

FOUGA MAGISTER CM.170



FLIGHT MANUAL



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1\ INTRODUCTION

1.1\ History

The CM.170 Magister is a French two-seat jet trainer aircraft build by Fouga. Its first flight was on 23rd of July, 1952, and service in French Air Force began in 1956. In total, 929 models were built for a dozen different armies, including France, Ireland and Belgium. Even though main use of the aircraft was pilot training, some have been used for close air support, during Six-Day war for instance.

It has two tandem seats, a distinctive butterfly tail configuration and wing tip tanks. Fouga was firstly powered by two Turbomeca Marboré II engines, each delivering 880 lbf of thrust. The Marboré IV was introduced later, with more power.

Athletic and playful, it is a reactive and polyvalent machine, which is capable of performing various types of operation, from sightseeing flights to committed aerobatics, activities for which it is mainly use nowadays by private pilots.

1.2\ Developer notes

The journey is still underway, and we are glad you are now part of it. As for our other products, we will propose updates each time we consider it as relevant, to bring new functionalities or fix discovered bugs.

Do not hesitate to contact us at contact@azurpolygroup.com or on www.azurpoly.com.

2\ GENERAL DESCRIPTION

2.1\ Specifications

Weights	
Empty weight	2,290 kg
Gross weight (without tip tanks)	2,850 kg
Maximum takeoff weight	3,200 kg
Dimensions	
Wingspan (including tip tanks)	12,5 m
Length	10,06 m
Height	2,8 m
Wing area	17,3 m²
Tail area	3,75 m²
Tail opening angle	110 °
Engines	
Fuel capacity	980 L
Maximum thrust	3,92 kN
Maximum engine speed	22,500 RPM

2.2\ Detailed views

Front panel (pilot)



1	Tachometer (RPM)	23	Main tank level (liters, without tip tanks)
2	Anemometer (kts)	24	Machmeter
3	Gyrocompass	25	Hydraulic pressure (hpz)
4	Attitude indicator	26	Voltmeter (volts)
5	Accelerometer (G-force)	27	Servo light
6	Nozzle temperature (Celsius)	28	Unlocked landing gear light
7	Altimeter (ft)	29	Starter light
8	Variometer (ft/min)	30	Panel lights (compass)
9	Turn coordinator	31	Servo switch
10	ADF indicator	32	Defrost handle
11	Landing gear state	33	Pitot heat switch
12	Oil temperature (Celsius)	34	Attitude indicator gyro supply switch
13	Pitch trim indicator (degrees)	35	Gyrocompass gyro supply switch
14	Flaps indicator	36	Generator switch
15	Oil pressure (hpz)	37	Battery switch
16	Cabin altitude (ft)	38	Landing gear handle
17	Oxygen regulator	39	Fuel pressure light
18	Sight setting (inoperative)	40	Landing gear alarm test
19	Horizontal situation indicator	41	Parking brake handle
20	Low fuel light (150 liters)	42	EFB button
21	Canopy lock light	43	Smoke switch
22	Engine fire lights	44	Compass

Lateral consoles (pilot)



1	Landing gear hydraulic circuit selector	14	COM frequency knob
2	Emergency spoilers selector	15	COM volume
3	Throttle	16	Intercom switch
4	Spoilers switch	17	Panel lights (radio)
5	Air conditioning temperature	18	ADF frequency
6	Flaps switch	19	NAV panel ON/OFF
7	Navigation lights switch	20	NAV volume
8	Air conditioning mode	21	VOR ident
9	Landing lights switch	22	VOR frequency knob
10	Panel lights (emergency)	23	VOR frequency knob
11	Panel lights (UV)	24	Starter light
12	Panel lights (console)	25	Starter
13	UHF panel ON/OFF	26	Fuel dump switches

Front panel (copilot)



1	Tachometer (RPM)	12	Flaps indicator
2	Anemometer (kts)	13	Oil pressure (hpz)
3	Gyrocompass	14	Oxygen regulator
4	Attitude indicator	15	Intercom panel (inoperative)
5	ADF indicator	16	Starter light
6	Nozzle temperature (Celsius)	17	Low fuel light (150 liters)
7	Altimeter (ft)	18	Generator light
8	Variometer (ft/min)	19	Pitot heat light
9	Turn coordinator	20	Engine fire lights
10	Landing gear state	21	Landing gear handle
11	Oil temperature (Celsius)	22	Panel lights (radio)

2.3\ Instruments

BEZU 32 gyrocompass

The aircraft is equipped with a gyrocompass (*BEZU 32 model*).

