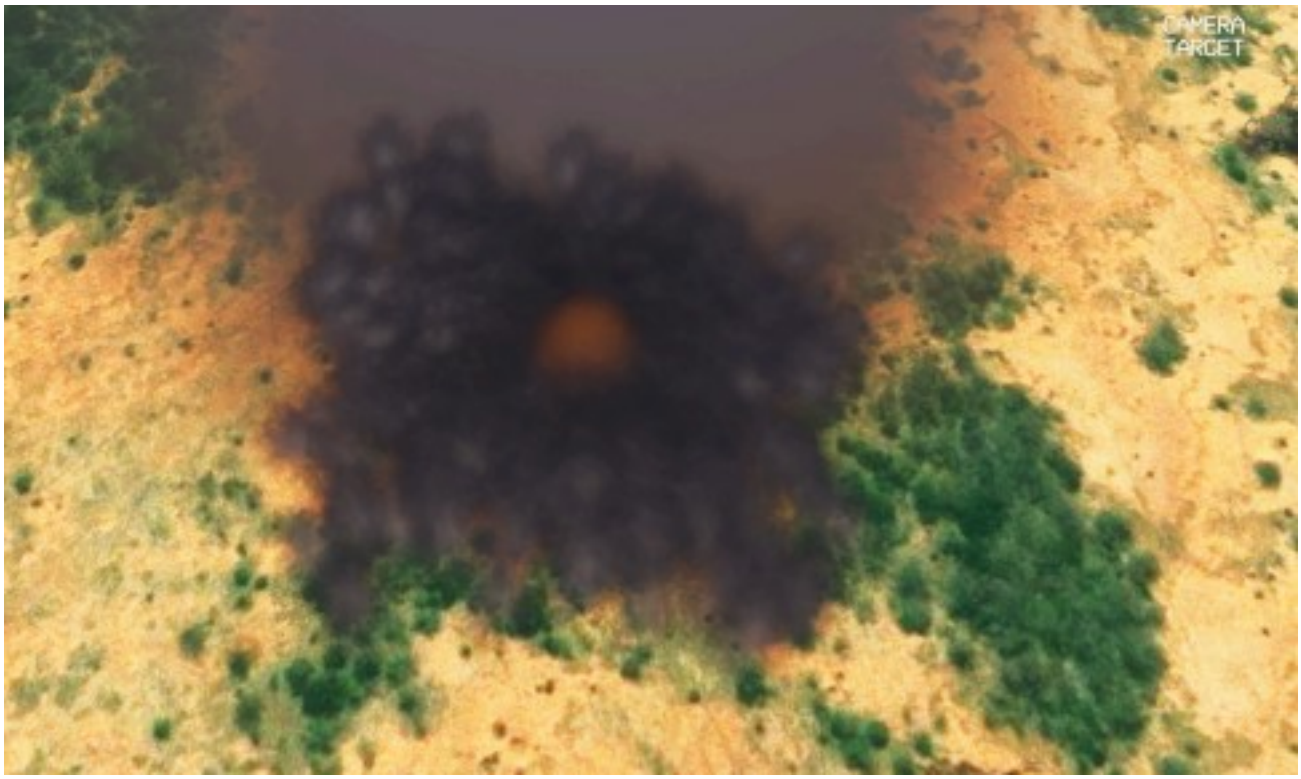
A small label in the upper-right corner of the screen indicates the currently active camera.

- `TOGGLE_FEATHER_SWITCH_1` toggles between the normal camera and a camera following the most recently fired weapon.



Custom camera on SCALP missile

- `TOGGLE_FEATHER_SWITCH_2` toggles between the normal camera and the designated-target camera. This camera follows the selected aircraft in `A/A` mode or the designated surface target in `A/S` mode.



Custom camera on ground target

- `TOGGLE_FEATHER_SWITCH_3` cycles through the available weapons when several fired weapons are currently active.

Countermeasures

The Rafale can carry several types of expendable countermeasures.

Our version supports the release of flares, intended to decoy infrared-guided threats.

Only manual dispensing is currently supported. The binding used to release flares is described in the controls section.

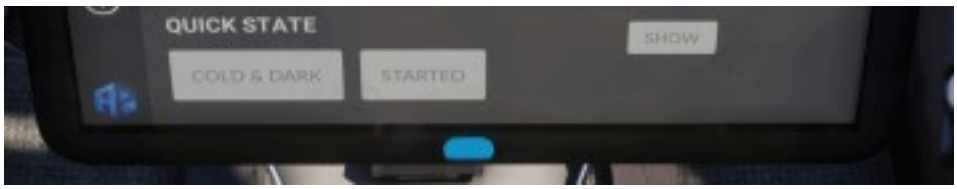
Nine different dispensing programmes can be selected on the LD ECM page. Each programme defines the number of countermeasures released and the dispensing rate.

