DCS SERIES

MIRAGE F1

for **DCS** World

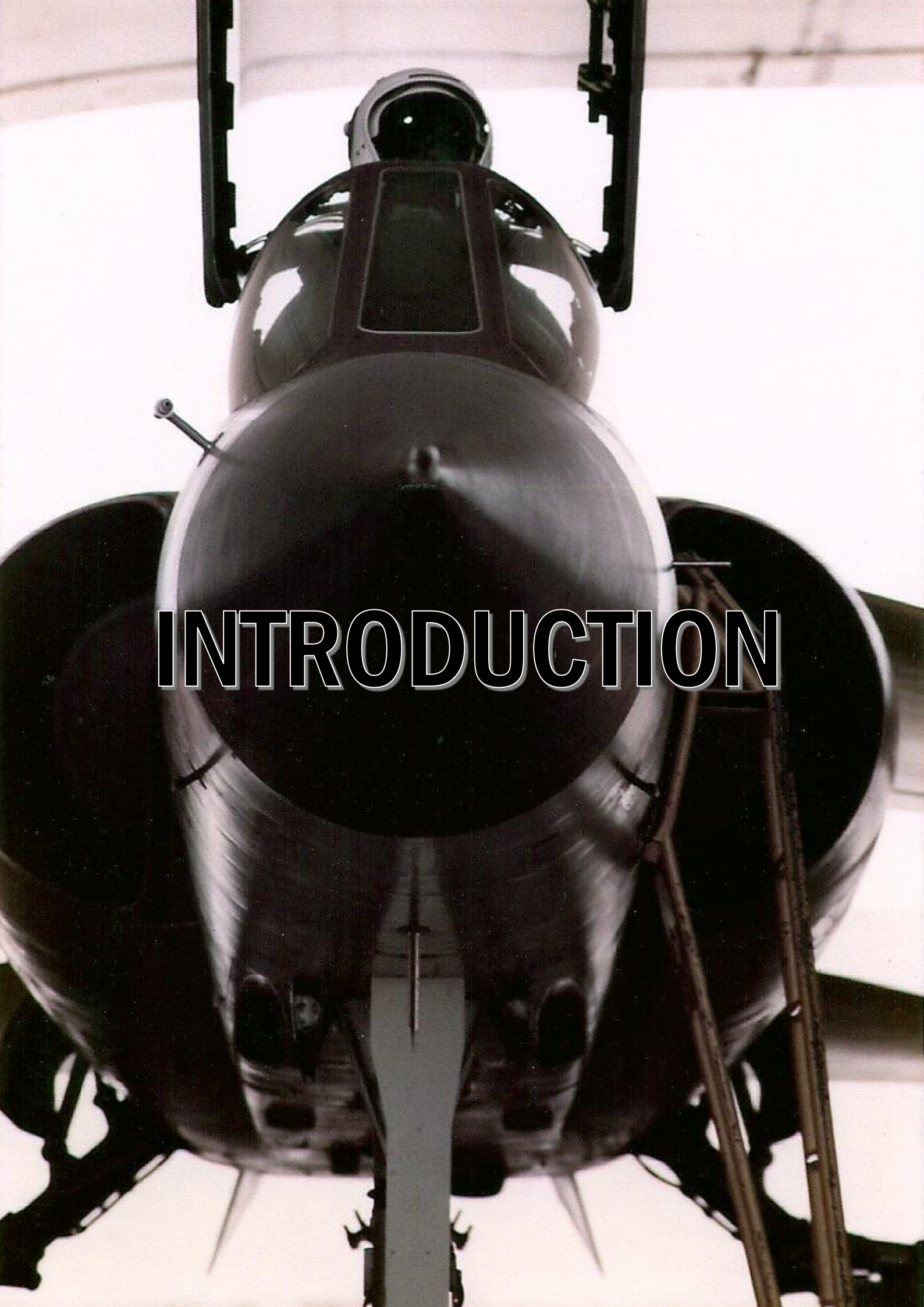
AERGES

THE FIGHTER COLLECTION

EAGLE DYNAMICS

Flight Manual

0. Contents



INTRODUCTION

1. INTRODUCTION

Introduction

The Mirage F1 is a single engine French fighter and attack aircraft first introduced in the early 1970s. It was envisioned originally as an all-weather interceptor and has seen many variants, roles and configurations. It is still in service today with multiple air forces and private companies.

The F1 is equipped with a single SNECMA Atar 9K-50 afterburning turbojet, capable of delivering 70 kN of thrust at sea level. A Cyrano IV monopulse radar (later Cyrano IVM) is carried by most of the variants of the aircraft.

The aircraft can carry an extensive variety of payloads: Both IR and radar air to air missiles, guided and unguided bombs, rockets, as well as countermeasures, reconnaissance and electronic warfare pods. Most versions also carry two internal 30 mm DEFA 553 cannons. Some of the latest variants can carry the famous AM39 Exocet antiship missile.

This manual refers mainly to the Mirage F1 CE. The differences with other versions implemented in this simulation are described in the corresponding annexes.

History

During the 1960s, several fighter design projects were being developed in France: the F1, the larger F2, the swing-wing G and the AFVG (the latter in conjunction with the UK). Cost and political issues led to the cancellation of all of these projects, except of the F1, which was a lighter fighter aircraft designed from the beginning to be the successor of the Mirage III and V families of aircraft.

The Mirage F1 wing and empennage configuration enabled it to improve upon some of the problems that the Mirage III and V suffered due to their delta wing configuration: The high lift devices of the F1 allowed for shorter landing distances and better manoeuvrability and handling at low speeds. The F1 was also able to carry 40% more fuel internally and had a more powerful engine.

The initial prototype first flew on the 23rd of December of 1966, already achieving speeds in excess of Mach 2 in its fourth flight. A fatal accident related to fluttering destroyed this prototype but, after a redesign, the testing of the aircraft continued successfully and the first deliveries of the production aircraft took place in May 1973.

The type has partaken in multiple conflicts serving different countries throughout its extensive service life. With France it has served in Operations Manta, Epervier, Daguet (the Gulf War), Provide Comfort, Harmatan and Serval over Chad, Libya, Mali, Kuwait… As well as in Afghanistan. It partook in the South African Border War with South Africa, in the Paquisha War with Ecuador, in the Libyan civil war, in the Western Sahara War with Morocco and, perhaps most famously, in the Iran-Iraq and Gulf wars with Iraq.

The Mirage F1 has served in the air forces of several countries: France, Iraq, Spain, South Africa, Greece, Jordan, Kuwait, Ecuador and Qatar. It is still in operation in several others: Morocco, Iran, Libya, Gabon and the Republic of the Congo. It also serves in private aggressor training services in the USA.

Main variants

More than 700 units of the Mirage F1 have been produced and it has been exported to several countries. The different necessities of customers over the years have led to the emergence of multiple variants to better satisfy specific requirements:

- Mirage F1-C: The original all-weather interceptor variant for the 'Armée de l'Air', exported to several countries (Spain, Greece, Morocco…). Several of these aircraft were reconverted to the CT (close air support) specification for France. The C-200 was a C version with air refuelling capability, also for the 'Armée de l'Air'. Despite its main role as an interceptor, a secondary role as ground attacker was considered, and a wide selection of air-to-ground ordnance was also available for these models.
- Mirage F1-B: Two seat conversion trainer of the Mirage F1-C. It was capable of carrying the same ordnance as the Mirage F1-C but the extra seat came at the cost of less fuel, a slight increase in weight and the loss of the internal cannons. External cannon pods could be mounted instead.
- Mirage F1-E: Multirole and ground attack version of the Mirage F1-C, it was equipped with a better navigation suite and air refuelling capability. All of the E versions made were for export clients (Iraq, Spain, Jordan, Ecuador…). Of special note are the later Iraqi versions, which were equipped with a wide variety of guided air to ground weapons.
- Mirage F1-D: Two seat version of the F1-E. Only 2 were built, both for Qatar.
- Mirage F1-A: Simplified ground attack variant for the South African Air Force and the Libyan Air Force. It substituted the Cyrano IV radar with a laser rangefinder.
- Mirage F1-CR: Dedicated reconnaissance version which included visual and IR cameras (the IR camera replaces one of the cannons), a radar with extra ground mapping capabilities and a variety of pods, including ELINT and side looking radar. It served with the 'Armée de l'Air' and some were later sold to an aggressor company in the USA.
- Mirage F1-M: Spanish modernised version based on the Spanish C and E models carried out by Thomson-CSF. The modernisation vastly improved air to ground capability, included the new Cyrano IVM radar with sea search modes, as well as new navigation suites, a colour LCD and new HUD.

The Mirage F1-CE

The Mirage F1-CE is the export variant for Spain of the interceptor French F1-C, it entered service in 1975, making the 'Ejército del Aire' the second client to buy the type. It differs slightly from the French version in its ability to carry American made AIM-9 Sidewinder missiles, as well as having an incorporated countermeasure suite. Most of their operative life was spent in the 'Ala 14', based in Los Llanos Air Force Base, until the year 2000, in which it was completely replaced by the F1-M.

AIRCRAFT CHARACTERISTICS

2. AIRCRAFT CHARACTERISTICS

2.1 PHYSICAL CHARACTERISTICS

Clean aircraft gross take-off weight comprising:

- empty weight equipped……7849 kg… (17,304 lbs)
- pilot……95 kg…….(209 lbs)
- fuel (JP1)*……3397 kg…….(7489 lbs)
- shells……145 kg……(320 lbs)

GW: 11,486 kg….(25,322 lbs)

Overall dimensions:

- length……15.25 m…..(50.03 ft)
- span……8.44 m…..(27.69 ft)
- height (clean aircraft, fully fueled)……4.49 m…..(14.73 ft)

Undercarriage:

- wheelbase (clean aircraft, fully fueled)……4.87 m….(15.98 ft)
- track……2.48 m…..(8.14 ft)

Propulsion:

- SNECMA ATAR 9 K50 jet engine
- Test bed thrust:
  - Full power dry……4770 daN…(10,725 lbs)
  - Max. afterburner……6830 daN…(15,355 lbs)

* Fuel density: 0.79 kg/l

2.2 TECHNICAL CHARACTERISTICS

Clean aircraft permissible load factor:

- In subsonic flight (Mach < 0.95)……-3/+7.2
- In supersonic flight (Mach > 1)……-3/+6

Maximum speed……700 kt (0 – 20,000 ft)

750 kt (> 20,000 ft)

Mach number limit……..2.1

Ceiling (high altitude equipment is not part of aircraft specifications).....55,000 ft

Service ceiling……50,000 ft

Figure 2-1 Mirage F1CE Lateral View

Figure 2-2 Mirage F1CE Top View

AIRCRAFT SYSTEMS

3. AIRCRAFT SYSTEMS

3.1 COCKPIT CONTROLS AND INDICATORS

Figure 3-1 Main Instrument Panel

1 CANOPY HINGED HANDLE	7 JAMMER DETECTION LIGHT AND (C + M OR SW) R LIGHT
2 CLOCK	8 MANUAL GRAVITY DROP SELECTOR INDICATOR
3 STANDBY MAGNETIC COMPASS	9 ACCELEROMETER
4 CHAF AND FLARE DISPENSER PANEL	10 MASTER FAILURE WARNING LIGHT
5 INCIDENCE INDICATOR	11 AUTOPILOT CONTROL AND INDICATOR UNIT
6 SIGHT HEAD	

12 CONFIGURATION INDICATOR 13 SIGHT CAMERA 14 WARNING LIGHTS 15 SHOCK-CONE POSITION INDICATOR 16 MACH/AIRSPEED INDICATOR 17 RADAR INDICATOR SCOPE 18 FIRE WARNING LIGHT (ENG/AB) + HORN 19 MATRA 550 OR SIDEWINDER JETTISON 20 RPM INDICATOR 21 SLAVED ALTIMETER 22 STANDBY ALTIMETER 23 JPT (JET PIPE TEMPERATURE) INDICATOR 24 SPHERICAL INDICATOR	25 VERTICAL SPEED INDICATOR 26 STANDBY HORIZON 27 NAVIGATION INDICATOR 28 RADAR DETECTOR INDICATOR 29 EMERGENCY JETTISON 22 STANDBY ALTIMETER 30 JETTISONING SELECTOR SWITCH 31 SELECTIVE JETTISON 32 DUAL FUEL GAUGE 33 FUEL REMAINING INDICATOR 34 CROSSFEED SWITCH AND EMERGENCY TRANSFER SWITCH 35 FUEL TRANSFER INDICATOR

Figure 3-2 Forward Lower Panel

1 ANTI-SKID (SPAD) SWITCH 2 SHOCK-CONE MANUAL CONTROL SWITCH 3 SHOCK-CONE PUSHBUTTON 4 FUEL TRANSFER SEQUENCE SELECTOR SWITCH 5 HYDRAULIC PRESSURE SELECTOR SWITCH 6 NOSE WHEEL STEERING HIGH SENSITIVITY BUTTON	7 NOSE WHEEL STEERING SWITCH 8 IFF CONTROL PANEL 9 DUAL HYDRAULIC PRESSURE GAUGE 10 CABIN ALTIMETER 11 TRIM INDICATOR 12 ALTERNATIVE FIRING HANDLE

Figure 3-3 Left Side Panel

1 BRAKE CHUTE CONTROL	25 RADAR CONTROL STICK SCALE SELECTION
2 CANOPY EMBRITTLE CONTROL	26 RADAR CONTROL STICK ELEVATION/ALTITUDE
3 STANDBY RECEPTACLE LIGHT	DIFFERENCE BUTTON
4 (C + M OR SW) R DESELECTION SWITCH	27 RADAR CONTROL STICK
5 TELEMETER/ZONE SCANNING SWITCH	28 RADAR CONTROL STICK SCAN SELECTION
6 EMERGENCY REGULATION CONTROL LEVER	29 ANTENNA-GYRO SWITCH
7 EMERGENCY REGULATION SWITCH	30 THROTTLE LEVER
8 EMERGENCY REGULATION LIGHT	31 THROTTLE CUT/IDLE SWITCH
9 LANDING LIGHT CONTROL	32 IN-FLIGHT RELIGHT BUTTON (HIDDEN)*
10 LANDING GEAR SAFETY LEVER AND CONTROL LEVER	33 ALTERNATIVE PTT
11 ANTI-RETRACTION OVERRIDE BUTTON	34 IGNITION/VENTILATION SELECTOR SWITCH
12 EMERGENCY/PARKING BRAKE HANDLE	35 START BUTTON
13 SERVO RESET BUTTON	36 STARTING PUMP SWITCH
14 ARTHUR SELECTOR SWITCH	37 L/H LP PUMP SWITCH
15 STICK UNCOUPLE SWITCH	38 R/H LP PUMP SWITCH
16 YAW/ANTI-SLIP SWITCH	39 LP MAIN COCK SWITCH
17 PITCH SWITCH	40 V/UHF RADIO CONTROL UNIT
18 LEAD LIGHT	41 SLAT/FLAP LEVER
19 INCIDENCE TEST SWITCH	42 RUDDER TRIM CONTROL SWITCH
20 FLIGHT CONTROL TEST RESTART BUTTON	43 HIGH-LIFT DEVICE SELECTOR SWITCH
21 FLIGHT CONTROL TEST SWITCH	44 RADIO SELECTOR UNIT
22 UHF RADIO CONTROL UNIT	45 ARMAMENT MASTER SWITCH
23 JPT EMERGENCY REGULATION SWITCH	46 OXYGEN SYSTEM CONTROLS (PARTIALLY HIDDEN)**
24 A/B MAIN COCK SWITCH	

*Figure 3-4 *Throttle detail*

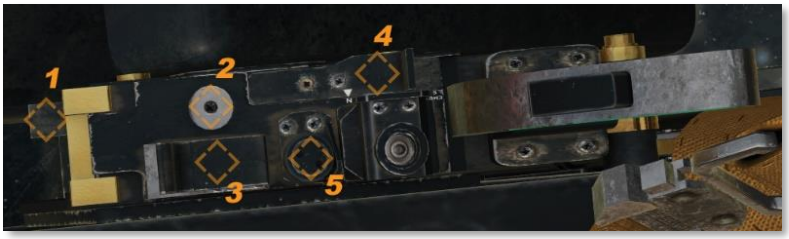


*Figure 3-5 **Oxygen system controls*

1 THROTTLE CUT/IDLE SWITCH 2 IN-FLIGHT RELIGHT BUTTON

1 ANIT-G VALVE COCK 2 ANIT-G TEST BUTTON 3 ANIT-G CONNECTION COVER	4 N-100%-EMEG MODE SELECTOR SWITCH 5 OXYGEN OVERPRESSURE BUTTON

Figure 3-6 Cockpit Left Side View

1 FACE BLIND FIRING HANDLE 2 REAR-VIEW MIRROR	3 CANOPY OPEN/CLOSE HANDLE 4 CANOPY SHEAR KNIFE

NOTE:

When the canopy is open, the limit of the pilot horizontal head movement is extended 10 cm.

Figure 3-7 Right Side Panel

1 DINGHY PUNCTURE	20 TACAN X/Y MODE AND FREQUENCY SELECTORS
2 CANOPY LOCK CONTROL	21 VOR-ILS/OFF/TACAN AND OMNIBEARING SELECTORS
3 EMERGENCY LANDING GEAR HANDLE	22 VOR-ILS CONTROL UNIT
4 CANNONS TOO HOT LIGHT	23 HEADING SELECTION KNOB
5 TR RESET BUTTON	24 PILOT OXYGEN TEST BUTTON
6 BATTERY SWITCH	25 AIR CONDITIONING SYSTEM EMERGENCY CONTROL SWITCH
7 ALTERNATOR 1 SWITCH	26 AIR CONDITIONING SYSTEM MASTER VALVE CONTROL SWITCH
8 ALTERNATOR 2 SWITCH	27 AIR CONDITIONING SYSTEM TEMPERATURE CONTROL REHOSTAT
9 INVERTER SELECTOR SWITCH	28 LIGHTING CONTROL UNIT
10 FAILURE WARNING PANEL	29 AIR CONDITIONING SYSTEM AUTO/MANUAL SELECTOR SWITCH
11 NAVIGATION LIGHT CONTROL	30 AIR CONDITIONING SYSTEM HOT/COLD SELECTOR SWITCH
12 FORMATION LIGHT CONTROL	31 AIR CONDITIONING SYSTEM RAM AIR SWITCH
13 SEE RIGHT SIDE PANEL DETAIL *	32 AIR CONDITIONING SYSTEM DEMIST SWITCH
14 CANOPY SEAL VALVE CONTROL LEVER	33 CIRCUIT BREAKER BOX
15 RADAR INDICATOR SCOPE CONTROL BOX	
16 SEAT HEIGHT ADJUSTMENT CONTROL	
17 HEADING AND VERTICAL REFERENCE SYSTEM CONTROL SWITCH	
18 HEADING AND VERTICAL EMERGENCY GYROMAGNETIC COMPASS SWITCH	
19 HEADING AND VERTICAL EMERGENCY HEADING CONTROL UNIT ERECTION BUTTON	

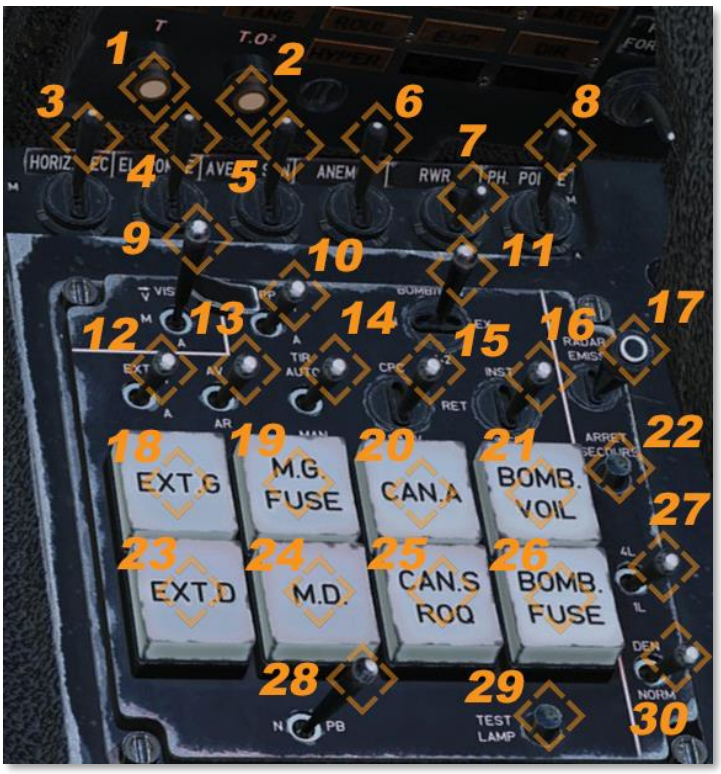


*Figure 3-8 *Right Side Panel Detail*

1 FAILURE WARNING PANEL T TEST BUTTON	18 LEFT MATRA R550 OR SIDEWINDER MISSILE PUSHBUTTON
2 FAILURE WARNING PANEL O2 TEST BUTTON	19 LEFT OR FUSELAGE MATRA R530 MISSILE PUSHBUTTON
3 STANDBY HORIZON SWITCH	20 AIR-TO-AIR GUNS PUSHBUTTON
4 ELECTRO-PUMP SWITCH	21 WING BOMBS PUSHBUTTON
5 WARNING HORN SWITCH	22 RADAR EMERGENCY TRANSMISSION BUTTON
6 PROBE HEATER SWITCH	23 RIGHT MATRA R550 OR SIDEWINDER MISSILE PUSHBUTTON
7 RADAR DETECTOR SWITCH	24 RIGHT MATRA R530 MISSILE PUSHBUTTON
8 SEARCH LIGHT CONTROL	25 AIR-TO-GROUND GUNS OR ROCKETS PUSHBUTTON
9 SIGHT SELECTOR	26 FUSELAGE BOMBS PUSHBUTTON
10 FIRING FUEL DIPPER SWITCH	27 RADAR 4 LINES/1 LINE SCAN SWITCH
11 BOMB/ROCKET SELECTOR	28 R530 MISSILE NORMAL/ALTITUDE DIFFERENCE SELECTOR SWITCH
12 MATRA 550 OR SIDEWINDER MISSILE SWITCH	29 NORMAL/JUMMER PURSUIT SWITCH (NO FUNCTION)
13 FORE/AFT SELECTOR SWITCH	30 ARMAMENT PANEL LIGHTS TEST
14 AUTO/MANUAL FIRING SELECTOR SWITCH	
15 SINGLE/SALVO SELECTOR	
16 INSTANTANEOUS/DELAY/SAFE SELECTOR SWITCH	
17 RADAR SELECTOR	

3.2 ELECTRICAL SYSTEM

Description

The electrical system consists of:

- Two 15 kVA three phase alternators at 400 Hz and 115/200 V AC
- Two 100 A transformers-rectifiers (TR)
- One 40 Ah battery.
- A static inverter
- A switching box that enables to supply an emergency AC system by the alternators or the DC system through the static inverter.
- A standby receptacle that enables certain equipment to be energized and preheated on the ground.
- An external AC power receptacle to supply the systems from an auxiliary power unit.

The electrical power is distributed by:

- AC system 1, normally supplied by alternator 1
- AC system 2, normally supplied by alternator 2
- Emergency AC system, normally supplied by alternator 1
- DC system, normally supplied by the TR's and the battery. It comprises:
    - a direct battery system
    - a main system
    - a utility subsystem, with automatic shedding in case of both alternators failure.

There are three missile busses, shedding occurs if an alternator fails and RPM are < 5600.

See limitations chapter regarding alternators ventilation.

Operation

When there is undervoltage detection in AC system 1, the emergency AC system is switched to the inverter. The EMG~ light is on.

When the standby receptacle is connected, the battery and the distribution systems are isolated.

During start, the cranking and ignition of the engine are electrically accomplished on the battery.

After starting, the alternators cut in when they reach their frequency and voltage thresholds, this happens at approximately 2800 engine RPM.

The inverter selector is set to RESET, switching the emergency AC system to system 1. The EMG~ light goes out.

As soon as the alternators cut in, the standby receptacle disconnects and the aircraft is supplied normally.

When the external power receptacle is connected, the alternators are isolated (battery switch ON, light is out) and the two AC systems are supplied.

The external power has priority over the alternators.

There is no external DC power receptacle, since the aircraft is equipped with transformer-rectifiers.

Controls

- Battery switch: connects the battery to the DC system.
- Alternator 1 switch: connects alternator 1 to the AC system.
- Alternator 2 switch: connects alternator 2 to the AC system.
- TR reset button: used to reset the transformer-rectifiers.
- Inverter selector switch: enables the emergency AC system to be supplied by the alternators or the DC system through the static inverter. It has two steady positions, INV (CONV) and AUTO, and a RESET (REARM) spring-loaded position.

Failure lights

- Red BATT light: the battery is disconnected from the main system.
- Amber ALT 1 light: the alternator 1 is not supplying its system.
- Amber ALT 2 light: the alternator 2 is not supplying its system.
- Amber TR1 light: the transformer-rectifier 1 is not supplying the DC systems.
- Amber TR2 light: the transformer-rectifier 2 is not supplying the DC systems.
- Amber SEC~ light: emergency (“secours”) AC system supplied by the inverter.
- Red MODUL light: excessive modulations of the vario-alternator driving torque.

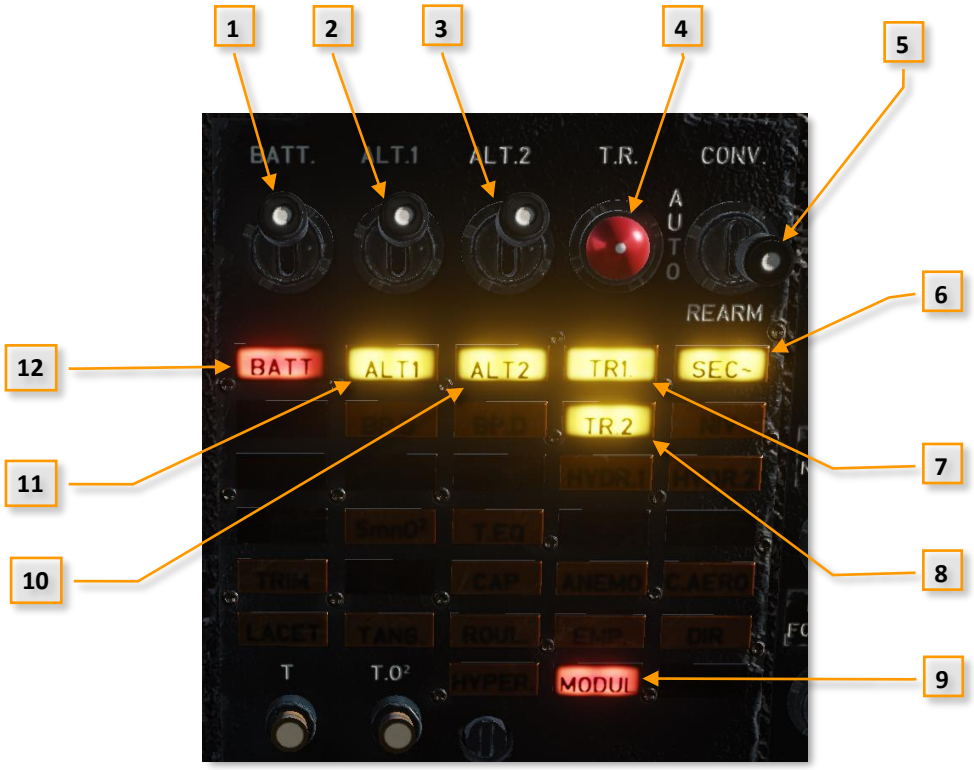


Figure 3-9 Failure Warning Panel

1 BATTERY SWITCH
2 ALTERNATOR 1 SWITCH
3 ALTERNATOR 2 SWITCH
4 TR RESET BUTTON
5 INVERTER SELECTOR SWITCH
6 SEC~ AMBER LIGHT
7 TR1 AMBER LIGHT
8 TR2 AMBER LIGHT
9 MODUL RED LIGHT
10 ALT2 AMBER LIGHT
11 ALT1 AMBER LIGHT
12 BATT RED LIGHT

Failures

BATT light on

Warning horn sounds.

The battery is disconnected from the main system, but it can supply its own bus.

If the battery is exhausted the inflight relight system is inoperative.

ALT 1 light on

The EMG~ light may come on.

The alternator 1 is not supplying its system.

The alternator 2 takes over and supplies AC systems 1 and 2.

The emergency system is supplied by the inverter.

ALT 2 light on

The alternator 2 is not supplying its system.

The alternator 1 takes over and supplies AC systems 1 and 2.

ALT 1 and ALT 2 lights on

The EMG~ light comes on.

TR1 and TR2 come on when battery voltage is < 25V.

Neither alternator supplies its system.

The emergency system is supplied by the inverter.

A load shedding occurs in the utility DC subsystem.

The battery is the only source that supplies the electrical system. It has an endurance of at least 13 minutes if the electrical pump is off.

EMG~ (SEC~) light on

The inverter supplies the emergency AC system.

TR.1 or TR.2 light on

Only the transformer-rectifier whose light is out supplies the DC systems.

TR.1 and TR.2 lights on

Neither transformer-rectifier supplies the DC systems.

Only the battery supplies DC power.

MODUL light on

Warning horn sounds.

Excessive alternator driving torque.

COMPLETE ELECTRICAL FAILURE

All lights are out.

The battery is exhausted (<18V) or there is a complete failure of the alternators and the reverse-current relay.

These are the systems that remain operative:

- clock
- RPM indicator
- standby compass
- standby altimeter, Mach/airspeed indicator, vertical speed indicator
- accelerometer
- canopy embrittle and seat ejection systems
- brake chute
- brakes (without antiskid)

Status of the aircraft in this situation:

- Emergency gear extension.
- Engine gravity feeding.
- Slats and flaps inoperative.
- Flight controls operate in mechanical mode.
- ARTHUR low mode.
- Shock cones remain in the position they had at the time of the failure.

CIRCUIT BREAKER PANEL

Figure 3-10 Circuit Breaker Panel

C de GYRO	Gyro control unit power supply
C de HYP	High-lift device servo unit power supply
OXY	Indicator and failure detector power supply
C de CONV	Inverter transfer unit power supply and control
P HYD	Dual hydraulic pressure gauge power supply
GACH TIR	Gun firing trigger power supply
ROB BP	LP cock power supply
EP	Electro-pump relay power supply
REMP VOL	Flight refueling system power supply
P CAB	Cabin pressurization system power supply

PUIS CONV	Inverter 28 V power supply
C de TRAIN	U/C normal operation power supply
V.UHF	V/UHF power supply
DEMA	Starter and sequencing system power supply
TRIM PROF	Manual trim control power supply
T CAB	Valve position repeater, control valve and ground mode power supply
SIGN	Failure warning panel and master failure warning light power supply
Cle TRAIN	Configuration indicator (U/C section) and U/C warning light power supply
IFF	IFF power supply
REG SEC	Emergency regulation system and control lever power supply

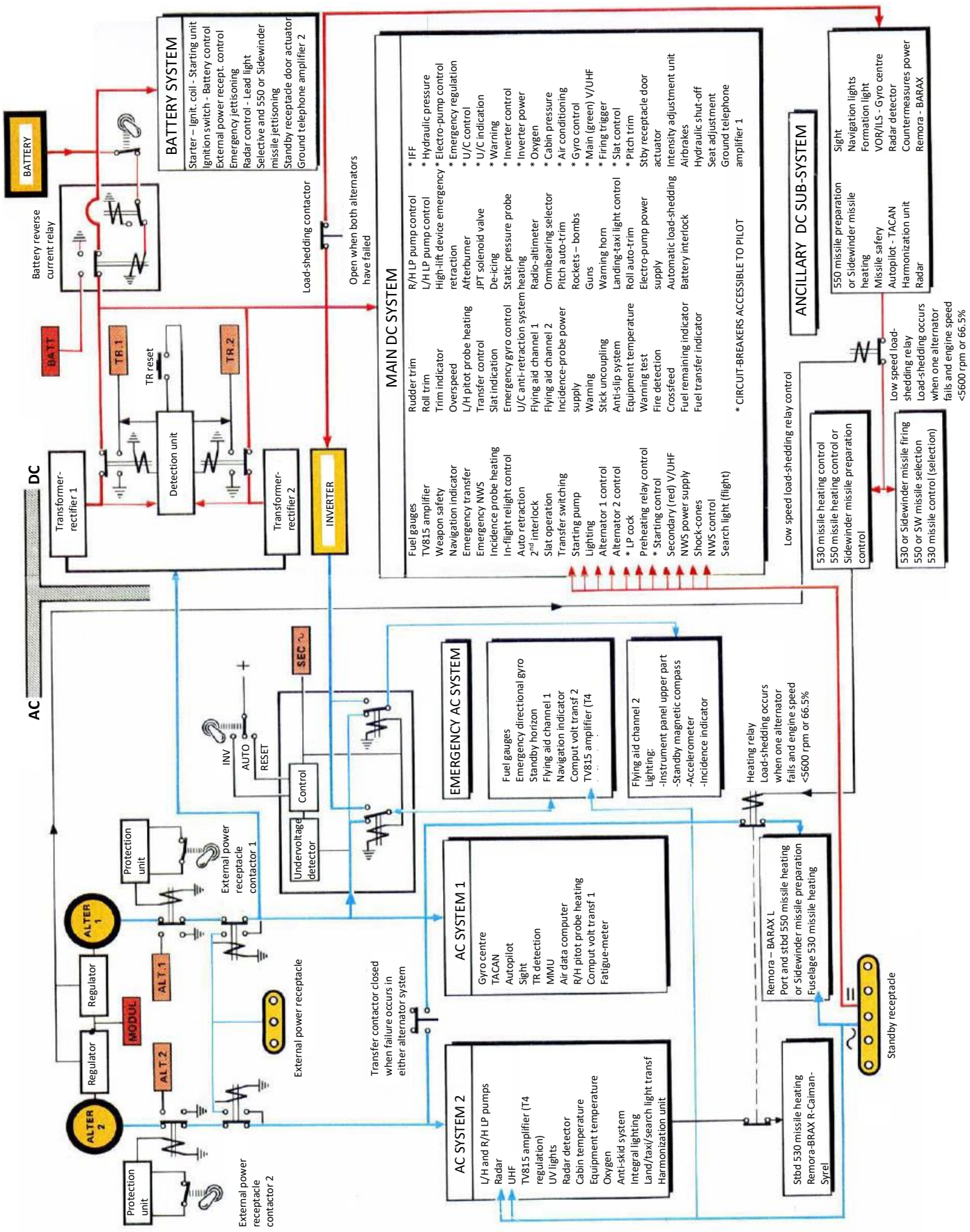


Figure 3-11 Electrical System Diagram

3.3 FUEL SYSTEM

Description

The aircraft has a total of 9 internal fuel tanks (7 in the fuselage and 2 in the wings) plus a negative-g flight accumulator to allow for inverted flying and capability of carrying 3 external tanks. This allows it to carry a maximum of 4240 l (7650 l with the external tanks). Ultimately, all the tanks transfer fuel to the feeder tanks, which then transfer it to the engine. The tanks are distributed in the following way:

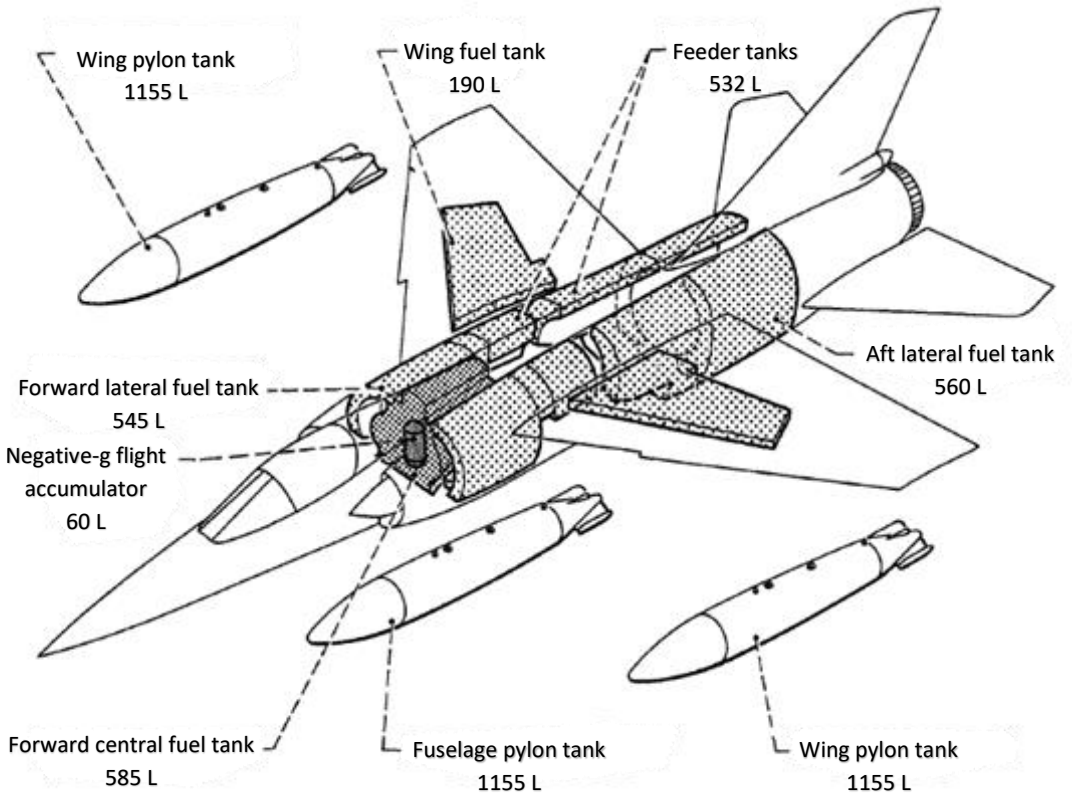


Figure 3-12 Fuel Tank Arrangement

There are 2 draining order configurations for the aircraft, depending on if external fuel tanks are being carried or not. The mode is selected through a fuel transfer sequence selector switch. The level of the feeder tanks descends as the other tanks are emptied, in such a way that, when a certain level is reached in the feeder tanks, the transference from the next tank to be used to the feeders starts. The configurations are:

- When the switch is on ‘CLEAN’ (‘LISSE’):
    1. External tanks and wing tanks
    2. Central front
    3. 2/3 of laterals rear
    4. Laterals front
    5. Remaining 1/3 of laterals rear
    6. Remaining at feeders
    7. Negative-g flight accumulator

- When the switch is on ‘EXTERNAL TANKS’ (‘BIDONS’):
    1. External tanks and wing tanks
    2. 2/3 of laterals rear
    3. Central front
    4. Remaining 1/3 of laterals rear
    5. Laterals front
    6. Remaining at feeders
    7. Negative-g flight accumulator

The engine and the negative-g flight accumulator are fed by 3 pumps from the feeder tanks: one in the left feeder and 2 in the right one (the extra pump in the right is the starter pump). The negative-g flight accumulator allows for 10-15 seconds of inverted flight, but exceeding this can result in either fuel starvation or damage to the engine.

Some models of the aircraft (such as the EE and the M) are air-to-air refuelling capable.

Controls

- Fuel transfer sequence selector switch: selects the transfer order.
- Feeder tank / fuselage switch: selects if the gauges display the fuel quantity in the feeder tanks or in the whole fuselage. Switch labels: F for fuselage, N for feeder tanks (“nourrices”).
- Crossfeed switch (“intercommunication”): allows the transfer between feeder tanks to correct any possible fuel imbalance in the aircraft. Switch labels: O (open, “ouvert”), F (closed, “fermé”).
- Emergency fuel transfer switch (“secours transfert”): enables an emergency transfer by gravity of fuel from the aft lateral tanks to the feeder tanks.
- LP main cock switch (“coupe feu”): enables the LP fuel supply to the engine and afterburner to be shut off.
- A/B main cock switch (“coupe feu P.C.”): enables the fuel supply to the afterburner only to be shut off.
- Left fuel pump switch (B.P.G): allows the left pump to be energized.
- Right fuel pump switch (B.P.D): allows the right pump to be energized.
- Starter fuel pump switch: allows the start pump to be energized. It is automatically actuated by the cover of the ignition switch.
- Fuel quantity reset thumbwheel: resets the fuel remaining indicator. There is an option in DCS Options Special tab to reset the countermeasures and fuel counters automatically on rearm/refuel. See the picture below.

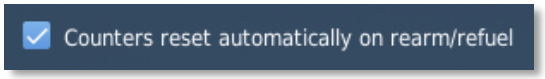


Figure 3-13 Fuel Remaining and Countermeasures Counters Reset Option

NOTE: The fuel counter (fuel remaining indicator) has a characteristic clicking sound that can be heard during flight. Nevertheless, it can be muffled, ticking the corresponding option in DCS Options Special tab. See the picture below.

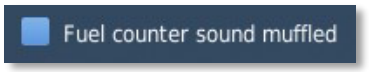


Figure 3-14 Fuel Counter Sound Muffled Option

Indicators

- Fuel transfer indicator: represents the different tanks of the aircraft, the corresponding light turns on whenever one of the tanks is empty (e.g. see figure 3-15 below, with empty wing tanks, shown by the red lights indication).
- Dual fuel level gauge: shows the remaining fuel quantity (in litres) either in the feeders or fuselage depending on 'Feeder tank / fuselage switch' position.
  NOTE: there are 2 needles, one for each side of the aircraft.
- Fuel remaining indicator: 4 digit counter of the remaining aircraft fuel (to be set every time a refuelling takes place, using the reset thumbwheel).

Failure lights

- Red LP (BP): indicates low pressure in the engine feeding system. The engine might be starved of fuel.
- Amber L/H LP (BP.G): indicates low discharge pressure of the left pump (< 500 mb). The pump is not powered or energized, has failed or is starved of fuel as a result of inverted flight.
- Amber R/H LP (BP.D): indicates low discharge pressure of the right pump (< 500 mb). The pump is not powered or energized, has failed or is starved of fuel as a result of inverted flight.
- Amber FUEL (NIV): indicates the fuel level in either of the feeder tanks is below 250 l.

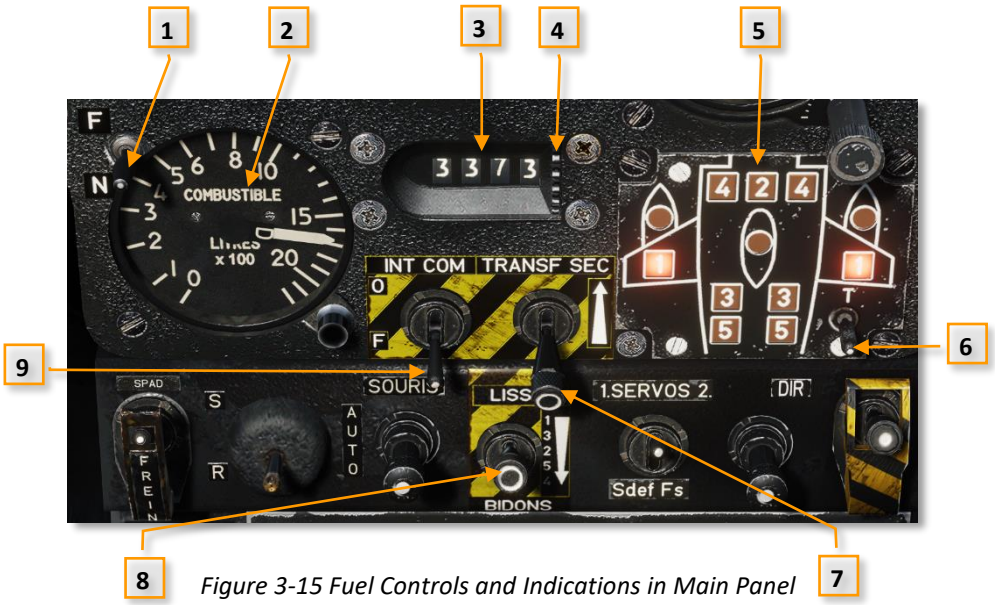


Figure 3-15 Fuel Controls and Indications in Main Panel

1 FEEDER TANK/FUSELAGE SELECTOR SWITCH
2 DUAL FUEL GAUGE
3 FUEL REMAINING INDICATOR
4 FUEL QUANTITY RESET THUMBWHEEL
5 FUEL TRANSFER INDICATOR
6 FUEL TRANSFER INDICATOR TEST
7 EMERGENCY FUEL TRANSFER SWITCH
8 FUEL TRANSFER SEQUENCE SELECTOR SWITCH
9 CROSSFEED SWITCH

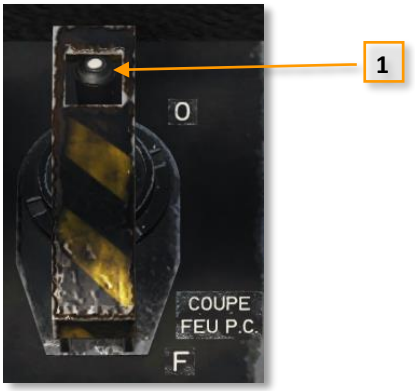


Figure 3-16 A/B Main Cock Switch in Left Console

1 A/B MAIN COCK SWITCH

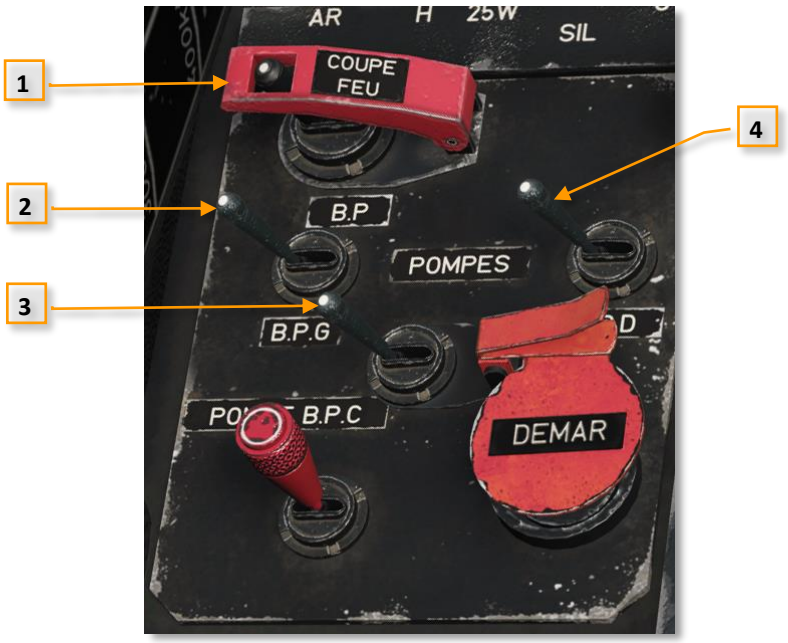


Figure 3-17 Fuel Controls in Left Console

1 LP MAIN COCK SWITCH
2 L/H LP PUMP SWITCH
3 STARTING PUMP SWITCH
4 R/H LP PUMP SWITCH

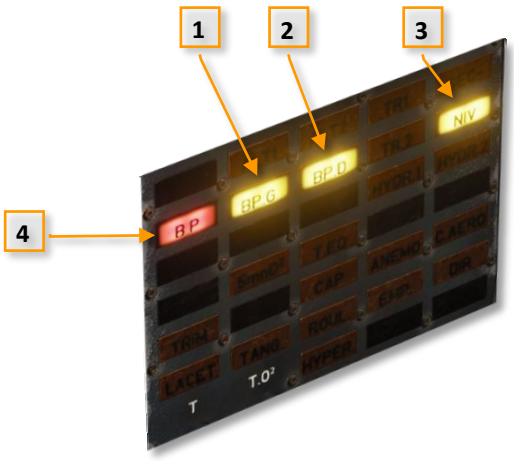


Figure 3-18 Fuel System Failure Warning Lights

1 L/H LP (BP.G) AMBER LIGHT
2 R/H LP (BP.D) AMBER LIGHT
3 FUEL (NIV) AMBER LIGHT
4 LP (BP) RED LIGHT

3.4 JET ENGINE

Introduction

The Mirage F1 is powered by the SNECMA ATAR 9K-50 afterburning turbojet. This engine is the pinnacle of the evolution of the ATAR family, started in the late 1940s by SNECMA with former BMW engineers for the Vautour and Mystère aircraft.

The engine is located in the rear part of the aircraft, with the air intakes behind and on the sides of the cockpit. Static and at sea level, it is capable of delivering 50 kN of thrust in military power settings and up to 70 kN in afterburner (A/B) mode. It can operate at speeds in excess of Mach 2.1.

Description

The engine has 9 stages in the compressor and 2 stages in the turbine. It also counts with a convergent-divergent adjustable nozzle. Supplementary valves open at the sides of the aircraft to increase airflow at low airspeeds and high thrust settings. Supersonic shock-cones also move to adjust the airflow at supersonic speeds and prevent the ingestion of shock waves.

Be sure to have the throttle set to stop before engine start-up, and set it to idle between 300 and 600 RPM to avoid a hot start.

In idle, the engine spins at 2900 RPM, in full power at 8400 RPM. At speeds above M 1.4, the maximum RPM is increased to 8900 and the engine enters a mode called ‘overspeed’. Changes to throttle input in ‘overspeed’ will result in an engine stall or flameout, so speed has to be reduced by airbrakes, manoeuvring or ascending in that situation.