You can use the right knob to switch between two modes:

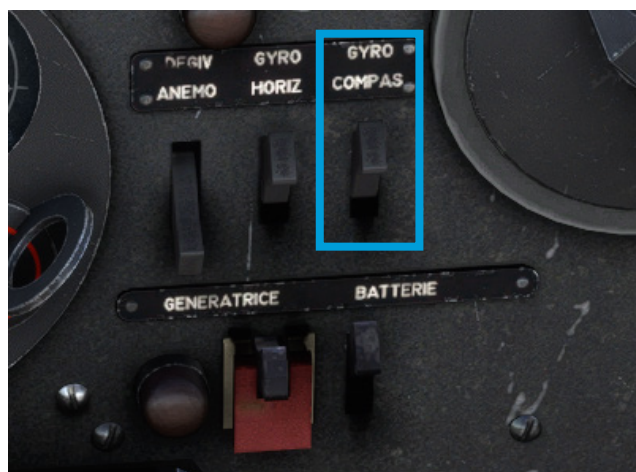
- Gyrocompass (D mode): Connected to the aircraft gyroscope, you will get a smooth rotation but you will need to recalibrate it frequently, like any gyrocompass.
- Magnetic compass (Cm mode): Indicating the magnetic heading, recalibration is not needed but display can become jerky, especially when aircraft is turning.

With the left knob, you can:

- Recalibrate the instrument (only if D mode is selected).
- Set heading bug (can be used to conserve a reference heading).



A switch allows to manage gyrocompass supply:



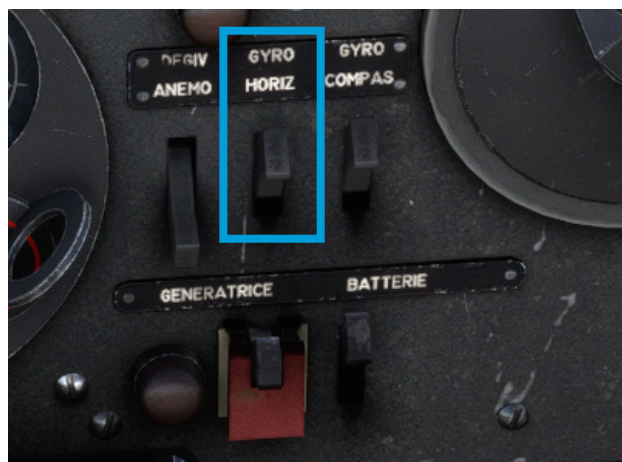
Attitude indicator

Attitude indicator fitted into the Magister is a classical one. The only setting available is the bars position change.



This instrument will indicate pitch angle between 0 and 80 degrees and bank angle with a graduation each 10 degrees between 0 and 60 degrees.

A switch allows to manage attitude gyroscope supply:



3\ AIRCRAFT SYSTEMS

3.1\ Flight controls

Although flight controls do not have big specificities compared to other aircrafts, butterfly tail imposes a special operation. Both pitch input from the stick and yaw input from the rudder are combined to create the ruddervator movement.

However, this is transparent for the user and will use the flight stick as you would do on any other plane.

Servo assistance

Aileron movement is assisted by servo, supplied by the hydraulic circuit. It can be disconnected by the pilot. As it is only an assistance aiming at easing aileron motion, servo effect has not been implemented in our aircraft.

A light will be visible when servo is disconnected.



3.2\ Canopy and pressurization

Pilot and copilot canopies can be handled separately.

You can lock and unlock canopy from the handle. A red light will be visible as soon as one of the canopies is not locked.

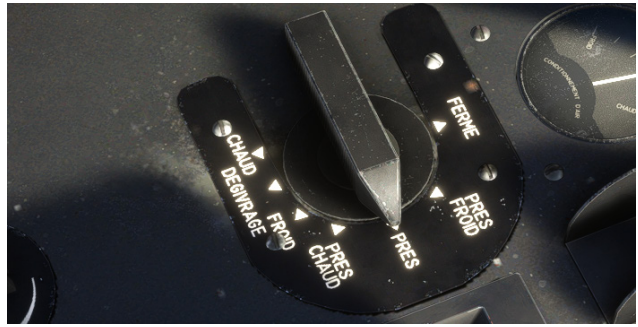


To open or close the canopy, you have to click on its left arm.