Electronic flight bag

The aircraft is equipped with a tablet running a custom electronic flight bag (EFB), completely independent of the simulator's built-in EFB.

It is used to configure various aircraft settings and perform the actions described in this section.

The EFB can be shown or hidden using the "home" button or the dedicated button on the upper instruments panel.



Tablet home button

The tablet can be moved freely by clicking and dragging its top border.

Tablet grab area

> **NOTE**
>
> The units displayed in the EFB depend on your simulator settings. You can switch between kilograms and pounds by changing `Units of Measurement` in `Language` settings.

> **WARNING**
>
> If an aircraft screen is positioned directly behind the EFB, the overlapping area of the EFB cannot be interacted with. It is therefore recommended to move the EFB only over areas where there are no aircraft screens behind it.

Aircraft

The first tab contains the main aircraft-related controls:

- `COVERS`: install or remove all aircraft covers.
- `CANOPY`: open or close the canopy.
- `CHOCKS`: install or remove the wheel chocks.
- `LADDER`: install or remove the pilot access ladder.
- `STORES DISPLAY`: display all available external stores on the ground in front of the aircraft.
- `APU`: start or stop the APU.
- `GPU`: show or hide the ground power unit.
- `GEAR DOORS`: open or close the landing gear doors.

Some buttons are disabled when the corresponding action cannot be performed. For example, the canopy cannot be opened while the aircraft is in flight.

Mechanic

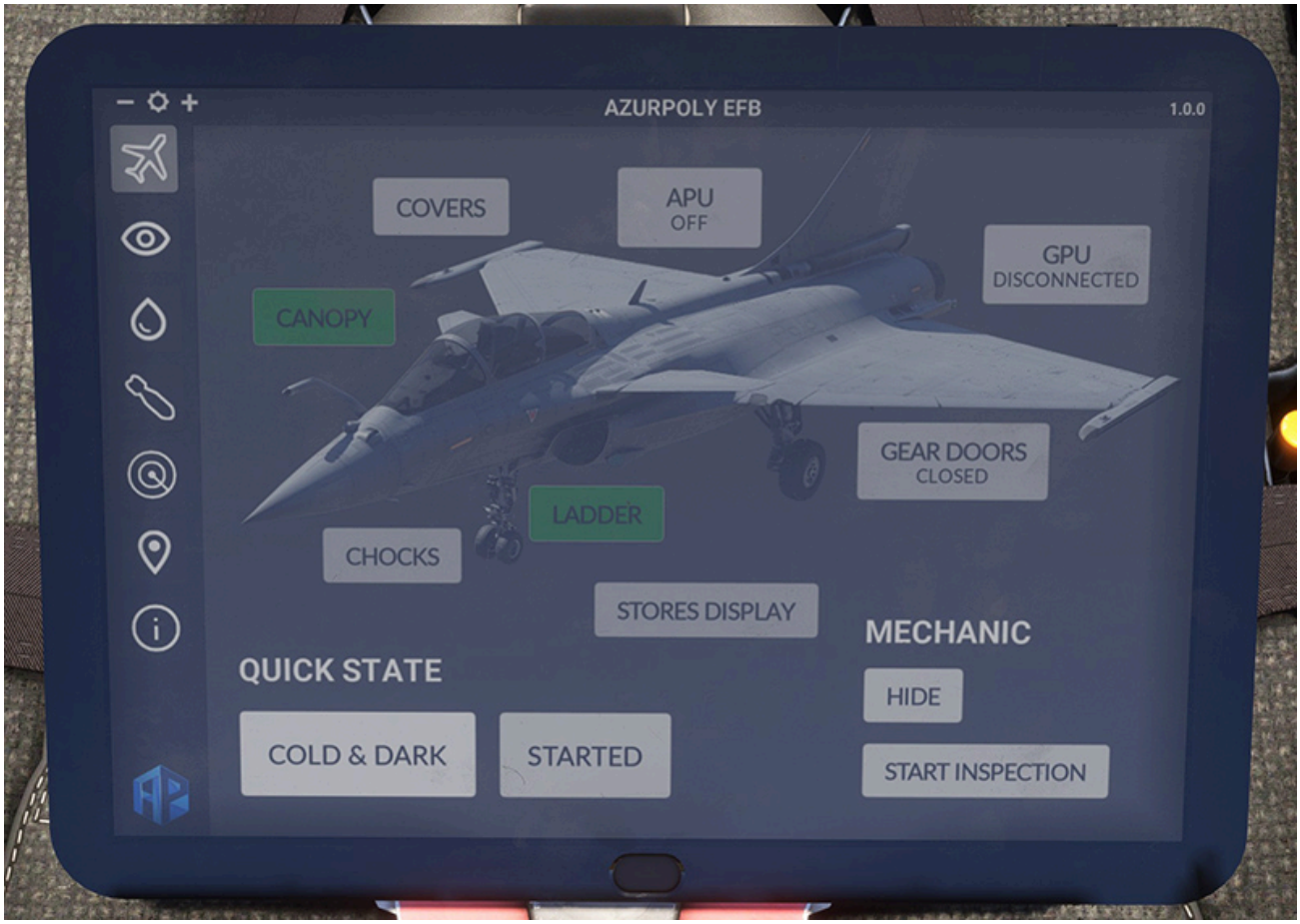
The `MECHANIC` section controls the mechanic avatar.