Lubrication is provided by an oil deposit of 9 litres (an emergency oil deposit of 3.5 litres is also available). Consumption of oil limits the autonomy of the aircraft to 6 hours. In case of failure of the throttle or main oil system, an emergency regulation mode exists, in which the emergency oil deposit is used and engine power is adjusted by pulses.

The start-up of the engine occurs sequentially, with an electric motor starting a gas generator, which, in turn, starts the engine. The starter pushbutton shouldn't be pressed for more than 2 seconds to avoid damaging the electric starter and should never be pushed when the engine is turning, at the risk of destroying the starter system.

A fuel dipper mechanism prevents engine stall from ingesting the exhaust fumes of the missiles or cannons. When a missile is fired, the fuel dipper reduces the amount of fuel sent to the engine, causing a drop in RPM, turning off the A/B and opening the nozzle for 3 seconds. In the case of the cannons, only a reduction of RPM occurs.

Jet pipe (“tuyere” in French) temperature is indicated in °C, while engine rotation speed is shown in rpm with two pointers for thousands and hundreds.

Shock-cones are also called mice (“souris” in French). Their position is indicated as a function of Mach number (see figure 3-24). They normally operate in auto mode, though can be controlled manually through the corresponding push-button and switch. Note that when manipulating the switch directly, the push-button will pop-out and will have to be pushed in to regain the auto function.

Controls

- Throttle lever: It has two ranges of travel: the dry sector which includes an idle stop, and the A/B sector that is reached by tilting the lever.
  The A/B detent position can be modified with an option in DCS Options special tab. It is set by default at a value of 59. It means the percentage of a 90° full travel at which the A/B detent is placed in the real Mirage F1 throttle. It corresponds therefore to 53°. This can be useful to get more precision in the non-afterburner area or to match the afterburner detent of the user's physical throttle. In most cases, it is usually recommended to increase this value to get more travel within the non-afterburner area. See figure 3-19 below.
- Ignition/ventilation selector switch: The ignition position is used in a normal start-up. In the ventilation position fuel supply and electrical supply to the plug are cut; it is used after a false start to crank the engine and eliminate the remaining fuel in the combustion chamber.
- Emergency regulation control lever: Controls the engine while in emergency regulation mode. It must be used in small steps, there is no rpm regulation and the response is slow.
- Emergency regulation switch: Activates the emergency regulation mode, used in most oil failures or rpm freezing cases. When this mode is on, the emergency regulation light illuminates and the engine exhaust nozzle opens, which causes a significant drop in thrust. As an indication, the maximum engine thrust in emergency regulation is significantly equal to that obtained in normal regulation at around 7300 rpm, 1500 ft and 200 kt (in standard atmosphere), that is, approximately 43% of maximum thrust.
  The afterburner cannot be used in emergency regulation mode.
  The energization of the starter is not possible during emergency regulation.
  The emergency regulation must not be switched on in overspeed mode.
- Starting pump switch: Activates the starting pump.
- Start button: Used to start the engine on ground, it is under a spring-loaded cover labelled DEMAR ("démarrage"). Do not use it in-flight.
- Throttle cut/idle switch: Used to set the throttle to idle or stop.
- In-flight relight control: Used to start the engine in-flight. When switched on it is self-held in this position for 30 seconds.
- JPT emergency regulation switch: It is switched off in some abnormal cases of low or excessive jet pipe temperature.
- Firing fuel dipper switch: activates the firing fuel dipper protection. It has two positions, A (off, "arret") and M (on, "marche").
- Shock-cone manual control switch: spring-loaded in neutral position. The upper position extends the shock-cones (S, "sorti") and the lower ones retracts them (R, "rentré").
- Shock-cone pushbutton: when depressed (self-held) the shock-cones operate in auto mode.

Figure 3-19 Afterburner Detent Position in DCS Special Options

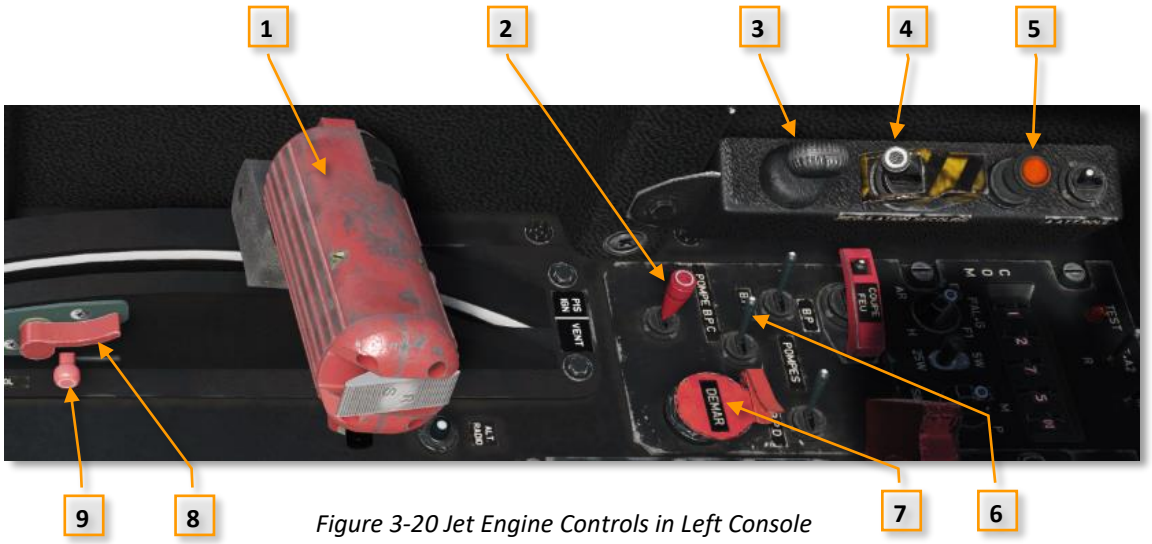


Figure 3-20 Jet Engine Controls in Left Console

1 THROTTLE LEVER
2 IGNITION/VENTILATION SELECTOR SWITCH
3 EMERGENCY REGULATION CONTROL LEVER
4 EMERGENCY REGULATION SWITCH (GUARDED)
5 EMERGENCY REGULATION LIGHT
6 STARTING PUMP SWITCH
7 START BUTTON (UNDER COVER)
8 THROTTLE CUT/IDLE SWITCH
9 IN-FLIGHT RELIGHT CONTROL

Figure 3-21 JPT Emergency Regulation Switch in Left Console

1 JPT EMERGENCY REGULATION SWITCH

Figure 3-22 Firing Fuel Dipper Switch in Right Console

2 FIRING FUEL DIPPER SWITCH

Figure 3-23 Shock-cone Controls in Main Panel

1 SHOCK-CONE MANUAL CONTROL SWITCH
2 SHOCK-CONE PUSHBUTTON

Indicators

- Shock-cone position Indicator: indicates shock-cones position as a function of Mach number. The shock-cones extend as Mach number increases.
- RPM Indicator: Includes two needles. The short one for thousands and the large one for hundreds.
- A/B injection light (INJ): When the pilot sets the A/B the A/B ignition fuel nozzle is energized and the INJ light illuminates. When the ionization probe detects A/B ignition the INJ light goes out and FON illuminates. Press the pushbutton to test the light.
- A/B function light (FON): Illuminates when the A/B is on ("fonction" in French). Press the pushbutton to test the light.
- ADF light: The ADF ("Allumage Dans la Foulée", immediate reheat) is a device that permits to move the throttle directly from any position in the dry sector to any position in the A/B sector. In case of ADF failure, the light illuminates, engine protection is no longer assured and there is a risk of compressor stall when setting the A/B with a high reheat load. Press the pushbutton to test the light.
- JPT indicator: Jet pipe temperature or T4 temperature indicator. Indicates nozzle ("tuyère") temperature in °C.

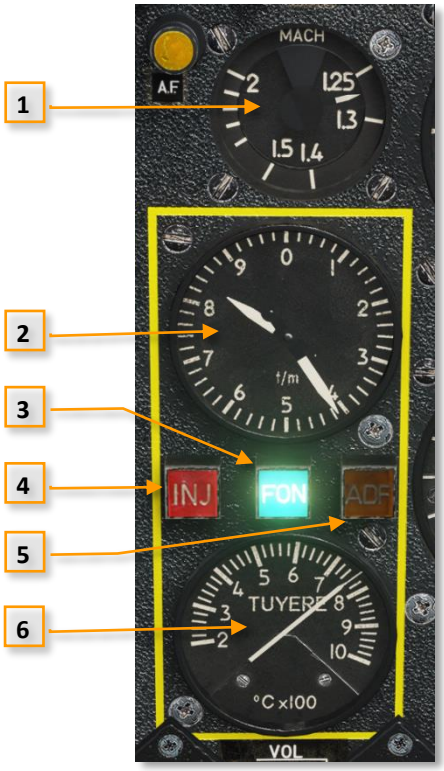


Figure 3-24 Jet Engine Indications in Main Panel

1 SHOCK-CONE POSITION INDICATOR
2 RPM INDICATOR
3 A/B ON LIGHT
4 A/B INJECTION LIGHT
5 SRL (ADF) FAILURE WARNING LIGHT
6 JPT INDICATOR

Failure lights

- Red HUILE (OIL): Signals that oil pressure is low (< 0.75 bar). It can be caused by multiple factors: prolonged inverted flight or failure of the oil or lubrication systems. Immediate action is required to avoid damage to the engine: return to level flight and, if it persists, engage emergency regulation mode and return to base.
- Red VAN.D (BLEED VALVE): Bleed valves position not matching orders.
- Engine fire light: It is an emergency, signals the engine is on fire. Immediately cut throttle and close the engine fuel cock. If the light disappears, restart the engine, if not, eject.
- A/B fire light: It is an emergency, signals the afterburner is on fire. Immediately cut A/B and close the A/B fuel cock.

Figure 3-25 Fire Warning Lights in Main Panel

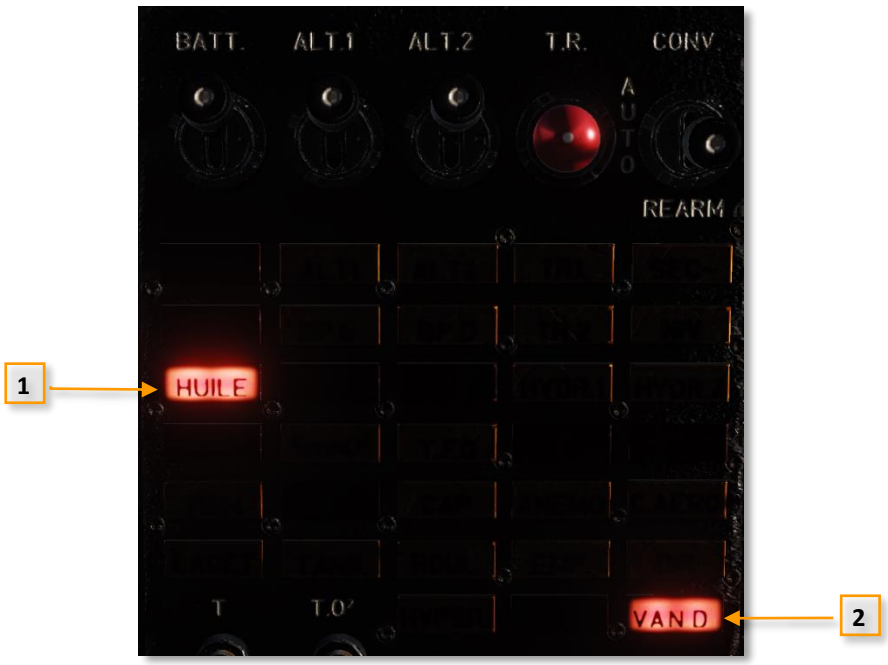


Figure 3-26 Failure Warning Panel

1 OIL (HUILE) RED LIGHT

2 B.O.V (VAN.D) RED LIGHT

3.5 HYDRAULIC SYSTEM

Description

The aircraft counts with 2 different hydraulic circuits to provide a certain redundancy in the hydraulic supply of some elements. Part of the Hydraulic circuit 1 can be isolated and fed through an electro-pump to keep the aircraft controllable in the case of an emergency.

Each circuit is pressurized by a pump powered by the engine and counts with a hydraulic deposit. As mentioned previously, in case of the pressure of circuit one falling beyond a certain threshold, part of the circuit is isolated and an electro-pump is activated. A diagram of the system shows which elements are fed by each circuit:

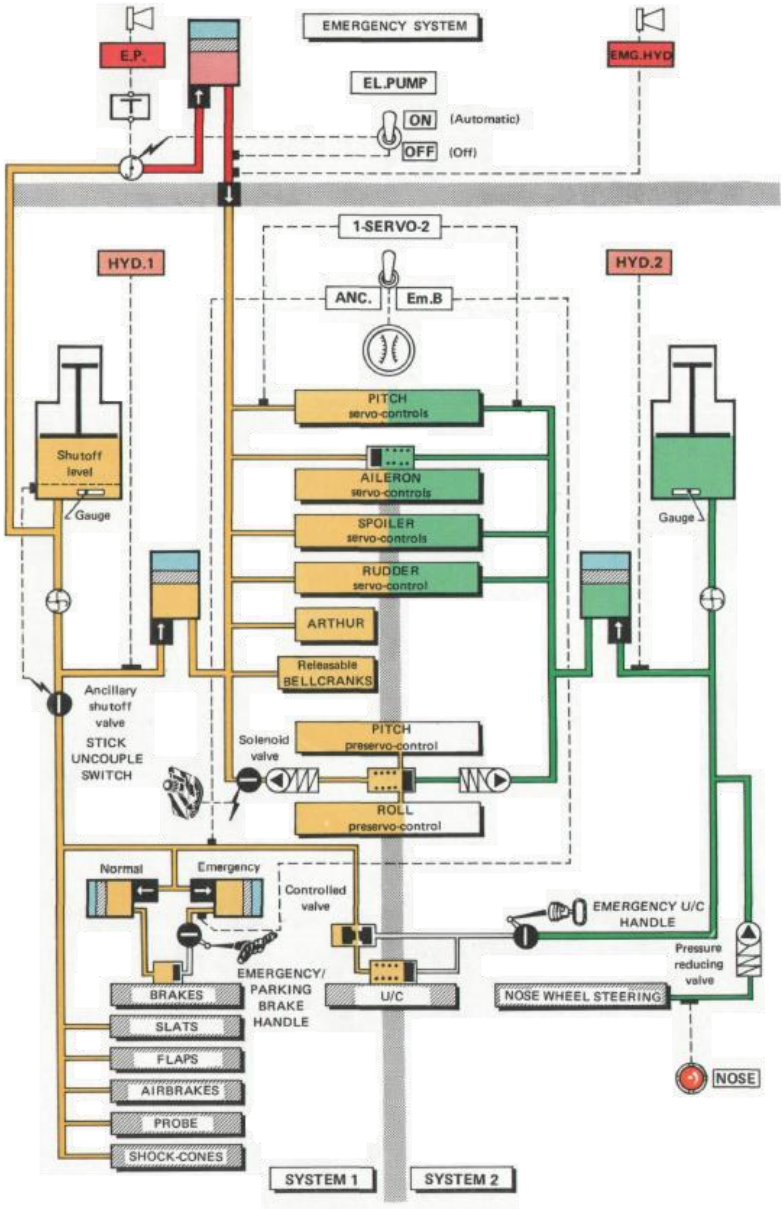


Figure 3-27 Hydraulic System Diagram

The hydraulic circuit feeds the control surfaces, the variable sensitivity crank bell (ARTHUR), the wheel brakes, the actuation of the landing gear, the high lift devices, the shock cones, the airbrakes and the nose wheel steering.

The landing gear can be deployed in the case of an emergency by an emergency deployment lever. The gear must be retracted at speeds above 240 kt to avoid the possibility of damage.

The airbrakes position can be set through a switch on the throttle. The positions are: retracted, extended unstable and extended locked. The airbrakes can be extended at any speed.

The braking system is equipped with an antiskid that can be disabled. The nose wheel steering has 2 modes: normal and high sensitivity.

The high lift devices are comprised of flaps and slats, which, in turn, are subdivided into inboard (drooped) slats, and outboard (slotted) slats. The slats usually work on automatic mode, while the flaps can be set to an automatic mode for combat. Retraction and deployment are commanded depending on angle of attack and airspeed. The automatic behaviour can also be overridden for landing and take-off. The following table describes the behaviour of the high lift devices on the different modes:

Selected configuration		**Slats**		**Flaps**	
		Inner	**Outer**	**Inner**	**Outer**
Automatic/combat mode	Automatic slats (AoA > 8º, Vi < 440 kt and M < 0.98)	Full out	Half out	Retracted	Retracted
	Combat flaps/slats (Vi < 300 kt, M < 0.75)	Full out	Full out	Half out	Half out
Take-off/landing mode	Slats + medium flaps	Full out	Full out	Half out	Half out
	Slats + full flaps	Full out	Full out	Full out	Full out

Controls

- Electro-pump switch: energizes the electro-pump (the electro-pump activates when the pressure of circuit 1 is too low).
- Electro-pump (EP) circuit breaker: protects the electro-pump from damage from overvoltage.
- Hydraulic pressure selector switch: Allows to visualize either hydraulic pressure in circuits 1 and 2 (1 SERVOS 2) or ancillary and emergency brake hydraulic pressure on the hydraulic pressure gauge (Sdes-Fs, “servitudes et freins secours”).
- Slats/flaps lever: controls the deployment of the high lift devices in manual mode (take-off/landing modes). “Becs/volets”: slats/flaps in French.
- High-lift devices lever (NORMAL-OFF-EMERG. RETRACTION): Controls the overall behaviour of the high lift devices. NORMAL is the normal behaviour with automatic deploy of the slats. In OFF mode, the automatic deployment of the slats stops. In EMERG. RETRACTION, the flaps and slats are retracted and other commands are overridden.
- Combat flap button/lever: selects/deselects the combat flaps mode.
- Slats/flaps (S/F) circuit breaker: Protects the electrical component of the high lift devices system from overvoltage.
- Airbrake control switch (retracted/unstable deployed/locked deployed): Commands the airbrakes.
- Undercarriage control lever: commands the deployment and retraction of the landing gear.

- Undercarriage safety lever: avoids an unwanted operation of the undercarriage control lever. There is a DCS special option that permits the automated operation of this lever, so that the landing gear can be actuated with a single press. See figure 3-29.
- Anti-retraction override button: permits landing gear retraction while the aircraft is on the ground.
- Emergency undercarriage handle: commands deployment of the landing gear in the event of lack of hydraulic pressure. First position: doors opened. Second position: gear down.
- Nose wheel steering high sensitivity button: Determines if the steering is on high sensitivity (45º of steering) or not (7º of steering). The button is released when there is no weight on the front wheel.
- Nose wheel steering switch (under guard): Disables nose wheel steering.
- Brake pedals: independently activates the brakes on each wheel.
- Emergency/parking brake handle: Used when parking the aircraft or when regular brakes do not work.
- Antiskid (SPAD) switch (under guard): Deactivates the antiskid.
- Configuration indicator test button: tests the configuration indicator lights as well as combat flaps light and NWS light.
- BIP button: when pressed an audio signal is generated if the landing gear is down. This signal is transmitted on the selected radio frequency and heard by the pilot.

Indicators

- Dual hydraulic pressure gauge: indicates the hydraulic pressure in circuits 1 and 2 or the pressure in the emergency and brakes circuits, depending on the position of the hydraulic pressure selector switch.
- Configuration indicator: Displays the state of the high lift devices, gear and gear doors.
- Airbrake light: indicates if the airbrake is deployed.
- Nose wheel steering light (DIR): Indicates if nose wheel steering is completely disabled.
- Brake light (FREIN): Indicates if parking/emergency brake is indicated or if brake testing is underway. To test the brakes, while flying and with the landing gear retracted, press and release the brakes and check if the lights turns on to indicate the system works properly.
- Combat flaps light (VCBT): indicates combat flaps operation.

VCBT light out	Combat flap lever retracted
VCBT light steady on	Combat flap lever extended within envelope
VCBT light flashing	Combat flap lever extended outside the envelope or combat flaps armed and flaps extended with the slats/flaps lever

- LIM light: steady red, together with a warning horn, indicates that slats or flaps limits have been reached. (See chapter 5.4, elements extended limitations and figure 3-142).
- TRAIN light: gear not down warning light flashing red. (See same chapter and figure as for LIM light above).

Failure lights

- Amber HYDR.1 and HYDR.2: Indicate low pressure in hydraulic circuits 1 and 2 respectively.
  HYDR.1 illuminates when:

140 bar ≤ servo 1 ≤ 174 bar
0 bar ≤ ancillaries ≤ 145 bar

  HYDR.2 illuminates when:

0 bar ≤ servo 2 ≤ 145 bar

- Red E.P: Indicates that the electro-pump has been active continuously for more than 8 seconds.
- Red EMG.HYD (HYDR.S): Indicates low pressure (< 115 bar) in the emergency circuit (isolated part of the hydraulic circuit 1, downstream of the electro-pump).
- Amber S/F (HYPER) light: Shows a disagreement between the commanded and the actual position of the high lift devices or the combat flaps activated well outside their use envelope.

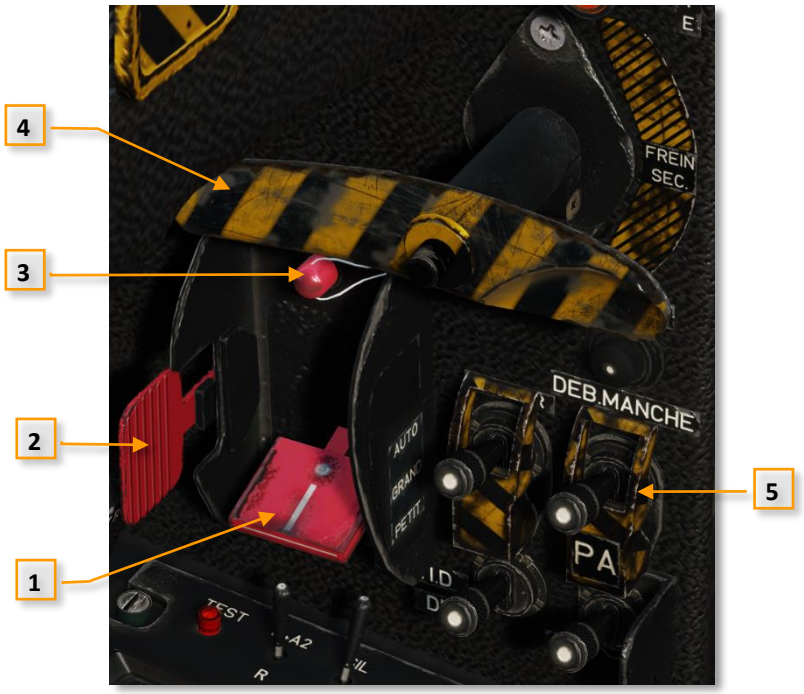


Figure 3-28 Parking Brake and Undercarriage Panel

1 U/C CONTROL LEVER
2 U/C SAFETY LEVER
3 ANTI-RETRACTION OVERRIDE BUTTON
4 EMERGENCY/PARKING BRAKE HANDLE
5 STICK UNCOUPLE SWITCH (GUARDED)

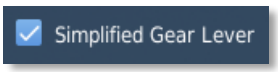


Figure 3-29 Simplified Gear Lever in DCS Special Options

Figure 3-30 Electro-Pump Switch in Right Console

1 ELECTRO-PUMP SWITCH

Figure 3-31 Emergency U/C Handle in Right Front Panel

2 EMERGENCY U/C HANDLE

Figure 3-32 Slat/Flap Lever in Left Console

1 SLAT/FLAP LEVER

Figure 3-33 High-lift Device Selector Switch in Left Console

2 HIGH-LIFT DEVICE SELECTOR SWITCH

Figure 3-34 Hydraulic System Controls in Main Panel

1 ANTI-SKID (SPAD) SWITCH (GUARDED)
2 HYDRAULIC PRESSURE SELECTOR SWITCH
3 NWS HIGH SENSITIVITY BUTTON
4 NWS SWITCH (GUARDED)

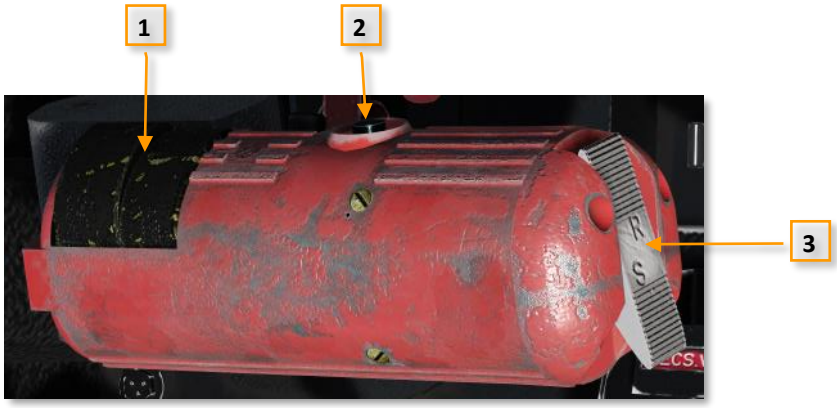


Figure 3-35 Throttle Lever

1 COMBAT FLAP LEVER

2 COMBAT FLAP BUTTON

3 AIRBRAKE CONTROL SWITCH

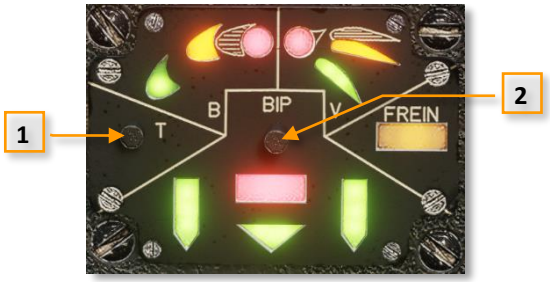


Figure 3-36 Configuration Indicator

Figure 3-37 Dual Hydraulic Pressure Gauge in Main Panel

1 CONFIGURATION INDICATOR TEST BUTTON

2 BIP BUTTON

Figure 3-38 Airbrake Light in Main Panel

Figure 3-39 NWS Light in Main Panel

Figure 3-40 Combat Flaps Light in Main Panel

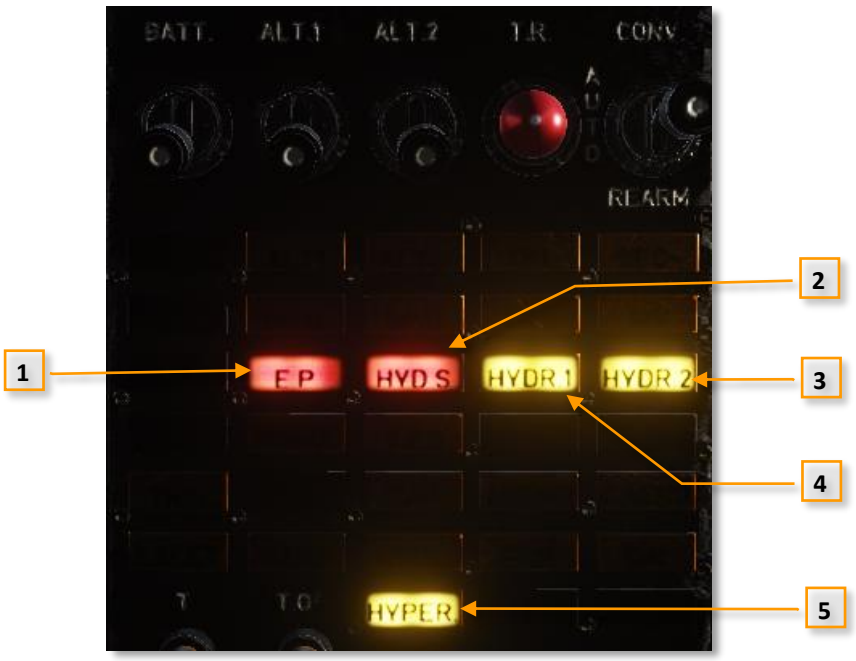


Figure 3-41 Failure Warning Panel

1 E.P. RED LIGHT

2 HYD.S (EMG.HYD) RED LIGHT

3 HYD.2 AMBER LIGHT

4 HYD.1 AMBER LIGHT

5 HYPER AMBER LIGHT

3.6 CONTROL SYSTEM

Description

The control surfaces for the aircraft are:

- Pitch: 2 stabilators
- Roll: 2 ailerons, 2 spoilers and differential stabilator deflection for dampening in automatic pilot mode.
- Yaw: A rudder

The normal operation mode for the control system is electrohydraulic in pitch and yaw and mechanical in roll. The flight stick is hydraulically connected in the pitch chain to 2 releasable bell cranks that can either transmit the pilot orders to servomotors or, when engaged in a degraded flight mode called 'manual hydraulic', directly to the control surfaces. The rudder pedals are similarly connected to the rudder.

This mode provides dampening in yaw and pitch and makes the behaviour of the aircraft generally 'smoother'. When strong acceleration changes occur, sometimes during sudden and hard manoeuvres, or when electrical supply to the servomotors is cut, the aircraft enters manual hydraulic mode. This mode is more uncomfortable for the pilot and makes the aircraft more difficult to control. The servomotors and the electrohydraulic mode can be reset through a pushbutton.

In the pitch chain, an element called ARTHUR plays an important role. The ARTHUR function is to limit the pitch sensitivity of the aircraft in certain situations. It has 3 modes: high sensitivity, low sensitivity and auto. In normal operation in auto mode, it adjusts the control stick sensitivity as a function of altitude and airspeed. Another element called DASH-POT increases the resistance of the stick as a function of the velocity of the input.

Trim is available for all 3 aircraft axes, with the roll trim only acting on the ailerons and not the spoilers. Furthermore, the yaw trim has an automatic anti-slip mode that compensates any sideslip in stabilized flight.

Special options settings

The way that the user's controls interact with the simulation can be adjusted through the Special menu in DCS Options. See the picture and the description of the different options below.

Figure 3-42 Mirage F1 Flight Controls Settings in DCS Special Options Menu

- Emulation of effects of stick forces on aircraft behaviour: In the real aircraft, elements like the ARTHUR and the Dashpot regulate the control stick resistance as a function of Mach, altitude and stick speed. On a non-FFB stick, this is impossible to recreate and would make the controls very sensitive in certain regimes. It is recommended to keep this option selected (especially in non-FFB users) to desensitise the pitch controls in certain flight regimes, as a way of emulating the increased resistance in the stick that occurs in the real aircraft.
- Minimum/Maximum FFB force: The resistance of the control stick is a function of the displacement of the stick, with the resistance being the minimum with a centered stick and maximum with maximum displacement. These options allow FFB users to regulate the feeling of the FFB stick in roll and pitch as a function of stick displacement. Note that if a lower maximum than minimum is selected, the maximum will equal the selected minimum and the stick will provide the same resistance through its whole range.
- Relation between maximum and minimum ARTHUR forces: The ARTHUR is an element in the force retribution system that adjusts control stick resistance to altitude and Mach. In automatic mode, at lower altitudes and in the transonic region, the resistance is maximum, while it is minimum at velocities near 0 (GRAND and PETIT ARTHUR modes can also be selected in the cockpit instead of the AUTO mode). This option allows FFB users to choose the relation between the maximum and minimum control stick resistance values. In the real aircraft, the minimum resistance is 60% of the maximum resistance.
- Shake effects on FFB stick: This option adjusts the level of FFB stick vibration depending on load factor, AoA and compressor stall.

Controls

- Control stick: controls pitch and roll.
- Rudder pedals: control yaw.
- Trim hat: controls pitch and roll trim.
- Rudder trim control switch (TRIM DIRECT.): adjusts yaw trim manually when the anti-slip function is off.
- Servo reset button (SERVO): allows for a reset of the servos if all the working conditions are met.
- Pitch mode switch (EMP): allows to activate and deactivate the pitch electrohydraulic mode.
- Yaw mode switch: (Anti-slip/Yaw/Off) allows to deactivate the anti-slip (ANTI D) and the yaw damper (DIR) electrohydraulic modes separately. The anti-slip mode adjusts yaw trim automatically. The yaw damper applies rudder as needed to coordinate the turns.
- ARTHUR switch: labelled AUTO/GRAND/PETIT (AUTO/HIGH/LOW), this under guard switch allows the pilot to select the sensitivity mode of the ARTHUR.
- Stick uncouple switch: labelled DEB. MANCHE (“déblocage manche”, stick uncouple in French), this under guard switch uncouples the control stick from the autopilot. If the autopilot is engaged, it will disconnect when activating the switch.

Indicators

- Trim indicators: show the position of pitch, roll and yaw trims.

Failure lights

- Amber ELEV (EMP): Failure or disconnection of the first pitch electric circuit. If no other pitch warning light is on, the second pitch electric circuit is operational and the aircraft behaves normally. Resetting of the circuit should be attempted with the Servo Reset pushbutton.
- Amber PITCH (TANG) + ROLL (ROUL) + ELEV (EMP): Failure or disconnection of both pitch electric circuits. The aircraft is in full manual hydraulic mode for pitch. Autopilot is no longer available. Resetting of the circuits should be attempted with the Servo Reset pushbutton.
- Amber RUD (DIR): Failure or disconnection of the first yaw electric circuit. If no other yaw warning light is on, the second yaw electric circuit is operational and the aircraft behaves normally. Resetting of the circuit should be attempted with the Servo Reset pushbutton.
- Amber YAW (LACET) + ROLL (ROUL) + RUD (DIR): Failure or disconnection of both yaw electric circuits. The aircraft is in full manual hydraulic mode for yaw. Anti-slip and autopilot are no longer available. Resetting of the circuits should be attempted with the Servo Reset pushbutton.
- Amber ROLL (ROUL): Differential stabilator deflection not functional. Autopilot is no longer available.
- Amber TRIM light: automatic trim failure. It doesn’t affect the autopilot or trim function.

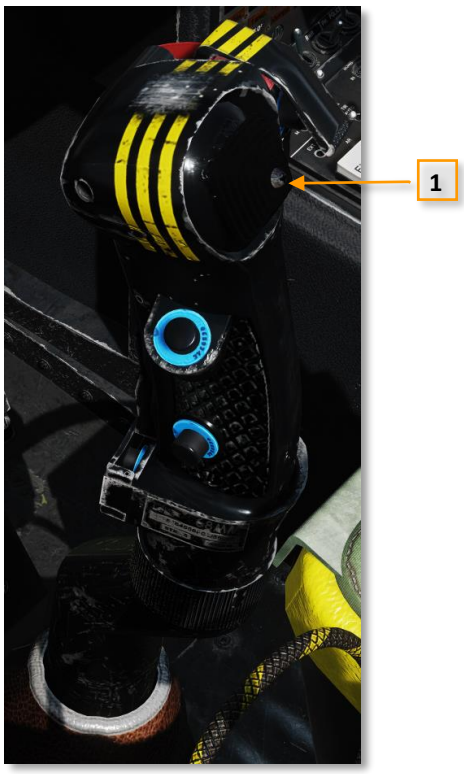


Figure 3-43 Control Stick

1 TRIM HAT

Figure 3-44 Rudder Trim Control Switch

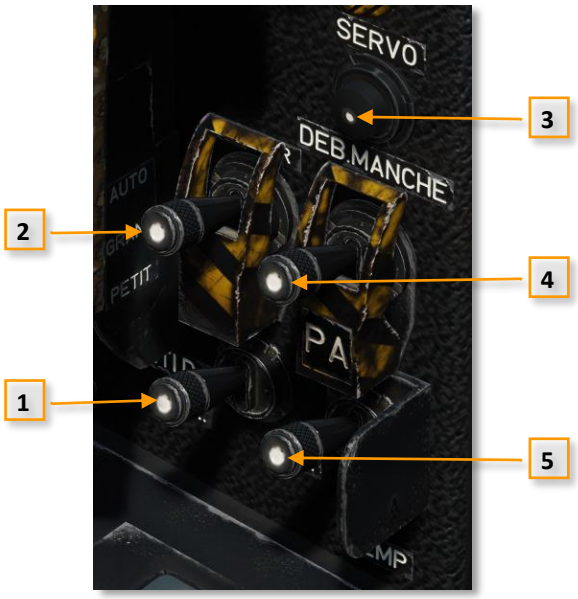


Figure 3-45 Control Switches and Button in Left Panel

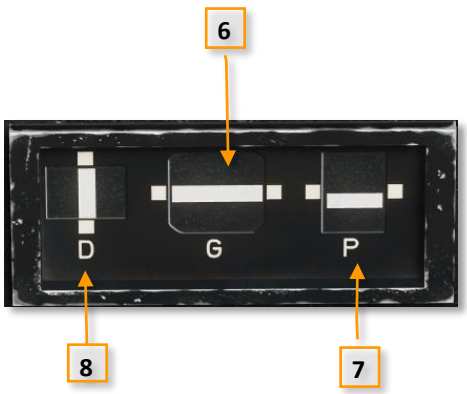


Figure 3-46 Trim Indicators in Main Panel

1 YAW/ANTI-SLIP SWITCH
2 ARTHUR SELECTOR SWITCH (GUARDED)
3 SERVO RESET BUTTON
4 STICK UNCOUPLE SWITCH (GUARDED)
5 PITCH MODE SWITCH
6 ROLL TRIM INDICATOR
7 PITCH TRIM INDICATOR
8 RUDDER TRIM INDICATOR

Figure 3-47 Failure Warning Panel

1 YAW (LACET) AMBER LIGHT
2 TRIM AMBER LIGHT
3 PITCH (TANG.) AMBER LIGHT
4 ROLL. (ROUL) AMBER LIGHT
5 RUD (DIR) AMBER LIGHT
6 ELEV (EMP.) AMBER LIGHT

3.7 AUTOPILOT

Operation

The autopilot is engaged by depressing the “PA” pushbutton. It is recommended to do it while holding the autopilot disconnect trigger depressed on the control stick grip, to avoid a possible unwanted reaction of the autopilot. Pressing again the “PA” button the autopilot will disengage.

The autopilot connects initially in basic functions (attitude hold) and PA illuminates. If the bank attitude during the autopilot connection is less than 10°, it will keep current heading.

The autopilot modes are:

- Altitude Hold Mode (ALT)
- Heading Hold Mode (CAP)
- Localizer Mode (R)
- Glide Slope Mode (G)

They are connected by pressing the corresponding pushbutton ALT (altitude), CAP (heading), R (route) or G (glide slope).

When passing through the transonic range the autopilot keeps connected, though it reverts to basic functions. ALT will keep flashing until the transonic range is fully surpassed. When trying to connect the autopilot ALT mode while in the transonic region the red part of the ALT pushbutton will flash.

Pressing the autopilot disengage lever or the PA pushbutton disengages the autopilot. (PA red light illuminates in the failure warning panel together with a warning sound).

The autopilot will also disengage when exerting a certain force on the control stick in pitch or roll. (PA red light will illuminate in the failure warning panel together with a warning sound).

Pressing the autopilot disconnect trigger the autopilot reverts to basic functions. It also resets the autopilot warning sound.

Keeping the autopilot disconnect trigger pressed the pilot can control the airplane pitch and roll with the control stick while keeping the autopilot armed. When released the autopilot will keep last attitude before release.

The heading for the Heading Hold Mode is selected using the Heading Selection Knob in the right console, and is displayed in the Navigation Indicator by the Selected Heading Index.

The BIP trim is a device which permits to modify the current pitch attitude and heading that the autopilot maintains while in basic functions.

It is controlled with pitch and roll trim pulses. A pulse in pitch modifies the attitude by 0.8° in pitch, and a pulse in roll modifies the current heading by 2°. The number of pulses is limited to ±10 in pitch and ±15 in roll, which translates into a maximum change in pitch attitude and heading of ±8° and to ±30° respectively.

The reset of the pulse counters is done by disengaging the autopilot.

The autopilot control and indicator unit test button tests the unit lights.

AUTOPILOT INDICATIONS DURING VOR, TACAN OR ILS INTERCEPT AND HOLD		
	A	Autopilot engaged
		Altitude hold mode engaged
		Heading hold mode engaged
	B	Autopilot engaged
		Altitude hold mode engaged
		Heading hold mode engaged
		Radial or localizer mode armed
	C	Autopilot engaged
		Altitude hold mode engaged
		Heading hold mode engaged
		Radial or localizer mode armed
		Glide slope mode armed
	D	Autopilot engaged
		Altitude hold mode engaged
		Heading hold mode disengaged
		Radial or localizer interception started
		Glide slope mode armed
	E	Autopilot engaged
		Altitude hold mode engaged
		Radial or localizer intercepted
		Glide slope mode armed
	F	Autopilot engaged
		Altitude hold mode engaged
		Radial or localizer intercepted
		Glide slope interception started
	G	Autopilot engaged
		Altitude hold mode disengaged (flashing red for 5 sec)
		Radial or localizer intercepted
		Glide slope intercepted
	H	Autopilot disengaged (flashing amber)
		Flashing red for 10 sec
		Flashing red for 10 sec

The table above shows the different autopilot indications during an interception and hold of a VOR or TACAN radial, or that of an ILS localizer and glide slope. The points A to H are depicted in the picture below.

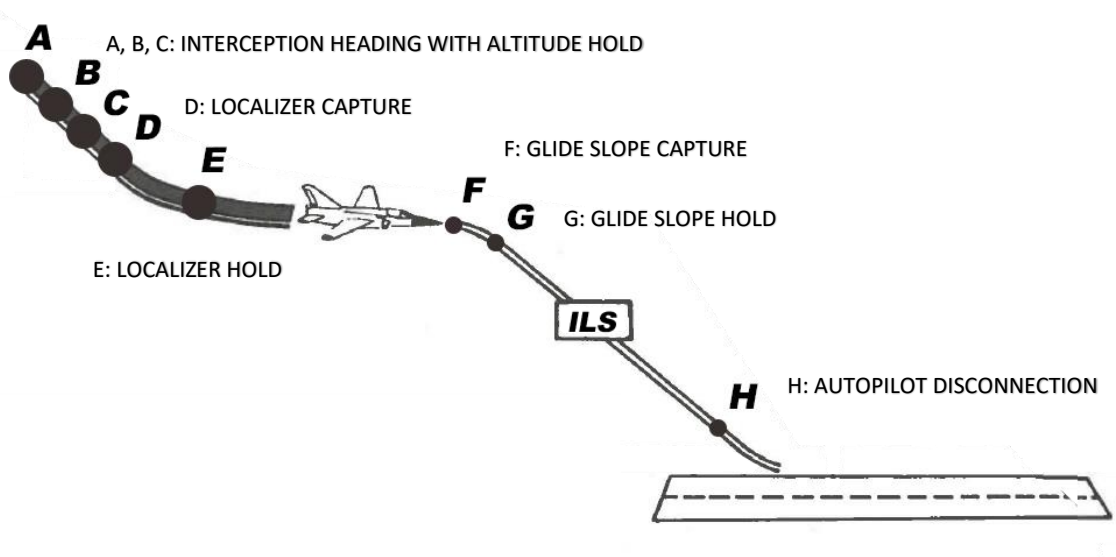


Figure 3-48 ILS Interception and Hold with Autopilot Engaged

There is a test display unit that enables the pilot or ground personnel to test the flying aid and autopilot interlocks. See Figure 3-54.

This test is performed every several flights after completing the flight.

To launch the test, extend combat flaps with combat flap button (“V” key), open the guard and set the test switch to on (M, “marche”). During the test, that takes about 90 seconds, the counter will display a sequence of numbers, which meaning is described in the table below. Several lights will illuminate as well in the failure warning panel as the test progresses.

When the counter reaches 35, the number will hold, press the PA (autopilot) button.

When the counter reaches 40, this number will hold, press the autopilot ALT button. ALT will flash red, after a while it will go off. When reaching 50 the autopilot disconnects. When reaching 56, press the autopilot disconnect trigger (“A” key).

The test ends when the counter reaches 88.

Retract combat flaps with combat flap lever (“LCTRL+V” key combination).

If the counter stops at a certain number, it means there is a fault in the associated system, write down the number and continue with the test pressing the restart button (“relance”).

DIGITS		FUNCTIONS/TESTS
00	20	SYSTEM ENERGIZATION
01	21	SERVOS REARMING
02	22	PITCH CHAIN ELECTRIC SAFE DISCONNECTION
03	23	YAW CHAIN ELECTRIC SAFE DISCONNECTION
04	24	STABILATOR SERVOS
05	25	RUDDER SERVOS
06	26	AUXILIARY
07	27	PITCH RATE GYRO
08	28	ROLL RATE GYRO
09	29	YAW RATE GYRO
10	30	RATE GYRO ROTOR SPEED SAFETY
11	31	ANTI-SLIP
12	32	
13	33	PITCH AND YAW CIRCUIT 1 ELECTRIC SUPPLY
	34	PITCH AND YAW CIRCUIT 2 ELECTRIC SUPPLY
	35	AUTOPILOT CONNECTION
	36	TRIM
	37	PITCH AND YAW CIRCUIT 2 ELECTRIC SUPPLY
	38	RESETTING WITH AUTOPILOT
	39	
	40	AUTOPILOT ALT ENGAGEMENT
	41-42	ALT SECURITIES
	43	ALT DISENGAGEMENT
	44-49	GENERAL AUTOPILOT SECURITIES
	50	AUTOPILOT DISCONNECTION
	51-56	AUTOPILOT SECURITIES
	57-87	
	88	COUNTER DIGIT LIGHT TEST

Controls

- Autopilot PA button: autopilot connection/disconnection in basic functions.
- Autopilot ALT button: altitude mode engagement.
- Autopilot CAP button: (“cap”, heading in French) heading mode engagement.
- Autopilot R button: interception and hold of VOR, TACAN radial or ILS LOC beam.
- Autopilot G button: interception and hold of ILS GP and LOC beams.
- Autopilot disconnect trigger: autopilot reversion to basic functions. Autopilot warning sound reset. Pitch and roll control with control stick while autopilot is on and trigger pressed.
- Autopilot Control and Indicator Unit Test Button: lights test.
- Autopilot disengage lever: autopilot disconnection.
- BIP trim control: pitch and heading control with trim hat while autopilot is on.
- Heading selection knob: heading selection while CAP mode is engaged.

Indicators

- AP (PA) Red Light: together with warning horn and amber PA flashing, means autopilot failure or disconnection. If the failure disappears the light goes out after 10 seconds.
- Selected heading index: indicates the heading the autopilot will follow in CAP mode.

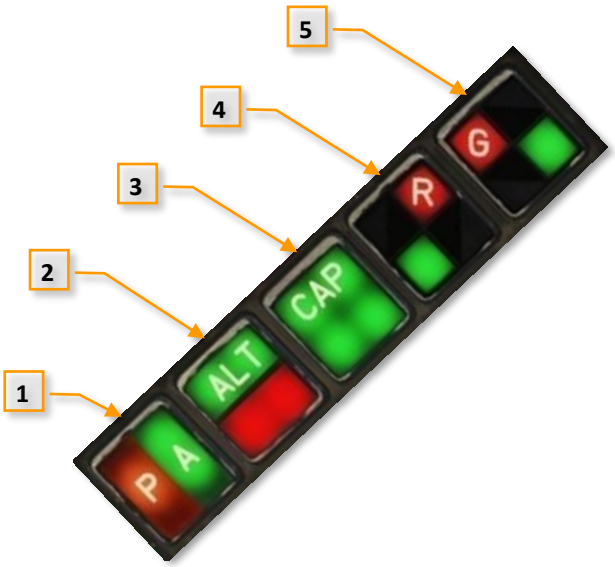


Figure 3-49 Autopilot Control and Indicator Unit

Figure 3-50 Autopilot Control and Indicator Unit Test Button

1 AUTOPILOT PA BUTTON
2 AUTOPILOT ALT BUTTON
3 AUTOPILOT CAP BUTTON
4 AUTOPILOT R BUTTON
5 AUTOPILOT G BUTTON

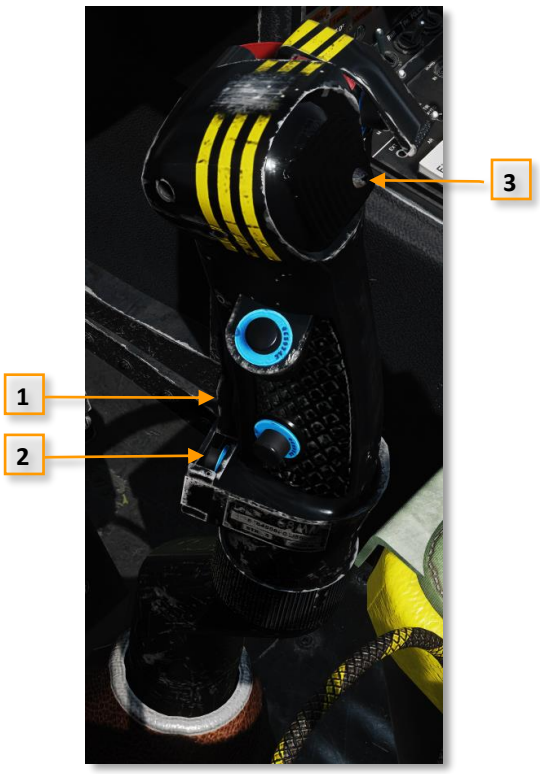


Figure 3-51 Control Stick

1 AUTOPILOT DISCONNECT TRIGGER
2 AUTOPILOT DISENGAGE LEVER
3 BIP TRIM CONTROL

Figure 3-52 Navigation Indicator (IDN)

Figure 3-53 Heading Selection Unit In Right Console

1 SELECTED HEADING INDEX
2 HEADING SELECTION KNOB

Figure 3-54 Test Display Unit in Left Console

Figure 3-55 AP (PA) Red Light in Failure Warning Panel

Red P.A light: Indicates that an interlock has activated: the autopilot disengages. If the failure disappears, the light goes out after 10 seconds.