Cabin pressurization and air conditioning is functional as soon as canopy is locked. A multi-position switch allows to choose air conditioning type:

- Closed (no air conditioning).
- Pressurization (temperature selection on three positions).
- Defrost (temperature selection on three positions).



Current selected temperature can be seen on the gauge.



When defrost is selected, air is directed upon the windshield. In addition, defrost handle on the main panel allows to spurt alcohol on the front glass to help defrosting (action is not simulated).



3.3\ Electrical system

Electric supply is provided in flight, thanks to a generator, rated 28.5V, connected to the left engine. A converter allows to feed gyroscopes.

Lights

The Fouga is fully capable of night flying, and each light has been reproduced in the game. In the exterior, you will find a landing light and navigation lights.

Navigation lights can be set on three positions:

- OFF
- FIXED
- FLASHING, where lights will blink approximately one time per second.



As we have to manage three distinct position, keyboard input cannot be taken into account. You need to use the switch on the left console to turn on or off the navigation lights.

In the interior, you will find for pilot and copilot:

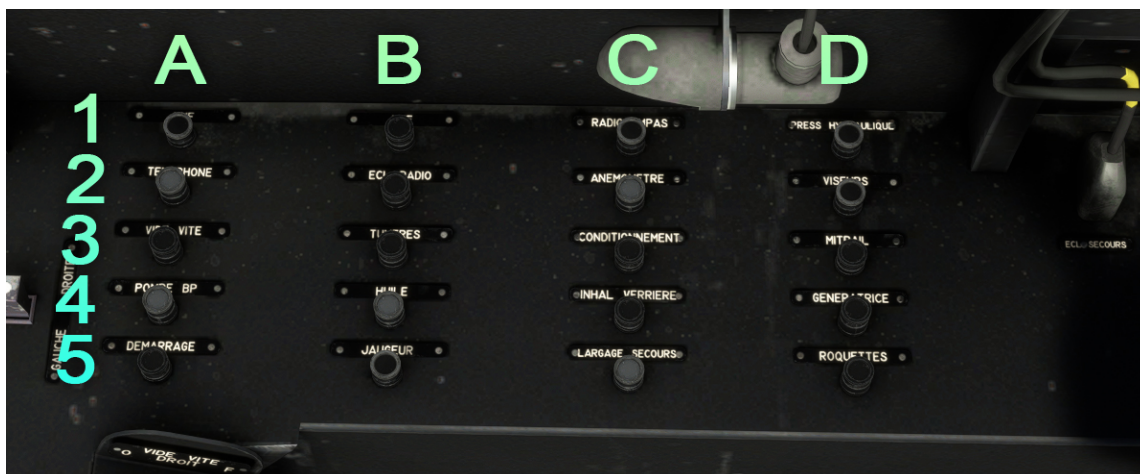
- Console lights (white).
- UV lights (front panel lights set by potentiometer).
- Emergency lights (red console lights set by potentiometer).
- Radio light (backlight for radio panels).



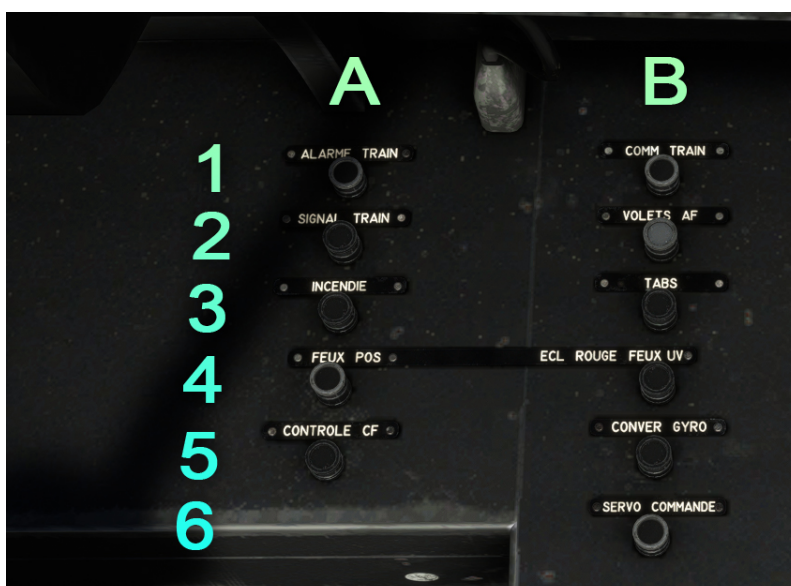
Pilot also has a compass light:



Fuses



A1	VHF	C1	Radio compass
A2	Intercom	C2	Pitot heat
A3	Fuel dump	C3	Air conditioning
A4	Low pressure fuel pump	C4	Low oxygen and canopy lights
A5	Starter	C5	Emergency drop
B1	UHF	D1	Hydraulic pressure indicator
B2	Radio lights	D2	Gun sight
B3	Nozzle temperature indicator	D3	Gun
B4	Oil pressure and temperature indicators	D4	Alternator
B5	Fuel level indicator	D5	Rockets



A1	Landing gear alarm light	B1	Landing gear
A2	Landing gear lights	B2	Flaps and spoilers

A3	Fire alarm lights	B3	Tabs
A4	Navigation lights	B4	Red and UV lights
A5	Turn coordinator	B5	Gyros
		B6	Servo

3.4\ Fuel system

The Fouga has three fuel tanks:

1. One fuselage tank (divided in two parts) containing 730 liters.
2. One tank on left wing tip (125 liters).
3. One tank on right wing tip (125 liters).

On some versions, bigger tip tanks (each 230 liters) can be installed. They are not implemented in our version yet.

In addition to those tanks, there is a back flying accumulator (11 liters) allowing to feed the engines when the aircraft is flying inverted. After approximately 30 seconds, engines will lose power and you will need to bounce back to resume fuel supply.

A low-pressure electric fuel pump is connected to the main electric circuit, allowing to feed high-pressure pumps and the back flying accumulator.

When fuel pressure goes below 350 millibars (too low to fill back flying accumulator) a red light will glow on the left of the panel:



3.5\ Hydraulic system

The Fouga is fitted with two hydraulic circuits, one NORMAL circuit and an EMERGENCY circuit. A pump connected to the left engine allows to maintain a 250 bars pressure into the circuit.

The following systems are connected to the hydraulic circuit:

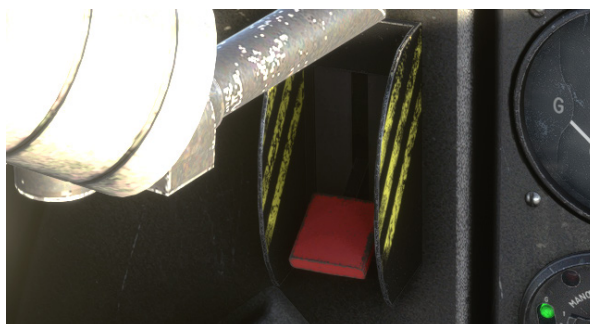
- Landing gear.
- Flaps.
- Brakes.
- Spoilers.
- Aileron servo.

Emergency circuit is supplied thanks to the handle on the right of the pilot.



Landing gear

Equipped with a tricycle landing gear, the movement is managed with the red handle on the left of the main panel.



Nose gear has a free movement and is not connected to the rudder pedals. During taxi, turns are done using differential braking. As differential braking can be achieved with specific hardware only (rudder pedals with brakes), we chose to connect front wheel to the rudder to facilitate ground manoeuvres.

A gauge with several bulbs allows to control landing gear state:

- 3 red bulbs are turned on when landing gear is not locked (not fully open or not fully retracted).
- Two sets of 3 green bulbs are turned on when landing gear is expanded and locked.



A light above main panel will blink when one of the engines is below 15,000 RPM and the landing gear is not down.



In case of issues with lights, you can use the auditory check button. Once pressed, a continuous sound will be emitted if landing gear is down and locked.



Flaps

The CM.170 has trailing edge flaps, composed by two elements per wing.

Thanks to the switch on the left console, flaps can be set on any position between 0 and 40 degrees. You can still assign pre-assign takeoff (15 degrees) and landing (40 degrees) positions to any of your joystick button to facilitate its use.



Spoilers

The aircraft has six plates per wing, each of them can rotate between 0 and 90 degrees.

Spoiler switch is present on the right side of the throttle, for both pilot and copilot. Like flaps, it is a three positions switch.



3.6\ Oxygen

Oxygen bottles are located behind the pilot seat. With a 2000 litres capacity (initial pressure of 150 bars), system can be opened or closed from a valve on the right of the pilot.