The first button shows or hides the mechanic.

The second button starts the pre-flight inspection, which lasts approximately one minute. The inspection can only be performed when the engines are off and the ladder is removed.

Quick actions

The quick-action buttons can be used to place the aircraft directly into either a `COLD AND DARK` state or a fully started state, without having to perform the complete manual procedure.



Aircraft page

Options

This tab contains various aircraft settings and assistance options.

Display

The following display options are available:

- `SMALL EFB`: display the tablet at a smaller size.
- `YOKE`: show or hide the control stick. The stick can also be hidden by clicking its base.
- `PILOT INTERIOR VIEW`: display the pilot body when using an interior camera.
- `FORCE PILOT HEAD`: force the pilot's head to remain visible with any interior camera.
- `PILOT REST POSITION`: place the pilot in a resting position with his left arm on the side of the cockpit. This option is only available when the canopy is open.

- `MIRROR SEAT REFLECTIONS`: display the seat reflections in the mirrors. Enabling this option forces the mirrors into a fixed position as MSFS does not currently support realistic dynamic reflections.

A slider is also available to adjust the intensity of the engine heat-blur effect.

Assistance

Several assistance options are available depending on the level of realism you prefer:

- `AUTO STORES SWITCH`: automatically set the stores configuration switch according to the current aircraft payload.
- `AUTO FUEL TOTALIZER`: automatically set the fuel totalizer during the whole flight.
- `AUTO IRS ALIGN`: automatically align the INS.
- `USE PEDALS FOR AUTOPILOT HEADING`: use rudder pedal inputs with differential braking to adjust the autopilot heading target, as on the real aircraft.

Throttle

This section allows you to choose how the afterburner is controlled.

The afterburner can either be included directly within the throttle axis range or toggled using a dedicated button. More information about the required bindings is available in the controls assignments section.

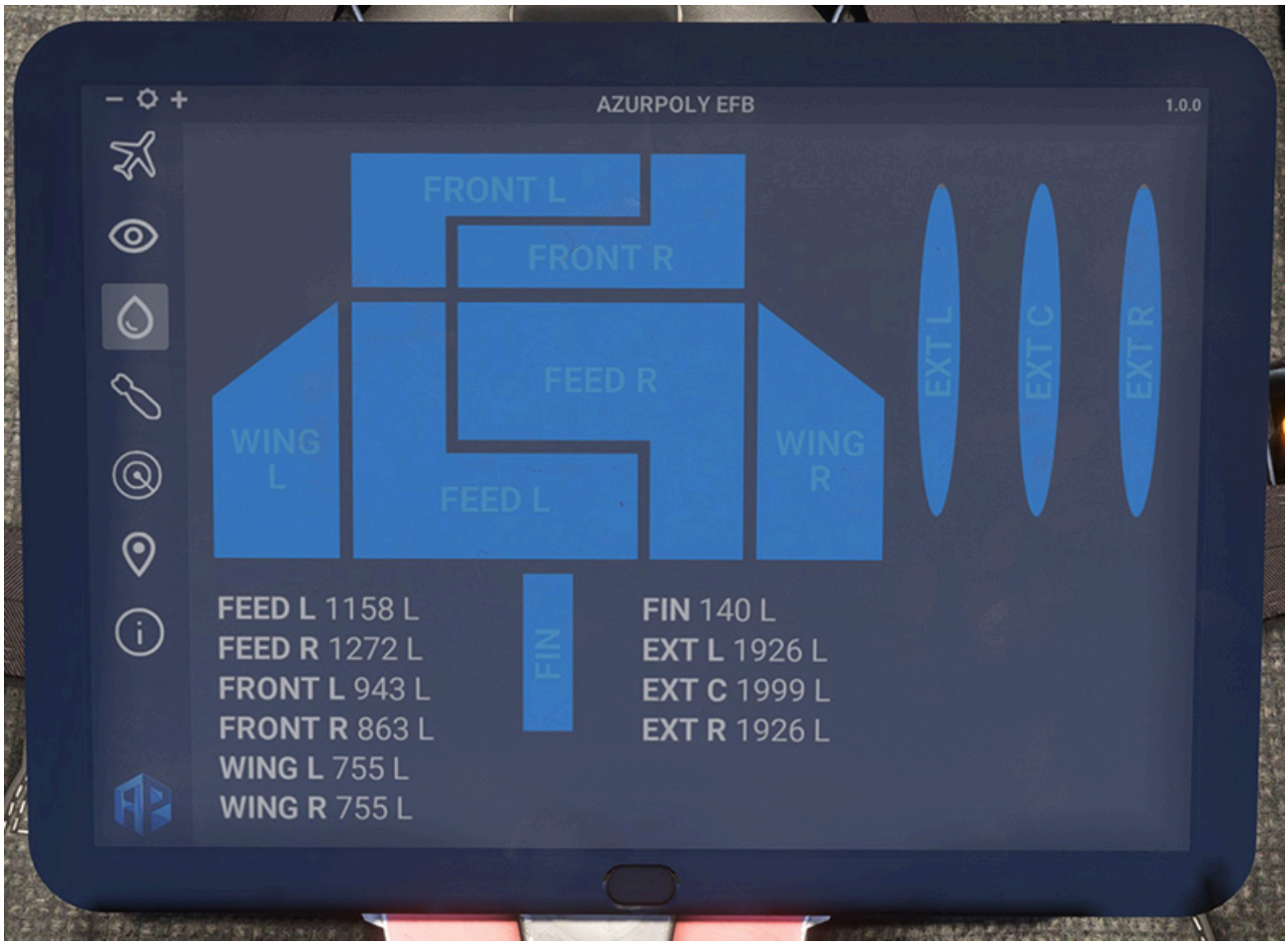
When the afterburner is controlled through the throttle axis, you can select the physical axis position at which the afterburner range begins.