3.8 MISCELLANEOUS SYSTEMS

Brake chute

Description

The brake chute is mechanically controlled, moving the control lever aft opens the chute and returning it forward drops the chute. It can only be deployed on ground, up to 210 kt. The chute assembly is located at the bottom of the fin, under the rudder.

Figure 3-56 Brake Chute Control Lever In Left Wall

Controls

- Brake chute control lever: located in the left wall, used to deploy and drop the brake chute.

IFF (IDENTIFICATION FRIEND OR FOE)

Description

The transponder permits the identification, friend or foe, of an aircraft, using codified answers. The interrogation is chosen from modes 1, 2, 3/A, C and 4.

The IFF uses an upper and a lower antenna.

A basic IFF implementation is always on by default in DCS, it detects the coalition of each aircraft in the mission.

An advanced IFF implementation is functional in this simulation, interacting currently with F-15E and Mirage 2000.

There are two types of IFF available for Mirage F1 CE, BE, EE and M: Without mode 4 or with mode 4. The first one was installed on most Mirage F1 CE, BE and EE airframes, while the second one was installed on several Mirage F1 CE, BE and EE airframes before the modernization, as well as on Mirage F1 M.

This section includes a generic description, operation, controls and indicators of the IFF without mode 4, as well as specific characteristics of the IFF with mode 4 at the end of it (see IFF Mode 4).

Each type of IFF can be selected both in DCS special options and in the Mission Editor.

When the corresponding option is ticked in DCS Mirage F1 special options, the mode 4 IFF will be installed in Mirage F1 CE, BE and EE models, unless otherwise specified in the Mission Editor.

The following options are included in the additional aircraft properties section of the Mission Editor:

- IFF Mode 2 Code: set at “auto” by default, in this case the code is 2000. Alternatively, a code between 0000 and 7777 can be set in this window.
- IFF Mode 4 Transponder Installed:
    - By global option: the mission will use the option set in DCS Mirage F1 special options.
    - Force installed: IFF with mode 4 will be installed for that mission, independently of the option selected in DCS Mirage F1 special options.
    - Force not installed: IFF without mode 4 will be installed for that mission, independently of the option selected in DCS Mirage F1 special options.

Figure 3-57 Selection of IFF Type in DCS Mirage F1 Special Options

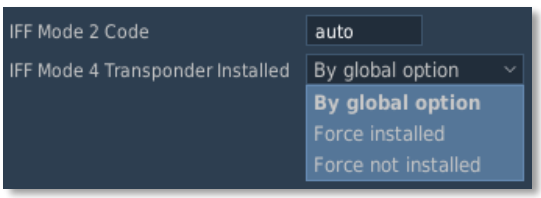


Figure 3-58 Selection of Mode 2 Code and IFF Type in Mission Editor

Operation

Startup

To start up the IFF, the function selector switch must be moved from OFF position to stand-by (SBY), normal (N) or emergency (EMER). A warm-up of 90 seconds takes place.

Modes operation

Each mode can be switched on or off individually placing in the up or down position, respectively, the corresponding mode switch.

Mode 1 uses two digits that are set with the MODE 1 coding selectors.

Mode 2 uses four digits that are set on ground, in our simulation it's done in the Mission Editor.

Mode 3 uses four digits that are set with the MODE 3A coding selectors.

Mode C transmits the coded aircraft's altitude, based on 1013,2 mb, that is provided by the air data computer. Not implemented in this simulation.

Mode 4 is described below (see IFF Mode 4). Note that mode 4 is not functional in the IFF panel described in this section (IFF without mode 4).

When own IFF is interrogated in modes 1, 2 or 3, and both stations use the same code, the interrogating station will get a friendly reply and the corresponding indication. Own IFF doesn't get any indication.

Emergency

When EMER is selected, the IFF transmits a distress signal, selecting the code 7700 (internally, not shown in the panel), even if mode switches are set to off. To select this position, the switch must be pulled and turned.

Ejecting results in a similar action, except that, if function selector switch is set to off, there's a delay of 15 seconds.

Test

The IFF uses three monitoring modes:

- Permanent test (every 30 s) without pilot action.
- Monitoring of the transponder in the event of an interrogation (response monitoring).
- Quick test available to the pilot.

Pressing the "FAULT" light:

- allows the control of the lamp.

- resets the test result.

The "TEST" button allows, when pressed, to check the operation of the IFF:

- "FAULT" lights up: IFF faulty.

The "FAULT" indicator lights up when the operation of the IFF is incorrect: either during operation or during the test.

In the event of untimely illumination of the "FAULT" warning light, the procedure to follow is as follows:

- press the indicator: the lamp goes out when the pressure is released (reset).

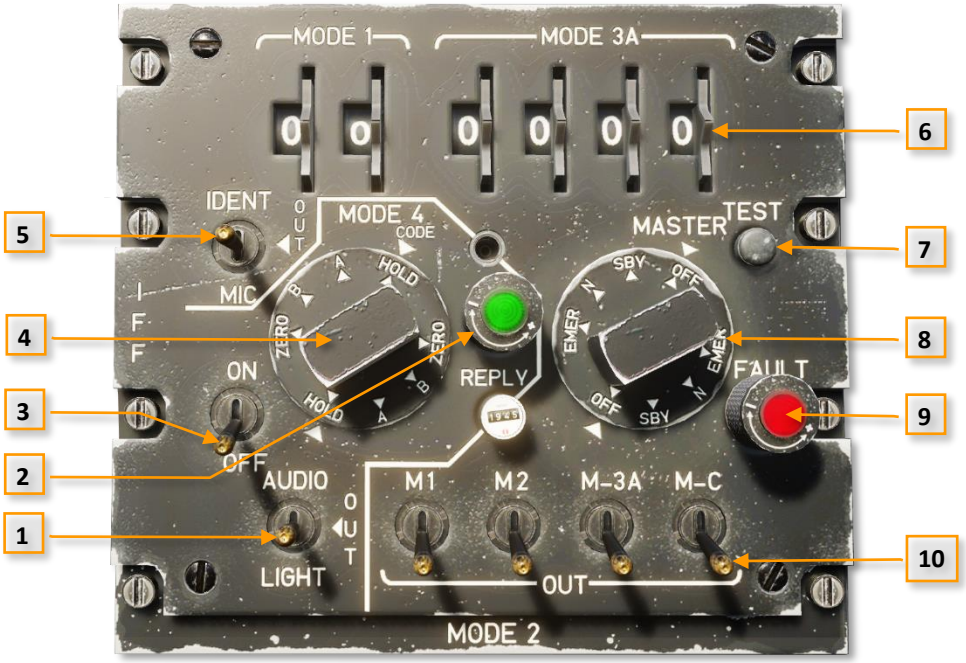


Figure 3-59 IFF Without Mode 4

1 AUDIO-OUT-LIGHT SWITCH (*)
2 REPPLY LIGHT INDICATOR (*)
3 MODE 4 ON-OUT SWITCH (*)
4 MODE 4 SELECTOR SWITCH (*)
5 POSITION IDENTIFICATION SELECTOR
** NOT FUNCTIONAL IN IFF WITHOUT MODE 4*

6 MODE CODING SELECTORS
7 IFF TEST BUTTON
8 FUNCTION SELECTOR SWITCH
9 IFF FAULT LIGHT
10 MODE SWITCHES

Controls

- Audio-out-light switch: permits the selection of the REPLY indicator, the IFF alarm light indicator as well as the audio alarm. It has three positions:
  - AUDIO: light indicators and audio alarms active.
  - LIGHT: light indicators only.
  - OUT: light indicators and audio alarms inactive.
- Mode 4 ON-OUT switch: controls the cryptographic computer energization, the REPPLY light indicator and the IFF alarm light indicator.
- Mode 4 selector switch: this switch handles the cryptographic computer. It has 4 positions:
  - A: present day password selection.
  - B: next day password selection.
  - ZERO: passwords reset.
  - HOLD: holding of codes in the calculator. Before engine shutdown hold must be selected. This position is spring-loaded.
- Position identification selector: position identification in modes 1, 2 and 3/A. At ground station request, a specific identification can be introduced by operating the 3 positions selector:
  - OUT: normal identification (position identification inoperative).
  - IDENT: (unstable position) immediate identification. It is not necessary to keep the selector in the IDENT position; a timer establishes the contact for 30 seconds after a blipping action.
  - MIC: identification as in IDENT each time the PTT is pressed.
- Mode coding selectors: code selection switches (2 for mode 1 and 4 for mode 3/A).
- IFF test button: used to test the system. See test operation above.
- Function selector switch: it has 4 positions:
  - OFF: sets the IFF to off.
  - SBY: the IFF receives interrogation signals but it doesn't reply.
  - N: normal operation.
  - EMER: transmission of a distress signal (7700) in all interrogation modes, even if interrogation mode switches are in OUT position.
- Mode switches: selection of desired modes.

Indicators

- REPPLY light indicator: this indicator illuminates during mode 4 replies emitted by the transponder (IFF).
- IFF fault light: this light indicator illuminates if:
  - no mode 4 reply and disparity after a mode 4 interrogation received by the transponder (IFF).
  - cryptographic computer associated to the transponder (IFF) on alarm
  - transponder (IFF) receiver failed.
  - transponder (IFF) not energized.
- The audio alarm is heard if:
  - no mode 4 reply and disparity after a mode 4 interrogation received by the transponder (IFF).
  - Presence of disparity due to detection of an invalid mode 4 interrogation message.

IFF Mode 4

Mode 4 allows positive identification, localization and friendly/foe discrimination of the carrier aircraft by means of an interrogator, provided that the interrogator and transponder encrypted codes are identical.

It consists of the IFF transponder and a cryptographic computer (QRTK-3A) associated to the IFF transponder.

The crypto unit is installed in the cockpit right side, behind the seat, in the single-seater, and in the rear cockpit left console in the two-seater.

The specific controls and indicators of mode 4 are described in previous section.

When the own aircraft is interrogated in mode 4 and provides a positive answer, the REPPLY light illuminates.

If there is no answer, the red IFF alarm indicator light illuminates, and the audio alarm is heard, depending on the position of the audio-out-light switch.

The red IFF alarm indicator light illuminates when the answer to a mode 4 interrogation fails, and when the crypto computer fails or mode 4 is off when own aircraft is interrogated.

The present day (A), or next day (B) password when passing 00:00Z, is selected with the mode 4 selector switch.

After landing, when weight-on-wheels is detected and the engine is shut down, mode 4 codes are deleted. The mode 4 selector switch must be kept at HOLD during shutdown to avoid this.

When the mode 4 selector switch is placed in the ZERO position (it must be pulled and turned to do so), mode 4 codes are deleted instantly. This also happens instantly after ejecting.

The fault indicator in the mode 4 IFF panel shows black when the IFF is energized and there is no fault. It will show fault indication (black and white) when there is an IFF fault detection.

When pressing the IFF test button, the fault indicator will also show black and white if the test fails.

To reset the fault to black indication, the indicator must be turned one quarter turn clockwise.

Mode 4 works currently with Mirage 2000 and F-15E in this simulation.

Figure 3-60 IFF With Mode 4

1 IFF FAULT INDICATOR

Figure 3-61 IFF Correct Operation Indication

Figure 3-62 IFF Fault Indication

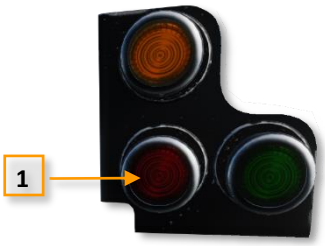


Figure 3-63 IFF Alarm Indicator Light in Upper Main Panel

1 IFF ALARM INDICATOR LIGHT

Figure 3-64 IFF Crypto Unit

3.9 AIR DATA SYSTEM AND MISCELLANEOUS INSTRUMENTS

Description

The air data computer and slaved altimeter, installed in the nose cone, measures the static pressure, dynamic pressure and total temperature, collected by the pitot static system and the total temperature probe. It then computes and transmits to several aircraft systems the following data:

- Mach number
- Calibrated airspeed
- Pressure altitude
- Vertical speed

The slaved altimeter, electrically powered, repeats the altitude computed by the air data computer and sends pressure altitude to the IFF.

The information is shown in the following form:

- A needle that rotates at a rate of one turn for each 1,000 ft.

- A four-drum counter that indicates the tens, hundreds, thousands and tens of thousands of feet up to 75,000 FT (mechanical stop).

    - At altitudes < 10,000 FT, the number of tens of thousands of feet is replaced by white stripes on a black background.
    - At altitudes < 0 ft, a white and black striped cover covers the lower part of the four drums.

- A red and white striped cover masks the four drums in the event of an indicator or air data computer failure.

The control button allows to adjust, with an accuracy of 0.5 mb, in a four-digit counter, the pressure in millibars in a range from 930 to 1070 mb.

The standby altimeter is of the three-needle type, it has a black and white shaded sector that is fully visible for altitudes < 10,000 ft and fully hidden for altitudes > 26,000 ft.

The reference pressure sector goes from 870 to 1050 mb.

The mach/airspeed indicator allows to simultaneously read the calibrated speed (in knots) in the outer sphere, and the Mach number in the inner sphere.

The variometer indications cover the sector ± 6000 ft/min.

The system includes an incidence indicator, also called angle of attack (AOA) indicator. The indicated incidence is shown in a band that moves in front of a scale with fixed readings. The scale reading range extends from 0° to 22°. Another scale shows 3° incidence sectors. Three of them are illuminated when the incidence is greater than 8°, they are shown:

- red between 22° and 15.5°

- yellow between 15.5° and 12.5°

- green between 12.5° and 9.5°

Another non-luminous blue sector is shown between 9.5° and 6°.

A standby compass shows the magnetic heading.

The clock includes a classic watch and a chronometer with a small needle that counts elapsed time up to 15 minutes. The clock spring has a total capacity of 2 days of operation. It is initialized at mission start in half wound state. An error may be expected when the spring is almost fully discharged.

The accelerometer, also called G-meter, indicates the instantaneous acceleration and the maximum values, positive and negative, reached.

Controls and indicators

- Reference speed index knob: controls the reference speed index.
- Reference speed index: movable index in the mach/airspeed indicator, used as speed reference.
- Barometric pressure setting knob: used to adjust the barometric pressure setting of the altimeter.
- Incidence indicator lighting rheostat: used to adjust the incidence indicator sectors brightness.
- Chronometer starting control and clock winding/setting knob: used to start, stop and reset the chronometer by pushing it. Used also to wind the clock by rotating it clockwise, or to set the clock time by rotating it when the clock winding/setting lever is pulled.
- Clock winding/setting lever: used to select clock winding, when pushed, or clock setting, when pulled.
- Accelerometer reset button and rheostat: used to reset the maximum and minimum registered acceleration values. Also used to adjust the instrument brightness by rotating the knob.

Failure lights

- ANEMO (PITOT) amber failure light: Indicates a failure of the left total probe or static port heating, or that the probe heater (ANEMO) switch is off. The incidence probe and the right total probe do not have heating failure indication.
- C.AERO (ADC) amber failure light:
    - Indicates a failure of the air data computer.
    - The autopilot disengages or cannot be engaged.
    - The flying aid gains get frozen, in particular:
        - The sock-cones and the ARTHUR remain in the last position
        - The following may be lost or operate untimely:
            - A/B oversboost
            - Overspeed
            - Limit warning light
            - Slaved altimeter
            - Combat high-lift devices

Figure 3-65 Mach/Airspeed Indicator

Figure 3-66 Slaved Altimeter

1 REFERENCE SPEED INDEX

2 REFERENCE SPEED INDEX KNOB

3 BAROMETRIC PRESSURE SETTING KNOB

Figure 3-67 Standby Altimeter

Figure 3-68 Vertical Speed Indicator

1 BAROMETRIC PRESSURE SETTING KNOB

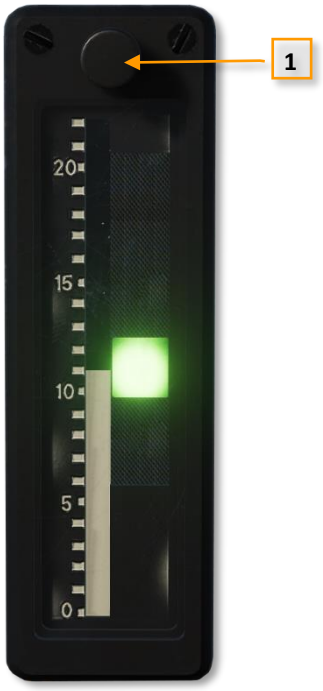


Figure 3-69 Incidence Indicator

Lighted ranges:
Red 15.5° - 22°
Yellow 12.5° – 15.5°
Green 9.5° - 12.5°

Unlighted blue range: 6° - 9.5°

1 LIGHTING RHEOSTAT

Figure 3-70 Clock

Figure 3-71 Standby Compass

1 CHRONOMETER STARTING CONTROL AND CLOCK WINDING/SETTING KNOB

2 CLOCK WINDING/SETTING LEVER

Figure 3-72 Accelerometer (G-meter)

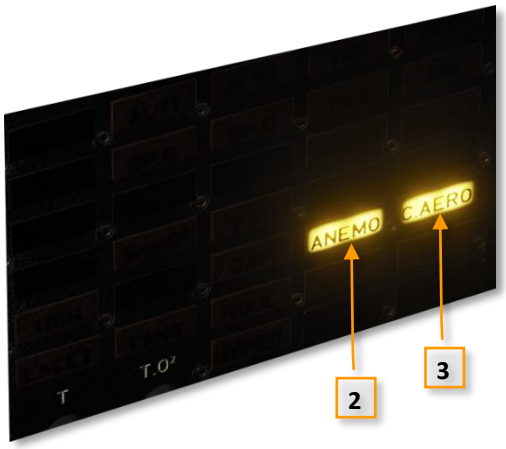


Figure 3-73 Failure Warning Panel

1 RESET BUTTON AND RHEOSTAT

2 PITOT AMBER LIGHT

3 AIR DATA COMPUTER AMBER LIGHT

3.10 COCKPIT SYSTEMS

Canopy

The canopy includes:

- A lock control
- A hinged handle to keep it partially open.
- An embrittle control

The canopy is moved by hand with the side handles (LCTRL + C).

Lock control forward: canopy locked.

Lock control aft: canopy unlocked.

If the pilots needs to escape the cockpit, in case of an emergency, a pyrotechnical system cracks the Plexiglas of the canopy, which then offers a low resistance. The embrittlement control is used to manually activate the system. It can be also be activated automatically when using the ejection seat.

Figure 3-74 Canopy Lock Control in Right Wall

Figure 3-75 Canopy Embrittle Control in Left Wall

Ejection seat

The Mirage F1CE is equipped with a MARTIN BAKER ERM6 ejection seat provided with a face blind firing handle and an alternative firing handle.

The safety pin prevents an accidental ejection when the airplane is on the ground.

Figure 3-76 Face Blind Firing Handle

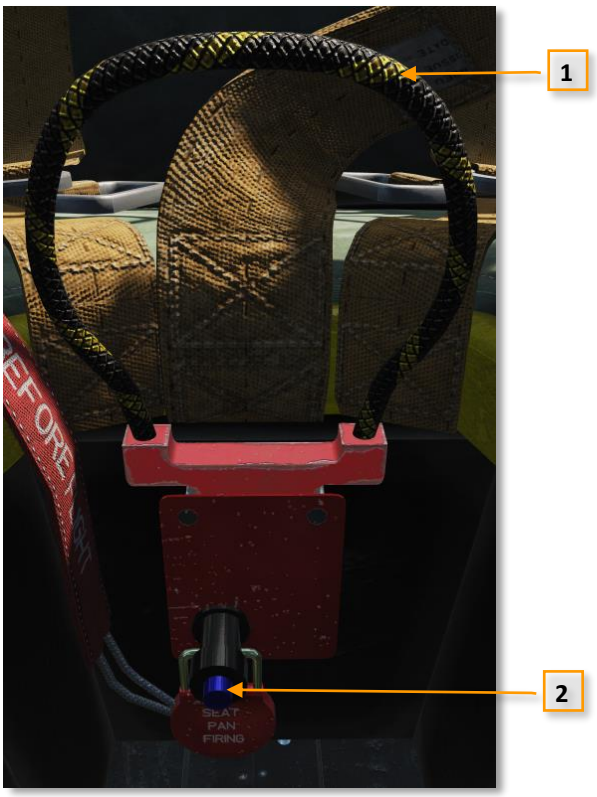


Figure 3-77 Alternative Firing Handle

1 ALTERNATIVE FIRING HANDLE *2 EJECTION HANDLE SAFETY PIN*

Lighting

Cockpit lighting

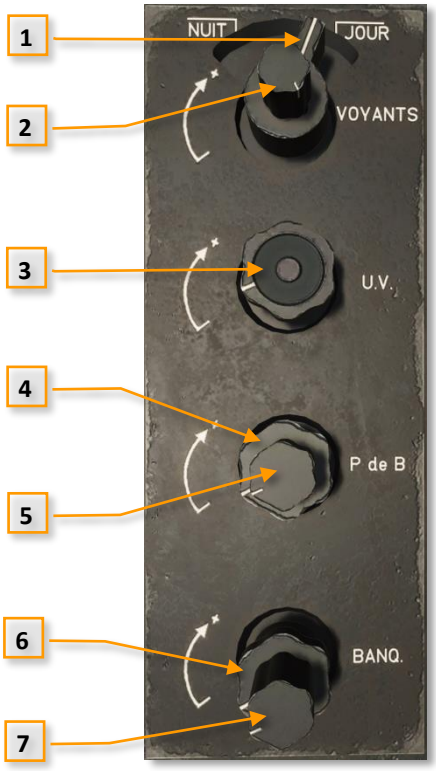


Figure 3-78 Lighting Control Box

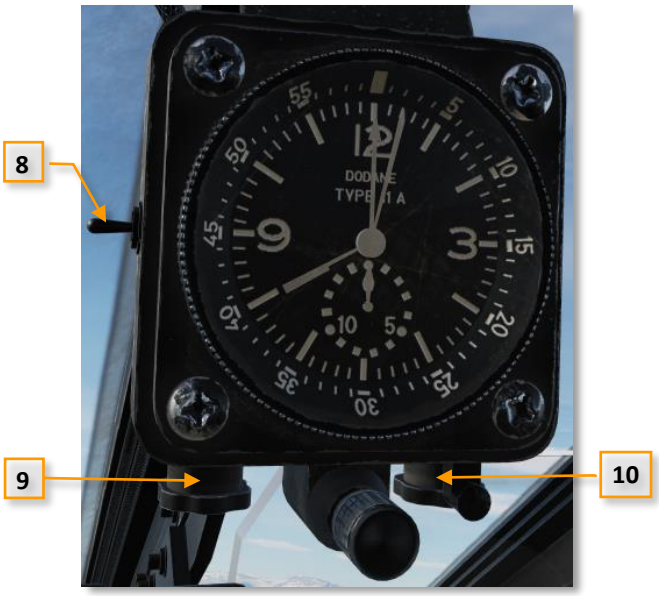


Figure 3-79 Clock Housing

1 DAY/NIGHT SELECTOR SWITCH

2 LIGHT AND PANEL LIGHTING RHEOSTAT

3 ULTRAVIOLET LIGHTING RHEOSTAT

4 DUAL INSTRUMENT PANEL LIGHTING RHEOSTAT (FLOODLIGHTS)

5 DUAL INSTRUMENT PANEL LIGHTING RHEOSTAT (INTEGRAL)

6 DUAL CONSOLE AND PEDESTAL LIGHTING RHEOSTAT (FLOODLIGHTS)

7 DUAL CONSOLE AND PEDESTAL LIGHTING RHEOSTAT (INTEGRAL)

8 MISCELLANEOUS INSTRUMENT LIGHTING SWITCH

9 MAP LIGHT RHEOSTAT

10 MISCELLANEOUS INSTRUMENT INTEGRAL LIGHTING RHEOSTAT

ANGLE OF ATTACK INDICATOR LIGHTING RHEOSTAT: See figure 3-60

Miscellaneous instrument lighting rheostat	- Standby compass - Clock, accelerometer - Angle of attack indicator tape
Miscellaneous instrument lighting switch	Allows independent regulation of the lighting of the AOA indicator tape
AOA indicator lighting rheostat	AOA indicator colored lights

Day/night selector switch: In the day (JOUR) position the indicator lights and panels brightness are at their maximum and are not adjustable. In the night (NUIT) position the brightness is adjustable with a maximum illumination slightly lower than that of JOUR.

Light and panel lighting rheostat: this knob adjusts the indicator lights and panels brightness when the day/night selector switch is in the night position.

Ultraviolet lighting rheostat: this knob adjusts main panel instruments ultraviolet light.

Dual instrument panel lighting rheostat (floodlights): this knob (outer) adjusts instrument panel red floodlights intensity.

Dual instrument panel lighting rheostat (integral): this knob (inner) adjusts the brightness of the instrument panel red integral lights.

Dual console and pedestal lighting rheostat (floodlights): this knob (outer) adjusts console and pedestal red floodlights intensity.

Dual console and pedestal lighting rheostat (integral): this knob (inner) adjusts the brightness of the console and pedestal red integral lights.

Map light rheostat: this knob adjusts the map light brightness.

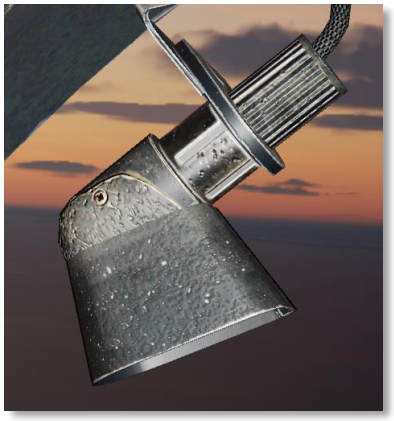


Figure 3-80 Map Light

Figure 3-81 Autopilot Control and Indicator Unit

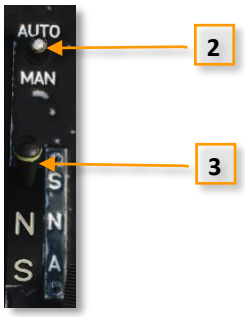


Figure 3-82 Sight Lighting Switches

1 AUTOPILOT INTENSITY CONTROL

2 SIGHT AUTO/MAN INTENSITY SELECTOR SWITCH

3 SIGHT LIGHTING SELECTOR SWITCH

Autopilot intensity control: this knob adjusts the brightness of the autopilot control unit buttons.

Sight auto/manual intensity selector switch:

- AUTO: the brightness set by the pilot varies automatically according to external luminosity to maintain a constant contrast.
- MAN: the brightness of the reticles is regulated, with a fixed value, by the pilot through brightness rheostats at the bottom of the sight head, these are identified by the drawing of the grids in question (see sight chapter in this manual).

Sight lighting selector switch:

- Aft (A): all reticles are off.
- vertical (N): normal operation, an N appears at the base of the lever.
- forward (S): emergency operation, an S appears in a red background at the base of the lever. This position is used when one reticle goes out (burnt bulb).

Exterior lighting

The landing light can only be operated when the nose landing gear is down. The aft position of the landing light control retracts the landing light and switches it off. The mid position powers on and extends the landing light to the taxi position. The forward position extends the landing light to the landing position.

The search light is operated by turning the search light control (energization) to on and holding depressed the search light button, located in the control stick.

The navigation light control has three positions:

- lower position: dim
- mid position: off (A, “arret”)
- upper position: bright

The formation light control has three positions:

- lower position: fixed
- mid position: off (A, “arret”)
- upper position: flashing (“clig”)

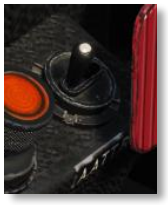


Figure 3-83 Landing Light Control in Left Console

Figure 3-84 Formation and Navigation Lights Controls in Right Front Panel

1 NAVIGATION LIGHT CONTROL

2 FORMATION LIGHT CONTROL

Figure 3-85 Search Light Control in Right Console

Figure 3-86 Search Light Button on Control Stick

3.11 OXYGEN SYSTEM

Description

The oxygen system includes a liquid oxygen tank with a capacity of 5 litres and an emergency gaseous oxygen cylinder with a capacity of 0.4 litres at 180 bar. This provides an oxygen tank duration that varies from 4 to 11 hours 30 minutes, depending on the pilot, type of flight, altitude and operation mode of the regulator. The emergency cylinder has a duration of 7 minutes in case of ejection.

Operation with oxygen tank:

- Normal
    - Selector set to N: Letter N shown in the magnetic indicator. A mixture of oxygen and air, which varies with altitude, is supplied on demand, and pure oxygen above 33,000 ft.
    - Selector set to 100%: White square shown in the magnetic indicator. Pure oxygen is supplied on demand at any altitude.
- Emergency
    - Selector set to EMG (S): Red square shown in the magnetic indicator. A mixture of air and oxygen, which varies with altitude, is supplied on continuous flow.

To test the oxygen quantity indicator, with external power connected, set the battery to on and keep pressed the “T” test button. The needle moves from empty to full continuously and should stabilize in its initial position when the "T" button is released. If the needle stabilizes outside the green zone, the tank must be changed.

If the external power is not connected, set the battery on and press the “TEST OXY” button, the indicator will read the oxygen quantity.

When the "OXY" circuit breaker is pulled, the oxygen regulation continues normally but there are no quantity and selector position indications, and the blinker is fixed; In addition, the fault monitoring no longer works (no warning indication or sound).

Controls and indicators

N-100%-emg mode selector switch: this selector has three positions: Normal, 100% and EMG.

Oxygen overpressure button and anti-g connection cover: not implemented in this simulation.

Blinker: oxygen on demand indication.

Oxygen quantity: indicates oxygen quantity in quarters. It includes a green band (oxygen quantity within limits) and a red band (oxygen quantity too low).

Selector position repeater: shows an N or a red square, indicating normal or emergency operation respectively.

Oxygen test button: used to test the oxygen indicator.

Oxygen quantity ground test button: “TEST OXY” button, used to test oxygen indicator on ground.

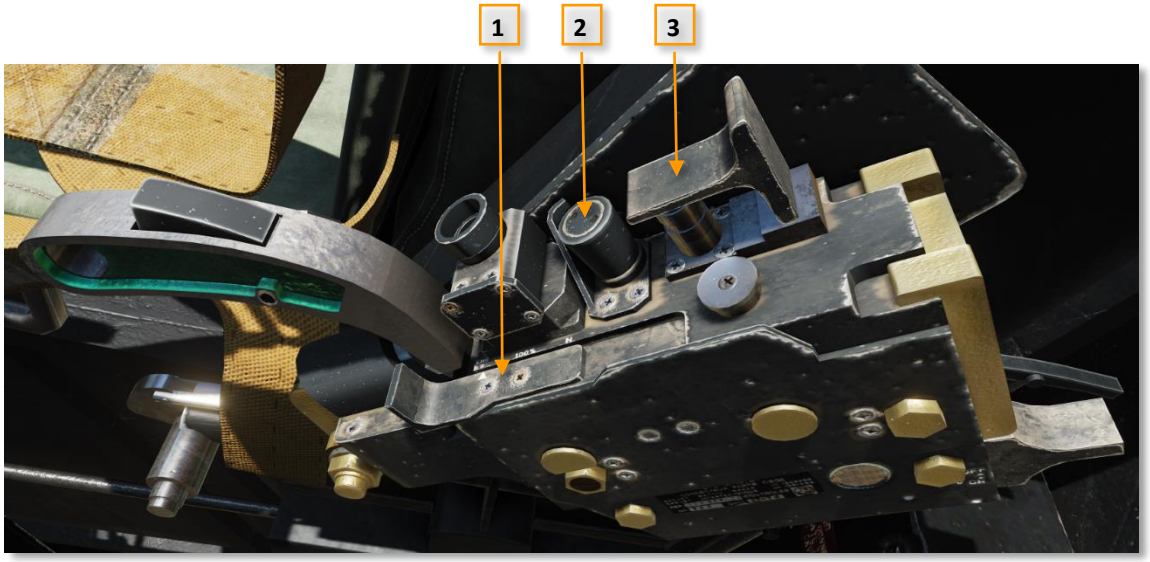


Figure 3-87 Pilot's Personal Equipment Connector

1 N-100%-EMG MODE SELECTOR SWITCH
2 OXYGEN OVERPRESSURE BUTTON
3 ANTI-G CONNECTION COVER

Figure 3-88 Oxygen Indicator

1 BLINKER
2 OXYGEN QUANTITY
3 SELECTOR POSITION REPEATER
4 OXYGEN TEST BUTTON
5 OXYGEN QUANTITY GROUND TEST BUTTON

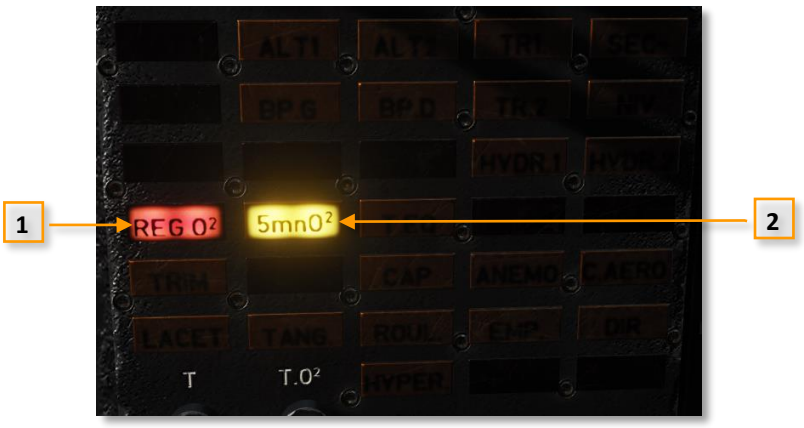


Figure 3-89 Failure Warning Panel

1 Ox REG RED LIGHT *2 5mn Ox AMBER LIGHT*

The REG O² red light comes on, together with the warning horn, when a regulator failure occurs with the selector switch set to N or 100%.

The 5mn O² amber light comes on when the pressure in the emergency system is less than 150 bar, in this case only a maximum of 6 minutes of oxygen is left.

3.12 AIR CONDITIONING AND PRESSURIZATION SYSTEM

Description

The cabin air conditioning and pressurization, and equipment air conditioning, are ensured by bleed air from the last compressor stage of the engine.

The cabin temperature basic regulating device is a solenoid valve, that admits more or less hot air into the hot/cold air mixture.

A ram air inlet, in the left side of the nose cone, ensures cabin ventilation with fresh air in case of malfunction of the air conditioning system.

The system includes a cabin demist switch and a cabin seal inflation lever.

To pressurize the cabin, the master switch must be set to ON, the canopy seal lever to the forward position (inflated) and the ram air switch to OFF.

The cabin pressurization program is as follows:

- from 0 to 6500 ft: cabin pressure equal to outside pressure
- from 6500 ft to 18,000 ft: constant cabin pressure of 6500 ft
- above 18,000 ft: cabin pressure 300 mb higher than outside pressure (to keep 4.35 psi).

Controls and indicators

- Canopy Seal Valve Control Lever: controls cockpit sealing. It has two positions: forward, inflation (“gonflage”) and rearward, deflation (“dégonflage”).
- Cabin Altimeter: indicates cabin altitude in ft.
- Master valve control switch: connects/disconnects cabin air conditioning and pressurization, and equipment air conditioning. A position: off (“arret”), M position: on (“marche”).
- Demist switch: when the switch is in the forward position (DESEMB), the demisting valve opens allowing a direct intake of warm air on the front and left side windows.
- Ram air switch (guarded): when the switch is in the forward position, ram air enters the cockpit. It can be used for canopy demisting in extreme cases, or in some emergency procedures, to eliminate cockpit fumes/smoke, or to reduce cockpit or equipment temperature.
- Hot/cold selector switch: used to manually control the equipment temperature when the auto/manual selector is in manual position. It has two spring-loaded positions: cold (“froid”) and hot (“chaud”).
- Auto/manual selector switch: used to select automatic or manual control of equipment conditioning.
- Temperature indicator: equipment temperature indicator.
- Temperature control rheostat: controls cabin temperature in auto or manual modes.
- Solenoid valve position indicator: indicates the position of the solenoid valve, admitting cold (F) or hot (C) air into the air mixture.
- Emergency cold switch (“secours froid”): commands a closing order to the solenoid valve.

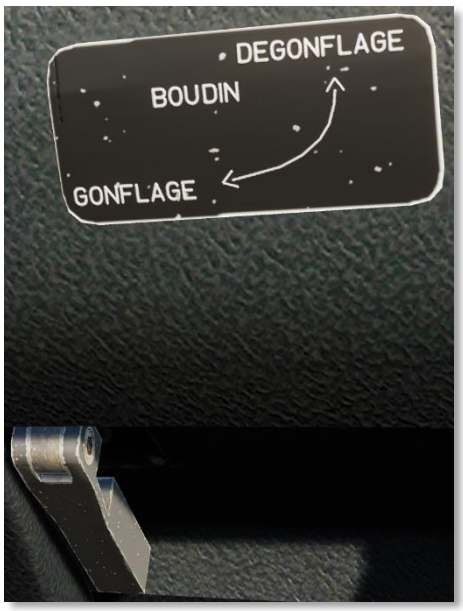


Figure 3-90 Canopy Seal Valve Control Lever in Right Wall

Figure 3-91 Cabin Altimeter in Main Panel

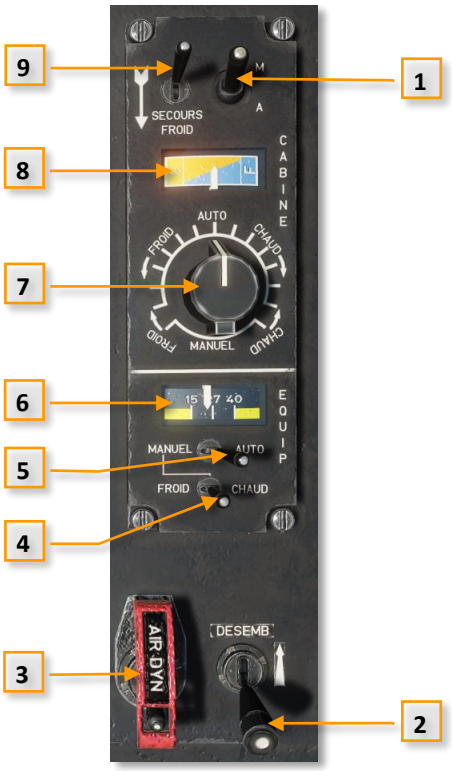


Figure 3-92 Air Conditioning and Pressurization Panel in Right Console

1 MASTER VALVE CONTROL SWITCH
2 DEMIST SWITCH
3 RAM AIR SWITCH (GUARDED)
4 HOT/COLD SELECTOR SWITCH
5 AUTO/MANUAL SELECTOR SWITCH
6 TEMPERATURE INDICATOR
7 TEMPERATURE CONTROL RHEOSTAT
8 SOLENOID VALVE POSITION INDICATOR
9 EMERGENCY COLD SWITCH

Figure 3-93 Failure Warning Panel

T.EQ amber light: temperature of the air flow into the equipment bay < 5°C or > 50°C

T.CAB red light: duct sensor temperature > 60°C and cabin temperature > 32°C

P.CAB red light: canopy open or cabin altitude > 30,000 ft.

3.13 RADIO SYSTEM

Description

The radio system of the Mirage F1-CE is composed by 2 radios: the V/UHF TRAP 136 and the UHF TRAP 137B.

Note for mission creators: Scripting trigger parameter names for radio frequencies are:

TRAP 136 - "VUHF_FREQ"

TRAP 137B - "UHF_FREQ"

TRAP 136

The TRAP 136 (also known sometimes as green radio) is a V/UHF radio unit. It can operate in the frequency ranges from 118 Mhz to 143,975 Mhz and from 225 Mhz to 399,975 Mhz. It is equipped with a transmitter receiver and a guard receiver. The main frequency can be inputted manually, selected from 20 preset channels or from the guard frequency. The guard frequency can be monitored at the same time as the main frequency.

TRAP 137B

The TRAP 137B (also known sometimes as red radio) is an UHF radio unit. It can operate in the frequency range from 225 Mhz to 399,975 Mhz. It is equipped with a transmitter receiver. The frequency can be chosen from 20 preset channels.

Preset channels of both radios can be set in the radio preset tab of Mission Editor.

Channel 20 of TRAP 137B is reserved when “Easy Comms” option is enabled; in this case, channel 20 will be overwritten by the radio system and frequency in use. It is available for use when “Easy Comms” is not enabled.

Radio selector unit (SIB box)

This intercom unit is used to select transmission/reception and adjust volume on each radio equipment. Warning sounds volume cannot be adjusted. V/UHF and UHF can be used simultaneously in emission/reception by pressing both pushbuttons.

Controls

TRAP 136

- Function selector (AR/PAL/PAL+G/F1/H): Allows to choose the operation mode of the radio: AR is off (“arret”), PAL allows to use only the main frequency, PAL+G allows to use the main frequency and listen to the guard receiver and F1 and H are unused.
- Frequency selection mode selector (M/P/G): Allows to select the source of the frequency: manual input, preset channel or guard frequency.
- Manual frequency selection thumbwheels: Allows the pilot to set the manual frequency.
- Preset channel selector: Allows the pilot to select the preset channel.

- Transmission power (25W/5W) switch: Selects the transmitter power.
- Silence SIL (squelch) switch: Allows the pilot to apply a squelch filter to the radio.
- Test selection switch (R/neutral/E+A2): Allows the pilot to start a receiver o transmitter test.

TRAP 137B

- Function selector (AR/M/F1/H): Allows to choose the operation mode of the radio: AR is off ("arret"), M is on ("marche") and F1 and H are unused.
- Preset channel selector: Allows the pilot to select the preset channel.
- Silence (squelch) switch: Allows the pilot to apply a squelch filter to the radio.
- Test selection switch (R/neutral/E+A2): Allows the pilot to start a receiver o transmitter test.
- Transmission power (5W/25W) switch: Selects the transmitter power.

Configuration indicator

- BIP button (on the configuration indicator): Allows to send a signal to the tower when the landing gear is down and locked. (See chapter 3.5).

Control stick

- PTT button: push-to-talk button. The pilot presses the button to transmit and releases it to receive.

Left console

- Alternative PTT button: alternative push-to-talk button.

Radio selector unit

- U + V pushbutton/potentiometer: when pressed the U/VHF radio is ready to transmit. The potentiometer adjusts U/VHF radio volume.
- U pushbutton/potentiometer: when pressed the UHF radio is ready to transmit. The potentiometer adjusts UHF radio volume.
- RAP + CME pushbutton/potentiometer: is used as a return button ("rappel"). By action on this button the potentiometers previously pressed return to the reception position. The potentiometer adjusts RWR volume ("CME").
- MKR + TP pushbutton/potentiometer: allows to contact with ground crew (telephone link between the pilot and the exterior). The potentiometer must be depressed. An amber light illuminates on the SIB box. To speak, the pilot must press the PTT. Listening a telebriefing is possible if "MKR + TP" is not pressed (not implemented). After ground crew disconnection, this potentiometer becomes MARKER potentiometer.
- AMPLI 2 – 1 selector switch: it changes between amplifier channels 1 and 2. The amplifier channel 1 is powered by the main DC bus, and the amplifier channel 2 by the battery bus.
- VOR potentiometer: controls VOR reception volume.
- TAC potentiometer: controls TACAN reception volume.
- MISS potentiometer: controls missile warning reception volume.

Indicators

- Test light: indicates if the transmitter test has started or if the landing gear down signal is being sent to the tower by the BIP button.
- Preset channel number: indicates the channel number selected with the preset channel selector.

Figure 3-94 PTT Button on Control Stick

Figure 3-95 Alternative PTT Button in Left Console

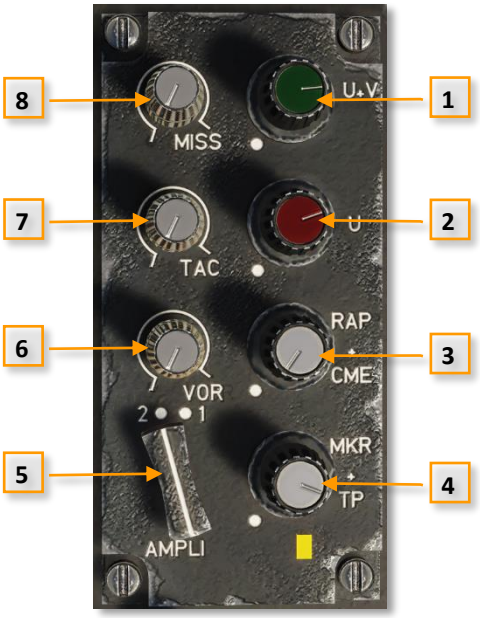


Figure 3-96 Radio Selector Unit (SIB Box)

1 U + V PUSHBUTTON/POTENTIOMETER
2 U PUSHBUTTON/POTENTIOMETER
3 RAP + CME PUSHBUTTON/POTENTIOMETER
4 MKR + TP PUSHBUTTON/POTENTIOMETER
5 AMPLI 2 – 1 SELECTOR SWITCH
6 VOR POTENTIOMETER
7 TAC POTENTIOMETER
8 MISS POTENTIOMETER

Figure 3-97 V/UHF Radio TRAP 136 (Green Radio)

1 PRESET CHANNEL NUMBER
2 PRESET CHANNEL SELECTOR
3 FREQUENCY SELECTION MODE SELECTOR
4 25W – 5W SWITCH
5 FUNCTION SELECTOR
6 FREQUENCY SELECTION THUMBWHEELS
7 SIL (SQUELCH) SWITCH
8 TEST SELECTOR SWITCH
9 TEST LIGHT

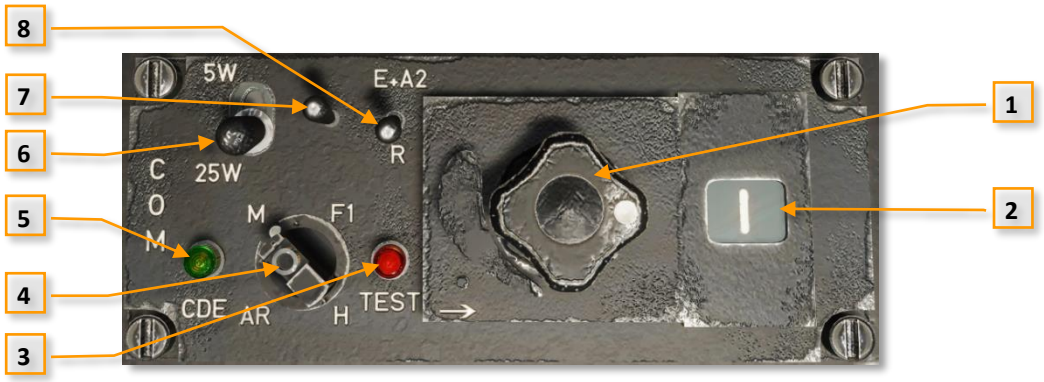


Figure 3-98 UHF Radio TRAP 137B (Red Radio)

1 PRESET CHANNEL SELECTOR
2 PRESET CHANNEL NUMBER
3 TEST LIGHT
4 FUNCTION SELECTOR
5 CDE BUTTON (NOT USED)
6 5W/25W SELECTOR SWITCH
7 SQUELCH SWITCH
8 TEST SELECTOR SWITCH

3.14 NAVIGATION SYSTEM

Description

The Mirage F1 CE is equipped with gyroscopes and a radionavigation suite with a TACAN and a VOR-ILS. Newer models, such as the F1 EE are also equipped with an inertial navigation system. The Mirage F1M also carries a GPS suite.

Gyroscopic system

The aircraft carries a main gyroscopic system and an emergency gyroscope that feed information to other systems such as the sight, the spherical indicator, the autopilot or the navigation indicator (IDN). The aircraft also carries a standby horizon.

The main gyroscopic system is composed of a vertical gyroscope, which provides pitch and roll information, and a gyromagnetic system, providing heading information (generally slaved to the magnetic field of the Earth). In turn, the gyromagnetic system is composed by a longitudinal gyroscope and a magnetometer. The system has 3 operation modes, that are selected with the heading control unit:

- Gyromagnetic (Gm), with the magnetometer providing corrections to the gyroscope.
- Purely magnetic (Cm).
- Emergency (Sec), in which the heading input is taken from the emergency gyroscope.

The emergency gyroscope only provides heading information and is also slaved to the magnetic field of the Earth through another magnetometer.

The spherical indicator provides attitude and heading indication.

Radionavigation

As mentioned above, the aircraft is equipped with both a TACAN and a VOR/ILS system. The heading, distance and flight slope information generated by these systems is used by the autopilot, the navigation indicator and the spherical indicator navigation pointers. The route commutation unit can be used to select the source of the radionavigation input to the pointers.