Both pilot and copilot have an oxygen regulator with:

- Needle showing the remaining oxygen in the circuit.
- Blinker which should do a complete movement for each breathing in and breathing out of the pilot/copilot.
- Bulb which will light up when oxygen pressure drops below 25 bars.
- Switch (N – 100%) to provide pure oxygen.
- Switch (N – Secours) used in case of emergency to provide pure oxygen in overpressure (50 mbar).

Pure oxygen is automatically supplied above 34,000 ft.



Autonomy will depend on the cabin altitude, and can be read in the following table:

Cabin altitude (ft)	Autonomy for two pilots (hours)				
	N	5.2	3.9	2.6	1.3
30,000	100 %	5.2	3.9	2.6	1.3
	N	5.2	3.9	2.6	1.3
25,000	100 %	4	3	2	1
	N	5.2	3.9	2.6	1.3
20,000	100 %	3.2	2.4	1.6	0.8
	N	5.2	3.9	2.6	1.3
15,000	100 %	2.5	1.8	1.2	0.6
	N	5.2	3.9	2.6	1.3
10,000	100 %	2	1.5	1	0.5
	N	5.2	3.9	2.6	1.3
0	100 %	1.4	1	0.7	0.3
	N	7	5.2	3.5	1.7
	Oxygen quantity	2000 L (1)	1500 L (3/4)	1000 L (1/2)	500 L (1/4)

3.7\ Radio

The right console is dedicated to everything related to the radios:

- UHF panel (COM 1).
- Radio compass (ADF) panel.
- Sound mixing panel (intercom).
- VOR panel (NAV 1).

Sound mixing panel is inoperative as COM and NAV volumes are already adjustable from UHF and VOR panels.

UHF panel

Originally, UHF box has pre-registered frequencies that can be set before flight and selected with the 20 positions wheel.

In order to be usable in the simulator, you can select any COM frequency from the central wheel.

Left knob allows to turn on/off UHF (HOM position is inoperative).

Right knob allows to set COM 1 volume.



Radio compass

In the CM.170, radio compass panel has plenty of knobs and switches used to connect manually to a station.



This complex operation is not needed to connect to modern NDB transmitters, and thus was not simulated in our aircraft.

You can simply use the top left knob in order to change ADF frequency.



ADF indicator will point to station direction.



VOR panel

This panel allows to select NAV frequency, thanks to two knobs.

The course deviation indicator shows deviation from the radial that can be set with OBS knob.



The CM.170 is not equipped with ILS.

4\ ELECTRONIC FLIGHT BAG

To help managing all actions related to the aircraft, an EFB has been implemented. It can be opened and closed thanks to a cockpit button.



When opened, screen brightness can be set from the top bar.



EFB can be closed with a click on its left border. It can be moved on the seat with a click on its right border.

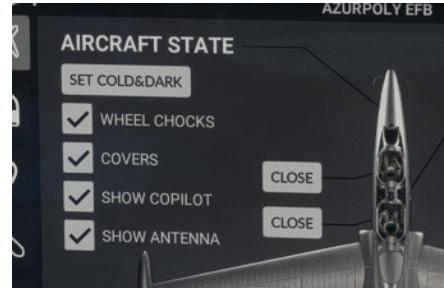
4.1\ Aircraft menu

Aircraft state

You can put here the aircraft in “cold and dark” mode. Engines will be stopped, systems will be off and ground protections will be put in the aircraft exterior.

Copilot and front antennas can be hidden.

You can also open and close pilot and copilot canopy from here.



Hydraulics

This menu allows to trigger hydraulic failure (main circuit), as this type of failure is not natively supported by MSFS.

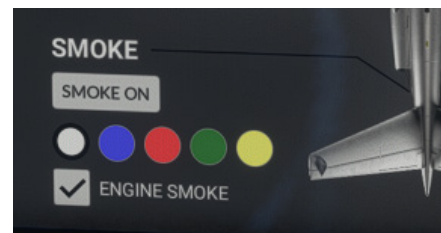
You will see main hydraulic pressure drops, which will let you practice emergency procedures in case of hydraulic failure, to maneuver landing gear and spoilers.



Smoke system

Here, you can turn the smoke system on (which can also be done with the switch on the main panel), and choose between five different colours.

Black smoke coming from the engine at high power can be disabled.



Oxygen

This menu shows oxygen valve state, in addition to the remaining quantity.