Options page

Fuel

This page displays all internal and external fuel tanks installed on the aircraft.

Click any tank to adjust its fuel quantity individually.



Fuel page

Payload

This page is used to configure the aircraft payload.

You can browse the available loadout presets and apply one directly to the aircraft.

Three custom preset slots are also available. These presets can be saved and reused during future flights.

Individual stations can be configured by clicking them and selecting the desired store.

The station labelled `G` represents the cannon and can be used to reload its ammunition.

The weight summary in the upper-right corner of the page displays:

- Fuel weight.
- Payload weight.
- Total aircraft weight compared to maximum take-off weight.

Payload page

Traffic spawner

This page was developed specifically for the aircraft. It allows you to generate AI air traffic on demand and create custom mission scenarios.

On the left side of the page, you can select the aircraft model to spawn and its livery. The available aircraft depend on the content installed in your simulator library.

> **NOTE**
>
> For aircraft originally developed for MSFS 2020, livery selection may not be available through a separate dropdown menu.
>
> Instead, each aircraft and livery combination appears as a separate entry in the `TYPE` list. This is caused by differences in the simulator architecture.

The traffic spawn position is determined by the location of the cursor on the center display.

You can then configure the traffic:

- Altitude.
- True airspeed.
- Heading.
- Behaviour mode.

When `DOGFIGHT MODE` is disabled, the aircraft flies in a straight line using the selected parameters.

When `DOGFIGHT MODE` is enabled, the aircraft performs pitch and roll manoeuvres to simulate an evasive target or a pursuit scenario.

Press `SPAWN` to generate a new AI aircraft using the selected parameters.

> **WARNING**
>
> For performance reasons, a maximum of nine AI aircraft can be generated simultaneously.

The right side of the page lists all aircraft currently generated by the traffic spawner.

Each aircraft can be removed or edited. Its altitude, speed, heading and dogfight mode are updated using the settings on the left side of the page.