The TACAN is a MITAC model with 3 modes: receive (REC), transmit/receive (T/R) and air to air (A/A).

The transmit/receive mode allows for ranging information to be obtained by the system.

In the receive and transmit/receive modes the TACAN provides the polar coordinates of the aircraft relative to a ground station.

The air to air mode provides the distance between two aircraft, determined by measuring the time elapsed between the sending of an interrogation and the receiving of a reply.

The link is made between similar TACAN equipment, airborne and selected in "A/A" mode in channels "X" or "Y" different in 63 units. For example, if the leader selects channel 10 X, the wingmen would select channel 10 + 63 = 73 X.

In the case of two aircraft, the distance separating the leader from his wingman is indicated in the IDN of each aircraft.

When more than two aircraft are involved, only the wingmen get the distance from the leader.

In "A/A" the leader's TACAN can respond to five similar teams; exceeding this figure, a saturation occurs.

Valid channels are from 01 to 116 in both X and Y. It can be tested.

The VOR provides information of radial and bearing towards the VOR station, while the ILS provides localizer and glideslope information for the instrumental approach to a runway. It can tune in frequencies from 108 to 117,95 MHz with a spacing between channels of 50 kHz. It can be tested.

Navigation indicator (IDN)

The navigation indicator is an instrument that can display an arrange of bearings from different radio sources: the TACAN, the VOR and the radar. If the system has distance and bearing information from a TACAN, an 'additional vector' function can be used. This function essentially allows the pilot to get bearing information from present position to any point, determined by polar coordinates, that is, bearing and distance, relative to the TACAN station.

The Navigation indicator modes are:

IDN elements	**Mode TT (Radar/TACAN)**	**Mode TE (Radar)**	**Mode VT (VOR/TACAN)**
Rose	To heading directed by gyromagnetic unit		
Wide needle	TACAN/additional vector bearing	Non-relevant information	TACAN/additional vector bearing
Distance counter	Distance to TACAN station or additional vector tip	Non-relevant information	Distance to TACAN station or additional vector tip
Counter flag	TACAN distance not available	Always retracted	TACAN distance not available
Index	Selected autopilot heading		
Narrow needle	Radar antenna position		VOR bearing
Left flag	Retracted		VOR fail
Right flag	Navigation indicator fail		

Operation

TACAN

To operate with the TACAN, set the TACAN mode selector in the required mode, usually "T/R" to get a TACAN station bearing and distance (to use the "A/A" mode see the radionavigation description section above). Tune a nearby TACAN channel with the TACAN control unit selectors and set the IDN mode selector switch in the "TT" or "VT" modes. Bearing and distance to the TACAN will be shown in the IDN, provided that the normal/additional vector selector switch is

in the “N” position, or the additional vector bearing and distance are set to zero if the normal/additional vector selector switch is in the “VECT. ADD.” position. The TACAN range is around 300 NM, depending on radio horizon.

Placing the omnibearing selector in TAC position, the TACAN-VOR-ILS (LOC) pointer in the spherical indicator will show TACAN deviation indications. Use the omnibearing selector knob to set the required radial or bearing.

To set an additional vector, place the normal/additional vector selector switch in the “VECT. ADD.” position, and adjust the polar coordinates of the additional vector with the bearing/distance selector knob, changing between bearing and distance with the additional target selector switch. The bearing and distance set will be shown in the additional vector bearing window and in the additional vector distance window, respectively. The wide needle will show the bearing from present position to the additional vector, or target, position.

Example: we are on bearing 180° (radial 360°), 10 NM out from a TACAN, and we want to proceed to a target located on radial 090°, 10 NM out from that TACAN. We set 090 in the additional vector bearing window and 010 in the additional vector distance window. We set the normal/additional vector selector switch in “VECT. ADD.” and we read 14 NM in the TACAN or additional target distance window and a bearing of 135° with the TACAN or additional target bearing pointer (wide needle).

TACAN test:

The test can be performed if:

- the heating time is complete (90 seconds)
- the selected mode is not "REC"
- the autopilot is not connected in TACAN mode.

The TEST lasts 10 seconds. The first 5 seconds check the green and red lamps, which must flash at a frequency of 3 Hz approx. The following 5 seconds check the operational status of the on-board TACAN equipment in the set mode ("T/R" or "A/A") and on the selected channel. During these last 5 seconds, after flashing, the green indicator light should stay on. If it stays off while the red indicator light stays on, the TACAN is faulty.

During the 10 seconds of the TEST, read in the IDN ("TT" or "VT" selection):

- distance between 0 and 4 NM (in ''T/R'' and "A/A")
- TACAN bearing 0° ± 5° (in "T/R").

The complete TACAN test is carried out in "T/R" and "A/A" modes and on channels "X" and "Y".

VOR/ILS

To operate with the VOR, set the VOR/ILS control unit ON/OFF selector in the ON position (M: “marche” or on, A: “arret” or off), tune a nearby VOR frequency with the VOR/ILS control unit selectors and set the IDN mode selector switch in the “VT” mode. Bearing to the VOR will be shown in the IDN.

Placing the omnibearing selector in VOR ILS position, the TACAN-VOR-ILS (LOC) pointer in the spherical indicator will show VOR deviation indications. Use the omnibearing selector knob to set the required radial or bearing.

To operate with the ILS, follow the same procedure as with the VOR: set the VOR/ILS control unit to on, tune the localizer frequency and set the omnibearing selector in the VOR ILS position. There is no need to set the ILS course with the omnibearing selector, the vertical and horizontal pointers in the spherical indicator will appear when there is a valid signal from the localizer and glide slope beams respectively.

Selecting a LOC frequency automatically activates the marker receiver. In that case, when overflying the landing beacons, the amber indicator light flashes on the spherical indicators and an audio signal is heard at the rate of the identification signal of the overflown beacon.

VOR receiver test:

Select a VOR frequency that doesn’t correspond to any VOR station with a valid signal near the aircraft. Placing the "TEST" knob in "HG" or "BD" position will show a north bearing indication in the IDN. When selecting a north course on the omnibearing selector, the vertical bar in the spherical indicator will center and the "TO/FROM" indicator will indicate "TO".

ILS receiver test:

Select a LOC frequency that doesn’t correspond to any ILS with a valid signal near the aircraft. Placing the "TEST" knob in "HG" or "BD" position will cause a maximum deviation of the bars of the spherical indicator:

- in "HG" the bars deviate up left
- in "BD" the bars deviate down right.

During the VOR-ILS test, a 1000 Hz test signal is audible in the headphones.

Marker receiver test:

This test is performed together with the ILS test. Placing the "TEST" knob in the "HG" or "BD" positions causes the successive listening of audio signals at 400, 1300 and 3000 Hz, as well as the simultaneous lighting of the amber indicator light in the spherical indicators.

Controls

Heading Control Unit

- Heading and vertical reference system control switch: This is the main gyroscopic system selector that selects the source of the heading info coming from the main gyroscopic unit: gyromagnetic (Gm), purely magnetic (Cm) or emergency (Sec). It can also turn off the system (A). If the system is turned off for more than 15s, turning it back on to Gm or Cm will start the erection process. When not on the ground, this process has to be performed in levelled flight. It takes roughly 35s to obtain an approximate alignment and 1 minute to be performed fully.

- Emergency gyromagnetic compass switch: This is the emergency gyroscope ON/OFF switch (M: marche or on, A: arret or off).

- Heading control unit erection button: This is the emergency gyroscope fast sync pushbutton. It performs a fast synchronization of the emergency gyroscope.

Spherical Indicator

- Pole setting and marker beacon light test: The pole setting selector, located in the spherical indicator, has two positions (N: Normal, P: Pole). In P position, the sphere ("boule") tilts towards its south pole and comes to rest in the center of the indicator. Pressing the pole knob (N/P), the MARKER indicator light test is carried out.
- Day/night (J/N) MARKER selector: The day/night ("jour", "nuit") selector switch, located in the spherical indicator, changes the brightness of the marker indicator light.

Standby Horizon

- Uncage and aircraft model control: This knob is used to cage, uncage and set the standby horizon. Pulling and turning the knob fully clockwise cages the standby horizon. Rotating the knob counter clockwise from the caged position, uncages it. Pulling the knob performs a fast erection and sets wings level (pitch and roll) in the standby horizon with current aircraft attitude. Rotating the knob adjusts miniature aircraft pitch.

TACAN Control Unit

- Frequency hundreds and tens selector: This control selects TACAN channel hundreds and tens digits.
- Frequency units selector: This control selects TACAN channel units digits.
- X/Y mode selector: This control selects TACAN channel mode (X or Y).
- Mode selector: This control selects TACAN mode: receive (REC), transmit/receive (T/R), air to air (A/A) and off (OFF).
- Test button: performs a test of TACAN system.

VOR/ILS Control Unit

- Mhz frequency selector: This control selects VOR/ILS frequency Mhz.
- Khz frequency selector: This control selects VOR/ILS frequency Khz.
- ON/OFF selector: VOR/ILS ON/OFF switch.
- Test selector: This switch performs a test of the VOR/ILS equipment.

Omnibearing and VOR/ILS-TACAN Selector

- VOR/ILS-OFF-TACAN selector: Selects the VOR/ILS or TACAN signals to feed the spherical indicator pointers.
- Omnibearing selector: Used to select the TACAN or VOR course.

Navigation Indicator (IDN)

- Mode selector switch: Selects navigation indicator mode (TT, TE, VT, off).
- Test button: This pushbutton tests that the navigation indicator works correctly. The big needle should move to 45° and the distance counter should show 250 NM.
- Normal/Additional vector selector switch: commands the wide needle and distance counter to show info relative to the TACAN station or to the tip of the additional vector.

- Additional target selector switch: allows to select the distance or bearing window to input the additional vector polar coordinates.
- Bearing/distance selector knob: allows to input the polar coordinates of the additional vector in relation to the TACAN station, bearing or distance, depending on the position of the additional vector selector switch.
- Additional vector selector: allows to input the polar coordinates of the additional vector in relation to the TACAN station.

Indicators

Heading Control Unit

- Heading deviation needle: this emergency gyroscope sync state needle displays the error of the emergency gyroscope.

Spherical Indicator

- Marker indicator light: This light, located in the day/night selector switch, blinks when overflying the marker station.
- ILS (GS) pointer: Shows the aircraft deviation from the ILS glide slope. Only present when the signal is valid.
- TACAN-VOR-ILS (LOC) pointer: shows the aircraft deviation from the ILS localizer or the difference between the selected and present TACAN or VOR radial. Only present when the signal is valid.
- Roll scale: Shows roll angle in degrees from 0° to 90° in 10° increments.
- Roll index: Shows aircraft roll angle on the roll scale.
- Failure warning flag: This flag appears in case of failure of the information coming from the gyroscopic system.
- Sideslip ball: Indicates aircraft sideslip. The ball will be centred in coordinated flight.
- Aircraft model: shows aircraft attitude and magnetic heading on the spherical indicator (“boule”).
- TO-FROM indicator: Shows the sector (TO or FROM) the aircraft is in, with reference to the course selected with the omnibearing selector. If the current radial differs more than 90° from the selected course, the indication will be FROM (FR), and vice-versa. There is a 20° sector with no TO/FROM indication, when the difference if > 80° and < 100°.

Standby Horizon

- Caging and failure warning flag: This flag appears on the left side of the standby horizon when there is a system failure. It is normally removed 50 seconds after energizing and unlocking the horizon.

TACAN Control Unit

- Selected channel window: shows TACAN selected channel.
- Red warn light: illuminates if there is a failure, when an invalid channel is selected or during TACAN test. Invalid channels are X00, X127, X128 and X129.

- Green go light: illuminates during TACAN test, indicating that the equipment operates properly.

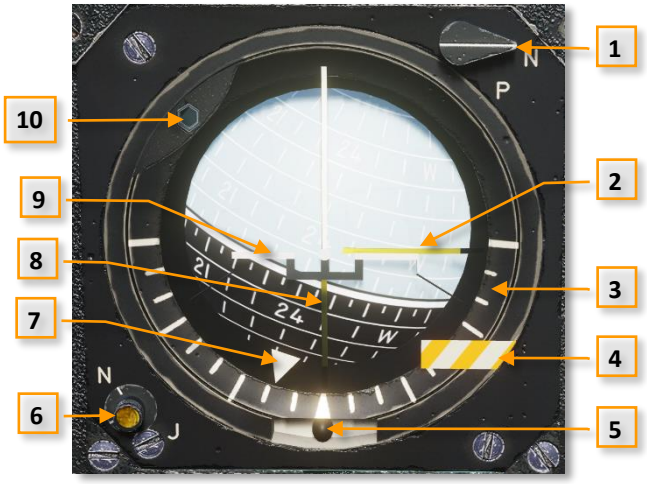
VOR/ILS Control Unit

- Selected frequency window: shows VOR/ILS selected frequency.

Navigation Indicator (IDN)

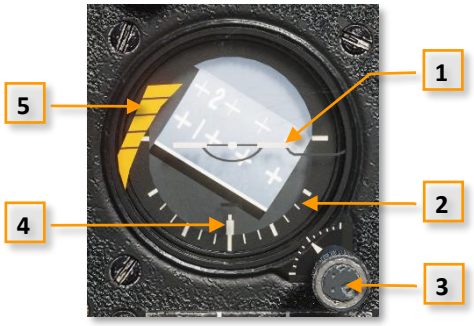
For general navigation indicator (IDN) display, see table in description.

- Additional vector distance window: shows the selected length of the additional vector (in NM).
- Additional vector bearing window: shows the heading of the additional vector.
- Heading selected for autopilot: shows the heading selected with the heading selection unit (“cap affiché”).
- TACAN or additional target distance: this window shows the distance to the selected TACAN station or additional vector.
- TACAN distance failure flag: indicates a failure in TACAN or additional vector distance reading.
- TACAN or additional target bearing: the head of this wide needle shows the bearing to the TACAN station or to the additional target, when the mode selector is on “TT” or “VT”. The tail of the needle shows, therefore, the radial the aircraft is in.
- VOR or LOC failure: indicates VOR or LOC failure when in VT mode.
- IDN failure: indicator failure on parameters reception, wide needle or distance counter.
- Radar antenna relative bearing: this narrow needle shows the radar antenna azimuth when the selector is on "TT" or "TE", or VOR bearing when the selector is on "VT". The white arc represents the radar scanning limits.
- Heading index: present heading reference.



1 POLE SETTING AND MARKER BEACON LIGHT TEST
2 ILS (GS) POINTER
3 ROLL SCALE
4 FAILURE WARNING FLAG
5 SIDESLIP BALL
6 DAY/NIGHT SELECTOR SWITCH AND MARKER INDICATOR LIGHT
7 ROLL INDEX
8 TACAN-VOR-ILS (LOC) POINTER
9 AIRCRAFT MODEL
10 TO-FROM INDICATOR

Figure 3-99 Spherical Indicator



1 AIRCRAFT MODEL
2 ROLL SCALE
3 UNCAGE AND AIRCRAFT MODEL CONTROL
4 ROLL INDEX
5 CAGING AND FAILURE WARNING FLAG

Figure 3-100 Standby Horizon

Figure 3-101 Navigation Indicator (IDN)

1 NORMAL/ADDITIONAL VECTOR SELECTOR SWITCH
2 ADDITIONAL VECTOR BEARING WINDOW
3 TEST BUTTON
4 ADDITIONAL VECTOR DISTANCE WINDOW
5 ADDITIONAL TARGET SELECTOR SWITCH
6 BEARING/DISTANCE SELECTOR KNOB
7 HEADING SELECTED FOR AUTOPILOT
8 MODE SELECTOR SWITCH
9 TACAN OR ADDITIONAL TARGET DISTANCE
10 TACAN DISTANCE FAILURE FLAG
11 TACAN OR ADDITIONAL TARGET BEARING
12 VOR OR LOC FAILURE
13 IDN FAILURE
14 RADAR ANTENNA RELATIVE BEARING
15 HEADING INDEX

Figure 3-102 CAP (HDG) Amber Light in Failure Warning Panel

CAP amber light: When this light is on the autopilot disengages or it can't be engaged again. It indicates a failure in the heading chain or in the BSM (Magnetic Surveillance Box).

To determine the failure, it is enough to change to emergency heading:

- If CAP light goes out: it is a failure in main heading chain. The emergency heading can be read in the spherical indicator and in the navigation indicator. The autopilot can still be used.
- If CAP light remains on: it is a BSM failure. The emergency heading can be read only in the navigation indicator. The autopilot can no longer be used.

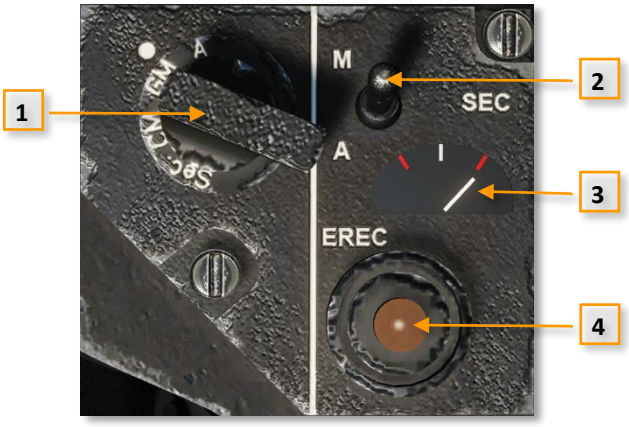


Figure 3-103 Heading Control Unit in Right Console

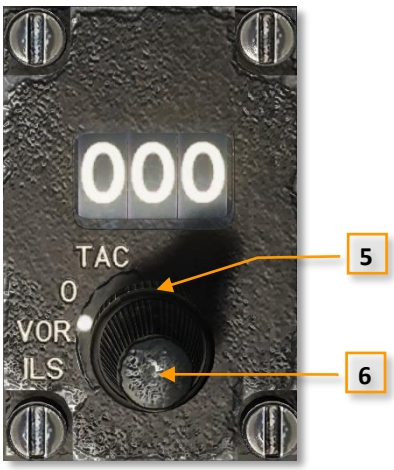


Figure 3-104 Omnibearing and VOR/ILS-TACAN Selector in Right Console

1 HEADING AND VERTICAL REFERENCE SYSTEM CONTROL SWITCH
2 EMERGENCY GYROMAGNETIC COMPASS SWITCH

3 HEADING DEVIATION NEEDLE
4 HEADING CONTROL UNIT ERECTION BUTTON
5 VOR/ILS-OFF-TACAN SELECTOR
6 OMNIBEARING SELECTOR

Figure 3-105 TACAN Control Unit in Right Console

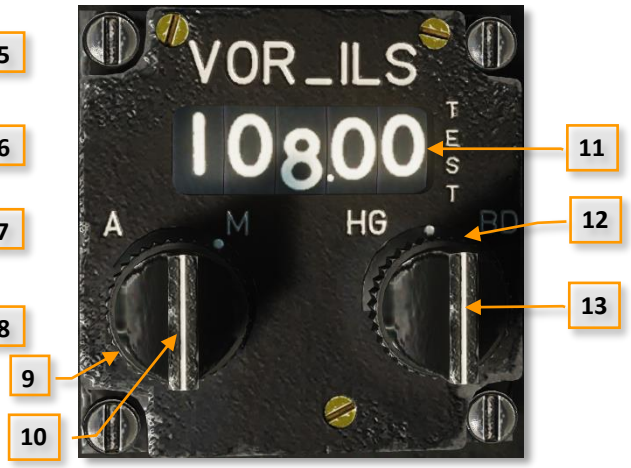


Figure 3-106 VOR/ILS Control Unit in Right Console

1 FREQUENCY HUNDREDS AND TENS SELECTOR
2 X/Y MODE SELECTOR
3 SELECTED CHANNEL WINDOW
4 TEST BUTTON
5 RED WARN LIGHT
6 GREEN GO LIGHT
7 MODE SELECTOR

8 FREQUENCY UNITS SELECTOR
9 ON/OFF SELECTOR
10 MHZ FREQUENCY SELECTOR
11 SELECTED FREQUENCY WINDOW
12 TEST SELECTOR
13 KHZ FREQUENCY SELECTOR

3.15 ARMAMENT SYSTEM

Description

The armament system comprises the weapons and associated elements in the aircraft. The Mirage F1 is equipped with a wide variety of weaponry, even the earlier versions such as the F1-CE. As an interceptor, the CE has multiple guided and unguided air to air weapons but, to fulfil a secondary role as a ground attacker, it can also carry rockets and bombs.

The safety of the armament is ensured by a master arm switch (under guard) and by a landing gear up check. The normal selection of weapons is done through the weapon selection panel, which also sets the visor mode. Interlocks prevent pushbuttons from being depressed at the same time, except “MG. FUS.” and “MD.” pushbuttons which can be depressed at the same time, as well as “BOMB VOIL.” and “BOMB FUS.”. The panel pushbuttons and switchology are described in the controls section.

Other switches in the armament panel allow the pilot to choose the arming mode of the bombs, to select the launch of either inner, outer or both wing bombs/rockets and to select the launch mode between pickle (coup per coup / CPC) or salvo (SALV).

The sight missile air to air mode includes information about the readiness and lock status of the missiles. A white triangle indicates the missile is selected and ready and an amber circle indicates the missile is locked. In the case of the radar guided missiles, a green larger middle circle indicates missile is within launch distance parameters and a red one indicates that the aircraft is too close to the target.

A dogfight mode, called rapid cannon + MATRA R550 or SW, is available through the (C + M or SW) R button on the throttle. When the button is pressed, the sight changes to cannon air-to-air mode with radar guidance, the outer missiles are selected and a green light on the side of the sight mount turns on. Further short presses of the button release the current radar lock and command a radar search in front of the current target. A long press of the button commands the restart of the search pattern from the initial position. The (C + M or SW) R mode can be exited by actuation of an unstable switch on the left wall of the aircraft.

Weapons and other payloads can be jettisoned through pushbuttons on the frontal panel. An emergency jettison that drops all payloads is available but station can also be selected through a switch. Outer missiles are not jettisoned, being launched not armed instead.

Cannons

The aircraft is equipped with 2 internal DEFA 553 with 150 rounds each. External DEFA cannon pods can also be mounted, especially in the case of the Mirage F1-B, which is not equipped with internal cannons.

Firing occurs by pressing the trigger on the control stick and is independent of the mode selected on the armament panel, being only limited by the master arm switch.

Outer missiles

The Mirage F1-CE can carry the MATRA R550 Magic I, the AIM-9 B, the AIM-9 J, the AIM-9 JULI and the AIM-9 P on its wing tips. The ability to carry Sidewinder variants is one of the main differences it has with the base C model.

The AIM-9 JULI is an autochthonous variant of the AIM-9 N/P that substitutes the seeker and control units by those of the AIM-9 L. Therefore, it is the only of these missiles with all-aspect capability.

Inner missiles

The Mirage F1-CE can carry 3 types of missile on its inner (or fuselage) pylons: The R530 IR, the R530 EM and the S530 F.

The MATRA R530 IR is an infrared guided medium range missile. It can be fired independently from the radar and has a limited all aspect capability.

The MATRA R530 EM is a radar guided semi-active medium range missile. It needs guidance from the radar all the way to impact.

The MATRA S530 F is a radar guided semi-active medium range missile, it is an evolution of the R530 EM. It needs guidance from the radar all the way to impact. It is worth mentioning that the 'supermatra' was never used by the Spanish Air Force (except on its EDA aircraft acquired from Qatar) but all the Mirage F1 types used by Spain had the capability to employ it.

Rockets

The F1 has multiple rocket launchers at its disposal: The MATRA F1 (carries 36 rockets), the MATRA F2 (carries 9 rockets) and the MATRA F4 (carries 18 rockets and is also known as MATRA 155). All of them use SNEB 68 mm rockets, with interchangeable heads for different purposes.

Bombs

The Mirage F1 has a wide selection of bombs at its disposal. It can carry all the French SAMP bombs from 125 to 400 kg in both free fall and parachute versions. The Spanish types are certified to carry American Mk 82, Mk 83, GBU 10 and GBU12 bombs, as well as Spanish BR 250 and BR 500 bombs. Cluster BLG 66 Belouga and anti-runway BLU107 Durandal are also available.

Controls

Armament panel pushbuttons

- Air to air cannon (CAN. A.): Sets the sight to cannon air to air mode.
- Air to ground cannon and rockets (CAN. S. ROQ.): Sets the sight to cannon/rockets air to ground mode and enables the firing of rockets in case they are being carried.
- Wing bombs (BOMB VOIL.): Sets the sight in bombing mode and enables the launch of the wing bombs. Can be selected in conjunction with the BOMB FUS button.
- Fuselage bombs (BOMB FUS.): Sets the sight in bombing mode and enables the launch of the fuselage bombs. When carrying a CLB4 pylon, the button light turns off when all of the bombs carried in the pylon are released. Can be selected in conjunction with the BOMB VOIL button.
- Left or fuselage inner missile (MG. FUS.): Sets the sight to missile air to air mode and enables the locking and firing of the inner left pylon or fuselage missile. In the case of the R530 IR it, together with the master arm, commands the cooling of the missile seeker. Can be selected in conjunction with MD. When both are pressed (and both left and right missiles are present), the locked missile has launch priority. In case both missiles are locked, if one is IR and the other is EM, the IR missile has priority. In case both are locked and the same type, the left missile is fired first.
- Right inner missile (MD.): Sets the sight to missile air to air mode and enables the locking and firing of the inner right pylon missile. In the case of the R530 IR it, together with the master arm, commands the cooling of the missile seeker. Can be selected in conjunction with MG. FUS. The logic when both are pressed is described above.
- Outer left missile (EXT. G.): Sets the sight to missile air to air mode and enables the locking and firing of either of the outer missiles. When both outer missiles are present and locked, it gives launch priority to the left missile.
- Outer left missile (EXT. D.): Sets the sight to missile air to air mode and enables the locking and firing of either of the outer missiles. When both outer missiles are present and locked, it gives launch priority to the right missile.

Armament panel switches and buttons

- Single/salvo selector: Launch mode switch that selects whether the bombs and rockets are launched on salvos (SALV) or one by one (CPC: “coup par coup”).
- Bomb/rocket selector: Wing station selector (EX/IN/1+2) that allows selection of which wing bomb/rockets station are to be launched: outer, inner or both.
- Instantaneous/delay/safe selector switch: Bomb arming selector (INST/RET/OFF) that allows the selection of arming mode for the bombs: nose, tail or not armed.
- Normal/jammer pursuit switch: no function.
- MATRA 550 or sidewinder missile switch: Some systems of both outer missiles (MATRA R550 or Sidewinder) are switched on when the switch is placed in the M position (on, “marche”). The switch must be in the on position two minutes before launching those missiles.

- Fore/aft selector switch: Specifies the type of attack when the radar is locked in direction but not in distance (case of jamming tracking). It has two positions: "AV" (“avant”) and “AR" (“arrière”), fore and aft respectively.
- Auto/manual firing selector switch: Allows to select automatic or manual firing of the MATRA R530 or MATRA S530.

  In AUTO position the missile is fired automatically when the white, amber and green indications in the sight are on.

  In MANUAL position the pilot can fire the missile when the white and amber lights are on.
- Sight selector: Permits to select the normal attitude reticle, used in navigation air-air and air-ground modes, or the simplified attitude reticle, used in approach only (velocity vector function).
- Firing fuel dipper switch: Activates the fuel dipper mechanism, see chapter 3.4 Jet Engine.
- Radar selector: See radar chapter, controls in the armament panel section.
- Radar 4 lines/1 line scan switch: See radar chapter.
- R 530 missile normal/altitude difference selector switch: Used in "NORM" for firing MATRA 530 missiles and in "NORM" or "DEN" for firing the MATRA S 530.

  The "DEN" (“dènivelée”, altitude difference) position selects, in the interception calculator, the missile-target collision function in the horizontal plane projection where the fighter evolves. The orders cause the fighter to perform a navigation that makes it climb to 20,000 ft below the target or, if the altitude difference is lower, to keep level. In the horizontal plane the orders are calculated as in the case of shooting without altitude difference.
- Lights test: Tests armament panel pushbutton lights.
- Secours (emergency) push-button: Not enumerated in the armament panel figure below, see the «EMERGENCY» button in radar chapter.

Other armament switches and buttons

- Master arm switch (under guard): Allows weapons to be armed and fired.
- Gun firing trigger: This is the cannon trigger, located on the control stick; once unfolded it can be used to fire the cannons and activate the sight recorder, as it presses the gun and sight recorder buttons.
- Gun button: used to fire the cannons.
- Sight recorder button: used to activate the sight recorder.
- Bombs, rockets, missiles and sight recorder button: Launch button, located on the control stick; depending on the selection of the armament panel mode, it can be used to launch missiles and bombs, to fire rockets and to activate the sight recorder.
- Gun firing safety: It has two positions. When flush firing is forbidden while sight recording is allowed, when pulled firing cannons is allowed.

- (C+ M or SW) R mode button: Located on the throttle, engages the (C+ M or SW) R mode or commands the unlock of target and restart of search.
- (C + M or SW) R mode deselection switch: This unstable switch, located on the left wall, commands deactivation of (C+ M or SW) R mode.
- Cannon 300-600m and missile lock/unlock button: Located on the throttle, when pressed forbids the radar emissions and sets the cannon sight distance to 600 m.
- Antenna-Gyro Switch: Located in left console.
    - In ANT position, if the radar is locked, the operation of the sight is based on radar antenna coordinates (see chapter 7, combat employment for further description).
    - In GYRO position, the sight operates in a classic gyroscopic mode.
- Emergency jettison button (under guard): Commands the jettison of all underwing and fuselage stores.
- Jettison selection switch (VOIL1/VOIL 2/FUS): Selects what stations can be selectively jettisoned.
- Selective jettison button (under guard): Commands the jettison of the selected station.
- Outer missile emergency launch button (under guard): Activates the motors and releases the (unarmed) outer missiles.
- Manual gravity drop selection thumbwheel: Used to select sight reticle depression angle.

NOTE: There is an option, in DCS Options special tab for the Mirage F1, to use a simplified firing safety logic. When this option is selected, all control stick weapon safeties will open as soon as the “Gun button” or “Bombs, rockets, missiles and sight recorder button” are depressed. See the figure below.

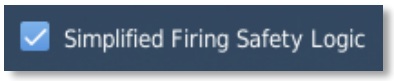


Figure 3-107 Simplified Firing Safety Logic in DCS Special Options

Indicators

- (C+ M or SW) R green light: indicates that the (C+ M or SW) R dogfight mode is engaged.
- Jamming detection light: illuminates when a jammer is detected.
- Cannons too hot light: Located in the right front panel, illuminates when cannons are too hot. The light can be tested by pressing it.
- Manual gravity drop window: shows sight reticle depression angle in mrad.

Figure 3-108 Master Arm Switch in Left Console (Guarded)

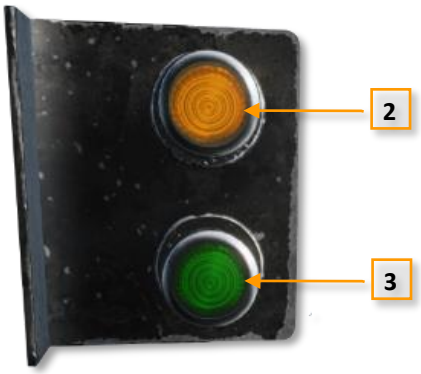


Figure 3-109 (C + M or SW) R Mode Light in Main Panel

1 ARMAMENT MASTER SWITCH (GUARDED)
2 JAMMING DETECTION LIGHT
3 (C + M OR SW) R MODE LIGHT

Figure 3-110 Throttle Lever

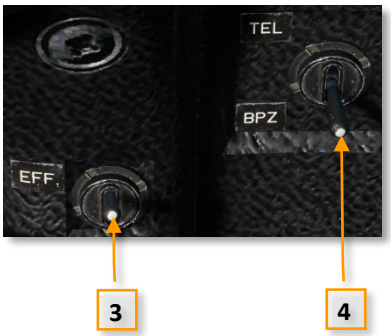


Figure 3-111 Switches in Left Wall

1 (C + M OR SW) R MODE BUTTON
2 CANNON 300-600M AND MISSILE LOCK/UNLOCK BUTTON

3 (C + M OR SW) R MODE DESELECTION SWITCH
4 TELEMETER/ZONE SCANNING SWITCH

Figure 3-112 Antenna-Gyro Switch in Left Console

Figure 3-113 Cannons Too Hot Light in Right Front Panel

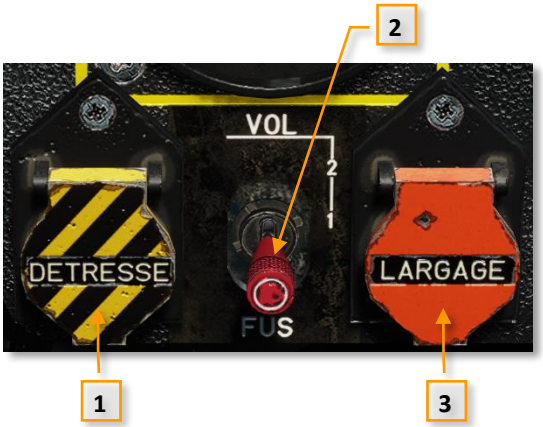


Figure 3-114 Jettison Panel

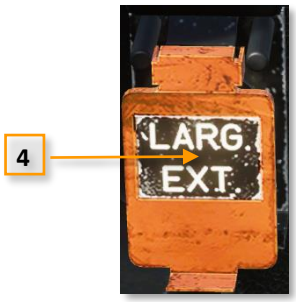


Figure 3-115 Outer Missile Emergency Launch Button (under guard)

1 EMERGENCY JETTISON BUTTON (GUARDED)
2 JETTISONING SELECTOR SWITCH
3 SELECTIVE JETTISON BUTTON (GUARDED)

4 MATRA 550 OR SIDEWINDER JETTISON BUTTON (GUARDED)

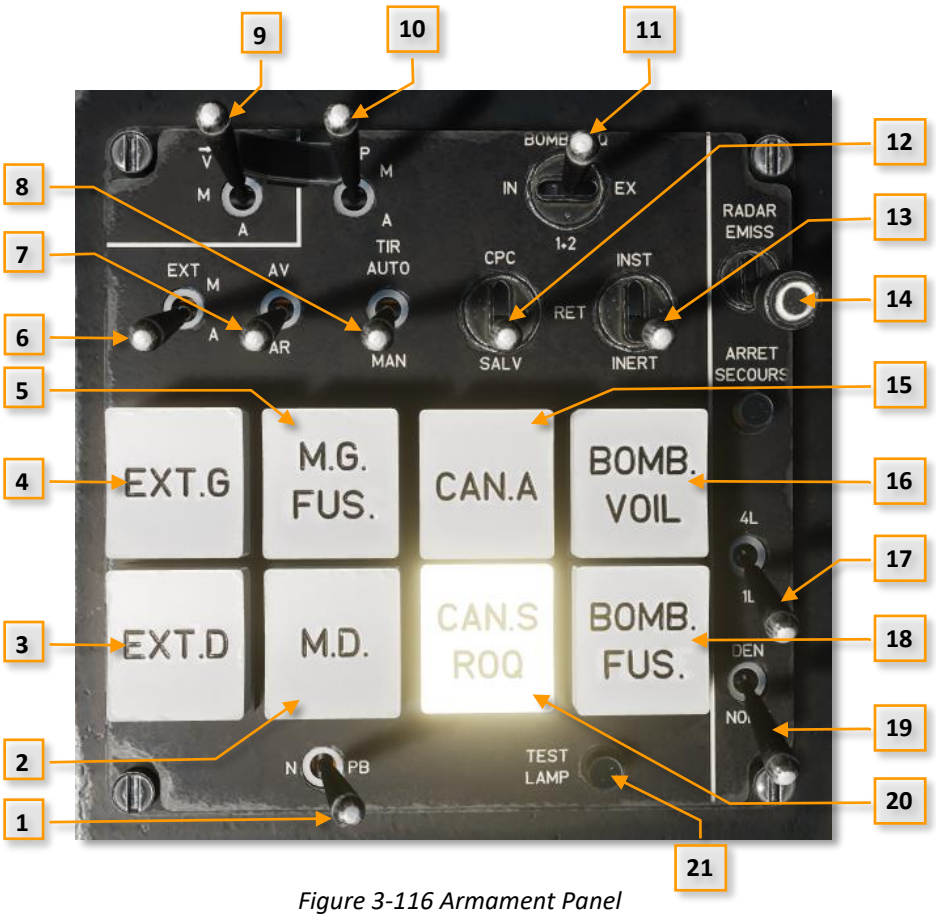


Figure 3-116 Armament Panel

1 NORMAL/JAMMER PURSUIT SWITCH (NO FUNCTION)

2 RIGHT MATRA R530 MISSILE PUSHBUTTON

3 RIGHT MATRA R550 OR SIDEWINDER MISSILE PUSHBUTTON

4 LEFT MATRA R550 OR SIDEWINDER MISSILE PUSHBUTTON

5 LEFT OR FUSELAGE MATRA R530 MISSILE PUSHBUTTON

6 MATRA 550 OR SIDEWINDER MISSILE SWITCH

7 FORE/AFT SELECTOR SWITCH

8 AUTO/MANUAL FIRING SELECTOR SWITCH

9 SIGHT SELECTOR

10 FIRING FUEL DIPPER SWITCH

11 BOMB/ROCKET SELECTOR

12 SINGLE/SALVO SELECTOR

13 INSTANTANEOUS/DELAY/SAFE SELECTOR SWITCH

14 RADAR SELECTOR

15 AIR-TO-AIR GUNS PUSHBUTTON

16 WING BOMBS PUSHBUTTON

17 RADAR 4 LINES/1 LINE SCAN SWITCH

18 FUSELAGE BOMBS PUSHBUTTON

19 R 530 MISSILE NORMAL/ALTITUDE DIFFERENCE SELECTOR SWITCH

20 AIR-TO-GROUND GUNS OR ROCKETS PUSHBUTTON

21 LIGHTS TEST

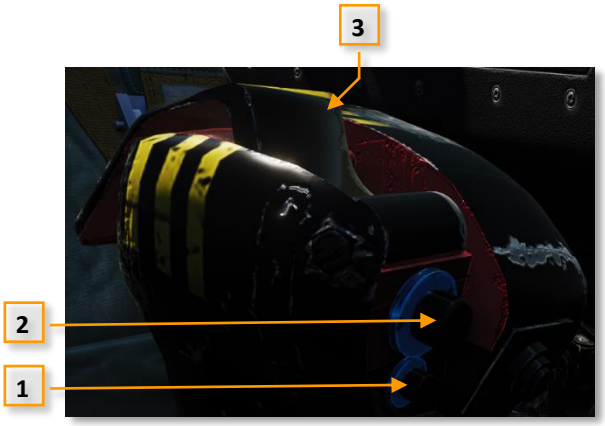


Figure 3-117 Control Stick Detail (Rear View)

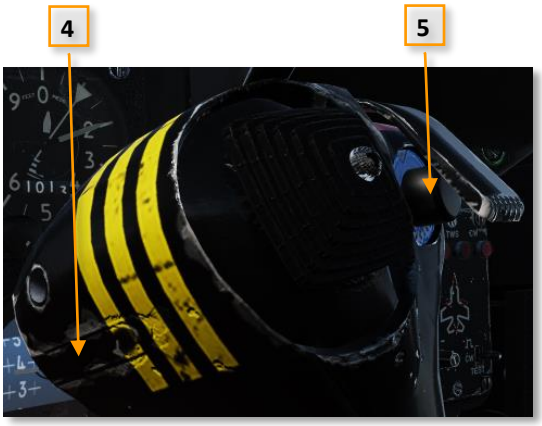


Figure 3-118 Control Stick Detail (Front View)

1 SIGHT RECORDER BUTTON
2 GUN BUTTON
3 GUN FIRING TRIGGER (FOLDED)

4 GUN FIRING SAFETY
5 BOMBS, ROCKETS, MISSILES AND SIGHT RECORDER BUTTON

Figure 3-119 Manual Gravity Drop Window and Selection Thumbwheel

1 MANUAL GRAVITY DROP WINDOW

2 MANUAL GRAVITY DROP SELECTION THUMBWHEEL

3.16 COUNTERMEASURES

Description

The integrated countermeasure system is an ALE-40, capable of launching chaff and flares. It was installed on Spanish (and later Moroccan) aircraft and is one of the principal differences between the Spanish CE and the base C model.

It is possible to mount either 30 chaff or 15 flare charges per side (although in practice flares were only mounted on the left side for safety reasons). Countermeasures can be launched on single mode, multiple or on a specific program. The timing and number of countermeasures released on each configuration is adjusted on the ground. The possible modes are:

- Single: Only one countermeasure is released per side (if both sides are selected).
- Multiple: Allows the launch of a certain number of cartridges in a pre-set interval. 1, 2, 3, 4, 6 or 8 cartridges with a time in-between of either 100, 200, 300 or 400 ms.
- Program: Commands the repetition of the previous 'Multiple' launch a certain number of times with an interval. In this case, 1, 2, 4, 8 or C times, with C being continuous until the countermeasures run out. The possible times between repetitions are: 1, 2, 3, 4, 5, 8 or R, with R meaning a random time interval.

Countermeasures can be set in the Mission Editor. See figure 3-114 below.

The system includes a programmer which is described in the AN/ALE-40 PROGRAMMER section of the Mirage F1 BE annex.

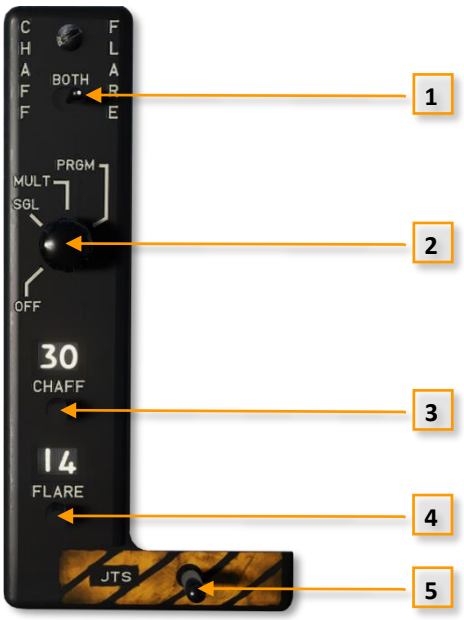
Controls

- OFF-SGL-MULT-PRGRM selector: enables the pilot to select the working mode of the system: off, single, multiple and program.
- Chaff-Both-Flare selector: Allows the pilot to select if the launch order is to be sent to the flares, the chaff or both.
- Emergency Jettison (JTSN): Commands the sequential and rapid ejection of all the flares.
- Chaff counter reset button: when pressed resets chaff counter to the desired value.
- Flares counter reset button: when pressed resets flares counter to the desired value.

NOTE: There is an option, in DCS Options special tab for the Mirage F1, to reset the countermeasures counters automatically on rearm. See figure 3-13.

Indicators

- Countermeasure counters: 2 counters inform the pilot of the remaining number of chaff and flares.



1 CHAFF/FLARES SELECTOR SWITCH
2 PROGRAM SELECTOR SWITCH
3 CHAFF COUNTER RESET BUTTON
4 FLARES COUNTER RESET BUTTON
5 EMERGENGY JETTISONING SWITCH

Figure 3-120 Countermeasures Panel

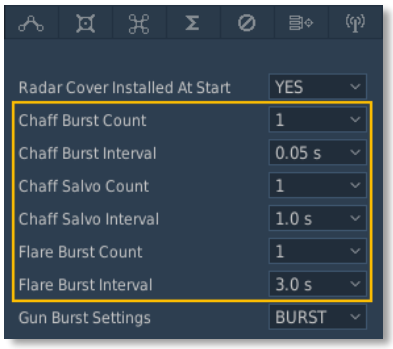


Figure 3-121 Countermeasures Settings in Mission Editor

3.17 RADAR DETECTOR

Description

The BF radar detector provides the pilot an omnidirectional alert (visual and aural), an indication on the direction and on the nature of the threat when the aircraft is illuminated by a tracking or fire control radar.

The detected radar transmissions are of the following type:

- Aimed pulse modulated radar (⎍⎍): antenna aimed at the target during tracking.
- Track While Scan (TWS) pulse modulated radar: the antenna keeps scanning during tracking.
- Continuous wave (CW) radar: for example, ground-to-air missile guidance.

Controls and indicators

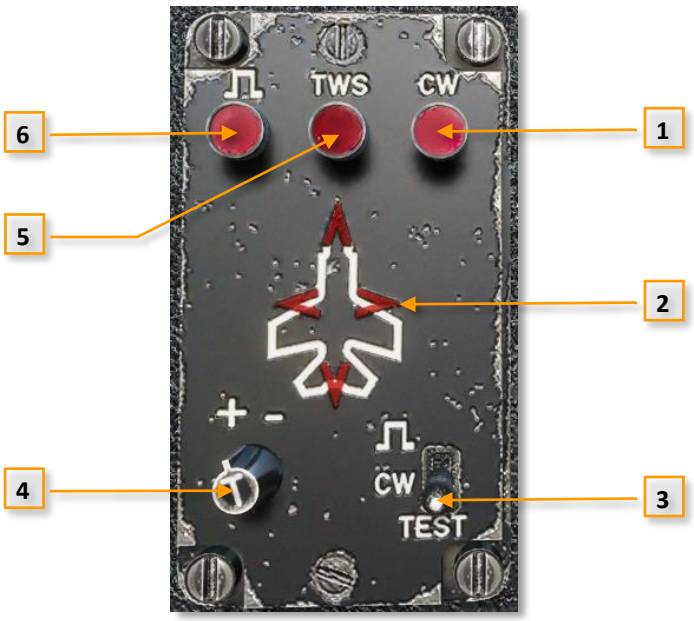


Figure 3-122 Radar Detector Indicator in Main Panel

1 CW "NATURE OF THREAT" RED LIGHT
2 DETECTION SECTORS RED ARROWS
3 TEST SWITCH
4 INDICATOR LIGHT INTENSITY ADJUSTING SWITCH AND LIGHTS "T" TEST BUTTON
5 TWS "NATURE OF THREAT" RED LIGHT
6 "NATURE OF THREAT" RED LIGHT

3.18 RADAR

Description

The Mirage F1CE is equipped with the CYRANO IV on-board fire control radar.

It has a maximum range of 60 NM in search mode, and 35 NM in lock-on mode. It incorporates antijamming circuits for passive directional tracking. The antenna platform is slaved to the horizontal position, provided that the aircraft roll angle is less than ±80°.

Radar functions

- **Interception**
  It includes:
  - search that leads to the detection of the target
  - engagement, in distance and in direction, of a selected target
  - automatic pursuit phase which makes it possible to bring the aircraft into a firing position or to carry out a blind rendezvous
  - manoeuvring phase after firing.
- **Close combat functions "TL" and "BZ"**
  These functions allow the radar to lock automatically a target located at a distance of less than 7 km.
  They have priority over all other functions.
  They are also divided into phases, which are:
  - search during which the radar scans ahead of the aircraft from 400 m to 7000 m
  - engagement on the first target found in the distance
  - automatic pursuit
- **AIR-GROUND function**
  In this function, the indicator scope presents the radar map of the terrain in front of the aircraft.
  Four distance representation scales are available to the pilot: 60, 35, 15 and 7 NM.
  The mean bearing position is zero and the radio-electric beam explores a sector of ± 60° or ± 30° in bearing centered on the aircraft axis.
  The elevation (tilt) is a function of the altitude of the flight (in the scales 60 and 35 NM) and can be modified to better illuminate the area of terrain overflown and obtain a usable representation on the scope.

Radar indicator scope

The radar indicator scope includes:

- The radar scope where the radar data is displayed.

- The radar status lights:

AP	Amber	parametric amplifier disabled
TCH	Red	too hot
EMI		no emission
PNE		failure

- The amber lights 7, 15, 35, 60 that indicate the scale in use.

- The function indicators:

HA	Amber	high altitude	
IC		short pulse	
TL	Green	AIR-AIR telemetry	
BZ		scanning by area	
TS		AIR-GROUND telemetry	inoperative
V1	Amber	visualization of the ground	
V2			inoperative
DC		iso-altitude cutout	
PR		blind penetration	
AC		anti-collision	
DB		jammer detection	

The "HA", "IC" and "V1" functions are selected by the radar indicator scope function selector.