You can refill the circuit as needed.



4.2\ Radio menu

If tooltips are disabled in your parameters, you may not see COM and ADF frequencies when setting them from the knobs. This menu shows all active frequencies, with current volume for COM and NAV.

As there is no transponder unit in the cockpit, you can also use this menu to set transponder state and code.



4.3\ Map menu

This menu consists of a map showing current aircraft position.

Different controls on the right part allow to interact with the map:

- Zoom buttons.
- Button to stop auto centering to aircraft position.
- Trajectory button to show or hide aircraft path.



4.4\ Weapons menu

From version 1.1, you can install various weapons on the aircraft from this EFB menu. Those weapons are static and cannot be jettisoned.

If you downloaded the Fougas from Microsoft Marketplace, this menu will be empty as Microsoft policy does not allow to sell aircrafts having external weapons. In this case, please download the patch [on our website](#) to install weapons manager on your EFB.

Unfortunately, XBox users cannot install any add-on manually, and hence cannot benefit from weapons management. We hope this could be solved in the future.

Once patch is installed, you will get the following view with several buttons to display or hide the weapons:



The Fougas was equipped with the following armament:



Ammunition	Caliber	Type	Quantity	Launch equipment	Hard points
Machine guns	7.5 mm		2 x 150	2 MAC 52	

Rockets	68 mm	SNEB	2 X 6	ALKAN LB 52 & MATRA LR 122	1 & 4
	120 mm	T 10	2 x 2	MATRA LR 20	2 & 3
Bombs	50 kg	EG 61 C	2 x 1	ALKAN LB 52	1 & 4
	50 kg	F 1	2 x 1	ALKAN LB 52	1 & 4

As you add armament, payload impact will be computed automatically. Hence, you should not manually change weights in payload menu, especially “wing payload” lines.

FUEL		L	KG
^ FUEL		100,00 %	
LEFT TIP	100	124.90 L	
RIGHT TIP	100	124.90 L	
CENTER 1	100	726.72 L	
^ PAYLOAD		38,99 %	
PILOT		65 kg	
COPILOT		65 kg	
WING PAYLOAD 1		0 kg	
WING PAYLOAD 2		0 kg	
WING PAYLOAD 3		0 kg	
WING PAYLOAD 4		0 kg	
WING PAYLOAD 5		0 kg	
Empty Weight / -		2 287 KG /	-
Fuel / Max Allowable Fuel		784 KG /	784 KG
Payload / Max Payload		130 KG /	333 KG
Total / Max Takeoff Weight		3 201 KG /	3 222 KG

Consumption and CO2 Emission

4.5\ Autopilot menu

The Fouga is not equipped with an autopilot. However, you will find an autopilot menu in the EFB, allowing you to hold altitude and/or heading as you wish.

When turning ALT or HDG mode on, current altitude/heading will be maintained, and you can change values using “+” and “-“ buttons.

Vertical speed selected for any altitude change can be chosen from the right.

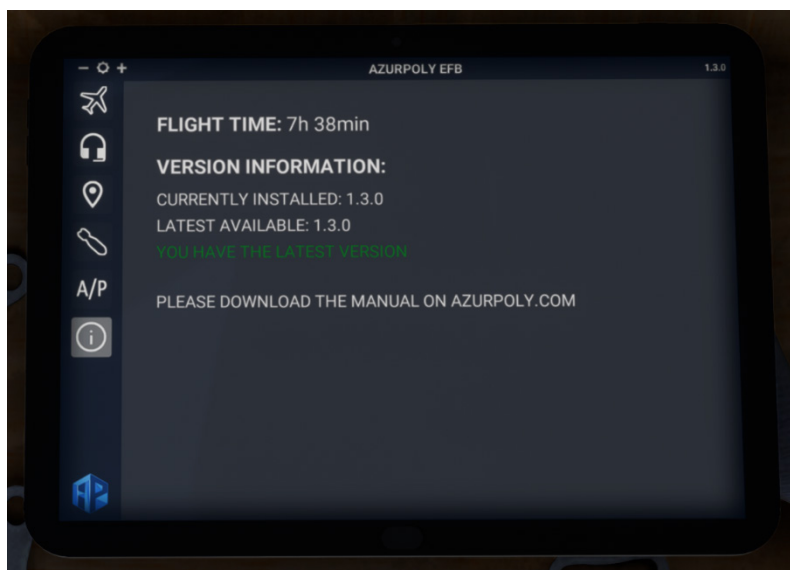


4.6\ Version menu

This menu indicates version of the aircraft currently installed on your machine.