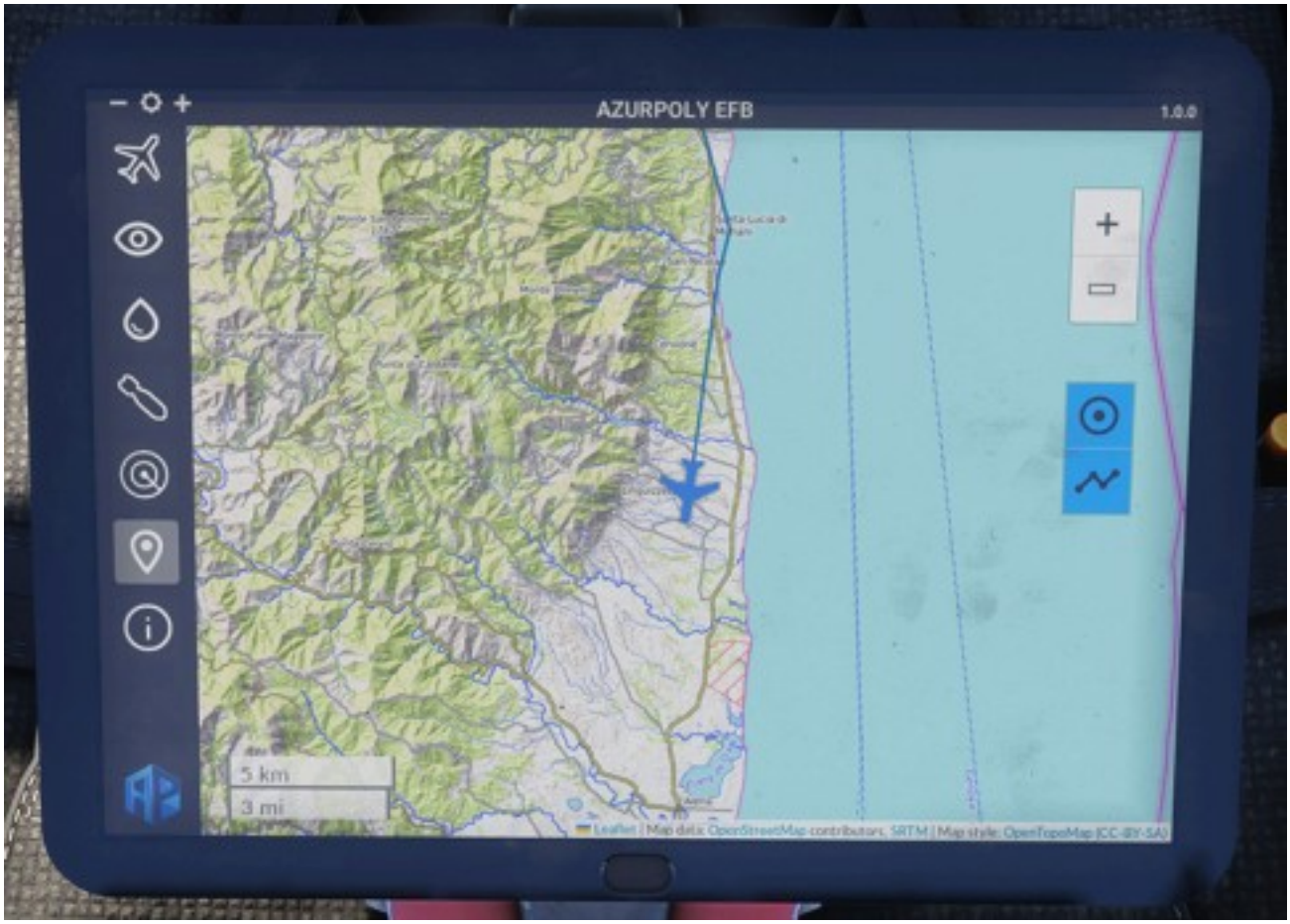
Traffic spawner page

Map

This page displays a map centred on the current aircraft position.

The controls on the right side of the page provide the following functions:

- Zoom in and out.
- Enable or disable automatic centring on the aircraft.
- Show or hide the recorded flight path.



Map page

Information

This page displays information about the currently installed version of the aircraft.

A notification is shown when a newer version is available.

The page also displays the total amount of time you have spent flying the Rafale.

Information page

Procedures

Reference speeds

The values below are indicative. Takeoff, approach and low-speed handling figures assume a normally loaded aircraft operating at low altitude. Actual speeds vary with aircraft mass, external stores, wind, airfield elevation and temperature.

Takeoff speed (clean configuration)	130 kts
Takeoff speed (heavy configuration)	155 kts
Approach speed	120-140 kts
Stall speed *	100 kts
Maximum speed	Mach 1.8

**The FCS protects the aircraft by limiting angle of attack, hence the indicated stall speed figure should not be treated as a fixed value but more as a reference. At that speed, the aircraft becomes barely controllable.*

Preflight inspection

A complete preflight inspection has been implemented within the capabilities provided by Microsoft Flight Simulator 2024.

It includes several interactive elements that can be checked or operated while preparing the aircraft for flight:

- Pitot tube and probe covers.
- Engine intake covers.
- Wheel chocks.
- Flight control surface checks.
- Landing gear strut checks.
- Functional pilot ladder.
- Ground crew mechanic inspection.

- Ground power unit interaction.

Walkaround inspection

During the walkaround inspection, you can check the items listed above and manually remove the aircraft protections.

When preflight pins are enabled in the general settings, interaction markers are displayed around the aircraft.

Preflight checks are optional, and you can enter the cockpit directly without completing the walkaround inspection.

Ladder

You can climb the ladder by clicking on it while standing nearby. Once you have reached the cockpit, click the canopy to enter.