- The alphanumeric display for visualizing the difference in altitude:

- E or D : E for elevation (tilt), D for altitude difference
- + or - : the + sign corresponds to a plane above the airplane
- 2 digits : always indicating the difference in altitude. The displayable domain is:

  ± 48,000 ft in 1,000 ft steps in AIR-AIR modes

  ± 4,800 ft in steps of 100 ft in display

- The controls at the bottom of the indicator, from left to right:

- TEST : button for launching a test sequence
- LUM : adjusting the brightness of the scope
- Function selection
- REM : adjustment of the remanence
- EFF : erase button, resets the screen to black level

- The polaroid control, at the scope periphery, allowing to modify the background of the scope according to the ambient luminosity

Indicator scope control box

Controls:

- EC : brightness of all indicator LEDs except the red fault lights (TCH, EMI and PNE). However, in the event of a fault, these three LEDs are off when EC is at minimum
- AL : luminosity of the alidade (strobe)
- MQ : brightness of the distance markers
- LH : brightness of the artificial horizon and the radial speed marker
- CH : vertical position of the artificial horizon

Radar handle

It Includes:

- on its base:
  - forward : selection of 60° and 30° sweeps
  - rear : selection of the 60, 35, 15 and 7 NM scales and the elevation or altitude difference switch button
- on the handle itself:
  - a protective arch (of the two elevation or altitude difference buttons)
  - two elevation or altitude difference control buttons
  - a knurled gain control knob with its quick reset button to maximum gain
  - a lever with two unstable positions:
    - press on the upper part, APS preselection authorization
    - press on the lower part, APC continuous pursuit authorization
  - the release (unlock) lever

In addition, the handle is movable around 2 axes:

- laterally it controls the movement in azimuth of the antenna and of the alidade (strobe). In area scanning it allows to select the left, center or right sector
- around its vertical axis it controls the movement of the alidade in distance

Telemeter - scan by zone selector

This selector, which is located in the left wall and has three stable positions, allows:

- on TL : the AIR-AIR telemetry function
- on BZ : the scanning by zone function
- on stop : using the radar in any other selected function

Jammer detection light

It is located in the front windshield structure, below the standby magnetic compass.

Controls in the armament panel

The armament panel includes the following radar controls:

- the radar selector. It has three positions, ARRET - VEIL - EMISS (OFF - STBY - TRANS), to set the radar off, on standby or into operation
- the SECOURS (EMERGENCY) push-button. It is used for relaunching transmission or resetting the power supply
- the 4-line - 1-line scan switch
- the NORM-DEN switch (normal-altitude difference) for firing MATRA S 530 missiles
- the armament selection keys

"Rapid canon + Magic or Sidewinder" button

This button, located in the throttle lever, is used to activate the cannon + Magic or Sidewinder rapid, (C + M or SW) R, function.

"Rapid canon + Magic or Sidewinder" erasing manipulator

This switch, located in the left wall, is used to restore the previous arming selection, if the (C + M or SW) R function was used.

Operation

1- Getting started

The radar is energized using the armament panel three-position selector:

- "AR": Radar power cut.
- "V": Heating of the tubes (no emission) and start of the emission timers. After 35 seconds, appearance on the radar indicator scope of: scanning, markers, alidade and lights.
- "EM": Starting of the transmission after 3 minutes of heating.

2- Adjusting the scope

It is provided by the controls located on the indicator and the indicator scope control box.

3- Tilt/altitude difference control

The radar antenna can be controlled in tilt or in altitude difference. The selection is made using the push-button located in the rear base of the radar stick, and causes the display of the letter E (elevation) or D (altitude difference) in the indicator scope display.

A. Altitude difference display: "D" selected

Using the two buttons on the radar handle:

- the larger one (on the left) causes an increase in the difference in height
- the smallest (on the right) causes a decrease

Each push-button continuously controls the scrolling of the altitude difference. Two scrolling speeds are available:

- until the 1st detent: 2°/s
- until the 2nd detent: 10°/s

The displayable domain is:

- ± 48000 ft in AIR-AIR
- ± 4800 ft in AIR-GROUND

The antenna tilt corresponds to the altitude difference displayed and varies according to the strobe (alidade) distance; but the command of the strobe has no effect on the display of the altitude difference.

B. Tilt display: "E" selected

Bring the alidade (strobe) to 10 NM. The tilt, displayed in the same way as the elevation, is then read directly in the indicator scope display.

When the alidade is at a distance different from 10 NM, the scope display always indicates altitude differences. I.e., the alidade control varies the altitude difference but has no action on the antenna tilt.

The antenna elevation limits are +28° to -32° in AIR-AIR.

NOTE: The “E” selection is inoperative in AIR-GROUND

4- Scan selection

The scanning consists of an automatic movement of the radar antenna that causes the radio-electric beam to describe simple geometric volumes. Various scanning programs are available to the pilot, these are:

- in AIR-AIR:
  - scanning ±60°
  - scanning ±30°
  - AIR-AIR telemetry scanning in the axis
  - scanning by zone
- in AIR-GROUND (visualization):
  - scanning ±60°
  - scanning ±30°

A. 60° scanning

In AIR-AIR:

The axis of the beam scans the space along four lines stabilized in roll and pitch. The beam width is of 4° in “HA” and “lC”. The beam explores a range of 8°. The time of this exploration is 4.8 seconds.

The scan is described in a clockwise direction, seen from the pilot, i.e. from left to right for the upper rows and from right to left for the lower rows.

NOTE: The 4-line scan can be reduced to a 1-line scan in two ways:

- manually by setting the "4L - 1L" switch in the armament panel to "1L"
- automatically in APS

The maximum bearing angle is ±57° with respect to the aircraft axis.

When in tilt or in elevation, the brightness of an echo, varying depending on the direction of the scan, allows to adjust the mean tilt:

- if the echo is only visible on the left to right scan, it means it is located above the rectangle described by the antenna; it is necessary to increase the tilt or the altitude difference
- if the echo is only visible on the right to left scan, it means it is located below the rectangle and it is necessary to lower the tilt or the altitude difference

The 1-line scan allows, when the antenna is correctly aimed in elevation, to see the echo at each scan and to improve the possibilities of detection.

The radar indicator presents the map of the echoes in a vertical scale according to the distance and horizontal scale depending on bearing. The central vertical axis, engraved on the scope, represents the zero relative bearing (aircraft axis). The area scanned on the scope is a rectangle 90 mm high and 70 mm wide.

NOTE: The width of the scan is reduced when the antenna reaches the high or low stop.

If the displayed distance is zero:

- scanning stops
- the "PNE" warning light flashes

In AIR-GROUND:

The echo map is offset on the screen. The center of the sector represents the aircraft, and the vertical axis of the screen the aircraft axis. Emission characteristics and elevation exploration are adapted to the exploration distance selected by the scales available to the pilot.

B. 30° scanning

In AIR-AIR:

The type of scan (4 lines) is the same as in 60° but the width is ± 30° in bearing. The exploration time is 2.4 seconds.

The 4-line scan can also be reduced to a 1-line scan.

The mean tilt is obtained as in 60° scan.

The mean bearing is controlled by the radar stick (tilting it left or right). It is copied onto the navigation indicator (narrow needle bearing selector on “R”).

As for the 60° scan, the exploration domain is stabilized in roll and pitch.

When the average bearing displayed exceeds 30°, the antenna reaches the stop and immediately goes back in the opposite direction resuming a new scan cycle.

The representation on the scope is identical to that of the 60° scan but the rectangle is 35 mm maximum wide centered on the mean bearing.

The average bearing is represented by the position of the alidade.

In AIR-GROUND:

The antenna's radio-electric beam carries out a bearing scan of ± 30° centered in the aircraft axis.

In the same way as in 60°, the scales condition the characteristics of the emission and the exploration in elevation.

C. AIR-AIR telemetry scan in the axis, “TL”

The antenna scans a square of 5° side, the area explored represents a square of 9.5° side.

D. Zone Scan, “BZ”

In this scan mode the antenna:

- is referenced in relation to the aircraft trihedron, therefore not stabilized in roll and pitch
- it searches in an area of 20° in elevation and 20° in bearing

Zone scanning can be performed in three different sectors:

- left sector or right sector by holding the radar stick to the left or to the right

- central sector by releasing the radar stick (spring-loaded to the centre position)

On the scope the mean bearing of the scanned area: left, central or right is materialized by the alidade whose length represents 7 km, i.e. the authorized engagement range.

The alidade is placed in the center of the search area when changing sectors.

The mean bearing of the scanned area is also copied by the narrow needle of the IDN (bearing narrow needle selector on “R”).

The scan covers 6 lines and takes 1.5 seconds.

NOTE: The "TL" and "BZ" functions have priority over any other radar function.

5- Selections according to the missions

The selection of scannings allows, as long as the position of the target is accurately known, to modify the search field and thus improve the illumination of the target by narrowing the search cone.

In order to sharpen the image on the scope, the pilot has at his disposal a second selection which is more particularly associated with the missions.

IN AIR TO AIR:

"HA", "IC" are the operating modes that determine the working conditions of the radar: repetition frequencies, pulse width and starting of the parametric amplifier.

The purpose of the interference echo attenuation device (DATEP) is, in "HA" and “IC", to limit the harmful effects of diffuse echoes.

"TL" and "BZ" are the functions designed for close combat.

IN AIR-GROUND:

"V1" is the selection that allows the visualization of the terrain flown over.

A. High altitude, “HA”

Characterized by a long pulse and by the use of the parametric amplifier, this function allows the most large ranges and the use of 60° and 30° sweeps.

B. 1 short pulse, "1 C"

The characteristics are the same as in “HA” but the pulse width is reduced, and the radar performance is slightly reduced in range.

C. DATEP (Interference Echo Attenuation Device)

The DATEP is used in AIR-AIR in the “HA”, “lC”, “TL”, and “BZ” modes.

The purpose of the device is to limit the harmful effects of diffuse echoes of various origins (clouds, ground clutter, sea return…):

- in search, by a better contrast of the useful echoes on the scope, therefore an easier exploitation by the pilot
- tracking, avoiding inopportune engagement of parasitic echoes

In “HA” and “lC”, on the 15 and 7 NM scales, the DATEP is in service only when the gain control is maximum.

D. Jammer pursuit, “PB”

In “HA” and “IC” function, a jammer detected during the search is displayed on the scope by two vertical line markers that frame the direction of the jammer.

The two markers are more distant from each other the closer or the more powerful is the jammer.

E. Ground visualization, “V1”

When viewing the ground, the electrical beam of the antenna explores the terrain in front of the aircraft by sweeping 60° or 30° on either side of the radar axis. This scan can be in two or one elevation lines depending on the scale selection.

The echo density is changed using the gain control.

6- Scale selection

Four distance scales are available to the pilot. This scale selection is done according to the target echo distance by means of the control on the radar control stick base at the rear.

Markers appear on the scope depending on the selection.

4 amber lights on the right of the radar indicator indicate this selection. Each LED indicates the displayed scale.

Scales	60 NM	35 NM	15 NM	7NM
Respective marker distances	10 NM	10 NM	5 NM	2NM

A. In "HA" and “IC” functions

These four scales are usable.

NOTE: If the "HA" and "IC" functions are selected, when selecting 530 (with an EM missile), the scale automatically switches to 35 NM when the scale selector is on "60".

B. In “V1”

The 60 and 35 NM scales provide a two-line scan. The upper row tilt (left to right) is a function of the airplane altitude given by the aerodynamic unit; it is such that, when the displayed tilt is zero, the intersection of the scan plane with the horizontal plane of the terrain overflown is at an oblique distance of 24 NM. The tilt of the lower line (right to left) is a function of the first. The correction that the pilot can add to the tilt of the upper line is approximately ± 1°.

The 15 and 7 NM scales provide a scan, at one elevation line, displayed by the pilot within the limits of ± 6°30'. The displayed tilt defines in hundreds of feet a fictitious horizontal plane that the radio-electric axis intercepts at a constant distance of 9 NM (15 NM scale) or 4 NM (7 NM scale).

C. In "TL" and "BZ"

Only the 7 NM scale is in service.

7- Alidade (strobe)

It is a segment appearing on the scope and whose brightness is adjustable by the "AL" potentiometer of the indicator scope control box. It allows the pilot, by positioning the alidade on the chosen and engaged echo, to define the bearing and the distance of this echo and to predetermine, for the radar computer, the average bearing of the antenna. The alidade is controlled in bearing by the lateral displacement of the radar stick around its longitudinal axis;

this manipulation gives a velocity movement (three sensitivities), not a position movement. When the bearing of the alidade is greater than the antenna travel, in 60° it returns to the lubber line of the aircraft axis indicator and the scan continues; in 30° AIR-AIR the antenna reaches the stop but the scan continues, the alidade then remains at the stop of the scope. In all cases the antenna bearing remains readable on the IDN's narrow pointer (selector on "R").

The alidade is controlled in distance by the rotation of the handle around its vertical axis. It is also a velocity movement (three sensitivities); anti-clockwise increases the distance, clockwise decreases it. The movement of the alidade cannot exceed 35 NM.

In search phase the segment is vertical and indicates the mean scanning axis of the antenna. The length of this segment delimits, in distance (3 km), the area where engagement is authorized.

NOTE: The length of the vertical segment is scale independent.

In pursuit phase (“PS" or "PC") the segment is horizontal and shifted by 2/3 of its length to the left of the locked target.

8- Types of engagement

A. Manual engagement

This is the operation that allows the radar to pass from autonomous search to automatic pursuit.

To execute this transfer, the pilot has a two-position lever on the radar stick:

- upper position, pre-selection authorization (APS)
- lower position, continuous pursuit authorization (APC)

1. Preselection Authorization (APS)

The "PS" is a pursuit of discontinuous information. In this function, the radar pursues a target while maintaining its sweep. It gathers information about the target thanks to a small slowdown scanning at the echo level. The echo is taken into account if it is located in an area of: 3 km distance and ± 70 mrd in bearing, centered on the vertical alidade.

The transit of the alidade to the horizontal confirms the radar lock-on in "PS".

Each time the antenna passes over the target, the antenna is recentred in distance and bearing.

In this function, scanning ± 60° in 1 line is imposed. The target square is present but undergoes fluctuations due to the resetting carried out at each scan.

NOTE: The firing of electromagnetic missiles is not possible in "PS".

2. Continuous pursuit authorization (APC)

The "PC" causes the program to stop, that is:

- stop scanning with antenna pointing in the direction displayed with the radar stick (positioning of the alidade)
- short pulse emission
- deletion of the distance markers for the whole time the program is stopped

The engagement on target echo is possible in an area of ±1500 m delimited by the length of the alidade.

The lock-on authorization will take place 0.1 second later if the echo coincides in distance and in direction with the alidade and if its level is sufficient.

The radar then switches to automatic tracking and the pilot can release the engagement lever.

The antenna remains focused on the hostile, the distance markers reappear in the video trace and the altitude difference counter remains on.

The radial speed marker appears if the "LH" brightness is set correctly. This marker of the thermometer type is in the form of a vertical segment, the length of which defines the range from +1800 kt to -450 kt, interrupted from 0 to -150 kt. A small horizontal bar moves in proportion to the relative fighter-target velocity (radial velocity) above zero for positive speeds and below for negative speeds.

B. Automatic engagement in “TL” and “BZ”

This engagement process is used in close combat.

The search area is between 400 and 7000 m.

NOTE: If the radar is locked and the pilot commands "TL" or "BZ", the radar remains locked but the scale presented on the scope changes to 7 NM.

9- Automatic engagement

When the radar is engaged, the radial speed marker and its index appear on the scope.

Radar tracking data is supplied automatically to the interception computer.

The result of the calculation is presented in the sight in the form of a piloting order: it is a bar movable in roll around its centre; the latter being mobile in pitch.

The intercept computer makes the aircraft perform an approach trajectory according to the selected weapon to place it in the optimal firing position, and controls the illumination of lights in the sight.

The orders are different depending on the weapon selected on the armament table.

In addition, limitations are introduced; exceeding these limitations is signalled to the pilot by a fixed red light in the sight (±80° in roll, - 1 < n < 4, 8000 m in height); the orders of the interception calculator are developed in such a way as not to reach these limitations.

10- Disengagements

A. Voluntary disengagement

A lever at the bottom of the radar stick controls the radar disengagement.

B. Inadvertent disengagement

At all times during automatic tracking, the position of the antenna and the distance are stored in memory. During an untimely disengagement, the radar is therefore able to reengage automatically by performing a distance search around the stored position. Only telemetry returns to search; the directional tracking, the interception and firing range calculator, and the sight remain in automatic tracking.

If after 3 seconds the radar is not reengaged, it returns to the previously selected scanning mode.

11- (C + M or SW) R button

A. When first briefly pressed

Allows the change of the radar to (C + M or SW) R without causing it to disengage.

The "IC" function is forced, even if the radar is in "V1".

B. During a second brief press (as well as for the following brief presses)

- For 0.3s

If the radar is in "TL" or "BZ" and locked, there is relaunch of the telemetry in the axis of the echo with the possibility of engaging from a distance 150 m greater than that of the previously hooked echo.

- From 0.3 to 0.8s

If the radar is in "TL" and locked, telemetry is restarted as before.

If the radar is in "BZ" and locked, the antenna scan is restarted from the middle of the furthest line close to the elevation of the initial echo.

- Beyond 0.8s

In «BZ» resuming of normal scanning.

In “TL” normal relaunch.

C. Maintained pressed

If the radar is in "TL" or “BZ", engagement is forbidden and appearance of the cannon 300 reticle.

12- Additional information and possibilities given by the radar

A. The horizon

It is a representation of the attitude of the aircraft (information coming from the gyroscopic assembly) by a horizon bar and a model moving in roll and pitch.

Two potentiometers on the indicator scope control box allow:

- by means of the "LH" potentiometer to display and adjust the brightness of the horizon and the radial velocity marker
- by means of the "CH" potentiometer to move the model vertically in an area of the screen where the map offers no interest

B. Status LEDs

The 4 status LEDs are located on the right side of the indicator;

- the amber "AP" (parametric amplifier) indicator lamp indicates by lighting up that the parametric amplifier is out of service until thermal stabilization is reached
- the red “TCH” (too hot) signals:
  - by flashing, a conditioning defect of the right or left URPs
  - by illumination, a fault in the conditioning of the nose cone or an abnormal temperature rise
- the red "EMI" (emission failure) light: this light is on when the radar selector is on “EM” and this does not take place for one of the following reasons:
  - no emission
  - the warm-up sequence is not complete
  - nose cone conditioning fault, the "TCH" light is also on
  - test triggered (on “EM”)

NOTE: When the radar selector is on "V", the "EMI" warning light is on.

- the red LED "PNE" (failure) indicates, when illuminated, the failure of the function that the radar is using

C. The "EFF" button (erasing)

Located on the radar indicator, allows to erase all the traces on the scope and to bring it back to the black level.

D. The gain control

This is the knurled knob on the radar stick. By acting on the gain of the receiver, it makes it possible to reduce the level of interference echoes on the scope, in order to bring out the useful echo.

It is efficient:

- in search of "HA" and "lC" on the 15 and 7 NM scales
- in visualization of the ground "V1": improvement of the radar map

A control located above this button allows a quick reset to maximum gain.

In the other radar functions, these commands are inoperative and the gain is automatic.

E. The «EMERGENCY» button

Located on the PCR (armament panel), it allows, in the event of the transmitter or the radar power supply disconnection, and without switching on the "TCH" light, to immediately reconnect the power supply and the radar transmission.

If the "PNE" and "EMI" warning lights are on, it is recommended to switch to "IC" for reseting.

In the event of a transmission failure, the scan remains on the scope.

In the event of a power failure, the scan disappears and all indicator status and function lights go out.

F. The 4 lines - 1 line scan switch

Located on the PCR, it allows antenna scanning to be reduced to 1 single line for the "HA" and “IC” AIR-AIR functions. It has no effect on the other functions.

G. The "DEN-NORM" ("SNAP-NORM") inverter (altitude difference - normal)

Located on the armament panel, it is used in "NORM" for firing MATRA 530 missiles and in "NORM" or "DEN" for firing the MATRA S 530.

The "DEN" position selects, in the interception computer, the function of missile-target collision in projection onto the fighter manoeuvring horizontal plane. The orders cause the fighter to perform a navigation in a climb that ends 20,000 ft below the target or, if the altitude difference is less, they keep the fighter in a level flight.

In the horizontal plane, the orders are calculated as in the case of firing without height difference.

H. Arming keys

When the radar is in AIR-AIR mode these keys select the functions of the radar and sight computers and firing circuits appropriate to the weapon displayed.

13- RADAR MANUAL TEST

It can be performed on the ground or in the air.

It is controlled by the "TEST" button located on the radar indicator scope, the radar can be on standby or transmitting in all functions except:

- (C +M or SW)R
- jammer tracking
- automatic pursuit (radar locked-on)
- visualization

Pressing the "TEST" button has no effect on these functions.

The test triggers a proper operation test sequence; in the event of a malfunction, or if the conditions of use are not met, the "PNE" indicator light comes on.

The course of the sequence lasts 6 seconds. For the duration of the test, if the radar is transmitting, the LED “EMI” lights up; after 6 seconds, the "PNE" warning light comes on in the event of a fault. To turn it off you have to change the function.

The sequence is as follows:

- press the "TEST" button
- the scale changes to 7 NM, the "7" light comes on
- distance markers every 2 NM
- appearance of echoes
- engagement on first echo encountered
- radar disengage after about 6 seconds
- return to the previously selected operating mode

14- Summary of radar operation in air-air search and display

Selection		Scale	Actual scan	Pulse	Gain control	OBSERVATIONS
Function	Scanning					
HA	60 30	60 35 15 7	60 30	Long	Automatic	On the 15 and 7 MN scales the DATEP is in service only when the gain control is at maximum. By reducing, the gain becomes manual.
IC	60 30	60 35 15 7	60 30	Short	Automatic	Same.
TL	60 30	60 35 15 7	in the axis	Short	Automatic	AIR-AIR telemetry if the radar is not in “PS” or in “PC”. The scale passes in 7 NM.
BZ	60 30	60 35 15 7	BZ 20	Short	Automatic	Scan by area if the radar is not in “PS” or in “PC”. The scale passes in 7 NM.
V1	60 30	60 35	60	Short	Manual	2 elevation lines scan.
		17 7	30			1 elevation line scan.

Simplified operation

To scan and lock a target in manual lock mode:

- Select the scan angle (60° or 30°)
- Select radar function (HA, SP, MA or LA)
- Select the scale (60, 35, 15 or 7)
- Adjust the echo in elevation
- Place the alidade (strobe) over the target
- Press the lock-on lever, when the range to the target is less than 35 NM
- Follow the interception commands shown in the sight
- Take into account the indications for radial velocity in the scope and green circle light in the sight, indicating missile within launch parameters

To lock a target in automatic mode:

- Set the “TL or BZ” switch in “TL” or “BZ” position
- Place the radar reference in the sight over or near the target (within range parameters)

To unlock a target:

- Press the unlocking (reject) lever

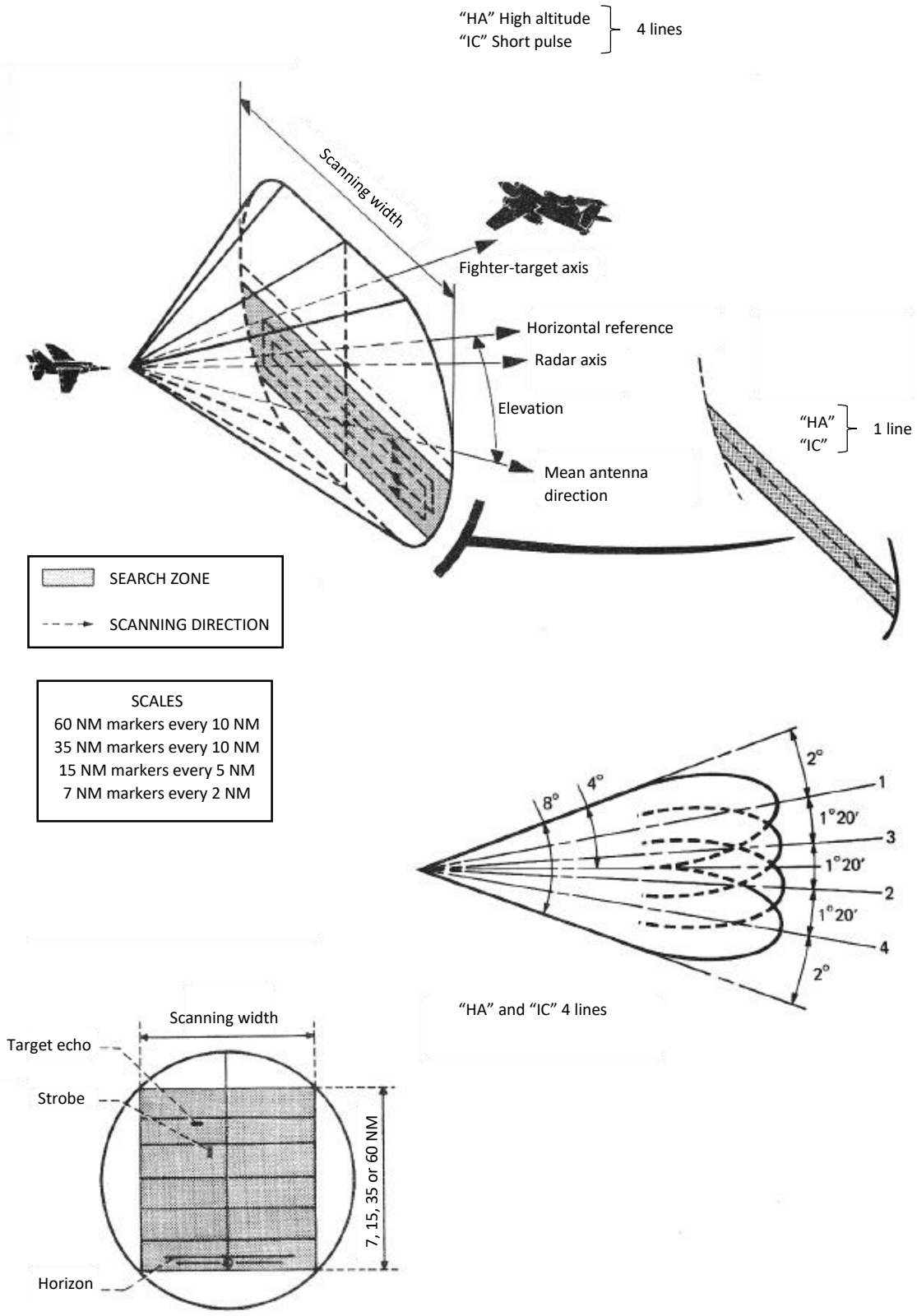


Figure 3-123 60° Scanning

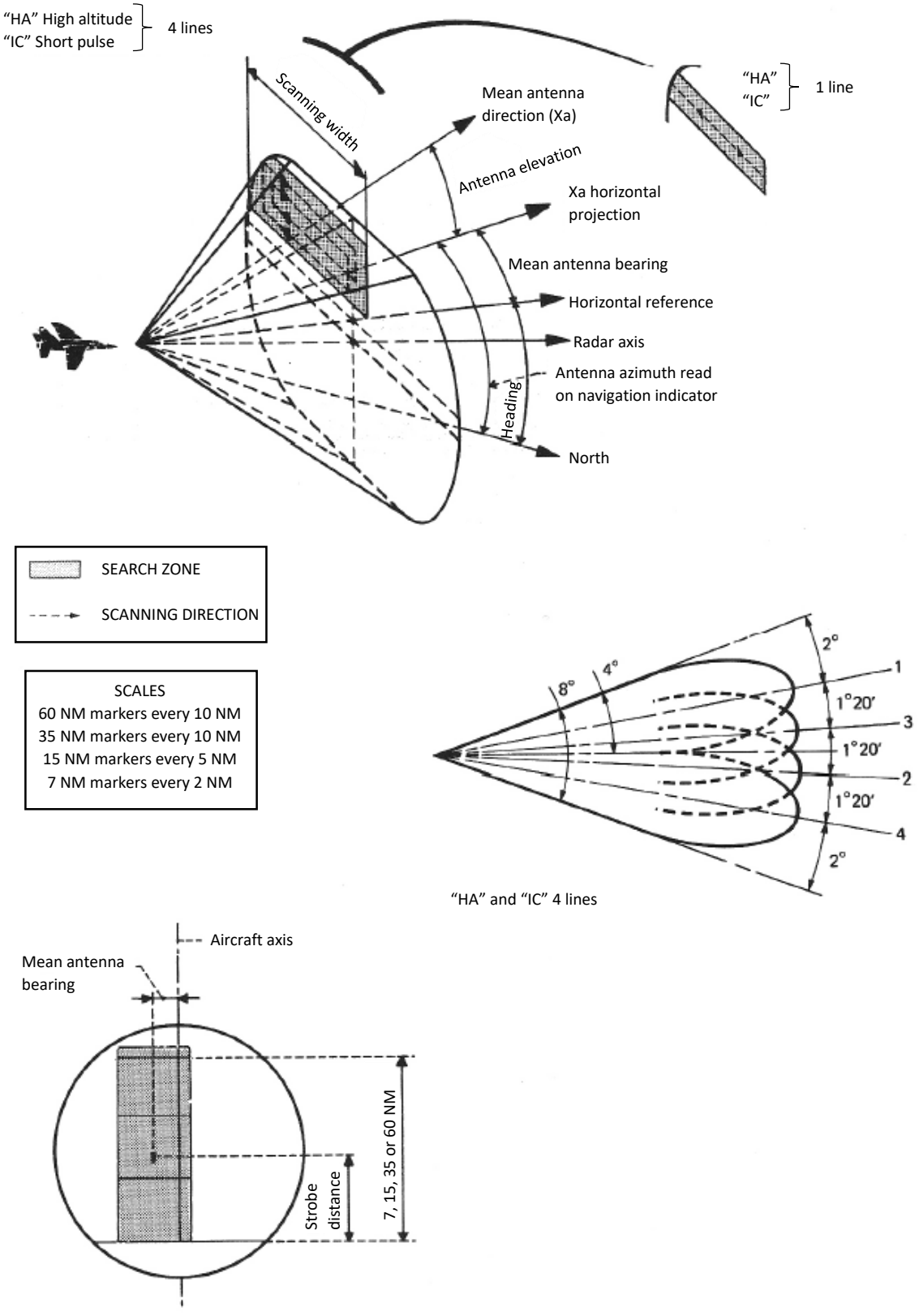


Figure 3-124 30° Scanning

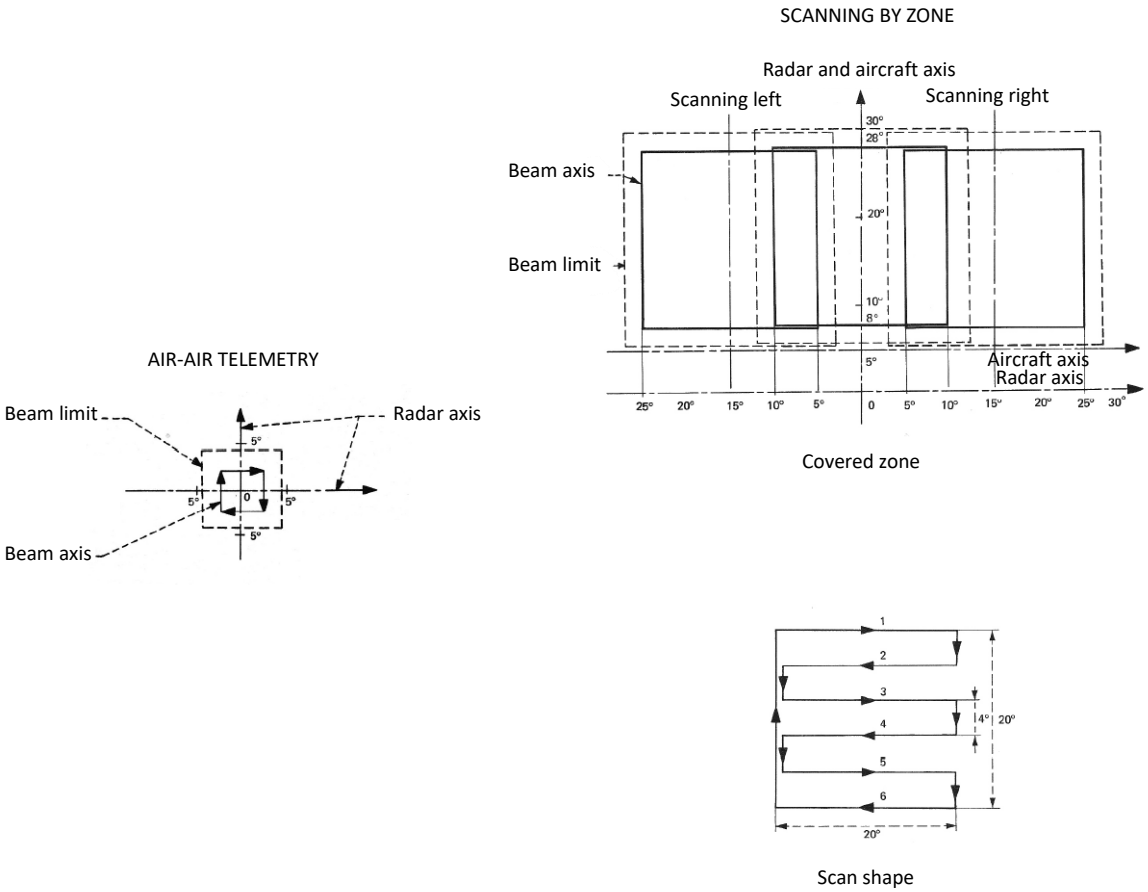


Figure 3-125 Air-Air Telemetry and Scanning by Zone

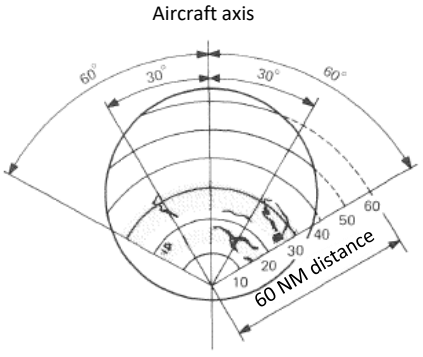


Figure 3-126 Air-Ground Radar in 60 NM Range

Radar system controls in DCS control options section:

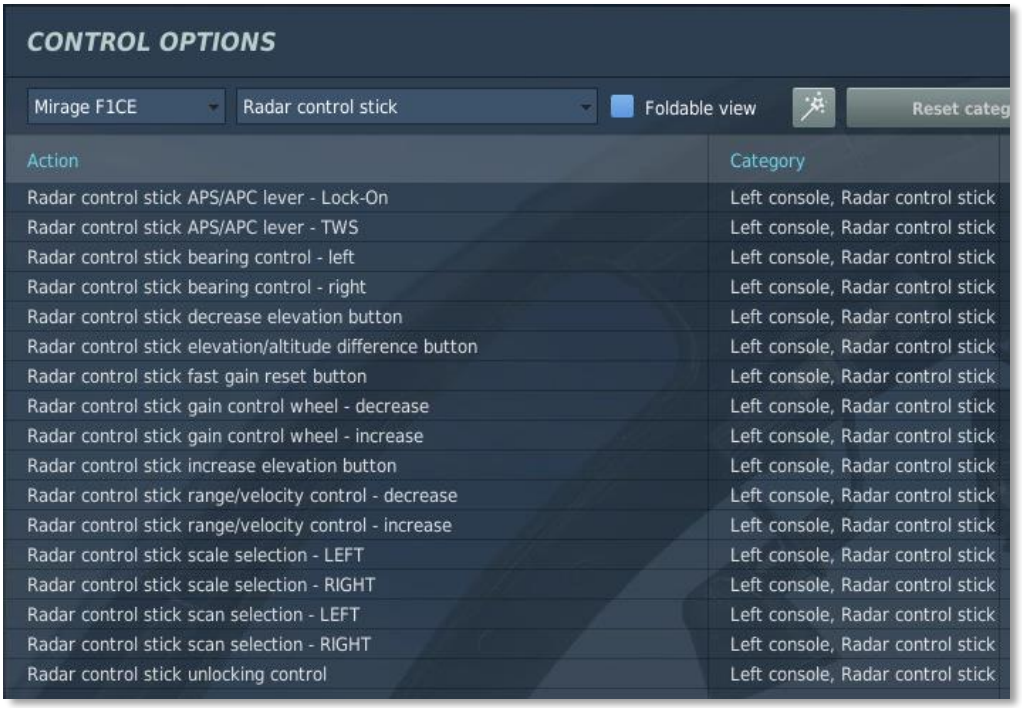


Figure 3-127 Radar Control Stick Controls Options

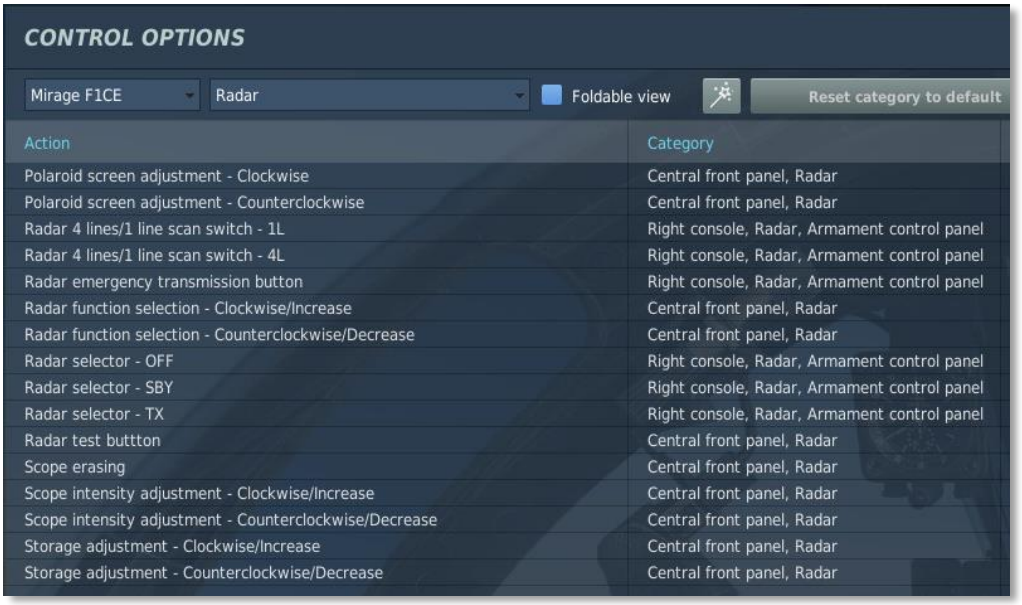


Figure 3-128 Radar Control Options

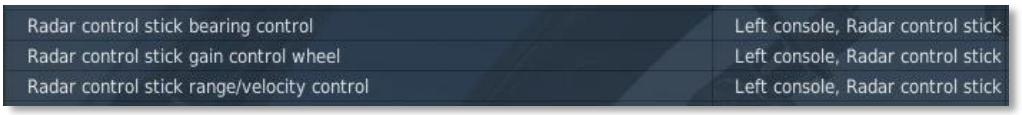


Figure 3-129 Radar Control Stick Axis Commands

Figure 3-130 Radar Before Lock-on

1 ALIDADE (STROBE)
2 DISTANCE MARKS
3 TARGET ECHOS
4 HORIZON

NOTE: The radar scope includes a cover that improves the display visualization in outside high luminosity conditions. This cover maybe be removed while on ground with the canopy open, or it can also be removed by default at mission start, by ticking the corresponding option in DCS Options special tab for the Mirage F1. See the picture below.

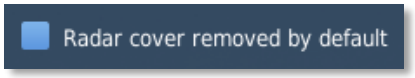


Figure 3-131 Radar Cover Removed by Default Option in DCS Special Options

Figure 3-132 Radar After Lock-on

1 RADIAL VELOCITY MARKER (POSITIVE VELOCITY)

2 ZERO VELOCITY

3 NEGATIVE VELOCITY

Controls and indicators

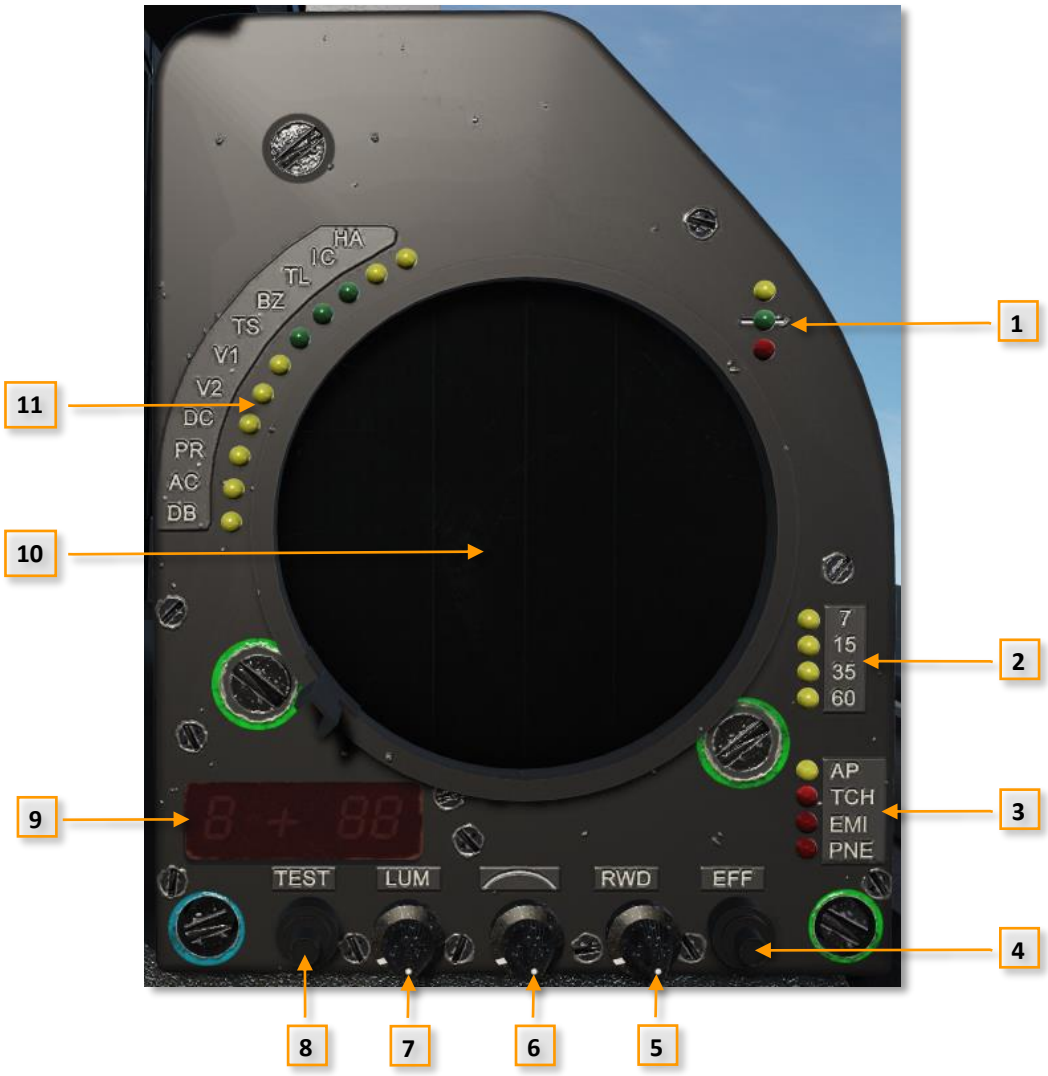


Figure 3-133 Radar

1 INOPERATIVE
2 SCALE LIGHTS
3 STATUS LIGHTS
4 SCOPE ERASING
5 STORAGE ADJUSTMENT
6 FUNCTION SELECTION
7 SCOPE INTENSITY ADJUSTMENT
8 TEST BUTTON
9 DISPLAY TILT E ALTITUDE DIFFERENCE D
10 RADAR SCOPE
11 FUNCTION LIGHTS

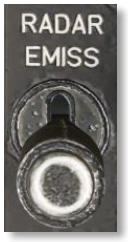


Figure 3-134 Radar Selector (Off-Standby-Transmit) in Armament Panel

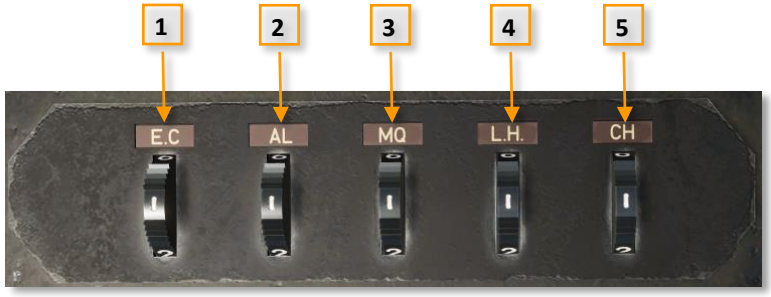


Figure 3-135 Radar Indicator Scope Control Box

1 INDICATOR LIGHTS BRIGHTNESS
2 STROBE BRIGHTNESS
3 DISTANCE MARKERS BRIGHTNESS
4 HORIZON AND RADIAL VELOCITY MARKER BRIGHTNESS
5 HORIZON SYMBOL VERTICAL POSITION

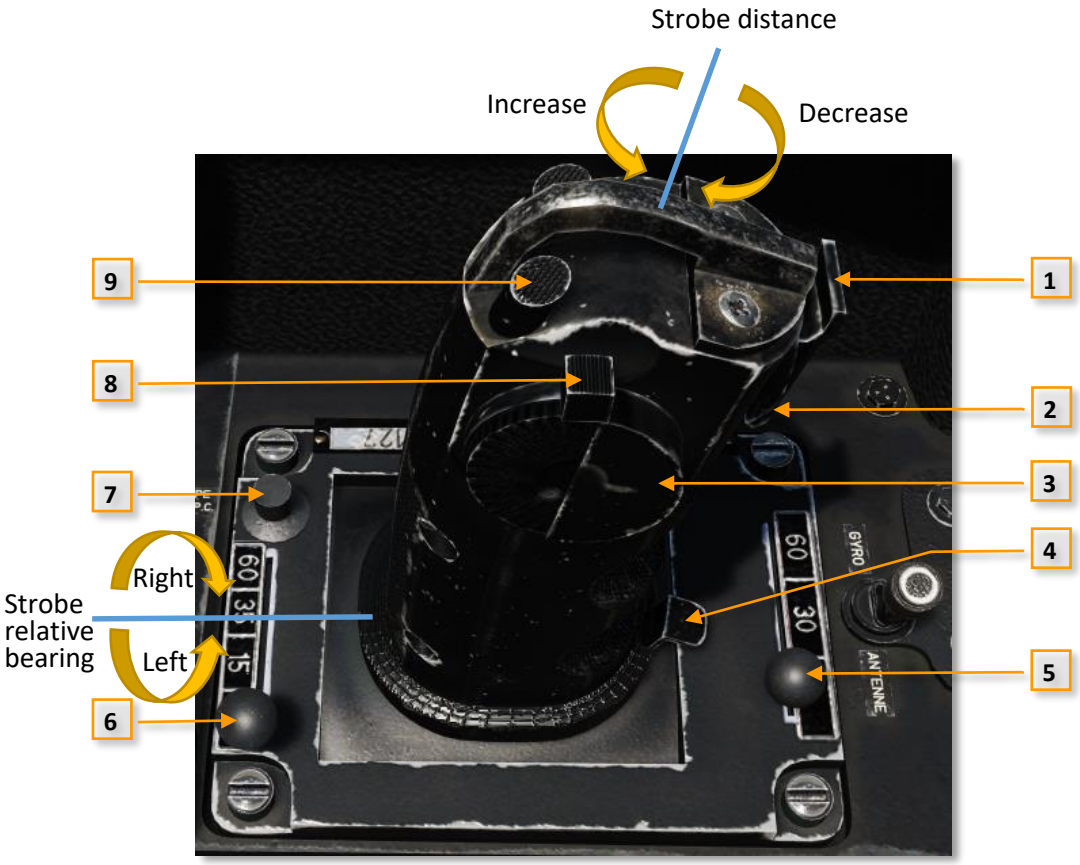


Figure 3-136 Radar Control Stick

1 PRESELECTION AUTHORIZATION
2 CONTINUOUS SEARCH AUTHORIZATION
3 MANUAL GAIN CONTROL
4 REJECT LEVER
5 SCAN SELECTION
6 SCALE SELECTION
7 ELEVATION/ALTITUDE DIFFERENCE BUTTON
8 MAXIMUM GAIN FAST RESET CONTROL
9 ALTITUDE DIFFERENCE CONTROL

Figure 3-137 Radar Controls in Armament Panel

1 ARMAMENT SELECTION KEYS
2 RADAR SELECTOR
3 SECOURS (EMERGENCY) PUSH-BUTTON
4 4-LINE - 1-LINE SCAN SWITCH
5 NORM-DEN SWITCH

Figure 3-138 "Rapid Canon + Magic or Sidewinder" Erasing Manipulator in Left Wall

Figure 3-139 Telemeter - Scan By Zone Selector in Left Wall

3.19 SIGHT SYSTEM

Description

The sight presents aiming marks and piloting orders and information to the pilot in the form of luminous images projected to infinity.

The sight system is equipped with a camera that allows to film the sight and the result of shooting. It is a camera with automatic adjustment of the exposure time by photo-cell. The recording starts when depressing the first detent of the gun trigger or the bomb/rocket/missile firing button, and stops when the overrun delay is completed after releasing the corresponding firing control. The camera is not implemented in this simulation.

Depending on the selection made on the armament table, the sight allows to perform the following operations:

- AIR-AIR gun shooting:
  - in GYRO mode (visual)
  - in ANTENNA mode (visual or blind).
- AIR-AIR missile firing.
- AIR-GROUND firing with guns, bombs or rockets.
- Navigation: normal sight mode.
- Approach: simplified sight mode for visual landing using the “air velocity vector”.

Controls

Some controls located on the control stick are described in the armament system chapter.