A message will be displayed if an update is available.

You can also see how much time you spent within the aircraft.



5\ NORMAL PROCEDURES

5.1\ Reference speeds

General	
Stall speed (full flaps)	78 kts
Stall speed (no flaps)	87 kts
Rotation speed	90 kts
Initial climb speed	120 kts

Final approach speed	110 kts
Maximum speed in turbulent air (VNO)	250 kts
Maximum gear extended	215 kts
Maximum speed	400 kts
Never exceed speed (VNE)	450 kts
Recommended for aerobatics	
Loop	280 kts
Roll	260 kts
Cuban Eight	280 kts

5.2\ Checklists

In addition to this manual, you can find in-game interactive checklists, with dynamic validation and cameras management to help you complete each step.

STARTING ENGINE

Battery	ON
<i>For each engine:</i>	
Throttle	0 %
Fuel valve	CLOSED
Starter	ON
Wait for 1000 RPM	
Ignition	ON
Fuel valve	OPENED
Wait for 4000 RPM	
Ignition	OFF
Starter	OFF
Oil pressure	1 bar
Alternator	ON
Voltage	28.5 V

Order of actions is very important for engines. Once starter is running, depressing the button on the fuel handle will initiate ignition, and pushing the handle will cause fuel to flow through the combined injection spark plugs into the combustion chamber.

At this moment, nozzle temperature should increase by approximately 100 degrees Celsius within ten seconds. Ignition button must be released immediately to avoid damaging the engine.



BEFORE TAXI

Canopy	CLOSED
Radio (UFH)	ON
Attitude indicator gyro	ON
Gyrocompass gyro	ON
Hydraulic pressure	OK
Aileron servo	ON
Spoilers	RETRACTED

BEFORE TAKEOFF

Flaps	15 degrees
Canopy	LOCKED
Oxygen	100 %
Trim	NEUTRAL
Pitot heat	ON

AFTER TAKEOFF

Landing gear	UP
Flaps	RETRACTED
Oxygen	NORMAL

BEFORE LANDING

Landing gear	DOWN
Hydraulic pressure	OK
Landing lights	ON
Flaps	40 degrees

AFTER LANDING

Trim	NEUTRAL
Spoilers	RETRACTED
Flaps	RETRACTED

SHUTDOWN

Oxygen	100 %
Pitot heat	OFF
Attitude indicator gyro	OFF
Gyrocompass gyro	OFF
Aileron servo	OFF
Fuel valve (both)	CLOSED
Battery	OFF

6\ EMERGENCY PROCEDURES

6.1\ Hydraulic failure

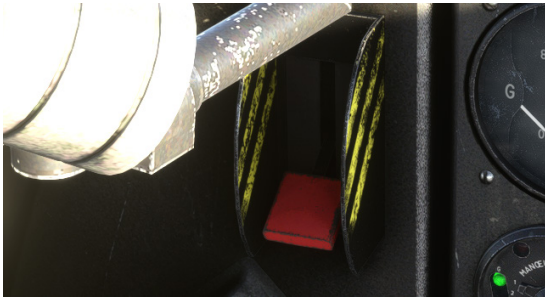
In case of hydraulic failure, you will need to use the emergency circuit to maneuver landing gear and spoilers.

In the real aircraft, brakes also need to be operated with the emergency hydraulic handle. This has not been reproduced because of the difficulty to give a precise input to the hydraulic handle while ground rolling.

Landing gear

Follow this procedure to extend the landing gear in case of hydraulic failure:

1. Lower landing gear handle.



2. Click on the button to use secondary hydraulic circuit.



3. Use manual pump to lower the landing gear.



4. Stop pumping once the three landing gear lights are green.



It is not possible to retract the landing gear using emergency circuit.

Spoilers

To extend or retract spoilers using secondary circuit, you simply need to set the three-positions switch as wanted.



Then, just use the manual hydraulic handle.

6.2\ Fuel dump

In case of emergency, tip tanks can be emptied with a fuel dump system.

To begin the fuel dumping, use the switch on the right console. A red light indicates the ongoing motion of the dumping valve (lasting only some seconds).



Once draining is in progress, you may wait for approximately 3-4 minutes to jettison the tank completely.

Dumping can be stopped at any time using the switch.