The ladder can also be used to climb onto the aircraft.

> **⚠ WARNING**
>
> You must stand close to the ladder before the character can begin climbing towards the cockpit. Once the ladder is clicked, the climbing animation starts and the ladder moves to its upper position.
>
> If you leave the aircraft by another method, click the ladder again to trigger the descent sequence before attempting to climb back up.

> **ⓘ INFO**
>
> Interaction detection zones prevent objects from being triggered from too far away. In some cases, you may need to move very close to an item before it can be clicked.

Mechanic

A ground crew mechanic has been modelled to improve immersion during aircraft preparation. The mechanic can perform the external inspection for you.

The mechanic can be displayed from the EFB, and the inspection sequence can be started from the same page. Once the inspection is complete, the mechanic returns to the initial position and salutes the pilot.

WARNING

The mechanic does not remove the wheel chocks. They must be removed manually or from the EFB before departure.

INFO

Once the mechanic inspection sequence has started, it cannot be stopped or rewound. To interrupt it, hide the mechanic using the dedicated EFB button. If you show him again, he will restart from his initial position.

Hatches and gear compartments

Several service hatches have been modelled around the aircraft. Click a hatch to open or close it.

The landing gear doors can also be opened from the EFB, allowing the landing gear bays and their internal details to be inspected.

GPU interaction

The GPU can be connected or disconnected manually, in addition to being controlled from the EFB.

To connect it, open the GPU service hatch and click the electrical socket. The GPU appears and is automatically connected to the aircraft.

To disconnect it, click directly on the GPU.

Checklists

The following checklists reproduce the procedures available in the simulator. Interactive in-game checklists also provide dynamic validation and camera guidance for each item.

Preflight inspection

Item	Required state
Covers	**REMOVED**
Ladder	**REMOVED**

Before starting engine

Item	Required state
5K knob	**STANDBY**
FAIL page	**DISPLAYED**
Fire test switch	**RIGHT ENG/APU**
Canopy	**CLOSED**
APU	**STARTED**
ECS	**ON (IF NEEDED)**
5K knob	**NORM**
NAV page	**DISPLAYED**
IRS alignment	**LAUNCHED**
Fire test switch	**LEFT ENG**
FAIL page	**DISPLAYED**
ENG page	**DISPLAYED**
Strobes	**BRT**
Navigation lights	**BRT**
Formation lights	**BRT**

Starting engine

Item	Required state
Throttle	**IDLE**
Auxiliary levers	**IDLE**
5K knob	**RIGHT**
5K knob	**LEFT**
N1	**WAIT FOR 41%**
Auxiliary levers	**NORM**
APU	**OFF**

Taxi

> **INFO**
>
> It is normal for the aircraft to begin moving on its own with the throttle at idle, due to residual engine thrust.

Item	Required state
IRS alignment	**FINISHED**
Flight control system	**TESTED (SHORT)**
Chocks	**REMOVED**
Parking brake	**OFF**
Taxi light	**ON**

Before takeoff

Item	Required state
Deice	**ON**
IFF	**NORM**

Item	Required state
Gen safety	**HOT**
Landing light	**ON**

Normal takeoff

> **INFO**
>
> Hold the wheel brakes and advance the throttle to full dry power. Once the engines are stabilized, release the brakes and select full afterburner for the takeoff roll.

Item	Required state
Brakes	**PUSHED**
Throttle	**FULL DRY**
Brakes	**RELEASED**
Throttle	**FULL AFTERBURNER**

Climb

Item	Required state
Landing gear	**UP**

Before landing

> **INFO**
>
> For a normally loaded aircraft, fly the final approach between `120` and `130 kts`. Adjust the flight path and thrust to reach the ideal `16°` angle of attack at touchdown, using the approach brackets displayed on the HUD as a reference.

Item	Required state
Landing gear	**DOWN**

Item	Required state
Landing light	**ON**

After landing

Item	Required state
Taxi light	**ON**

Parking

Item	Required state
Parking brake	**ON**
Taxi light	**OFF**
Landing light	**OFF**
Throttle	**IDLE**
Auxiliary levers	**STOP**
Strobes	**OFF**
Navigation lights	**OFF**
Formation lights	**OFF**
5K knob	**OFF**

Securing

Item	Required state
Chocks	**SET**
Canopy	**OPEN**
Covers	**SET**
Ladder	**SET**

Controls assignments

The Rafale is designed around the concept of Hands On Throttle And Stick (HOTAS), allowing the pilot to perform most common actions and interact with the aircraft systems without taking their hands off the primary flight controls.

To reproduce this concept as closely as possible, we provide a large number of assignable control bindings.