- Fixed reticle intensity rheostat: Adjusts intensity of sight symbology, mainly the radar reference, as the panel symbol close to the rheostat indicates.
- Moving and target reticles intensity rheostat: Adjusts intensity of sight symbology, mainly the target reticle, as the panel symbol close to the rheostat indicates.
- Attitude reticle intensity rheostat: Adjusts intensity of sight symbology, mainly the horizon, as the panel symbol close to the rheostat indicates.
- Sight system test button: Tests the sight when pressed.
- Exposure time repeater: Also used in case of servo failure.
- Overrun selection thumbwheel: Sets the overrun delay (0-2-5 or 40 seconds).
- Direct camera control: Test switch of direct use.
- Framing rate selector switch: Used to set 5 or 16 frames/second.
- AUTO-MAN intensity selector switch: This switch has two positions:
  - AUTO: The sight lighting intensity adjusted by the pilot varies automatically according to the outside lighting conditions to maintain a constant contrast.
  - MAN: The sight lighting intensity is adjusted with the three rheostats at the bottom of the sight.
- Lighting selector switch: This switch has three positions:

- Aft: An “A” symbol appears at the base of the switch. All reticles are off.
- Vertical: An “N” symbol appears at the base of the switch. Normal operation.
- Forward: An “S” symbol in a red area appears at the base of the switch. Emergency operation used when a reticle goes off (burnt bulb).

- Exposure time repeater: used in case of exposure time servo system failure.
- Overrun selection thumbwheel: used to adjust the overrun delay at 0, 2, 5 or 40 seconds.
- Direct camera control: TEST switch of direct use.
- Framing rate selector switch: used to set framing rate at 5 or 16 frames/second with automatic exposure time compensation.

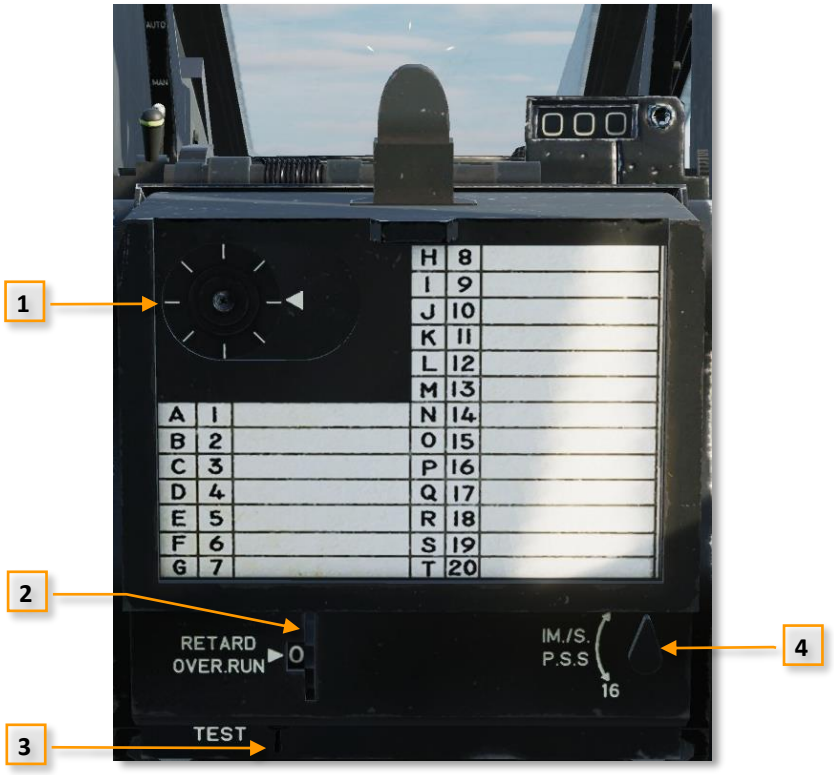
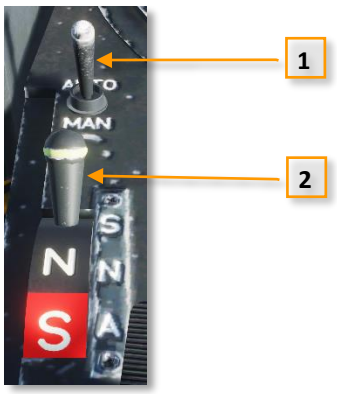


Figure 3-140 Sight Camera

1 EXPOSURE TIME REPEATER
2 OVERRUN SELECTION THUMBWHEEL
3 DIRECT CAMERA CONTROL
4 FRAMING RATE SELECTOR SWITCH



1 AUTO-MAN INTENSITY SELECTOR SWITCH
2 LIGHTING SELECTOR SWITCH

Figure 3-141 Reticle Intensity Switches

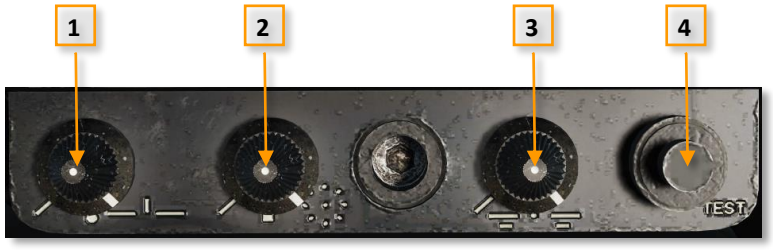


Figure 3-142 Sight Reticles Lighting Rheostats

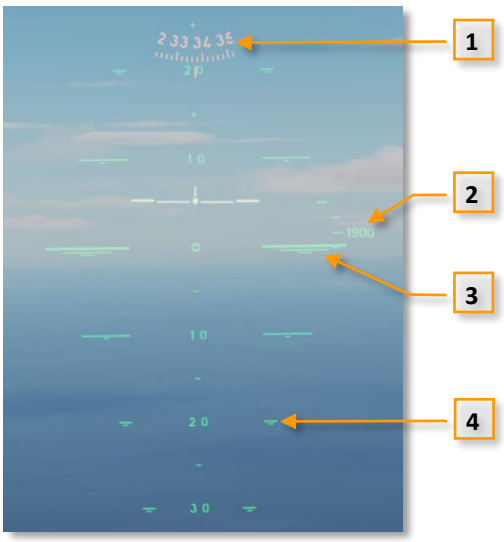
1 FIXED RETICLE INTENSITY RHEOSTAT
2 MOVING AND TARGET RETICLES INTENSITY RHEOSTAT
3 ATTITUDE RETICLE INTENSITY RHEOSTAT
4 SIGHT SYSTEM TEST BUTTON

Indicators

- Distance/heading scale: this scale reads distance or heading depending on the mode selected. Distance is read in NM for large distances, and in hm (hectometers or hundreds of meters) for distances ranging from 0 to 3500 m.
- Barometric altitude: this scale is graduated from 0 to 2000 ft and is used in low altitude navigation, approach and Air-to-Ground mode.
- Horizon: represents the horizon (actual horizon when in simplified attitude mode).
- Attitude scale: the attitude reticle consists of a main bar (horizon) and marks (attitude scale) that move in roll and pitch with respect to the radar reference. When the normal attitude reticle is selected with the sight selector, the attitude reticle provides the same attitude indications as the spherical indicator, in a scale of 1/5 in pitch. When the simplified attitude reticle is selected with the sight selector, the attitude reticle is superimposed on the actual horizon and the marks below the horizon (2.5° and 5°) serve as slope marks for the air velocity vector.

- Air velocity vector reticle: in velocity vector function, it moves in elevation only and its distance from the horizon represents the slope. It therefore displays the trace on the ground of the aircraft air velocity vector with zero bank and no drift.
- Actual horizon: this symbol represents the actual horizon, which will coincide with the Earth's horizon at sea level. At high altitudes the actual horizon will be much higher than the Earth's horizon, due to the curvature of the Earth.
- Firing reticle in approach in velocity vector function: it serves as an incidence mark. It is fixed, with a diameter of 40 mrd and located 5° under the radar reference, or 10° under the fuselage reference line (FRL, not shown in the sight).
- Target reticle: this orange square is superimposed on the target in space when the radar is locked on, in Air-Air mode, including "rapid gun" function.
- Radar command reticle: this reticle consists of a central pipper and two small wings that show pitch and roll commands towards the locked target. The pilot must maneuver the airplane to superimpose the radar reference on the radar command reticle. These orders will take the airplane on an interception course to the target, and provide break-away orders as well.
- Radar reference: it is composed of two horizontal bars and a vertical bar, it is set 5° below the fuselage reference line (FRL) and shows the radar line.
- Steady green indicator light: indicates missile within range. A steady red light appears 10° below the green light position in the sight when aircraft attitude and load factor limitations are exceeded, or a flashing red light when a break-away must be conducted.
- White triangle indicator lights: Missile ready (steady) or not launched (flashing).
- Amber circle indicator lights: Missile locked on (steady) or shadowed (flashing).
- Air-Air gun firing reticle: it has a diameter of 20 mrad when the radar is locked on, or a diameter of 40 mrad otherwise.
- Closing speed, target aspect angle or missile flight time scale: If the radar is locked, a graduated closing speed scale from -100 m/s to +600 m/s appears in orange when using the (C + M or SW) R mode. When using cannon mode or A/A short range missiles it shows target closing velocity. When using 530 missiles it represents:
    - before firing: missile flight time
    - after firing: the time remaining before the break-away.

  10 units represent 1 second.
- Air-Ground firing reticle: it has a diameter of 20 mrad. The angle of depression is set with the manual gravity drop selection thumbwheel.

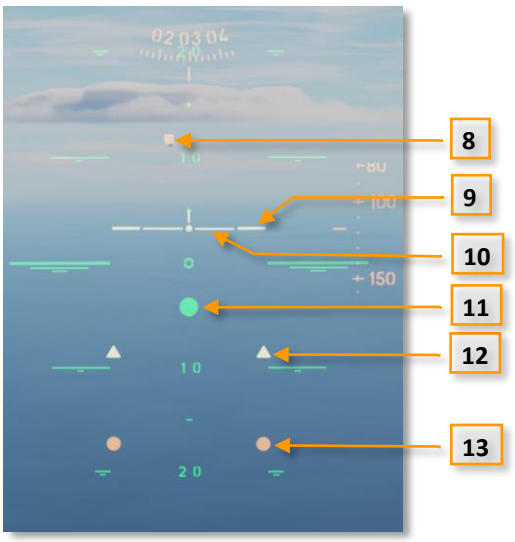


1 DISTANCE/HEADING SCALE
2 BAROMETRIC ALTITUDE (FT)
3 HORIZON
4 ATTITUDE SCALE

Figure 3-143 Sight in Navigation Mode

5 AIR VELOCITY VECTOR RETICLE
6 ACTUAL HORIZON
7 FIRING RETICLE IN APPROACH IN VELOCITY VECTOR FUNCTION

Figure 3-144 Sight in Approach Mode

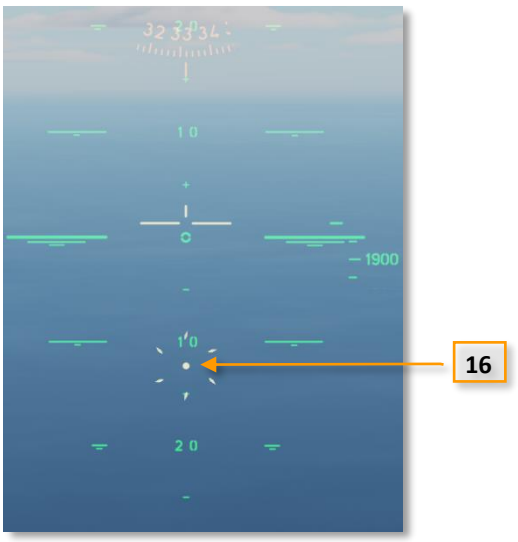


8 TARGET RETICLE
9 RADAR COMMAND RETICLE
10 RADAR REFERENCE
11 STEADY GREEN INDICATOR LIGHT (MISSILE WITHIN RANGE)
12 MISSILE READY (STEADY) OR NOT LAUNCHED (FLASHING) INDICATOR LIGHTS
13 MISSILE LOCKED ON (STEADY) OR SHADOWED (FLASHING) INDICATOR LIGHTS

Figure 3-145 Sight in Air-to-Air Combat Mode

14 AIR-AIR GUN FIRING RETICLE (RADAR LOCKED ON)
15 CLOSING SPEED, TARGET ASPECT ANGLE OR MISSILE FLIGHT TIME SCALE

Figure 3-146 Sight in (C + M or SW) R Mode



16 AIR-GROUND FIRING RETICLE

Figure 3-147 Sight in Air-to-Ground Mode

3.20 WARNING SYSTEMS

Description

The different warning lights, as well as their particular triggering conditions, are treated in the corresponding system chapter.

Some of them are grouped into a single panel (configuration indicator, failure warning panel).

Failures are indicated to the pilot by means of:

- the failure warning panel (red and amber indicator lights)
- the master failure warning light (double: red and amber)
- a warning horn (with four different sounds)

The red lights of the failure warning panel require an immediate action, while the amber lights allow a delayed action.

When there is a failure, the detection closes a circuit that causes:

- the illumination of red or amber indicator lights
- the illumination of the master failure warning light
- eventually, the triggering of the warning horn

Pressing the master failure warning light:

- the light extinguishes
- the warning horn stops, except for REG 02 that lasts as long as the failure persists
- the system resets to indicate a new failure

The light in the failure warning panel remains lit for as long as the fault persists.

Failures and limitations with particular importance generate the following audible warnings:

- a sound for the red lights of the failures warning panel (except REG O2) and for the fire warning lights (engine and A/B)
- a sound for the REG O2 light of the failure warning panel
- a sound for the limit incidence
- a sound for the "LIM" light

Energization of the warning horn is obtained by the warning horn switch.

The illumination of the “LIM” light, accompanied by the particular audible warning, indicates that the permitted limits have been exceeded in the following configurations:

Full flap deflection	IAS > 225 Kt	Microswitch on left flap
½ flap deflection through slat/flap lever	IAS > 300 Kt	Microswitch on left flap
½ flap deflection in combat	IAS > 335 Kt or M > 0.85	Microswitch on right flap
Slats extended	IAS > 470 Kt or M > 1.1	Microswitch on left inboard and outboard slats
U/C down	IAS > 240 Kt	Nose U/C not uplocked or nose U/C door not locked in closed position
Total temperature 135°C	M = 2.1 in standard atmosphere above 36,000 ft	Total temperature probe
NOTE: The values indicated apply for increasing IAS. For decreasing IAS the values read will be lower by approximately 20 kt.		

Controls and indicators

Below there is a resume of each failure warning panel light (for more detailed description of some of the lights refer to the corresponding system chapter):

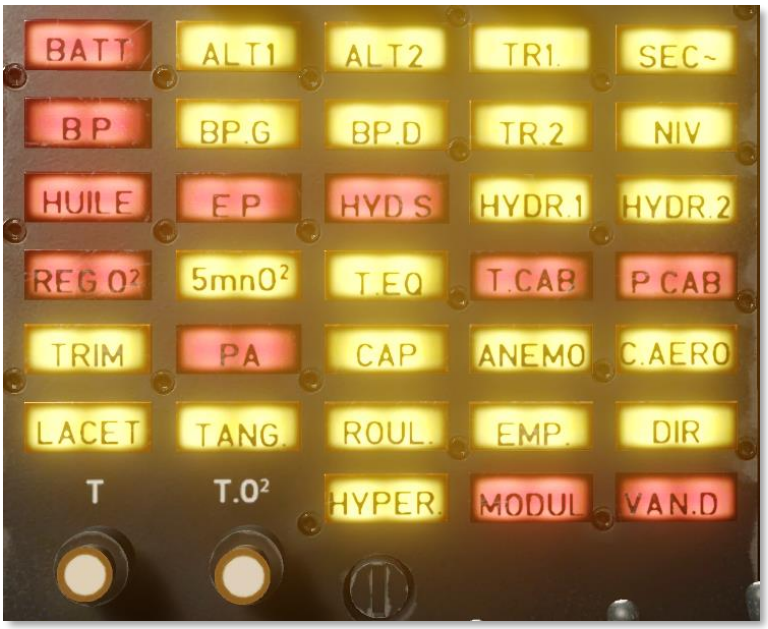


Figure 3-148 Failure Warning Panel Indicator Lights

BATT	Battery disconnected from the main system
ALT.1	Alternator 1 not supplying its system
ALT.2	Alternator 2 not supplying its system
TR.1	Transformer-rectifier 1 not supplying the DC systems
SEC~	Emergency AC system supplied by the inverter
BP	Low pressure in the engine feeding system
BP.G	Low discharge pressure of the left pump (< 500 mb)
BP.D	low discharge pressure of the right pump (< 500 mb)
TR.2	Transformer-rectifier 2 not supplying the DC systems
NIV.	Fuel level in either of the feeder tanks < 250 l
HUILE	Low oil pressure
E.P	Electro-pump continuously active for more than 8 seconds
HYDR.S	Low pressure in the emergency circuit (< 115 bar)
HYDR.1	Low pressure in hydraulic circuit 1
HYDR.2	Low pressure in hydraulic circuit 2
REG.O²	Oxygen regulator failure
5mnO²	Pressure in the emergency system < 150 bar
T.EQ	Temperature of the air flow into the equipment bay < 5°C or > 50°C
T.CAB	Duct sensor temperature > 60°C and cabin temperature > 32°C
P.CAB	Canopy open or cabin altitude > 30,000 ft
TRIM	Automatic trim failure. Autopilot or trim function not affected.
P.A	Interlock activated: the autopilot disengages
CAP	Heading chain or BSM failure
ANEMO	Left total probe or static port heating, or probe heater switch off
C.AERO	Air data computer failure
LACET	Failure of the emergency yaw damper
TANG	Failure of the pitch damper
ROUL	Failure of the roll damper. The autopilot can no longer be used
EMP	Failure or disconnection of the first pitch electric circuit
DIR	Failure or disconnection of the first yaw electric circuit
HYPER	Flaps/slats position disagreement or combat flaps activated outside envelope
MODUL	Excessive modulations of the vario-alternator driving torque
VAN.D	Discharge valves position not matching orders

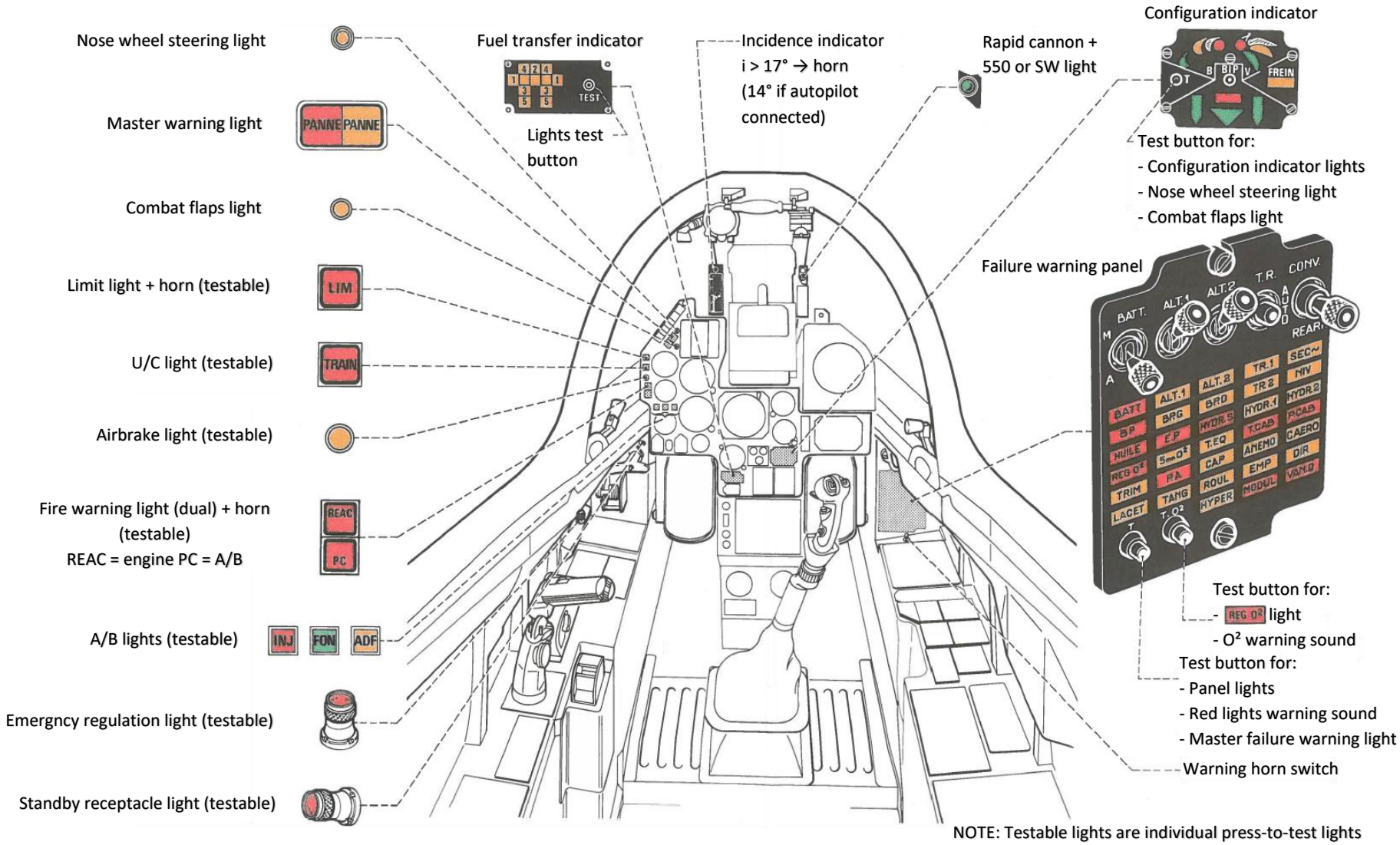
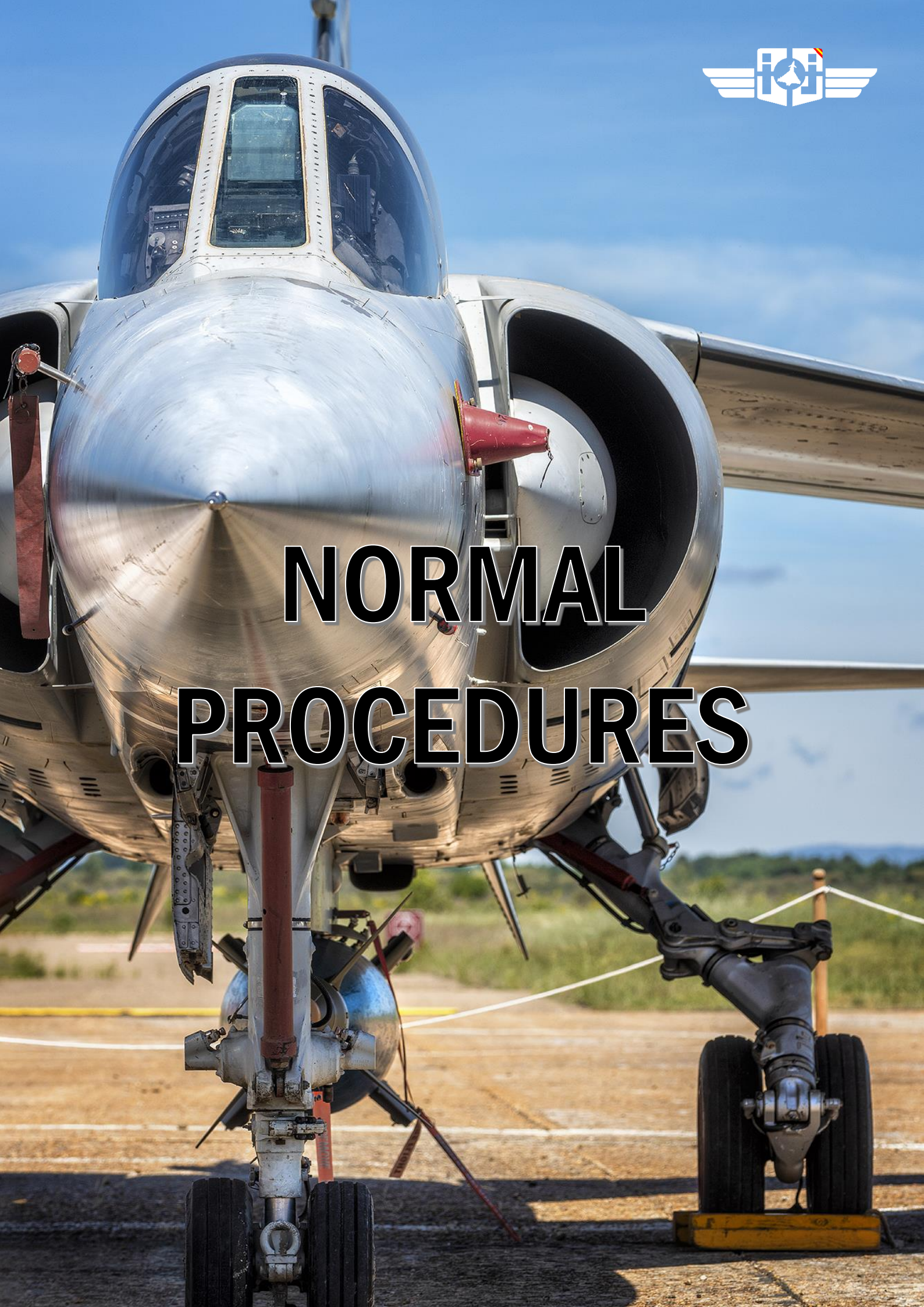


Figure 3-149 Warning Lights and Indicators



NORMAL PROCEDURES

4. NORMAL PROCEDURES

ENTERING COCKPIT

1 EXTERIOR INSPECTION	PERFORMED
2 PARKING BRAKE	SET
3 RUDDER PEDALS	ADJUSTED
4 STRAP IN, PUT ON HELMET, CONNECT MASK	PERFORMED
5 BATTERY	ON
6 WARNING HORN	ON
7 SEAT HEIGHT	ADJUST
8 OXYGEN	CHECK

CABIN CHECKS

1 CABIN LIGHTING RHEOSTATS	AS REQUIRED
2 EMERGENCY FUEL TRANSFER SWITCH	OFF
3 JPT EMERGENCY REGULATION SWITCH	AUTO
4 A/B MAIN COCK SWITCH	ON (GUARDED)
5 IN-FLIGHT RELIGHT CONTROL	AFT
6 COMBAT FLAP LEVER	IN
7 ANTI-SKID (SPAD) SWITCH	ON (GUARDED)
8 HIGH-LIFT DEVICE SELECTOR SWITCH	OFF
9 IGNITION/VENTILATION SELECTOR SWITCH	L/H OR R/H
10 STARTING PUMP SWITCH	OFF
11 R/H LP PUMP SWITCH	OFF
12 L/H LP PUMP SWITCH	OFF
13 LP MAIN COCK SWITCH	CLOSED (UNGUARDED)
14 EMERGENCY REGULATION SWITCH	OFF (GUARDED)
15 LANDING LIGHT CONTROL	OFF
16 U/C CONTROL LEVER	DOWN

17 YAW/ANTI-SLIP SWITCH	ANTI-SLIP
18 PITCH SWITCH	ON
19 ARTHUR SELECTOR SWITCH	AUTO (GUARDED)
20 STICK UNCOUPLE SWITCH	OFF (GUARDED)
21 HYDRAULIC PRESSURE SELECTOR SWITCH	1 SERVOS 2
22 BRAKE CHUTE CONTROL	FORWARD
23 CANOPY EMBRITTLE CONTROL	AFT
24 SHOCK-CONE PUSHBUTTON	DEPRESSED
25 NOSE WHEEL STEERING SWITCH	ON (GUARDED)
26 NOSE WHEEL STEERING HIGH SENSITIVITY BUTTON	DEPRESSED
27 ARMAMENT CONTROL PANEL SELECT PUSHBUTTONS	RELEASED
28 INSTANTANEOUS/DELAY/SAFE SELECTOR SWITCH	SAFE
29 MATRA 550 MISSILE SWITCH	OFF
30 EMERGENCY TRANSFER SWITCH	OFF
31 CROSSFEED SWITCH	OFF
32 EMERGENCY U/C HANDLE	IN AND FOLDER BACK
33 ALTERNATOR 1 AND ALTERNATOR 2 SWITCHES	ON
34 INVERTER SELECTOR SWITCH	AUTO
35 CANOPY SEAL VALVE CONTROL LEVER	INFLATE (FORWARD)
36 RAM AIR SWITCH	OFF (GUARDED)
37 CABIN TEMPERATURE CONTROL RHEOSTAT	AUTO
38 EMERGENCY COLD SWITCH	OFF
39 AUTO/MANUAL SELECTOR SWITCH	AUTO

STARTUP

1 CANOPY	CLOSED OR PARTIALLY OPEN
2 CANOPY LOCK CONTROL	FORWARD
Move it forward when the canopy is fully closed	
3 PARKING BRAKE	SET
4 LP MAIN COCK	OPEN
5 L/H AND R/H LP PUMPS	ON
6 IGNITION/VENTILATION SELECTOR	IGNITION
Switch to other plug, left or neutral position of the switch, to permit alternate use of the plugs upon starting.	
7 STARTER BUTTON GUARD	LIFT
The starting pump switches on.	
8 STARTER BUTTON	DEPRESS FOR 1 SEC
9 Between 300 and 600 RPM	THROTTLE TO IDLE

AFTER START

1 HIGH-LIFT DEVICE SELECTOR SWITCH	NORMAL
2 COMBAT FLAP LEVER	IN
3 UHF RADIO	ON
4 SLAT/FLAP LEVER	FULL AFT
5 V/UHF RADIO	ON
6 25W - 5W SWITCH	5W
7 INVERTER SELECTOR SWITCH	RESET
8 SERVOS	RESET
9 TRIMS	TESTED and NEUTRAL
10 HYDRAULIC PRESSURES	CHECKED
11 IFF	SBY
12 NAVIGATION INDICATOR	AS REQUIRED
Mode selector switch in VT, TE or TT.	
13 STANDBY HORIZON SWITCH	ON
14 ELECTRO-PUMP SWITCH	ON

15 WARNING HORN SWITCH	CHECK ON
16 PROBE HEATER SWITCH	ON
17 RADAR DETECTOR SWITCH	ON
18 SEARCH LIGHT SWITCH	AS REQUIRED
19 SIGHT SELECTOR	AS REQUIRED
ON or APP.	
20 RADAR SELECTOR	STANDBY
21 HEADING AND VERTICAL REFERENCE SYSTEM CONTROL SWITCH	GM
22 HEADING AND VERTICAL EMERGENCY GYROMAGNETIC COMPASS SWITCH	ON
23 TACAN	REC
24 VOR/ILS	ON
25 VOR-ILS/OFF/TACAN SELECTOR	VOR/ILS OR TACAN
26 AIR COND. MASTER VALVE CONTROL SWITCH	ON
27 TEMPERATURE CONTROL RHEOSTAT	AUTO
28 STANDBY HORIZON	UNCAGE
29 RADAR DETECTOR WARNING PANEL	TESTED - TONE ADJUSTED
30 FLIGHT CONTROLS	CHECK FREE AND FULL DEFLECTION

BEFORE TAXI

1 EJECTION HANDLE SAFETY PIN	REMOVED
2 SLAVED ALTIMETER	SET
3 STANDBY ALTIMETER	SET
4 PARKING BRAKE	RELEASE
5 BRAKES	CHECK
Advance throttle at 6000 RPM, start rolling and then apply brakes.	

DURING TAXIING

1 IFF	TEST
2 ADJUST RADAR AND SIGHT	AS REQUIRED
3 STANDBY HORIZON	MINIATURE AIRPLANE ADJUSTED

BEFORE LINE-UP

1 HELMET VISOR	LOWERED
2 CANOPY	CLOSED AND LOCKED (P.CAB LIGHT OUT)
3 FAILURE WARNING PANEL LIGHTS	OUT
4 HARNESS	ADJUSTED AND LOCKED
5 RADAR	TRANSMISSION
6 TACAN	T/R
7 SLATS AND FLAPS	CHECK EXTENDED
8 EMERGENCY REGULATION LIGHT	OUT

Before the first flight of the day, perform the emergency regulation test:

9 THROTTLE	IDLE
10 EMERGENCY REGULATION SWITCH	ON
11 EMERGENCY REGULATION LIGHT	CHECK ON
Increase engine RPM by blipping the emergency regulation control lever.	
12 EMERGENCY REGULATION SWITCH	OFF
13 EMERGENCY REGULATION LIGHT	CHECK OUT
Check that RPM return to 2900 ±100	

TAKEOFF

- Apply full power with AB.
- Keep the runway centerline with the nose wheel steering. Be gentle with the rudder.
- Rotate at 120 kts and establish the takeoff attitude of approx. 12°.
- The aircraft becomes airborne at approx. 150 kt.
- Retract the landing gear.
- Retract the flaps at 200 kts.
- AB off at 300 kts.

CLIMB

Subsonic climb schedules		
clean configuration	military thrust	IAS 470 kts M 0.92
	maximum thrust	IAS 500 kts M 0.95
configuration with two RP 35 drop tanks	military thrust	IAS 422 kts M 0.84
	maximum thrust	IAS 475 kts M 0.92

supersonic climb schedule
climb according to one of the subsonic schedules up to 30,000 ft
accelerate up to 610 kts in level flight
climb at constant IAS of 610 kts up to 36,000 ft
accelerate up to M 1.8 in level flight
maintain M 1.8 up to the desired altitude

CEILING

Limited to 50,000 ft for safety reasons.

CRUISE

The navigation parameters (altitude and IAS) and the loading parameters (external stores), selected according to the mission, greatly affect the flight time and fuel consumption.

COMBAT

1- Auto slats

High-lift device selector	NORMAL

2- Combat slats and flaps

High-lift device selector	NORMAL
Normal operation of combat slats and flaps is manual.	

Combat flap lever	AS REQUIRED
Extend or retract as needed within the combat flap envelope (300 kts M 0.75)	
Use preselection out of the envelope only during momentary maneuvers, and never beyond M 0.9. The flaps will retract and extend by the interlocks.	
Retract the combat flap lever when maneuvering definitively out of the envelope, in particular if Mach exceeds 0.9.	

DESCENT

ECONOMICAL DESCENT	
RPM	6500
Airbrakes	retracted
IAS	300 kts
Demist switch	ON (no effect in DCS)
~1.5 NM and 2 liters per 1000 ft	

OPERATIONAL DESCENT	
RPM	~6500
Flight path slope	-10°
Airbrakes	retracted
Mach/IAS	0.92 then IAS 450 kts
Demist switch	ON (no effect in DCS)
~1 NM per 1000 ft	
FAST DESCENT	
RPM	6500
Airbrakes	extended
Attitude	-20°
Demist switch	ON (no effect in DCS)

LETDOWN	
RPM	6500
Airbrakes	extended
IAS	300 kts
Demist switch	ON (no effect in DCS)
1 NM and 2 liters per 1000 ft	
Flight path slope -10°	
 *Figure 4-1 Sight approach mode display with airbrakes*	
If rate of descent has to be reduced: retract airbrakes, flight path slope -5°	
 *Figure 4-2 Sight approach mode display without airbrakes*	

PATTERNS

In straight flight, an aircraft always stalls at the same incidence (angle of attack, AoA), regardless of the weight, while the stall speed depends on the weight.

During approach, set the aircraft in landing configuration, allow the incidence to increase up to 10° and note the corresponding speed. In the final turn, adjust power to keep that speed. Use the incidence indicator as a reference (12° - 13°, green light on).

Relation between i and IAS at n=1 versus weight		Incidence readings	IAS versus weight		
			* 8700 kg	** 11000 kg	*** ±100 kg
	BLUE	8			±0.85
		9	156	177	
L/D max (all down)		9.5			
Optimum (all down)	GREEN	10	151	172	
		11	146	167	
Watch rpm		12	141	162	
		12.5			
Touchdown		13	136	157	
	YELLOW	14			
		15			
		15.5			
Keel limits		16			
Limit	RED	17	117	138	
		22			

* Without external stores and 1000 liters remaining
With drop tanks empty and 500 liters remaining
** Wing tanks empty (maximum landing weight)
*** ±100 kg = ±125 liters

Table 4-1 Indicence Indicator

LANDING

- Set the sight selector in simplified attitude reticle (velocity vector function).
- Place the velocity vector on the runway threshold.
- Indicence: 9° - 11°.
- Glide slope: 2.5° ±1°.
- RPM: 7300 ±300.
- After touchdown: i ~ 13°. It is advantageous to use aerodynamic braking by holding the nose high down to 120 kts.
- Fully close the throttle.
- The nose wheel steering high sensitivity mode can be used as required, by depressing the button.
- Consider the use of the brake chute.

GO-AROUND

- Set full military power.
- Establish 12° of attitude.
- If necessary, select A/B.
- With positive rate of climb, gear up.
- At 200 kts, flaps up.

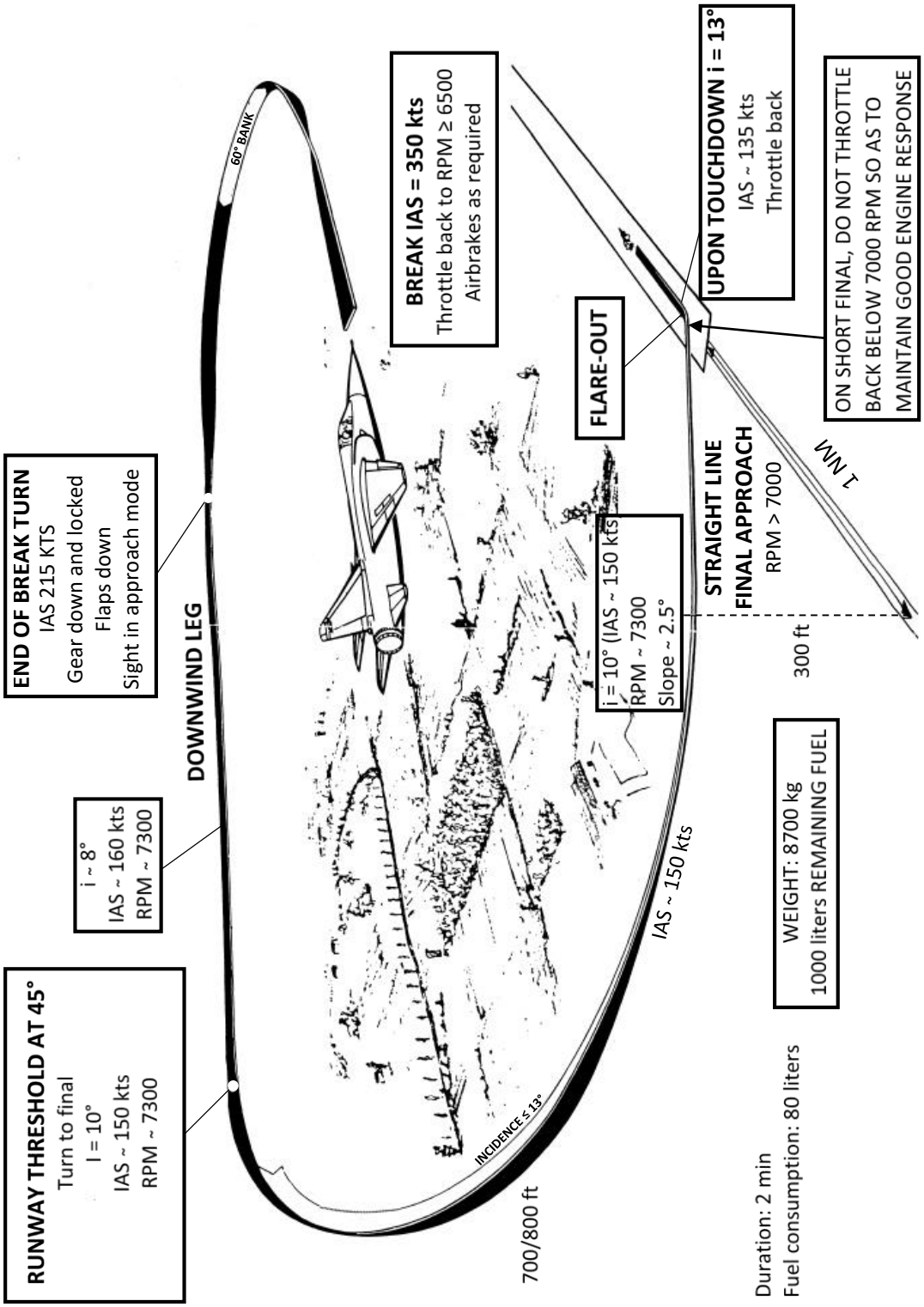


Figure 4-3 Break Pattern

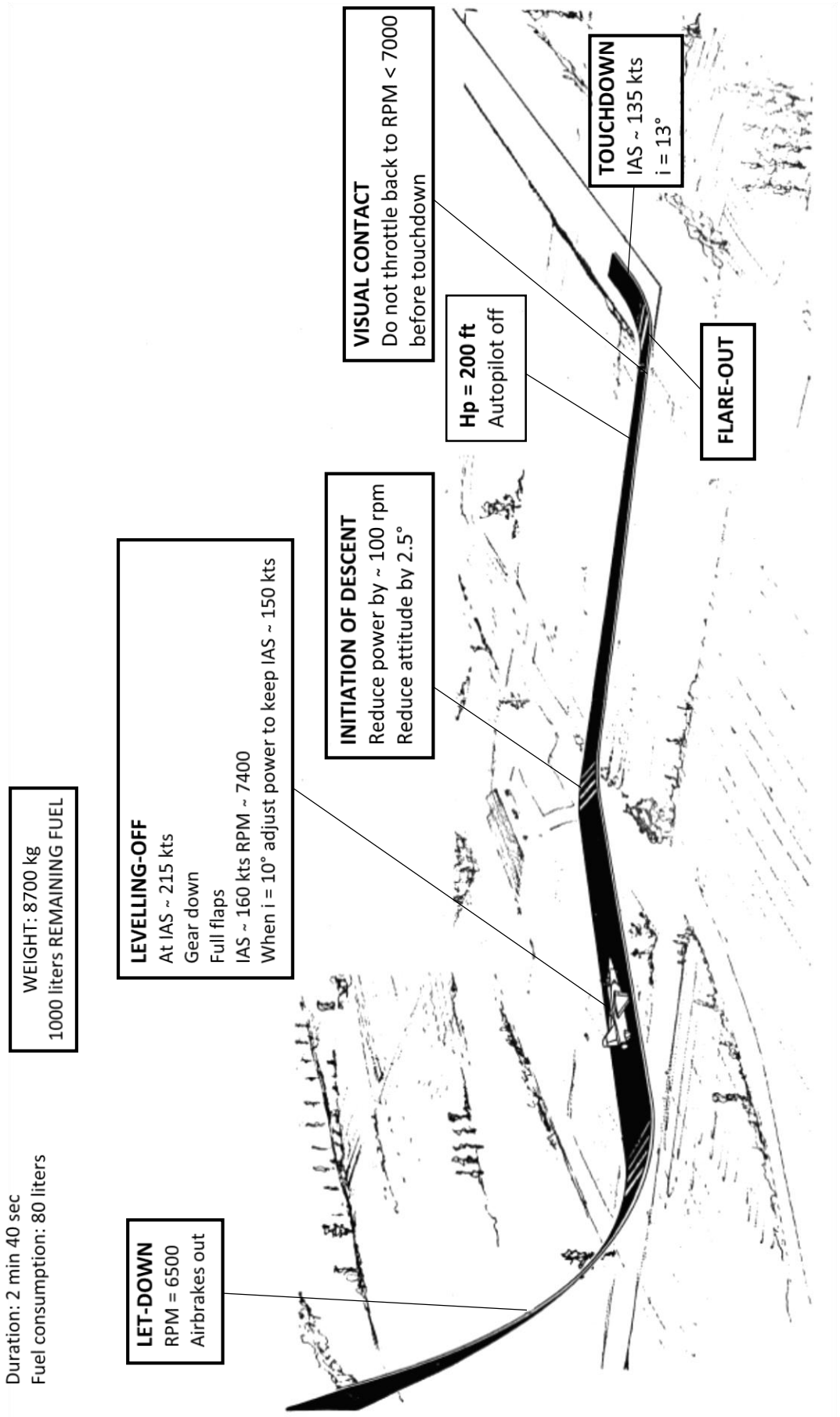


Figure 4-4 GCA or ILS Pattern

USE OF THE AUTOPILOT

The autopilot is engaged by depressing the “PA” pushbutton while holding the autopilot disconnect trigger depressed on the control stick grip.

The autopilot connects initially in basic functions (attitude hold) and PA illuminates.

The autopilot modes are:

- Altitude Hold Mode (ALT)
- Heading Hold Mode (CAP)
- Localizer Mode (R)
- Glide Slope Mode (G)

They are connected by pressing the corresponding pushbutton ALT (altitude), CAP (heading), R (runway) or G (glide slope).

When passing through the transonic range the autopilot reverts to basic functions.

Pressing the autopilot disengage lever or the PA pushbutton disengages the autopilot.

Pressing the autopilot disconnect trigger the autopilot reverts to basic functions.

Figure 4-5 Autopilot Control and Indicator Unit

RETURNING TO PARKING AREA

1 NOSE WHEEL STEERING HIGH SENSITIVITY BUTTON	HIGH SENSITIVITY (BUTTON DEPRESSED)

AFTER CLEARING THE RUNWAY

2 EJECTION HANDLE SAFETY PIN	INSTALLED
3 DEMIST SWITCH	OFF
4 TACAN	OFF
5 RADAR	STBY
6 IFF	OFF
7 SLATS AND FLAPS	UP
8 HIGH-LIFT DEVICE SELECTOR SWITCH	OFF
9 TRIMS	NEUTRAL

10 FLIGHT CONTROL, COMBAT HIGH-LIFT DEVICE AND AUTOPILOT INTERLOCK TEST	PERFORM
This test is performed after the first flight of the day.	

11 AUXILIARY SERVOCONTROL BARREL 2 TEST	PERFORM
This test is performed weekly.	

12 EMERGENCY REGULATION TEST	PERFORM
This test is performed weekly.	

ON PARKING AREA

1 PARKING BRAKE	SET

With RPM stabilized at idle. From left to right:

2 UHF	OFF

3 V/UHF	OFF

4 INTERCOM CONTROL BOX	AMPLI 1

5 U/C CONTROL LEVER SAFETY	IN PLACE

6 STANDBY HORIZON	CAGED

7 NAVIGATION INDICATOR	OFF

8 STANDBY HORIZON SWITCH	OFF

9 ELECTRO-PUMP SWITCH	OFF

10 WARNING HORN SWITCH	OFF

11 PROBE HEATER SWITCH	OFF

12 RADAR DETECTOR SWITCH	OFF

13 SEARCH LIGHT SWITCH	OFF

14 SIGHT SELECTOR	OFF

15 RADAR	OFF

16 ARMAMENT CONTROL PANEL	PUSHBUTTONS RELEASED

17 GYRO REFERENCE SYSTEM	OFF
Heading and vertical reference system control switch to off.	

18 EMERGENCY GYROMAGNETIC COMPASS	OFF
Heading and vertical emergency gyromagnetic compass switch to off.	

19 VOR/ILS	OFF

20 OXYGEN	CHECK REMAINING QUANTITY

21 AIR CONDITIONING	OFF
Master valve control switch to off	

22 THROTTLE	STOP

23 CHRONO	START
Start timing the engine run-down time. Wait for the engine to stop rotating.	

24 LP PUMPS (ALL THREE)	OFF

25 LP MAIN COCK SWITCH	OFF

26 BATTERY + NIGHT LIGHTING	OFF

27 CANOPY	OPEN

LIMITATIONS

5. LIMITATIONS

5.1 CLEAN AIRCRAFT LIMITATIONS

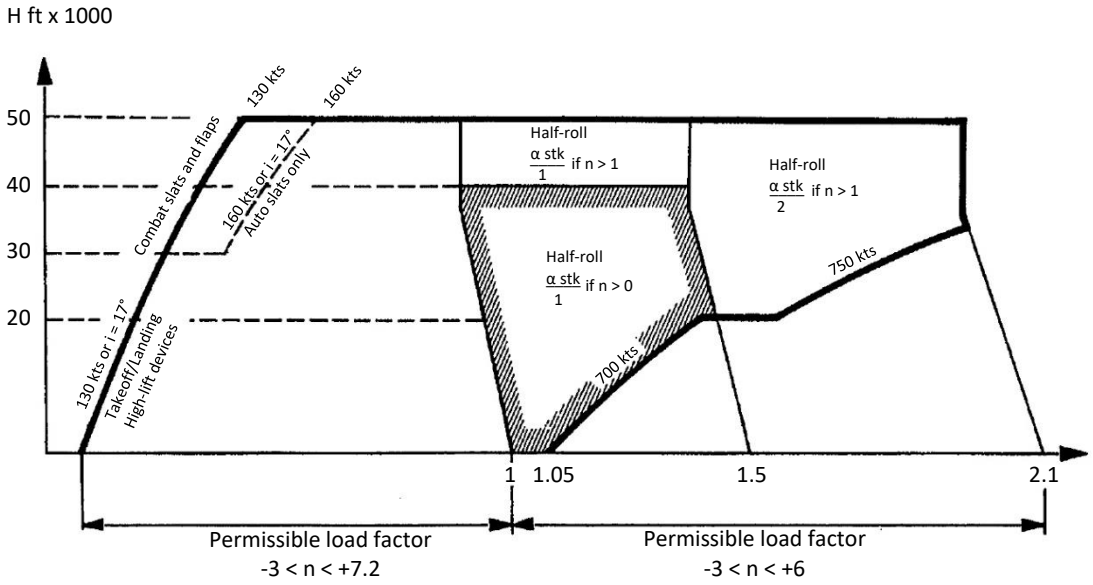


Figure 5-1 Clean Aircraft Configuration

Fast roll maneuvers

Fast roll maneuvers should be limited to avoid:

- Excessive skids (high Mach at low altitudes)
- Divergent flight conditions (high Mach at high altitudes)

In case of damper failure:

- In subsonic flight:
  - Do not perform successive rolls
- In supersonic flight:
  - Half rolls permited:
    - Up to M 1.5 with full roll control travel if load factor is higher than 0 below 40,000 ft and higher than 1 above 40,000 ft
    - Beyond M 1.5, half roll with half roll travel if load factor is higher than 1
    - Up to M 2.1
    - i = 17° except at transonic range i = 15°
    - Crosswind ≤ 25 kts
    - In supersonic flight, dive ≤ 30°
    - n ≤ 0 limited to 15 sec (due to engine fuel supply)

5.2 ALTERNATORS VENTILATION

The alternators are ventilated by air bled from the air intake duct. During engine run-up or at low speed the air intake is under negative pressure and ventilation is reversed. In flight, at certain speed, ventilation becomes direct. Therefore, there is a transition zone where ventilation is low (low speed or high altitude).