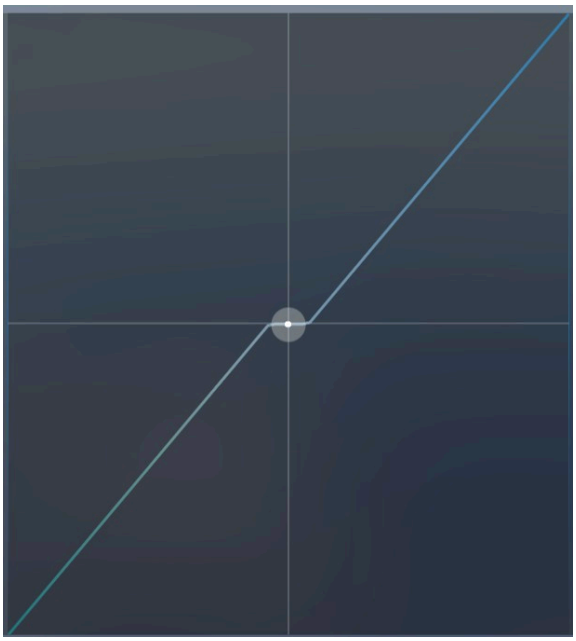
This section explains how to configure your physical controllers and which simulator commands should be assigned to operate the aircraft.

Stick

No aircraft-specific bindings are required to control the Rafale in pitch, roll, or yaw. You can use the standard simulator axis assignments: `AILERONS AXIS`, `ELEVATOR AXIS` and `RUDDER AXIS`.

Depending on your controller and personal preferences, you may adjust the sensitivity, dead zones, and response curves in the simulator controls options.

There is no universal recommended curve, as the ideal settings depend on the travel, precision, and centering mechanism of your hardware.



Basic curve with dead zone to avoid unvoluntary inputs

Throttle

The Rafale uses a single combined throttle lever.

In order to command the mono-throttle with your physical controller, you need to bind `THROTTLE AXIS` or `THROTTLE 1 AXIS`. Throttle 2 axis is ignored.

If you are using buttons instead of an axis, you should use `THROTTLE INCREASE` and `THROTTLE DECREASE` events.

By default, the full axis range is used for dry power, and you have to bind `TOGGLE AFTERBURNER` event to use the afterburner range.

If you want to use the axis for dry & afterburner without afterburner toggling, you can change mode from the tablet.

See EFB section to switch between the two modes.

Bindings

The aircraft provides assignable simulator commands for its main systems and HOTAS functions.

These bindings can be configured from the **Controls Options** menu in the simulator, in the same way as standard aircraft commands.

Some bindings correspond directly to controls located on the real aircraft's throttle and stick. Their associated functions are described in the HOTAS section.

> **TIP**
>
> Some of these binding names may seem unrelated to their function in the Rafale (for example, `TOGGLE PLASMA`) because existing simulator events have been repurposed for aircraft-specific functions. Developers cannot create new binding names in the simulator's control settings.
>
> We recommend creating a dedicated control profile for the Rafale and assigning these events to your controllers.

K: Event	Binding name (english menu)	Description	HOTAS
`PROPELLER_REVERSE_THRUST_TOGGLE`	TOGGLE PROPELLER REVERSE THRUST	Target designation (A/A or A/S)	MG4
`TOGGLE_PROPELLER_SYNC`	TOGGLE PROPELLER SYNC	Change combat mode: IDF, MIR, MIF, GUN, etc.	MG6
`SPOILERS_TOGGLE`	TOGGLE SPOILERS	Toggle spoilers	MG7
`AP_MACH_HOLD`	TOGGLE AUTOPILOT MACH HOLD	Toggle autothrottle	MG8
`TOGGLE_PROPELLER_DEICE`	TOGGLE PROPELLER DEICE	Flares salvo	MG9
`PLASMA_TOGGLE`	TOGGLE PLASMA	HUD drift cut-out	MG11
`ATTITUDE_BARS_POSITION_DOWN`	DECREASE ATTITUDE BARS POSITION	Zoom down center display	MGP3 (down)
`ATTITUDE_BARS_POSITION_UP`	INCREASE ATTITUDE BARS POSITION	Zoom up center display	MGP3 (up)
`PROP_PITCH1_HI_EX1`	PROPELLER 1 PITCH HI	Create a MRK point in database	MGP4
`PROP_PITCH4_DECREASE_EX1`	DECREASE PROPELLER 4 PITCH	Taxi light on	MGP10 (down)
`PROP_PITCH1_DECREASE_EX1`	DECREASE PROPELLER 1 PITCH	Landing/taxi/police lights off	MGP10 (left)
`PROP_PITCH2_DECREASE_EX1`	DECREASE PROPELLER 2 PITCH	Police light on	MGP10 (right)