The higher the electrical load, the higher the heat that alternators have to dissipate.

All this can lead to the failure of one or both alternators at certain conditions of speed, altitude and electrical load.

With alternator failure light on, get out of the forbidden zone (see figure below) and switch off the corresponding failed alternator.

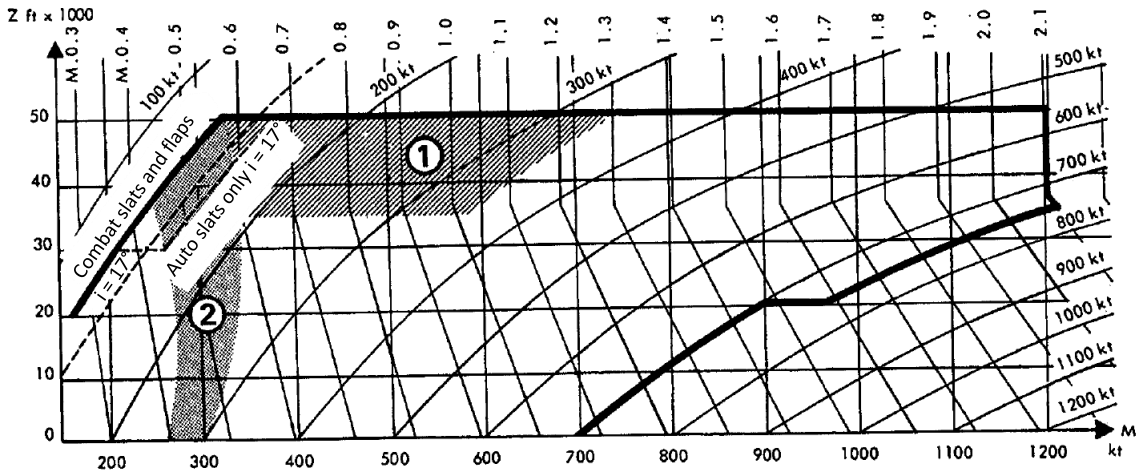


Figure 5-2 Alternator Envelope

Zone 1: low air density and therefore ventilation is not so efficient

Zone 2: transition zone where ventilation is low

5.3 ENGINE LIMITATIONS

Engine envelope

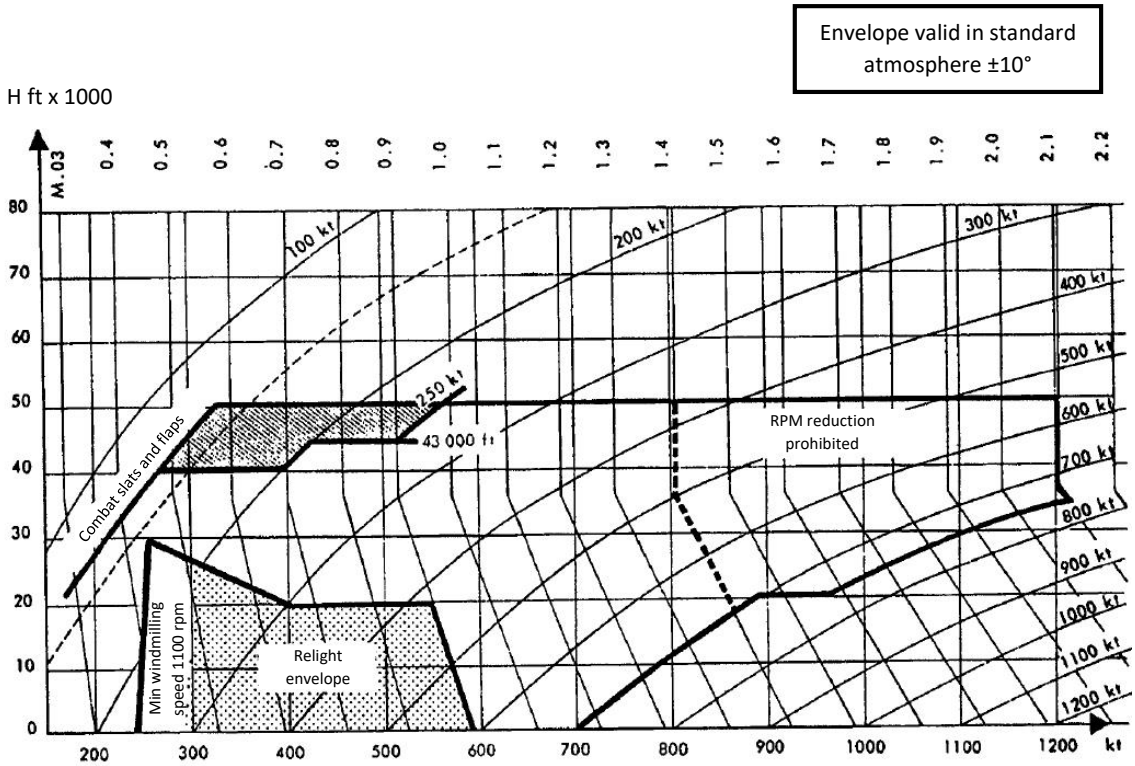


Figure 5-3 Engine Envelope

Avoid flying outside this envelope, it can cause compressor stall or engine damage.

Inverted flight

Limited to 15 seconds.

Emergency regulation

Switch on is prohibited in case of compressor stall or in overspeed mode.

Control lever actuation is permissible when M ≤ 1 and at altitudes (Hp) according to the following envelope:

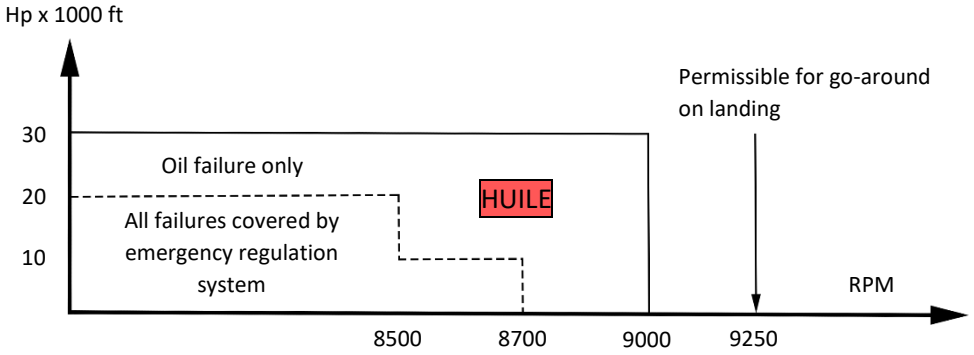


Figure 5-4 Control Lever Actuation Envelope

Use engine rpm > 7200 only if needed (limited turbine endurance with exhaust nozzle open).

The emergency oil deposit of 3.5 liters provides lubrication for only 20 minutes, irrespectively of power setting.

5.4 ELEMENTS EXTENDED LIMITATIONS

COMBAT HIGH-LIFT DEVICES	IAS / MACH	LOAD FACTOR AND INCIDENCE
Auto slats only	470 kts / 1.1	-3 G +7.2 G or i < 17°
Combat slats and flaps	335 kts / 0.85	-3 G +7.2 G or i < 17°

TAKEOFF/LANDING HIGH-LIFT DEVICES	IAS	LOAD FACTOR AND INCIDENCE
Half flaps	300 kts	i < 17°
Full flaps	225 kts	0 G +2.5 G or i < 17°

LANDING GEAR

Maximum takeoff weight	15200 kg (33510 lbs)	
Normal landing weight	9000 kg (19842 lbs)	Max R/D 550 ft/min
Exceptional landing weight	11000 kg (24251 lbs)	Max R/D 395 ft/min
Emergency landing	>11000 kg	Lowest possible R/D (< 300 ft/min)

LIM warning light + warning horn when nose gear not uplocked or door open and IAS ≥ 240 kts

EMERGENCY PROCEDURES

6. EMERGENCY PROCEDURES

6.1 FAILURES DURING TAKEOFF

- In case of:
  - Engine failure.
  - Thrust drop.
  - Severe vibrations.
  - Any red light except REG.O².

  - Perform a rejected takeoff or
  - proceed with engine failure after takeoff.

REJECTED TAKEOFF

❖ If IAS < V decision (not calculated in this manual):
- Shut down the afterburner and retard the throttle to idle.
  - In case of engine or A/B fire:
    - Throttle to STOP.
    - Close the LP (BP) main cock.
- Deploy the brake chute.
- Brake with the antiskid system (SPAD).
  - In case of engine or A/B fire:
    - Turn off all the electrical switches except the battery switch.
  - If the brake chute is released at a speed near V decision, the decision to:
    - Eject
    - Continue the takeoff
    - Abort the takeoff

    Will depend on the failure and the nature of the terrain at the end of the runway (ground, obstacles, etc.).

❖ If IAS > V decision:
- Refer to engine failure after takeoff.

ENGINE FAILURE AFTER TAKEOFF

❖ In case of engine flameout or confirmed fire:
- EJECT.

❖ Other cases of failure:
  - If thrust drop or HUILE (OIL) light on:
    - JETTISON THE STORES
- Retract the landing gear.
- Retract flaps at 200 kt.
- Maintain full A/B and attempt to reach H > 1500 ft and IAS > 250 kt.
  - If IAS drops in level flight:
    - EJECT.
- At H ≥ 1500 ft and IAS ≥ 250 kt: apply the corresponding specific failure procedure.

Specific failure procedure for HUILE (OIL) light on during takeoff:

- Maintain H ≥ 1500 ft and IAS ≥ 250 kt.
- Shut down the A/B.
- Throttle ≤ 8000 RPM.
- Emergency regulation switch ON.
- Adjust RPM with the emergency regulation control lever (max. continuous: 9000 RPM).
- Throttle to idle.
- Land ASAP (20 min of lubrication endurance).

6.2 ELECTRICAL SYSTEM

BATT light on + warning horn

- Check the battery switch.
- Try to reset (3 times).
  - If the fault persists:
    - Leave the switch on.
- Check that TR.1 and TR.2 lights are out.
- Avoid any risk of engine flameout.
- Return to base.

ALT.1 or ALT.2 light on

- In case of ALT.1 light on: SEC~ (EMG~) light may come on.
  - Check the switch.
  - Reset 2 or 3 times with an interval of 5 to 10 seconds between each attempt.
    - If the failure persists:
      - Leave the switch off.
- If the SEC~ light is on:
  - Reset the inverter. The SEC~ light should go out.
  - Return to base.

See alternator ventilation limitations.

ALT.1 and ALT.2 lights on

TR.1, TR.2 and SEC~ lights also come on.

- Try to reset both, then one at a time while switching of the other one.
  - If no result:
    - Proceed to maximum load shedding:
      - Probe heater (according to weather conditions)
      - V/UHF, avoid transmitting
      - Lighting: reduce to minimum

    The only remaining electrical source is the battery, with an endurance of 11 minutes approximately.
    - Spherical indicator is lost.
    - Use standby horizon, gyromagnetic heading is read in the IDN.
    - Set the heading selector to SEC (EMG).
    - Land ASAP.
  - If HYDR.2 comes on:
    - Extend the landing gear in normal mode when feasible before the battery gets exhausted.

SEC~ light on

- Check “C de CONV” and “PUIS CONV” circuit breakers.
- Check that the invertor selector is in “AUTO”.
- Reset two or three times if the alternators are correct.
- Do not reset if the alternators hunt, and set the inverter selector to “CONV”.
- The flight can be continued.

TR.1 or TR.2 light on

- Reset two or three times with an interval of 5 to 10 seconds between each attempt.
  - If the reset is unsuccessful:
    - The remaining TR is capable of supplying the DC system, except when the electro-pump is in operation.
  - If operation of the electro-pump is necessary (hydraulic system 1 failure):
    - Load shed DC system (V/UHF, IFF, ...).

TR.1 and TR.2 lights on

- Reset
  - If both TR’s remain inoperative:
    - Proceed to maximum load shedding on DC system.

    The only remaining DC power source is the battery.
    - Return to base.

COMPLETE ELECTRICAL FAILURE

All lights are out

- "BATT" switch to "A" (OFF).
- "ALT.1" switch to "A" (OFF).
- "ALT.2" switch to "A" (OFF).
- "BATT" switch back to "M" (ON).

The ALT.1, ALT.2, TR.1, TR.2, SEC~ lights should come on.

- "ALT.1" switch back to "M" (ON).

The ALT.1, TR.1 and TR.2, lights go out.

  - If the reset is successful:
- "ALT.2" switch back to "M" (ON).

The ALT.2 light goes out.

- Reset the SECOURS (inverter selector switch to REARM).
  - If the failure persists:
    - Proceed to the nearest airfield.
    - Avoid risk of engine flameout and probe icing (fly at low altitudes and moderate power settings).

    On landing:

    - Extend the landing gear in the emergency mode.
    - Use the Mach/airspeed indicator on landing.
    - Use the brake chute.
    - Brake carefully.

6.3 FUEL SYSTEM

ENGINE FUEL SUPPLY FAILURES

BP (LP) light on + warning horn

  - During takeoff:
- See failures during takeoff.
  - After takeoff: (H ≥ 1500 ft and IAS ≥ 250 kt):
- Shut off the A/B.
- Reduce engine RPM.
- Check that the BP (LP) switches are on (M) and the BP.G (L/H LP) and BP.D (R/H LP) lights are out.
- Land ASAP.
- Check the fuel remaining indicator and the fuel gauge to detect a possible leak; in case of leak, there is a risk of engine fire.

BP.G light on

- Shut off the A/B.
- Check the left BP switch.
  - If it is ON (M) and the light remains on:
    - Open the crossfeed system.
    - Turn the left BP switch off.

BP.D light on

- Shut off the A/B.
- Check the right BP switch.
  - If it is ON (M) and the light remains on:
    - Switch off the BP.D (right LP) pump (the starting pump is feeding).
    - Leave the crossfeed system closed.
    - Keep watching the fuel gauges.
  - When the asymmetry becomes important:
    - Open the crossfeed system to reestablish symmetry and then close it again.

BP.D and BP.G lights on

- Carry out the procedure applicable to BP light on.
  - If the failure persists:
    - Switch off the left and right pumps (the starting pump remains on).
    - Open the crossfeed system.

IMPORTANT ASYMMETRY IN FEEDER TANK GAUGE READINGS

With or without BP (LP) failure indication.

  - If this asymmetry is not accompanied by the illumination of the fuel transfer indicator lights in abnormal sequence:
- Open the crossfeed system.

The trouble is probably due to a defective BP (LP) pump.

TRANSFER FAILURES

NIV. (FUEL) light on (transfer in progress)

- Shut off the A/B.
- Check the feeder tank level and the fuel transfer indicator:

❖ One feeder tank reads < 250 l:

- If the light illumination sequence is normal:
  The trouble is due to an important asymmetry.
- Open the crossfeed system.
- If the light illumination sequence is abnormal:
- Open the crossfeed system.
- If necessary, use the emergency fuel transfer system.

❖ Both feeder tank gauges read < 250 l + fuel transfer lights on with or without the 3 lights (pressurization failure):

- Reduce engine RPM.
- Descent to 20,000 ft approx. and proceed to the nearest airfield.
- At this altitude, select 8000 RPM (30 seconds max.):
  - If the fuel gauge indications do not increase:
    - Use the emergency fuel transfer system.
  - If the fuel gauge indications increase:
    - Continue flying at this altitude, if necessary.

NOTE 1: Whenever the emergency fuel transfer system is used, watch the feeder tank gauges: if their indications decrease abnormally, turn off the emergency fuel transfer system.

NOTE 2: In all cases, turn off the emergency fuel transfer system before the level flight leg preceding the final approach.

ABNORMAL INDICATION OF FUEL TRANSFER INDICATOR

❖ All lights are on with or without the 3 lights (pressurization failure):
- Confirm the failure by increasing engine RPM if it was at full idle.
- Shut of the A/B, slow down to subsonic and proceed to an airfield while descending to 20,000 ft approximately.
- At 20,000 ft, readjust the engine RPM to about 8000.
- If the failure persists more than 30 seconds and if the 3 and 5 tank fuel has not already been consumed, use the emergency fuel transfer system.
  In this case, remains a maximum of 2000 l of consumable fuel.
  CG will be forward on landing

❖ No illumination of one light on one side:
- Test the fuel transfer indicator and read the fuel gauge indications.
  - If the gauge readings are in the transfer range:
    - Do not open the crossfeed system as long as the NIV. light remains out.
      When the NIV. Light comes on:
      - If 1 or 2 or 4 light is out:
        - The corresponding fuel is lost.
      - If 3 and 5 or 5 lights are out:
        - Open the crossfeed system.
        - Use the emergency fuel transfer system.

❖ Asymmetry in feeder tank indicators:

Excessive asymmetry may be caused by jamming of a transfer sequence selector valve in the intermediate position. In this case, cycling the transfer sequence selector switch (lisse/bidons, clean/pylon tanks) may unjam the selector valve and resume normal fuel transfer.
If the asymmetry persists, open the crossfeed system while closely watching the transfer sequence.

ASYMMETRY OF FEEDER TANK GAUGES

❖ Transfer indicator light illumination sequence is normal:
- Open the crossfeed system (possible BP pump failure).
  - If the end of transfer of one wing pylon tank occurs too soon:
    - Open the crossfeed system until the end of transfer of the other tank, then close the crossfeed system.

❖ One feeder tank gauge is at maximum level:
- Do not open the crossfeed system.
- Wait for the end of transfer of the tank corresponding to the defective valve.

FUEL CANNOT BE TRANSFERRED FROM ONE WING PYLON TANK

This failure involves an aircraft asymmetry which cannot be fully compensated with roll trim. However, the residual force makes it possible to land without jettisoning the pylon tanks.

- The fuel of the corresponding tank cannot be consumed.
- Precautionary landing.

6.4 ENGINE

ENGINE STARTING INCIDENTS

DURING GAS GENERATOR STARTING

- ❖ If the gas generator sequence stops:
  - If the RPM indicator has started registering:
    - Attempt a new start after complete engine stop.
  - If the RPM indicator has not started registering:
    - Switch off the starting BP pump.
    - Wait 1.5 minutes before attempting a new start.
- ❖ If the starter continues to operate with no engine ignition occurring:
    - Pull out the DEMA (START) circuit breaker.

DURING ENGINE STARTING

- ❖ If the JPT increases rapidly and exceeds 700°C:
  SHUT DOWN THE ENGINE INMEDIATELY:
  - Move the throttle to STOP.
  - Switch off the starting BP (LP) pump.
- ❖ If the engine ignition does not occur:
  - Move the throttle to STOP.
  - Wait until the engine stops, then:
  - Switch off the starting pump.
  - Switch to the other plug.
  - Repeat the starting procedure (after complete engine stop).
  - Cancel the flight.
- ❖ If the second attempt has failed and there has been fuel flow:
  - Perform a dry ventilation.

DRY VENTILATION

• Throttle.....	Stop
• Battery switch.....	Checked on
• Ignition/ventilation selector.....	Ventilation
• Starting circuit breaker.....	Checked pushed in
• BP main cock switch.....	Open (guarded)
• Starting pump switch.....	On
• Left and right BP pump switches.....	On
• BP light.....	Out

WARNING

BEFORE ACTUATING THE STARTER BUTTON, CHECK THAT THE ENGINE IS COMPLETELY STOPPED.

- Depress the starter button for about 1 second
- Leave the throttle at STOP

Observe the engine RPM, peak 1300 ≤ RPM ≤ 1800

Ventilation duration should be < 25 seconds.

If the sequence does not stop automatically within this period:

- Pull out the DEMA (START) circuit breaker.

ENGINE FAILURES

OIL light on + warning horn

- During takeoff:
- See failures during takeoff.
- After takeoff:
- Watch engine RPM to avoid overspeed.
- Shut off the A/B, decelerate rapidly to M = 1.4 and move the throttle to idle.
- At M < 1.4, emergency regulation switch to on (start stopwatch).
- Slow down to subsonic.

  As soon as M < 1.0 and Hp < 30,000 ft:
- Adjust engine RPM with the control lever in short steps.
- Land ASAP. Remains a maximum of 20-minute lubrication endurance.

SOURIS (SHOCK-CONES) FAILURES

This is detected by a non-agreement between both machmeter readings.

- ❖ If the utility pressure is correct:
  - Check that the souris (shock-cones) are in AUTO position (pushbutton depressed).
    - If the automatic system is no longer serviceable (air data computer failure):
      - Correct the shock-cone position manually.
- ❖ If the utility pressure = 0 (the shock-cones remain in the position existing at the time of failure):
    - If the shock-cones are retracted:
      - Shut off the A/B, decelerate.
      - Reduce RPM carefully.
      - Slow down to subsonic.
    - If the shock-cones are fully or partially extended:
      - Avoid high engine RPM's in subsonic.
      - Avoid high angles of attack.

ENGINE RESTART IN FLIGHT

Restart procedure:

- Throttle at idle
- Move forward the in-flight relight button, located in the left console, under the throttle lever
- In order to get a satisfactory engine relight the aircraft must be within the restart envelope, see the picture below.

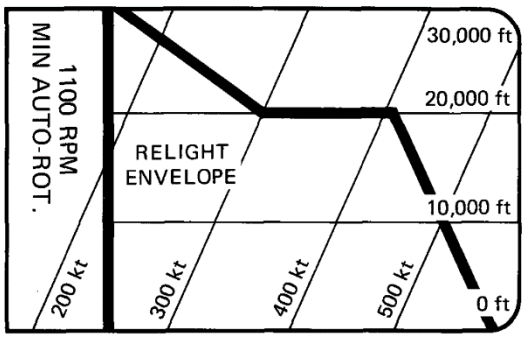


Figure 6-1 Engine In-flight Restart Envelope

COMPRESSOR STALL

A compressor stall can be partial or total.

To recover from a partial compressor stall reduce engine power to idle and pitch down to increase air flow to the engine. The procedure is as follows:

- Throttle at idle
- Pitch down to get an IAS ≥ 300 kt
- Watch JPT, when jet pipe ("tuyere") temperature (T4) returns to ~200°C and buffet ceases:
- Advance the throttle and check that the engine accelerates normally.

If the above procedure does not recover the compressor stall, shut down the engine and try a restart.

If T4 values increase above permissible values, shut down the engine.

If the high engine temperature remains for a long time, it may result in and engine damage and possible engine fire.

FLAMEOUT PATTERN

As soon as possible:

• Electro-pump switch	ON
• Undercarriage	DOWN
• High-lift device selector switch	OFF (ARRET)
• Combat flap lever	IN
• Pitch switch	OFF
• Yaw/Anti-slip switch	OFF

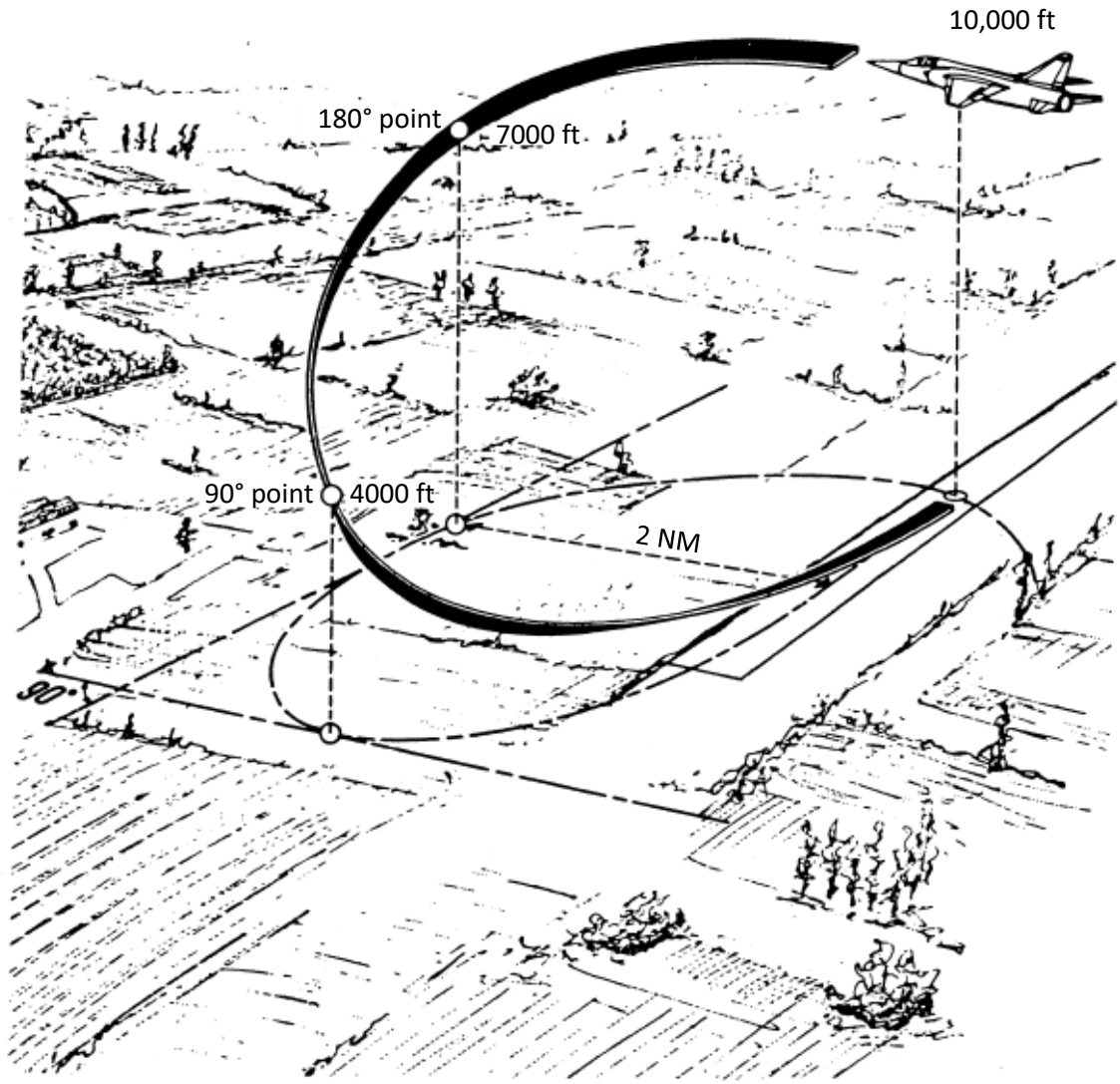
Configuration:

- U/C DOWN
- IAS 230 kt
- DAMPERS OFF

Final glide slope: 700ft/1000m (~12°)

Rate of descent: 4500 ft/min

If needed extend ½ flaps at the flareout.



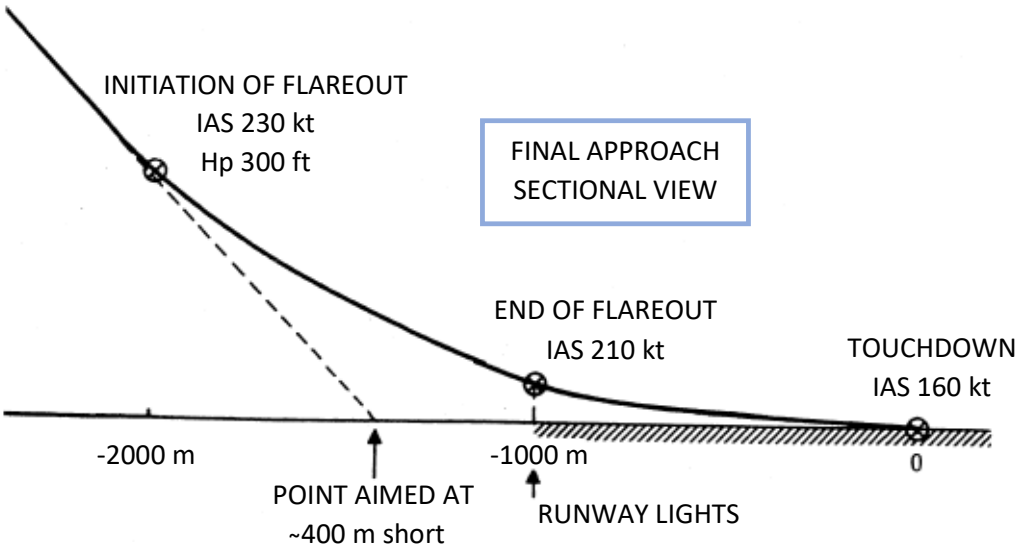


Figure 6-2 Flameout Pattern

6.5 HYDRAULIC SYSTEM

In all cases of failure:

Return to base in subsonic flight conditions.

Check the pressures on the hydraulic pressure indicator.

Check that the P HYD circuit breaker is pushed in.

Plan to make a long final landing as far as possible.

SDES (UTILITY) SHUTOFF

Pressure readings: Sdes (Utility) = 0
Servo 1 = 210 bar

- If the shock-cones are extended:
- Avoid high engine RPM's in subsonic flight as well as high AoA maneuvers.
- If the shock-cones are retracted:
- Mach numbers above 1.3 are prohibited.

Before extending the L/G in emergency mode:

- Select ½ flaps.
- Extend the L/G in emergency mode as per procedure A specific to HYD.1 out.
- If the slats lock in the extended position:
- Select flaps full.
- If the high-lift devices do not extend:
- Land with i = 11°, IAS: { 9 t = 195 kt / 11 t = 215 kt }
- Deploy the brake chute.
- Apply the brakes moderately and continuously with the antiskid system on.
- If necessary, use the emergency brakes and control the aircraft with the nose wheel steering system.
- Shut down the engine after clearing the runway, if necessary.

HYDR.1 light continuously on

Pressures	140 bar < servo 1 < 174 bar 0 < Sdes < 145 bar	E.P. light on or out

Depending on the value of the utility pressure, it will be possible or not to place the shock-cones in a position matching the flight conditions, and to use the utility system on landing.

- Turn the EL. PUMPE (EL PUMP) switch off and turn it on again, if necessary.
  After a short while: HYDR.1 and HYDR.S lights come on + warning horn.
  Then LACET + TANG + ROUL + EMP + DIR lights come on.
  Before landing:
  In level flight, before extending the elements:
- Turn the EL. PUMPE switch on.
  All the lights should go out, except the HYDR.1 light.
- Select ½ flaps.
  - If the slats lock down:
- Extend full flaps.
  - Otherwise:
- Keep ½ flaps.
- Extend the L/G in the emergency mode as per procedure B specific to HYDR.1 on.
  On landing:
- Deploy the brake chute.
- Use the normal brakes and the emergency brakes if necessary.
- Shut down the engine after clearing the runway, if necessary.

HYDR.2 light on

- Check the servo 2 pressure (< 145 bar).
- Return to base.
- Check stick uncouple switch in up position.

HYDR.S light on + warning horn

Check:

- EP circuit breaker pushed in.
- EL. POMPE (EL PUMP) switch on.

HYDR.S light stays on + warning horn.

- Switch off the electro-pump and do not use it anymore.
- Return to base.

HYDR.S + E.P lights on + warning horn

Pressures are normal.

Leak in emergency system:

- Switch off the electro-pump (it can no longer be used).
- Watch the servo 1 and Sdes pressures.
- Return to base.

E.P light continuously on + warning horn

Servo 1 pressure is normal.

- Test the failure warning panel.
  - If all the other lights are correct and out:
- Switch off the electro-pump (it can be switched back on if necessary).

HYDR.1 + HYDR.S lights on + warning horn and LACET + TANG + ROUL + EMP + DIR lights on

Pressures	0 < servo 1 < 115 bar 0 < Sdes < 145 bar

Check:

- EP circuit breaker pushed in.
- Electro-pump on.
  - If HYDR.S light goes out:
    - Apply same procedure as for HYDR.1 failure.
  - If HYDR.S stays on, whether E.P light comes on or not:
    - Apply the procedure applicable to the following failure:

HYDR.1 + HYDR.S + E.P lights on + warning horn

LACET + TANG + ROUL + EMP + DIR lights also come on.

- Return to base in subsonic flight.

Pressures	0 < servo 1 < 115 bar 0 < Sdes < 145 bar

- Switch off the electro-pump.
- Landing: according to pressures, apply at best same procedure as for HYDR.1 failure without switching the electro-pump back on.

HYDR.1 + HYDR.2 lights on (case of engine seizure)

LACET + TANG + ROUL + EMP + DIR lights also come on.

- Fly the aircraft smoothly. Avoid causing servo 1 pressure to drop < 100 bar to reach conditions favorable for ejection.
  The E.P light may come on.
  In case of engine seizure, the battery endurance is about 3 minutes.

HYDR.1 + HYDR.2 + HYDR.S + E.P lights on + warning horn

Locking of controls is more or less imminent.

LACET + TANG + ROUL + EMP + DIR lights also come on.

- CARRY OUT EJECTION PROCEDURES.

6.6 FLIGHT CONTROLS AND FLYING AIDS – AUTOPILOT

FLYING AIDS FAILURES

EMP light on

- Reset with the SERVO button.

If this is unsuccessful, the mission can be continued but avoiding high speeds at very low altitudes.

TANG + ROUL + EMP lights on

- Check that the EMP (PITCH) switch is on.
- Reset with the SERVO button.
  - If this is unsuccessful:
- Turn off the EMP switch.
- Avoid rough maneuvers:
  - In pitch at high subsonic speeds.
  - In roll at high supersonic speeds.

The autopilot can no longer be used.

DIR light on

- Reset with the SERVO button.

If this is unsuccessful, the mission can be continued but avoiding high airspeeds at very low altitudes and high roll speeds, especially in supersonic flight.

LACET + ROUL + DIR lights on

- Check that the DIR switch is on.
- Reset with the SERVO button.
  - If this is unsuccessful:
- Turn off the DIR switch: same instructions as when DIR light is on.

The autopilot can no longer be used.

LACET + TANG + ROUL + EMP + DIR lights also come on

- DO NOT RESET: turn off the EMP and DIR switches.

If this is unsuccessful, the mission can be continued but avoiding high airspeeds at very low altitudes and high roll speeds, especially in supersonic flight.
The autopilot can no longer be used.

ROUL light on

- Reset with the SERVO button.
  - If this is unsuccessful:

The autopilot can no longer be used.

AUTOPILOT FAILURES

P.A light on + warning horn + amber PA pushbutton light flashing

- Actuate the autopilot disengage lever (the amber light goes out)

If the PA light goes out, the autopilot can be used again.

P.A light on + warning horn + amber PA pushbutton light steady on + red ALT pushbutton light steady on + red excessive deviation lights steady on

Autopilot is definitively unserviceable:

- Switch the lights off by actuating the autopilot disengage lever.

TRIM light on

- Disconnect the autopilot while holding the control stick firmly.
  If the failure re-occurs, do not use the autopilot again.

6.7 HYDRAULIC ANCILLARIES (SDES)

HIGH-LIFT DEVICES – AIRBRAKES – SOURIS (SHOCK-CONES)

COMBAT HIGH-LIFT DEVICES (Auto)

EXTENSION DOES NOT OCCUR WITHIN ENVELOPE

Check:

- C de HYP (S/F) circuit breaker.
- High-lift device selector switch in NORMAL.
- Combat flap lever extended.
- Sdes (ancillary) hydraulic pressure.

Auto slats case:

- Combat flaps can normally be used.

Combat flaps case:

- Combat flaps lever retracted.
- Auto slats can be used.

In case of failure of auto slats + combat flaps:

- High-lift device selector switch to ARRET (OFF).

RED SLATS-NOT-LOCKED LIGHT ON CONFIGURATION INDICATOR STAYS ON

Failure of one droop slat to extend or retract.

- Check Sdes (ancillary) hydraulic pressure.
- High-lift device selector switch to ARRET (OFF).
- High-lift device selector switch to RENTREE SECOURS (EMG RETR) if necessary, then to ARRET (OFF).
  - If unsuccessful:
- Limit the airspeed to IAS = 440 kt, M = 0.98

HYPER light on with or without red slat light on configuration indicator

High-lift device selector switch to RENTREE SECOURS (EMG RETR), then to NORMAL.

- If unsuccessful:

Limit the airspeed to IAS = 335 kt, M = 0.85

HYPER light on + LIM light on + warning horn then LIM light goes out (the flaps retract)

- If IAS ~ 330 kt or M ~ 0.85
- Retract the combat flap lever.
- Extend the combat flap lever only within the combat flap envelope.

HYPER light on + LIM light on + warning horn

- If IAS ~ 470 kt or M ~ 1.10

- High-lift device selector switch to ARRET (OFF), then to NORMAL.

If the failure reoccurs, leave the high-lift device selector switch at NORMAL only if IAS < 440 kt or M < 0.98

TAKEOFF/LANDING HIGH LIFT DEVICES (Manual)

LANDING HIGH-LIFT DEVICES FAIL TO EXTEND

The configuration indicator stays out.

Check:

- C de HYP (S/F) circuit breaker.
- Sdes (utility) hydraulic pressure.
- That the high-lift device selector switch in not at RENTREE SECOURS (EMG RETR), HYPER light out.

  - If this check confirms the failure:

- Slat/flap lever to IN.
- Land without high-lift devices, i = 11°

SLATS FAIL TO EXTEND

Configuration indicator out.

Check:

- C de HYP (S/F) circuit breaker.
- Sdes (utility) hydraulic pressure.

  - If this check confirms the failure:

- Land with a maximum of ½ flaps, i = 11°

TAKEOFF/LANDING HIGH-LIFT DEVICES FAIL TO RETRACT OR RETRACT PARTIALLY ONLY

- Do not exceed the airspeed corresponding to illumination of the LIM light.
- Cycle the high-lift devices at IAS < 225 kt.
- Attempt an emergency retraction.

  - If unsuccessful, return to base for landing:
    - If the LIM light comes on + warning horn at IAS = 225 kt, select full flaps.
    - If the LIM light does not come on at IAS > 225 kt, select ½ flaps.

Take care to observe the alternator limitations (cooling) while holding in these configurations.

HYPER light on

- High-lift device selector switch to RENTREE SECOURS (EMG RETR), then to NORMAL.

AIRBRAKES

Airbrakes fail to extend or retract:

- Check Sdes (utility) hydraulic pressure

  - If correct:

- Cycle airbrakes. Leave the control in the retracted position if cycling is unsuccessful.

SOURIS (SHOCK-CONES)

See SOURIS (SHOCK-CONES) FAILURES.

UNDERCARRIAGE, BRAKES

U/C RETRACTION INCIDENTS

- ❖ Control lever jammed in down position after takeoff:
  - Maintain IAS < 240 kt.
  - Check that the safety lever is off.
  - Do not use the emergency retraction button (the position of the shock struts is not known).
- ❖ Control lever ineffective:
  - Check the Cde TRAIN (U/C CONT) circuit breaker.
- ❖ Retraction sequence interrupted:
  - Maintain minimum airspeed (IAS < 240 kt in all cases).
  - Check the failure warning lights and hydraulic pressures.
    - If a green arrow remains on:
      - Extend the U/C in the emergency mode as per appropriate procedure (A or B).
      - Lower the control lever.
      - Land.
    - In all other cases:
      - Reset the control lever to the down position.
        - If the U/C locks down:
          - Land
        - If the U/C does not lock down:
          - Extend the U/C in the emergency mode as per appropriate procedure (A or B).
    - In all cases:
      - Burn up fuel.

U/C EXTENSION INCIDENTS

- ❖ If the control lever is in down position and the sequence fails to take place:
  - Check that the Cde TRAIN and the Cle TRAIN circuit breakers are in.
  - Check the Servo 1-2 and Sdes (ancillary) pressures.
  - Extend the U/C in the emergency mode as per appropriate procedure (A or B).
- ❖ In all other cases of abnormal indications:
    - If one of the following three conditions applies:
      - Three green arrows on.
      - U/C warning light (tested before extension) out (RPM < 8100 and IAS < 215 kt).
      - U/C down audio signal heard.
  - Landing is permitted without any other action.
- ❖ Otherwise:
  - Apply appropriate U/C emergency procedure (A or B).

U/C EMERGENCY EXTENSION

A – HYDR.1 out, HYDR.2 out

Servo 1 and 2 pressures correct.

- Disengage the handle.
- After a rotation of 30° counterclockwise, pull out the handle. The doors open. Wait three seconds, except in case of extreme emergency.
- After an additional rotation of 60° counterclockwise, pull out the handle. The U/C extends.
- Rotate the handle 30° clockwise. The handle locks.
- Set the U/C control lever in down position.

The doors remain in the open position (red configuration indicator light on).

BIP operative.

CAUTION
DO NOT PUSH THE EMERGENCY U/C HANDLE BACK IN ONCE THE U/C IS LOCKED DOWN.

NOSE U/C LEG FAILS TO LOCK DOWN

After a normal extension procedure followed by an emergency extension procedure.

Landing procedure:

- Make a normal approach with all the flaps available.
- Cut off the antiskid (SPAD) system.
- Deploy the brake chute after touchdown on main U/C.
- Shut down the engine. Close the BP (LP) main cock.
- At about 110 kt, bring the nose wheels on the ground (control the impact with the pitch control).
- If possible, do not brake except to correct the direction of the aircraft.

ONE MAIN U/C LEG FAILS TO LOCK DOWN

After a normal extension procedure followed by an emergency extension procedure.

- Push the emergency U/C handle back fully in.
- Return the U/C control lever to the up position.
- Make a wheels-up landing.

If a main U/C leg fails to lock down and retraction is impossible:

- CARRY OUT EJECTION PROCEDURES.

B – HYDR.1 on

Servo 2 pressure correct.

CAUTION
ANY LEAK IN CIRCUIT 2 AFTER AN U/C EMERGENCY EXTENSION MAY RAPIDLY CAUSE TOTAL HYDRAULIC FAILURE.

- Stabilize at a safe height.
- Test configuration indicator lights.
- Check Cde TRAIN (U/C CONT) circuit breaker in.
- Put or leave U/C control lever in the down position.
- Disengage emergency U/C handle.
- After a rotation of 30° counterclockwise, pull out the handle. The doors open. Wait three seconds.
- After an additional rotation of 60° counterclockwise, pull out fully the handle. The U/C extends.
- As soon as the U/C is locked down (3 green lights + 1 red one). PUSH THE EMERGENCY U/C HANDLE BACK FULLY HOME.

The U/C is locked down. The doors remain open. The BIP is operative.

NOSE U/C LEG FAILS TO LOCK DOWN

See same situation in case A.

ONE MAIN U/C LEG FAILS TO LOCK DOWN

- CARRY OUT EJECTION PROCEDURES.

WHEELS-UP LANDING

- If a minimum of ½ flaps is not available: EJECT.
- Jettison payload unarmed.
- ALE-40 selector: jettison.
- Burn up fuel until only about 2 x 100 l remain.
- Use all the flaps available and the airbrakes.
- Establish i=10.
- Switch off the BP pumps and the starting pump.
- Flare out but do not hold off (avoid touchdown with high nose-up attitude).
- On touchdown:
  - Shut down the engine.
  - Deploy the brake chute.
  - Close the BP main cock.
  - Turn off all electrical system switches.

WARNING
CRASH LANDING AND DITCHING ARE PROHIBITED.

BRAKES LIGHT ON

In the configurator indicator.

- Check that the parking brake is pushed in and that the brake pedals are not depressed.

6.8 FLIGHT INSTRUMENT SYSTEMS

HEADING AND VERTICAL REFERENCE SYSTEM AND STANDY HORIZON

SPHERICAL INDICATOR MALFUNCTION

With or without flag.

- Check the Cde GYRO circuit breaker.
- Check the sight horizon.
  - If it is visible: only the spherical indicator is failed.
    - Set the N/P selector switch to P (the crossed pointers remain available).
    - Fly the aircraft using the standby horizon.
    - The heading is read on the navigation indicator.
    - The autopilot remains usable.
  - If it is not visible: the gyroscopic system is failed.
    - Set the heading and vertical reference system control switch to SEC.
    - Set the spherical indicator N/P selector switch to P.
    - Fly the aircraft using the standby horizon.
    - The emergency heading is read on the navigation indicator.
    - The autopilot can no longer be used.

CAP light on

- Make a resetting on Cm.
  - If unsuccessful:
    - Set the heading and vertical reference system control switch to SEC.
  - If the failure indicator disappears:
    - The emergency heading is read on the spherical indicator, the navigation indicator and the sight.
  - If the failure indicator remains visible:
    - Only the navigation indicator copies the emergency heading.
    - The spherical indicator remains usable for attitude indications.
    - The autopilot is not available.

HEADING DEVIATION NEEDLE OFFSET

- Press the ERECT button.

STANDBY HORIZON FLAG VISIBLE

- Check that the standby horizon switch is on.
- Check that the standby horizon is uncaged.
  - If the failure persists:
    - Cage the standby horizon.
    - Turn its switch off.

AIR DATA SYSTEM

ANEMO light on

- Check that the probe heater switch is on.
- Avoid icing areas. Fly at IAS > 350 kt.

C.AERO light on

❖ In supersonic flight:
- Manually adjust the shock-cone position according to the Mach number.
- If the overspeed system does not operate, limit the airspeed to M < 1.4.
- If it cuts out, decelerate to M < 1.4.

❖ In all types of flight:
- The ARTHUR selector switch may be used to match the pitch control forces with the flight conditions.

CAUTION
SET THE HIGH-LIFT DEVICE SELECTOR SWITCH TO OFF.

The slat/flap lever remains operative and will be used for the approach.

MISCELLANEOUS INSTRUMENTS

INCIDENCE INDICATOR FAILURE

Flag visible:

- Disregard incidence indicator readings.

The velocity vector is inoperative.

SLAVED ALTIMETER FAILURE

Flag visible:

- Use the standby altimeter.

6.9 PILOT'S EQUIPMENT AND ASSOCIATED SYSTEMS

OXYGEN

NO INDICATION

No indication of pressure, blinker, position, lights and warning horn:

- Check the OXY circuit breaker.

REG.O² light on + warning horn

- Set the mode selector switch to S (the position repeater magnetic indicator changes to red).
- Return to base.
- The flow indicator (blinker) is lost. The white square is visible.
- The REG.O² light goes out and becomes meaningless.
- The warning horn stops operating.

5mnO² light on

- Check the oxygen gauge and perform a test:
  - Descend rapidly below 12,000 ft.
  - Cancel the flight

AIR CONDITIONING

P.CAB light on + warning horn

Or abnormal pressurization:

- Check the P CAB circuit breaker.
- Compare the cockpit altitude with the aircraft altitude.
- Check:
    - Canopy closed and locked.
    - Canopy seal valve control lever full forward.
    - Ram air switch off (guarded).
    - Master valve control switch on.

If a failure has occurred:

- Descend to Hp < 20,000 ft.

T.CAB light on + warning horn

- Set the temperature control rheostat to MANUAL.
- Blip control in COLD direction.
- Watch the solenoid valve position indicator.
    - If the valve does not move (observe the position indicator):
        - Check the T CAB circuit breaker.
    - If the temperature is correct:
        - Try to switch back to AUTO.
    - If unsuccessful:
        - Set the emergency cold switch to SECOURS FROID.
            - If necessary:
                - Master valve control switch OFF.
                - Canopy seal valve control lever fully aft.
                - Ram air switch on at Hp < 10,000 ft and IAS < 450 kt.

T.EQ light on

Check the temperature indicator to determine the type of warning (too hot or too cold):

- Switch the AUTO/MANUAL selector switch to MANUAL.
- Actuate the valve through the control switch to bring the temperature to the desired range.
    - If the preceding operations are unsuccessful (mechanical valve jamming):
        - Reduce engine RPM if conditions permit.
        - Turn the master valve control switch off.
        - Descend to an altitude lower than 20,000 ft.
        - If necessary, use the ram air control switch (Hp < 10,000 ft – IAS < 450 kt).

6.10 FIRE

FIRE ON STARTING

REAC (ENG) and/or PC (AB) fire warning lights on + warning horn

- Throttle to STOP.
- BP (LP) main cock switch off.
- BP (LP) pump switches (all three) off.

In case of emergency:

- Turn off the BATT and ALT switches.
- Abandon the aircraft.

FIRE ON TAKEOFF

See FAILURES DURING TAKEOFF.