K: Event	Binding name (english menu)	Description	HOTAS
`PROP_PITCH3_DECREASE_EX1`	DECREASE PROPELLER 3 PITCH	Landing light on	MGP10 (up)
`WAR_EMERGENCY_POWER`	WAR EMERGENCY POWER	Weapon fire	PM1
`ELEV_TRIM_DN`	ELEVATOR TRIM DOWN (NOSE DOWN)	Autopilot pitch decrease / Pitch trim down	PM3 (up)
`ELEV_TRIM_UP`	ELEVATOR TRIM UP (NOSE UP)	Autopilot pitch increase / Pitch trim up	PM3 (down)
`AILERON_TRIM_LEFT`	AILERON TRIM LEFT	Autopilot bank left / Roll trim left	PM3 (left)
`AILERON_TRIM_RIGHT`	AILERON TRIM RIGHT	Autopilot bank right / Roll trim right	PM3 (right)
`STEERING_INC`	INCREASE STEERING	Toggle nose wheel steering (ground) Enable autopilot (flight)	PM8
`STEERING_DEC`	DECREASE STEERING	Disable autopilot	PM9
`PROP_PITCH1_INCREASE_EX1`	INCREASE PROPELLER 1 PITCH	Display system page on `LLD`	PM10 (center)
`PROP_PITCH2_INCREASE_EX1`	INCREASE PROPELLER 2 PITCH	Display DAS selection in `LLD`	PM10 (left)
`PROP_PITCH3_INCREASE_EX1`	INCREASE PROPELLER 3 PITCH	Display DAS selection in `RLD`	PM10 (right)

K: Event	Binding name (english menu)	Description	HOTAS
`PROPELLER_REVERSE_THRUST_HOLD`	HOLD PROPELLER REVERSE THRUST	Display autopilot page on `LLD`	PM11
`HORN_TRIGGER`	TRIGGER HORN	Emergency stores jettison	
`SMOKE_OFF`	SMOKE OFF	Disable smoke (Smokewinders)	
`SMOKE_ON`	SMOKE ON	Enable smoke (Smokewinders)	
`SMOKE_TOGGLE`	SMOKE TOGGLE	Toggle smoke (Smokewinders)	
`TOGGLE_FEATHER_SWITCH_1`	TOGGLE FEATHER SWITCH 1	Display custom weapon camera (depending on active mode)	
`TOGGLE_FEATHER_SWITCH_2`	TOGGLE FEATHER SWITCH 2	Display custom target camera (depending on active mode)	
`TOGGLE_FEATHER_SWITCH_3`	TOGGLE FEATHER SWITCH 3	Switch between fired weapons with custom weapon camera	

WARNING

If you fly using Thrustmaster® HOTAS WARTHOG, you may have unwanted APU start because of default bindings. Please go in controls options in order to remove all bindings related to APU.

Custom variables and events

Advanced controller software such as FSUIPC or SPAD.neXt can directly trigger custom variables (L:) or events (H:).

They provide access to more cockpit controls and functions.

Variable or event	Description
`L:AZP_RAF_AVIONICS_MF_KNOB_MODE`	Set multi-function knob (MFK) position: 0: R1 1: R2 2: H 3: BULL 4: BINGO 5: DEST 6: ALT
`H:AZP_RAF_AVIONICS_MF_KNOB_INC`	Rotate MFK (clockwise)
`H:AZP_RAF_AVIONICS_MF_KNOB_DEC`	Rotate MFK (counterclockwise)
`H:AZP_RAF_AVIONICS_MF_KNOB_PUSHED`	Push MFK
`H:AZP_RAF_AVIONICS_VISUALISATION_KNOB_LEFT_INC`	Rotate left visualization knob (clockwise)
`H:AZP_RAF_AVIONICS_VISUALISATION_KNOB_LEFT_DEC`	Rotate left visualization knob (counterclockwise)
`H:AZP_RAF_AVIONICS_VISUALISATION_KNOB_LEFT_PUSHED`	Click on left visualization knob
`H:AZP_RAF_AVIONICS_VISUALISATION_KNOB_RIGHT_INC`	Rotate right visualization knob (clockwise)
`H:AZP_RAF_AVIONICS_VISUALISATION_KNOB_RIGHT_DEC`	Rotate right visualization knob (counterclockwise)
`H:AZP_RAF_AVIONICS_VISUALISATION_KNOB_RIGHT_PUSHED`	Push right visualization knob
`L:AZP_RAF_ENGINE_AUXILIARY_LEVER_POS:1`	Set auxiliary engine control (AEC) position for left engine: 0: STOP 1: IDLE 2: NORM 3: FIX
`L:AZP_RAF_ENGINE_AUXILIARY_LEVER_POS:2`	Set auxiliary engine control (AEC) position for right engine (same as above)