FIRE AFTER TAKEOFF

Hp ≥ 1500 ft and IAS ≥ 250 kt.

REAC (ENG) and/or PC (AB) light(s) on + warning horn

- Shut off the A/B.
- Close the A/B main cock.
- Reduce engine RPM.
- Look for signals of fire: JPT, smoke trails in turns, smoke in the cockpit, etc.

If the fire is confirmed:

- Throttle to STOP.
- CARRY OUT EJECTION PROCEDURES.

If the fire is not confirmed:

- Land immediately, shut down the engine after clearing the runway.

CAUTION
THE ILLUMINATION OF A FIRE WARNING LIGHT, FOLLOWED BY ITS EXTINCTION, CAN INDICATE A VERY FIERCE FIRE: DESTRUCTION OF THE WARNING LIGHT POWER SUPPLY CIRCUIT.

COMBAT EMPLOYMENT

7. COMBAT EMPLOYMENT

Air-to-air mode can be engaged using the armament panel pushbuttons.

It can also be engaged using the (C + M or SW) R button on the throttle lever. In this case, the (C + M or SW) R deselection switch in the left wall is used to deselect it.

When only one missile is locked, it will always be given launch priority.

When both are locked, the selected one in the armament panel will be given launch priority.

In (C + M or SW) R mode, if both are locked the left one is launched first.

The MATRA R-530 missiles can either be carried on the fuselage station or on the underwing stations, but not on both.

Both MATRA R-530 (EM and IR) missiles can be selected at the same time or independently in the armament panel. When both are selected the locked missile has launch priority. When both are locked the IR missile has launch priority. If both missiles are of the same seeker head type, the left one is launched first.

The MATRA R-530 IR seeking head needs to be cooled down. In order to command cooling, the master arm switch needs to be on and the missiles need to be selected. Cooling time can take up to 20 seconds and the endurance of the cooling liquid is 20 minutes. When starting a DCS mission in the air the seeker head is already cooled and ready.

When engaging the air-to-air mode, if the radar is not tracking a target, the sight reticle is set initially at a fixed range of 300 m. When holding depressed the “cannon 300-600m and missile lock/unlock button” the sight reticle changes from a fixed range of 300 m to 600m.

The shooting reticle behavior is different in “GYRO” and “ANT” modes. “GYRO” mode works as a classical LCOS sight, assuming that the shooter is maneuvered to be in the target's plane of motion, preferably flying with the same airspeed as the target. The reticle must be kept on the target for some amount of time (up to 2 seconds) to achieve a successful shot. In “ANT” mode, the tracked target position and velocity are provided to the gunsight, allowing to shoot the target from any aspect angle, not necessarily being in the target plane of motion. The “ANT” mode is also called “Blind Shooting” (Tir Aveugle), as generally it is enough to put the shooting reticle on the target symbol to get a successful shot.

“GYRO” and “ANT” modes are switched between each other by the cockpit “GYRO/ANTENNE” switch. When there is no valid target track, the gunsight reverts to “GYRO” mode disregarding the “GYRO/ANTENNE” switch position. There is no direct indication in the cockpit though, showing which of the two modes is currently active.

With the “GYRO/ANTENNE” switch in “GYRO” position and a target tracked by the radar, the “GYRO” mode is provided with the actual target range and range rate.

Despite that the shooting reticle starts to be displayed at ranges below 2000 m, the maximum range used by the reticle is 1600 m.

The effective use of the gunsight in both modes is possible starting from 1200-1300 meters, as precision decreases at larger ranges up to 1600 m.

The “cannon 300-600m and missile lock/unlock button” button always overrides the sight to “GYRO” mode when the fixed range of 600 m is selected, disregarding whether a target is currently tracked or not.

In the Mirage F1 the following limitations are implicit in the gunsight calculations:

- Own aircraft sideslip and roll rate are not taken into account.
- Own velocity vector is built with the use of true AoA approximation for high indicated airspeeds (the so called “high speed AoA law”).

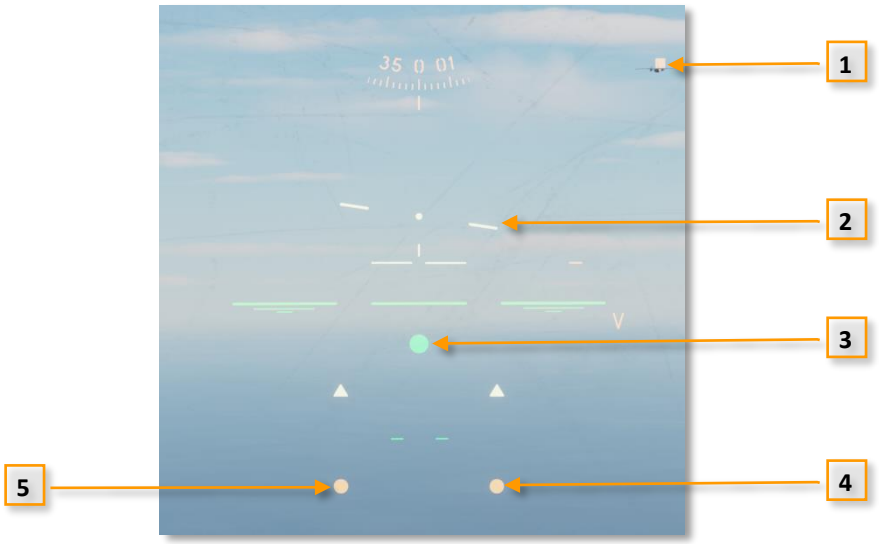


Figure 7-1 Sight Symbology with a Locked Target within Launch Parameters

1 TARGET RETICLE
2 RADAR COMMAND RETICLE
3 MISSILE WITHIN FIRING ZONE
4 RIGHT MISSILE LOCKED ON
5 LEFT OR FUSELAGE MISSILE LOCKED ON

When a target is locked, the target reticle shows the target position projection in the sight.

The radar command reticle provides command indications for the target interception and break-away.

The green circle indicates the missile is within firing range. A steady red circle indicates the launching parameters have been exceeded: excessive roll (> 80°), G-factor (< -1 or > 4) or negative pitch below 8000 ft. A flashing red circle indicates distance is too short for firing (< 500 m).

Green and red circles are incompatible.

7.1 AIR-TO-AIR GUNS

- ARMAMENT MASTER SWITCH – ON
    - AIR-TO-AIR GUNS PUSHBUTTON – PUSH or
    - (C + M or SW) R BUTTON – PUSH
    - CANNON 300-600M AND MISSILE LOCK/UNLOCK BUTTON – PUSH (optional)
- SIGHT SELECTOR – NORMAL
- GUN BUTTON - PRESS

7.2 MATRA R550 OR SIDEWINDER

- "EXT" SWITCH – ON (FORWARD) (2 minutes before launching)
- ARMAMENT MASTER SWITCH – ON
    - LEFT OR RIGHT MATRA R550 OR SIDEWINDER MISSILE PUSHBUTTON – PUSH or
    - (C + M or SW) R BUTTON – PUSH
- SIGHT SELECTOR – NORMAL
- AIM TOWARDS THE TARGET, ADQUIRE THE LOCK TONE AND GET WITHIN RANGE
- BOMBS, ROCKETS, MISSILES AND SIGHT RECORDER BUTTON - PRESS

7.3 MATRA R530 OR MATRA S530F

- ARMAMENT MASTER SWITCH – ON
- LEFT OR FUSELAGE OR RIGHT MATRA R530 MISSILE PUSHBUTTON – PUSH
- SIGHT SELECTOR – NORMAL
- LOCK THE TARGET
- FOLLOW INTERCEPTION COMMANDS
- BOMBS, ROCKETS, MISSILES AND SIGHT RECORDER BUTTON – PRESS WHEN WITHIN LAUNCH PARAMETERS (GREEN CIRCLE IN THE SIGHT)

7.4 AIR-TO-GROUND GUNS

- ARMAMENT MASTER SWITCH – ON
- AIR-TO-GROUND GUNS OR ROCKETS PUSHBUTTON – PUSH
- SIGHT SELECTOR – NORMAL
- GUN BUTTON - PRESS

7.5 ROCKETS

- ARMAMENT MASTER SWITCH – ON
- AIR-TO-GROUND GUNS OR ROCKETS PUSHBUTTON – PUSH
- SINGLE/SALVO SELECTOR – AS REQUIRED
- BOMB/ROCKET SELECTOR – AS REQUIRED (INNER, OUTER OR ALL PYLONS)
- SIGHT SELECTOR – NORMAL
- BOMBS, ROCKETS, MISSILES AND SIGHT RECORDER BUTTON – PRESS

7.6 BOMBS

- ARMAMENT MASTER SWITCH – ON
- WING OR FUSELAGE BOMBS PUSHBUTTON – PUSH
- SINGLE/SALVO SELECTOR – AS REQUIRED
- BOMB/ROCKET SELECTOR – AS REQUIRED (INNER, OUTER OR ALL PYLONS)
- INSTANTANEOUS/DELAY/SAFE SELECTOR SWITCH – AS REQUIRED (INSTANTANEOUS OR DELAY)
- SIGHT SELECTOR – NORMAL
- BOMBS, ROCKETS, MISSILES AND SIGHT RECORDER BUTTON – PRESS

7.7 Depression Angle Tables

Depression angle examples employing MATRA F4 rocket launchers and SAMP 250 LD bombs with a weight of 11000 Kg in a dive at various speeds (KIAS) and angles (°). The height is above target elevation.

The maximum depression that can be set is 218 mrad. Therefore, when the required depression is higher than 218 mrad, use the bottom diamond of the reticle, knowing that the diameter of the reticle is 20 mrad (bottom diamond is 10 mrad below the pipper).

Example: if the required depression is 220 mrad, set 210 mrad and use the bottom diamond as aiming reference (210 mrad + 10 mrad = 220 mrad).

MATRA F4	
11000 Kg 320 KTS DIVE -10°	
HEIGHT (ft)	**DEPRESSION ANGLE (mrad)**
1000	60
1500	65
2000	75
3000	85
4000	105
5000	120
6000	140

MATRA F4	
11000 Kg 420 KTS DIVE -10°	
HEIGHT (ft)	DEPRESSION ANGLE (mrad)
1000	40
1500	50
2000	55
3000	70
4000	90
5000	105
6000	125

MATRA F4	
11000 Kg 450 KTS DIVE -10°	
HEIGHT (ft)	DEPRESSION ANGLE (mrad)
1000	40
1500	50
2000	55
3000	65
4000	85
5000	100
6000	115

MATRA F4	
11000 Kg 400 KTS DIVE -15°	
HEIGHT (ft)	DEPRESSION ANGLE (mrad)
1000	50
1500	55
2000	55
3000	65
4000	75
5000	90
6000	100

MATRA F4	
11000 Kg 450 KTS DIVE -15°	
HEIGHT (ft)	DEPRESSION ANGLE (mrad)
1000	45
1500	45
2000	45
3000	55
4000	70
5000	85
6000	95

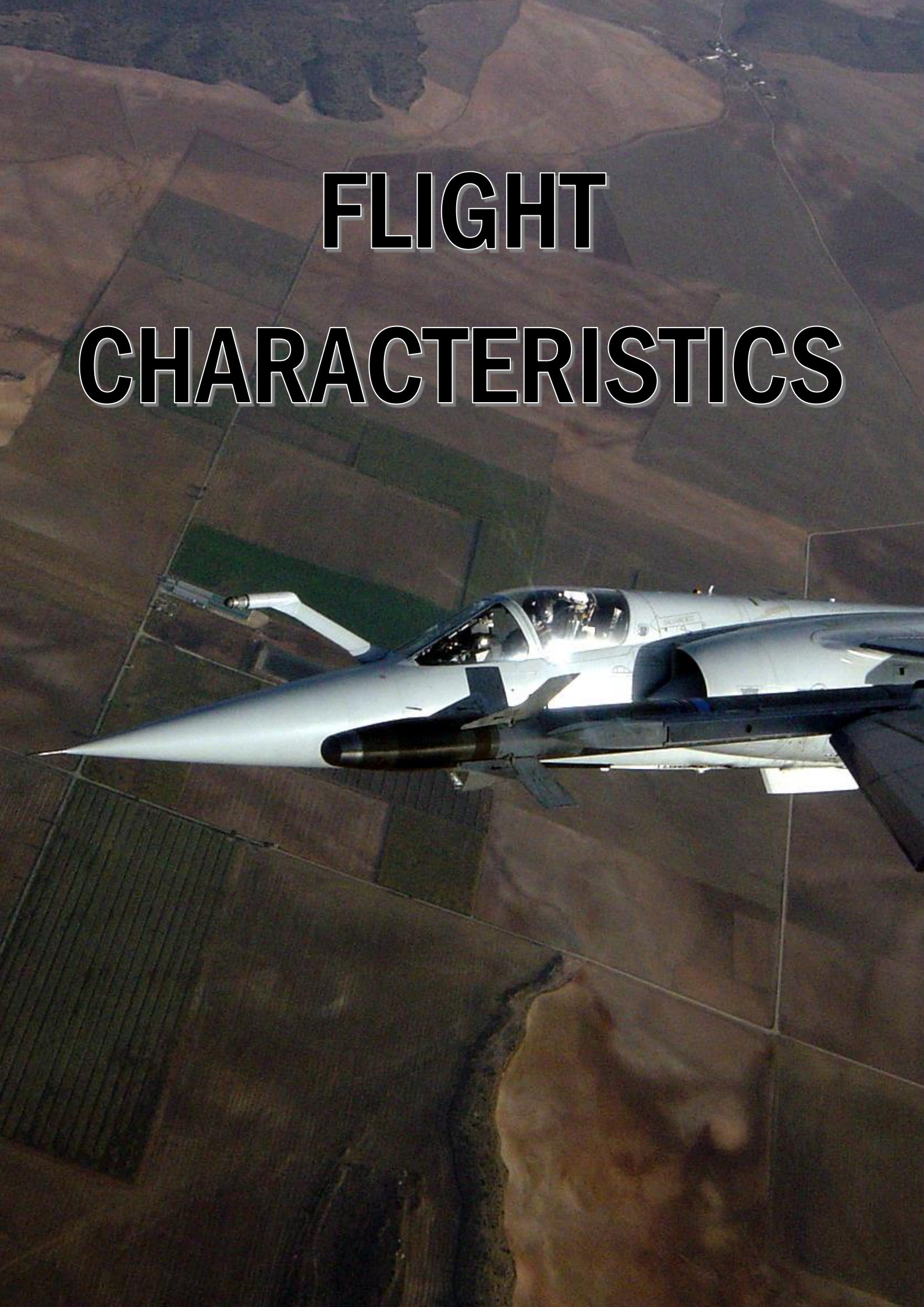
SAMP 250 LD BOMBS	
11000 Kg 400 KTS DIVE -10°	
HEIGHT (ft)	DEPRESSION ANGLE (mrad)
1000	145
1500	185
2000	215

SAMP 250 LD BOMBS	
11000 Kg 500 KTS DIVE -10°	
HEIGHT (ft)	DEPRESSION ANGLE (mrad)
1000	100
1500	125
2000	150
3000	185
4000	220

SAMP 250 LD BOMBS	
11000 Kg 420 KTS DIVE -20°	
HEIGHT (ft)	DEPRESSION ANGLE (mrad)
1000	110
1500	130
2000	155
3000	185
4000	215

SAMP 250 LD BOMBS	
11000 Kg 500 KTS DIVE -20°	
HEIGHT (ft)	DEPRESSION ANGLE (mrad)
1000	80
1500	100
2000	115
3000	145
4000	170

FLIGHT CHARACTERISTICS



8. FLIGHT CHARACTERISTICS

Rolling the aircraft at high incidence (angle of attack), induces a sideslip and turn reversal that can even end up in a spin.

The pilot should relax the pressure on the control stick when there is a tendency to refuse to turn.

Turns at high angle of attack should be done with rudder only, and avoid using the roll control as much as possible.

Spin recovery procedure:

- Release the control stick and rudder pedals
- Cut power
- Retract airbrakes
- Roll out
- Start pulling out above 200 kt IAS

Flat spin recovery procedure:

- Release the control stick (pitch and roll neutral)
- Cut power
- Retract airbrakes
- Apply full rudder opposite to the direction of the aircraft nose movement on the landscape
- Roll out
- Start pulling out above 200 kt IAS
- Restart engine if required

Both pitch and roll are sensitive in this aircraft. This effect is increased in the simulation when using conventional joysticks available in the market. The real control stick is usually longer than most joysticks, and the force applied in the real stick, which can be near 20 Kg at full deflection with Arthur in "high ratio" configuration, can be hardly reproduced in a joystick.

For this reason, the user might consider using the control input curves available in DCS options.

ANNEX I

MIRAGE F1 EE

9. ANNEX I MIRAGE F1 EE

9.1 INTRODUCTION

The Mirage F1 EE is the export version of the Mirage F1E for Spain, 22 were built.

Those 22 Mirage F1EE (C.14-52 to C.14-73), were delivered between February 1982 and April 1983, initially being assigned to the 462 Squadron at Gando. During the 90's all the Mirage F1 EE were stablished at the Ala 14 (14 Wing), Los Llanos Airbase (Albacete).

Better equipped than previous models, they had in-flight refuelling capability, an inertial navigation system, Cyrano IVM radar, Barax capacity and the ability to operate the Thomson-CSF TMV 018 Syrel electronic reconnaissance container (which requires the inertial system of the airplane to fulfil its functions).

In these aircraft the internal fuel capacity is less than that of the CE, 4,100 litres instead of 4,300, due to the space occupied by the inertial system and the refuelling equipment.

The standard Thomson-CSF BF RWR was replaced by a digitized system developed and manufactured in Spain, the AN/ALR-300, similar to the ALR-67 carried by the F/A-18.

Figure 9-1 Mirage F1 EE

The Mirage F1 EE has an internal fuel capacity of 4100 l (plus 3 external tanks of 1137 l of consumable fuel each). The fuel tanks arrangement and capacities are described in the picture below.

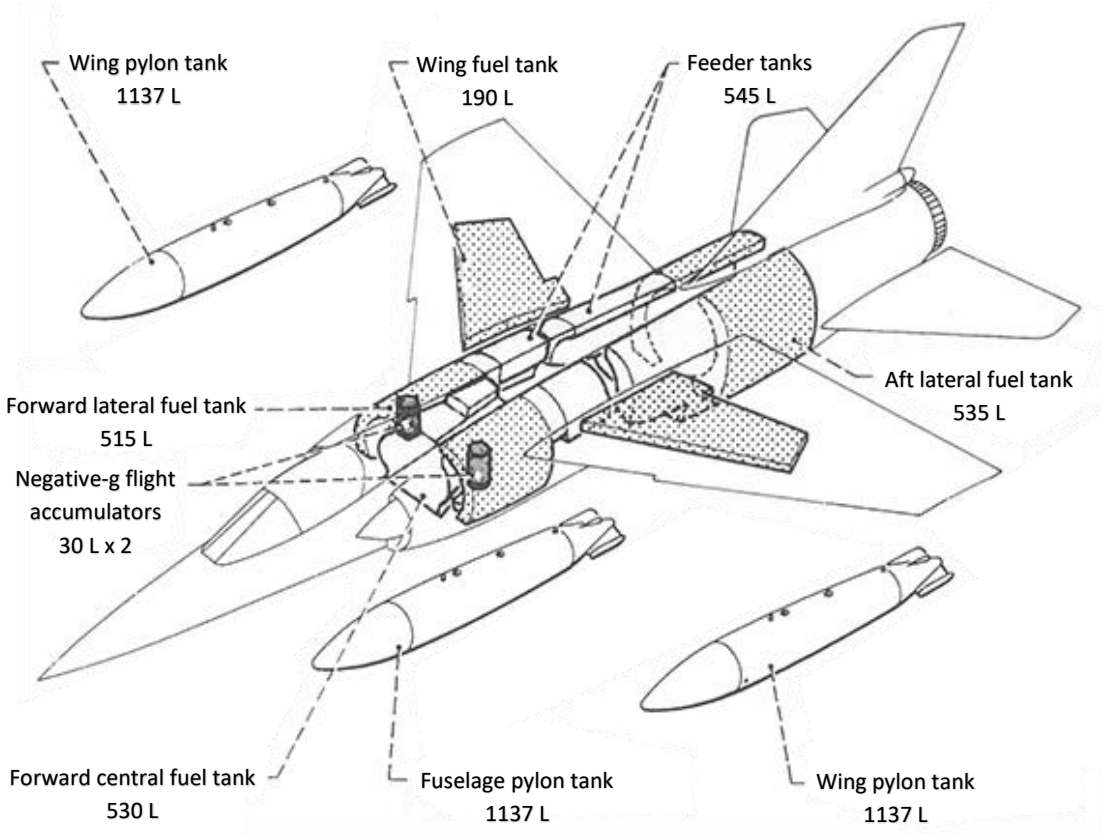


Figure 9-2 Fuel Tank Arrangement

9.2 COCKPIT CONTROLS AND INDICATORS

Even though the Mirage F1 EE shares most of the systems with the Mirage F1 CE, it presents a different cockpit arrangement.

These are the systems that differ from the Mirage F1 CE:

- Inertial Navigation System (INS)
- Navigation Indicator (IDN)
- Aerial Refuelling System
- Radar Warning Receiver AN/ALR-300
    - UCC (Cockpit Control Unit)
    - IA (Azimuth Indicator)

Their location in the cockpit is highlighted in the images below with orange diamonds.

Similarly, the location of the most relevant instruments and switches that present a different cockpit arrangement is highlighted with yellow diamonds.

	Location of systems that differ from Mirage F1 CE
	Location of instruments and switches that present a different arrangement from Mirage F1 CE

Figure 9-3 Main Instrument Panel

1 RWR UCC (COCKPIT CONTROL UNIT) *2 RWR IA (AZIMUTH INDICATOR)* *3 IDN (NAVIGATION INDICATOR)* *4 SHOCK-CONE CONTROL SWITCH AND PUSHBUTTON* *5 NOSE WHEEL STEERING SWITCH AND HIGH SENSITIVITY BUTTON* *6 FUEL TRANSFER AND FUEL REMAINING INDICATORS* *7 CROSSFEED SWITCH, EMERGENCY TRANSFER SWITCH AND FUEL TRANSFER SEQUENCE SELECTOR SWITCH*	*8 CONFIGURATION INDICATOR* *9 RADAR SELECTOR AND RADAR EMERGENCY TRANSMITTING BUTTON* *10 RADAR INDICATOR SCOPE CONTROL BOX* *11 SHOCK-CONE POSITION INDICATOR* *12 SLAVER ALTIMETER AND MACH/AIRSPEED INDICATOR* *13 VERTICAL SPEED INDICATOR*

Figure 9-4 Left Side Panel

1 AERIAL REFUELLING SYSTEM TRANSFER/FILLING SWITCH *2 FUEL PUMPS SWITCHES, IGNITION/VENTILATION SELECTOR AND START BUTTON* *3 INTERIOR LIGHTING CONTROL UNIT*	*4 IN-FLIGHT RELIGHT BUTTON* *5 ANTI-SKID (SPAD) SWITCH* *6 JPT EMERGENCY REGULATION SWITCH AND A/B MAIN COCK SWITCH* *7 UHF RADIO CONTROL UNIT*

Figure 9-5 Right Side Panel

1 INERTIAL NAVIGATION SYSTEM *2 ARMAMENT PANEL AND ASSOCIATED CONTROLS* *3 RAM AIR SWITCH* *4 HEADING SELECTION, OMNIBEARING SELECTOR AND TACAN, VOR/ILS CONTROLS*	*5 DEMIST SWITCH* *6 OXYGEN INDICATOR* *7 HEADING CONTROL UNIT* *8 AIR CONDITIONING AND PRESSURIZATION PANEL*

9.3 INERTIAL NAVIGATION SYSTEM

Description

The Inertial Navigation System (INS) is an autonomous navigation system that is composed mainly of three gyroscopes, three accelerometers, a platform, three servomotors and a computer.

The principle of operation consists in measuring the aircraft acceleration, integrating that signal to get its velocity and integrating the latter in turn to get the distance travelled by said aircraft.

To get all this, we need a stable and horizontal platform (that is, constantly perpendicular to the aircraft current position in relation to the Earth) and to know the initial position.

The INS platform incorporates three orthogonal gyroscopes and three orthogonal accelerometers, that means, perpendicular to each other, in the three coordinate axis. It also incorporates three orthogonal servomotors that stabilize the platform according to the feedback signal from the gyroscopes.

The INS is able to know by itself the latitude it is at, since it detects the vertical and horizontal components of the earth rotation vector. Nevertheless, it can't know the longitude; therefore, in order to align the INS once it is switched on, it needs to be fed with the initial position.

The initial position can be the last memorized position or it can be also introduced manually.

The INS suffers drift due to measurement errors that accumulate with time. This means that the current position must be updated from time to time. This is done in the INS of the Mirage F1 EE with the vertical designation button (⊥), pressing it when overflying a waypoint acquired visually (landmark) or, for example, using a TACAN, when we know the geographic coordinates and the polar coordinates from the TACAN station (radial and distance) of a certain waypoint, which must be previously memorized in the list of waypoints.

The PCN (Navigation Control Panel, "poste de commande navigation" in French) is powered by the emergency AC system.

The INU (Inertial Navigation Unit) is supplied by the AC system 1. In case of failure of both alternators, the INU is powered by a converter powered by the DC main system.

Operation envelope in navigation mode:

Altitude	0 to 70,000 ft
Ground speed	0 to 1,800 kt
Latitude	No limitation
Attitude angle	

Depending on operational requirements, there are three possible alignment processes differing in the time it takes to align and the performance subsequently obtained in navigation:

- ALN: Normal alignment. It takes 8 min, providing the best performance.
- ALCM: Alignment with memorized heading. It takes 1.5 min, allowing a take-off on alert if the aircraft has not been moved since last shut down of the system.

- ALR: Rapid alignment. It takes 3.5 min, providing a fast alignment but with worse performance than the previous ones.

The gyromagnetic system provides heading information to the INS in ALR and ALN modes to allow a faster alignment. It is therefore recommended to start the gyroscopic system before starting the INS for this reason.

Operation

To energize the INS set the modes selector from AR (arret, off) into VEI (veille, standby). This mode permits data entering.

If the aircraft was not moved while the INU was off, and the accumulated error at the end of the previous flight was low, then the last memorized position can be used to align it. Set the modes selector in ALN for a normal alignment process. ALCM or ALR can be used as well for a rapid alignment sequence.

Select PP in the parameters selector, the initial position used for the alignment will be the one shown in the PCN display. Press * button to start the alignment.

Set STS with the parameters selector, the PCN display will show a counter that represents the percentage of the alignment that has been completed. ALIGN will blink and illuminate steady when the counter reaches 720, that means that the precision provided is enough and the INS can be set to NAV. Nevertheless, a full alignment is accomplished when the counter reaches 999. PRET (ready) illuminates.

Set the modes selector to NAV once the alignment has been completed.

If there are waypoints created in the Mission Editor, they will appear memorized in the waypoints list. There are 9 waypoints. Use the waypoints selecting wheel to cycle them.

NOTE: Waypoints in the INS go from 1 to 9, therefore waypoint 0 in the Mission Editor corresponds to waypoint 1 in the INS, and so on.

To proceed to a waypoint, press the * button. The display will show VERS (towards) and the waypoint number.

To see the distance to a waypoint, select it with the waypoints selecting wheel, press * button ("go to" button) and select ΔL/ΔG with the parameters selector.

To create a waypoint, move the waypoints selecting wheel to the desired waypoint, enter the waypoint coordinates, press INSER after entering latitude and press again INSER after entering longitude.

NOTE: Waypoints are represented in degrees, minutes and tenths of minutes.

Example:

To enter Kobuleti coordinates (41°56'N 41°52'E) into waypoint 3 and show the distance to it:

- Select 3 with the selecting wheel, press the following buttons in sequence: N 4 1 5 6 0 INSER E 4 1 5 2 0 INSER.
- The waypoint will get memorized.
- Press * button to go to that waypoint.
- Select ΔL/ΔG to show the distance to that waypoint.

To align with the current position, instead of the memorized position, select the current position waypoint with the waypoints selecting wheel. If the current position is not memorized in one of the waypoints from the waypoints list, then it will have to be created, see waypoint creation above. Select POS with the parameters selector, the current position coordinates will be shown in the PCN display. Select ALN. Press * button.

To update the INS position in-flight, select the waypoint corresponding to a known landmark or waypoint with the waypoints selecting wheel, or create it if it was not already memorized, and then select it. When overflying the said landmark or waypoint, press the vertical designation button (⊥) and then VALID button to validate the coordinates (that can be checked selecting POS). The update can be cancelled pressing CLR button instead of the illuminated VALID button.

After pressing the vertical designation button (⊥) and before validating the coordinates, the accumulated error of the system up to that point should be checked by selecting ΔL/ΔG with the parameters selector.

To navigate to a waypoint, select the waypoint with the selecting wheel and press the * button in the PCN. Then move the mode selector switch in the IDN to NAV N (see figure 9-8). The double needle will show the course towards the waypoint, and the distance will be displayed in the IDN distance window.

NOTE: INS initial position at mission start can be set in the Mission Editor as always correct or random. It is set by default as correct (YES option). See the picture below.

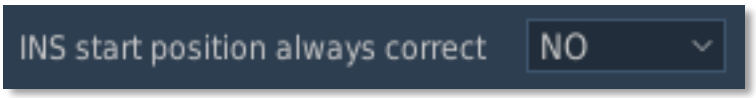


Figure 9-6 INS Option in Mission Editor

Controls and indicators

Modes selector:

AR: Off (arret).

VEI: Standby (veille).

CAL: Calibration (reserved for INU maintenance).

TEST: Test (reserved for INU maintenance).

ALCM: Fast alignment with memorized heading.

ALR: Rapid alignment.

ALN: normal alignment.

NAV: Normal navigation.

SEC: Emergency (“secours”) navigation.

Parameters selector:

ΔL/ΔG: The display shows distance to next waypoint in the left display (nothing is shown in the right display).

PP: The display shows present position.

VS/RT: The display shows ground speed/true heading.

POS: The display shows the position of the waypoint selected with the waypoints selecting wheel.

STS: Shows INU failures in the left window and the percentage of alignment time in the right window.

CDI: Shows INS codes and data. Position used to view or change the state of the INU.

Inertial system status lights:

	• Blinking: - In standby mode. - In the initial phase of the alignment. • Fixed: Last phase of the alignment (precision phase) in progress. • Off: Alignment complete
	Alignment complete.
	• Blinking: - In standby mode. - On "ALN", "ALR" or "ALCM" as long as "*" has not been pressed. - At the end of the INU self-test ("TEST" position of the mode selector). • Fixed: PCN failure or anomaly in information sharing.
  	• Fixed: - Operation of the INU on the protected 28 V DC bus. - When the mode selector is set to "SEC".

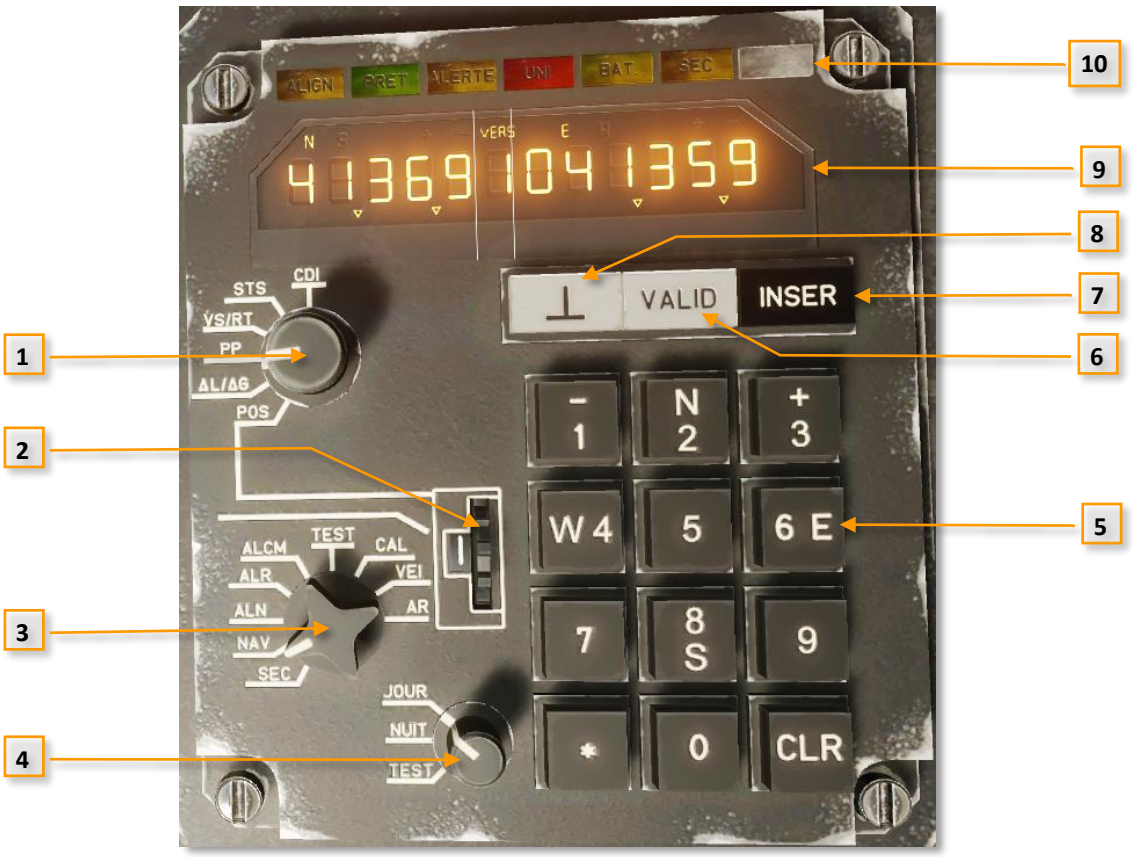


Figure 9-7 Navigation Control Panel (PCN)

1 PARAMETERS SELECTOR
2 WAYPOINTS SELECTING WHEEL
3 MODES SELECTOR
4 LIGHTS TEST AND BRIGHTNESS SELECTOR
5 DATA INTRODUCTION KEYBOARD
6 POSITION VALIDATION BUTTON
7 DATA INSERTION BUTTON
8 VERTICAL DESIGNATION BUTTON
9 DISPLAY WINDOWS
10 INS STATUS LIGHTS

9.4 NAVIGATION INDICATOR (IDN)

Description

The IDN in the Mirage F1 EE has some differences compared with the one installed in the Mirage F1 CE, though the operation is quite similar. It provides control and visualization functions for the autonomous navigation (inertial navigation) in addition to radio navigation.

The gyromagnetic/true IDN adding selector allows to show magnetic or true heading in the IDN compass rose.

The VOR/Radar narrow needle selector allows choosing the azimuth that will show the fine needle:

- Selector in "R": radar antenna azimuth
- selector in "V": VOR azimuth

The additional vector bearing/distance adjustment switch permits the selection of the additional vector.

This selection is only authorized in the positions:

- ρ: distance (from 0 to 359 NM)
- θ: bearing (true in NAV, magnetic in TACAN)

The distance or bearing coordinates are selected during adjustment by means of the wide needle and the distance counter.

The mode selector switch permits the selection of the operating mode.

The selected mode is indicated by the index: "NAV-N", "NAV-VA", "ρ", "θ", "RNAV-N" and "RNAV-VA".

Operation

Select the desired operating mode in the IDN.

The choice made of the IDN operating mode is summarized in the following table:

<table>
<tr><th>DISPLAY / MODE</th><th>"NAV-N"</th><th>"NAV-VA"</th><th>"ρ"</th><th>"θ"</th><th>"RNAV-N"</th><th>"RNAV-VA"</th></tr>
<tr><td>Rose</td><td colspan="2">Pilot selected heading</td><td colspan="2">Zeroized</td><td colspan="2">Pilot selected heading</td></tr>
<tr><td>Wide needle</td><td>Selected waypoint azimuth</td><td>NAV additional waypoint azimuth</td><td rowspan="2">Additional vector D display</td><td rowspan="2">Additional vector azimuth display</td><td>TACAN azimuth</td><td>TACAN additional point azimuth</td></tr>
<tr><td>Distance counter</td><td>D airplane - selected waypoint</td><td>D airplane - NAV additional waypoint</td><td>D airplane - TACAN station</td><td>D airplane - TACAN additional waypoint</td></tr>
<tr><td>Narrow needle</td><td colspan="6">Radar antenna azimuth (selector in “R”) or VOR azimuth (selector in “V”)</td></tr>
<tr><td>Heading bug</td><td colspan="6">Selected heading for autopilot</td></tr>
<tr><td>  Flag</td><td colspan="6">Compass rose function failure</td></tr>
<tr><td>  Flag</td><td colspan="6">Wide needle function failure</td></tr>
<tr><td>Distance counter flag</td><td colspan="2">IRS failure</td><td colspan="2">Flag hidden</td><td colspan="2">TACAN D failure</td></tr>
<tr><td>  Flag</td><td colspan="6">Narrow needle function failure</td></tr>
</table>

Controls and indicators

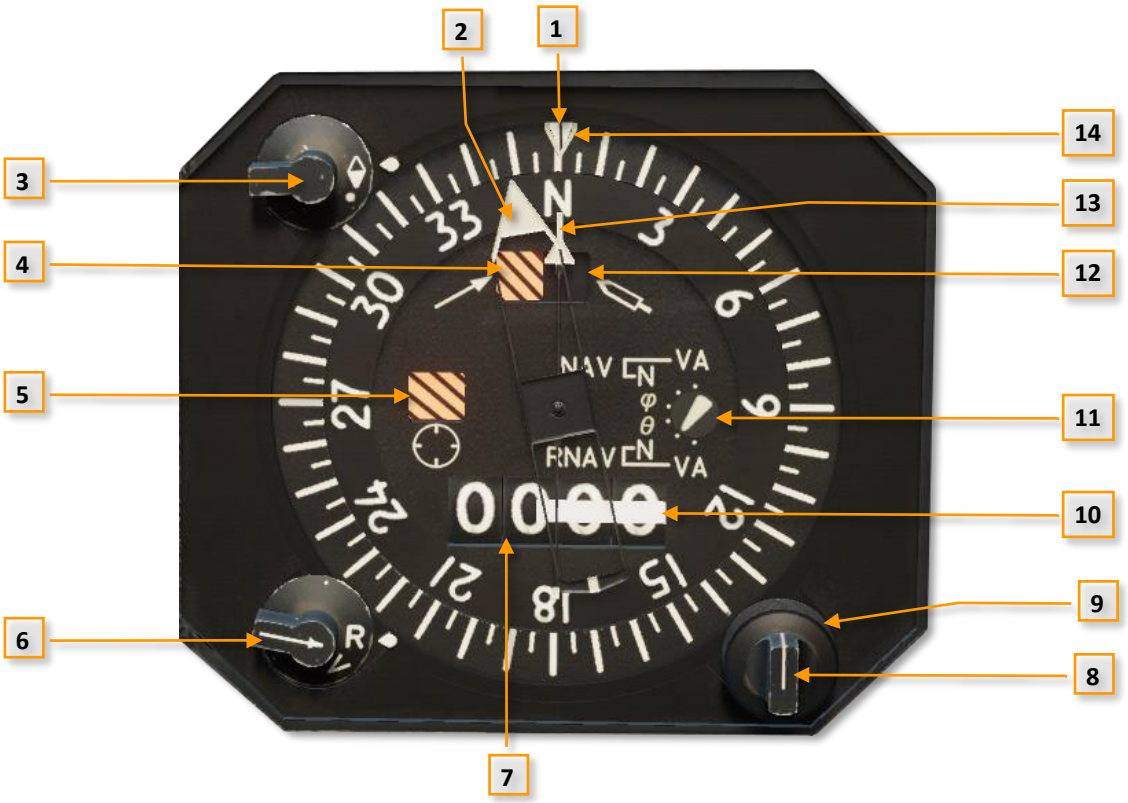


Figure 9-8 Navigation Indicator (IDN)

1 HEADING INDEX
2 WIDE NEEDLE
3 GYROMAGNETIC/TRUE IDN ADDING SELECTOR
4 NARROW NEEDLE FUNCTION FAILURE FLAG
5 COMPASS ROSE FUNCTION FAILURE FLAG
6 VOR/RADAR NARROW NEEDLE SELECTOR
7 DISTANCE COUNTER
8 ADDITIONAL VECTOR BEARING/DISTANCE ADJUSTMENT SWITCH
9 MODE SELECTOR SWITCH
10 DISTANCE COUNTER FAILURE FLAG
11 NAV-TACAN OPERATING MODE INDEX
12 WIDE NEEDLE FUNCTION FAILURE FLAG
13 NARROW NEEDLE
14 HEADING BUG

9.5 AERIAL REFUELLING SYSTEM

Description

In-flight refuelling is carried out by means of a probe fixed to the upper part of the forward fuselage nose.

It allows to completely fill the internal and external tanks.

Figure 9-9 Mirage F1 Aerial Refuelling

Operation

Switching on the refuelling system with the transfer/filling switch, the tanks depressurize and the fuel transfer indicator lights illuminate (see figure 9-11).

For safety reasons, the radar and TACAN must be switched off when refuelling.

This also reduces the load of the alternators at this critical air speed, preventing overheating of the alternators.

Once the refuelling is complete, the tanker will disconnect.

An amber light indicates the overflow of the feeder tanks escaping into the open air (not implemented). This light has two functions: jamming detection and feeder tank overflow. The second function operates only when the refuelling system is switched on.

A retractable headlight, located in the right air intake, allows refuelling at night. When the aerial refuelling light adjustment potentiometer is turned clockwise, out of the zero position detent, and the transfer/filling switch is on, the headlight extends and illuminates once it is fully extended.

Controls and indicators

Figure 9-10 Transfer/Filling Switch (guarded)

Figure 9-11 Fuel Transfer Indicator

Figure 9-12 Aerial Refuelling Light Adjustment Potentiometer in Left Console

Figure 9-13 Jammer Detection / Feeder Tanks Overflow Light

1 JAMMER DETECTION / FEEDER TANKS OVERFLOW LIGHT

9.6 AN/ALR-300

The ALR-300 V2 is the standard RWR (Radar Warning Receiver) in the Spanish Mirage F1 fleet since the modernization, it was incorporated into the Mirage F1 EE in the 90's.

The controls and indicators in the cockpit consist of an UCC (Unidad de Control de Cabina, Cockpit Control Unit) and an IA (Indicador de Acimut, Azimuth Indicator), located on the top left of the instrument panel, a test button next to the IA and a power switch located on the front part of the right console.

In the IA, a rheostat allows to regulate its brightness. Outer marks every 30° allow the pilot to have an approximate idea of the direction of the arriving signal.

Figure 9-14 IA

The UCC has five korries available whose function are as follows:

- CURS (CURSOR): Provides more accurate information on the status of the threat. When pressed, threat symbols on the screen are represented with four (4) alphanumeric symbols, indicating the status of the threat. The upper two digits are the same as in normal display, the lower ones can be: SC (Search), LO (Lock on), PD (Pulse Doppler) or CW (Continuous Wave) illumination. It starts with the priority threat and changes to the following ones in priority order with each successive press of the korry.
- REG (RECORDING): allows the recording of the parameters of the threats on the screen. The parameters recorded are: frequency, PRF, PW (signal intensity), sector, etc.). When pressed, the symbols turn into reverse video (the green symbol is replaced by a green square with the symbol in black inside). When 90% of the memory is used symbols blink slowly, and rapidly when 100% is used.
- AMEN ELIM (THREAT REMOVAL): leaves the five (5) threats considered most dangerous on the screen. If the criterion changes, the substitute appears and the warning AMENAZA (THREAT) is heard again.
- TONO ELIM (TONE REMOVAL): removes the voice messages that come along with the appearance of threats. Threat ("PRF") tones are still heard.
- EXPL ELIM (SCAN REMOVAL): deletes from the screen the radars classified as scanning.

Figure 9-15 UCC

The system can represent up to sixteen (16) threats simultaneously, classified by danger index out of the 100 included in the library. Unknown threats are depicted with an “U”.

Azimuth accuracy is better than 12° RMS (Root Mean Square).

C/D band threats have no azimuth and are placed in the center circle.

The more critical a threat is considered (received signal strength criteria and parameters entered in the library), the more towards the outside of the screen they are placed, giving a rough idea of the distance at which it is located and also providing a better indication of the arrival angle.

Placement of threats in concentric circles:

- EXT3: MISSILES (screen border)
- EXT2: CANNONS
- EXT1: LOCK-ON
- INT: SCANNINGS AND ACQUISITIONS

The equipment provides sound warnings associated with the threats that are the PRF, accompanied by the following voices:

- ALERTA (ALERT): sounds when a track is detected.
- AMENAZA (THREAT): sounds when a new threat, that is not an airplane or gun, is detected.
- AVIÓN (AIRPLANE): sounds when an airplane is detected.
- MISIL (MISSILE): sounds when a missile launch is detected.
- CAÑÓN (CANNON): sounds when a radar linked to a gun (on ground or see) is detected.

When pressing the test button the test is launched and the result is shown in the center of the screen. It can show O, L or T:

- O: OK
- L: Limited
- T: Fail

The pictures below correspond to the test button (located in the lower left corner of the IA), and the display that is shown when the test button is kept pressed.

Figure 9-16 RWR Test Button

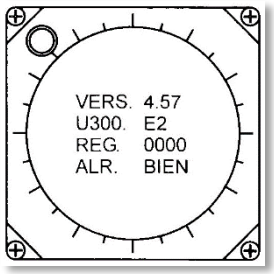


Figure 9-17 Test Result

When the UCC korries are pressed the indications are as shown in the picture below. ELIM illuminates in yellow color under TONO, EXPL and AMEN. And REG and CURS illuminate in green color. The TONO, EXPL and AMEN green part is always on.

In the case of AMEN, if it's clicked and more than 5 threats are locking your airplane, then the ELIM light flashes.

In the case of EXPL, if it's clicked and at least 1 search radar is painting your aircraft, ELIM light flashes.

In the case of TONO, ELIM light illuminates steady if pressed and only deletes voice warnings, not PRF tones.

Figure 9-18 UCC Indications with Korries Pressed

Figure 9-19 UCC Indications with Korries Not Pressed

The type of RWR installed in the Mirage F1 EE, ALR-300 or BF, can be selected in the Mission Editor. See the picture below.

Figure 9-20 Mirage F1 EE RWR Type Selection in Mission Editor

ALR-300 voice messages can be set in Spanish, French or English in DCS special options of the Mirage F1. When NO CHANGE is selected, the language is determined by the Avionics Language option. With Native option selected, the language is set to French for any other country than Spain. See the picture below.

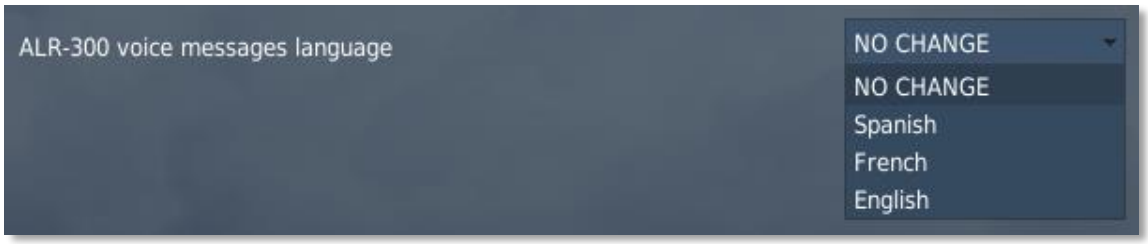


Figure 9-21 ALR-300 Voice Messages Language Option in DCS Special Options

Voice Message System can be disabled in DCS special options of the Mirage F1. See the picture below.

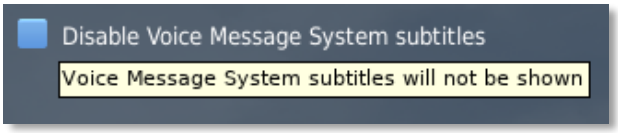


Figure 9-22 Disable VMS in DCS Special Options

IA symbology when expanded mode is in use (CURS):

	F1 SC	Steady	Mirage F1 radar Scanning Low threat
	15 SC	Steady	SA-15 SAM sys. radar Scanning Low threat
	U SC	Steady	Unknown radar Scanning Low threat
	F1 LO	Flashing	Mirage F1 radar Lock-on Medium threat
	15 SC	Steady	SA-15 SAM sys. radar Scanning Low threat
	U SC	Steady	Unknown radar Scanning Low threat
	F1 CW	Flashing	Mirage F1 radar Missile launch High threat
	15 SC	Steady	SA-15 SAM sys. radar Scanning Low threat
	U SC	Steady	Unknown radar Scanning Low threat

ANNEX II

MIRAGE F1 BE

10.ANNEX II MIRAGE F1 BE

10.1 INTRODUCTION

The Mirage F1 BE is the two seater export variant of the Mirage F1 for Spain, with local designation CE.14A. Six were delivered between 1980 and 1981.

This annex describes the main differences between the Mirage F1 CE and the BE.

The front section of the fuselage is 30 cm longer than the C model, the empty weight is increased by 200 Kg, the internal fuel capacity is reduced to 3850 l, and it lacks internal cannons. All this is due to the extra seat and controls added, and to the replacement of the two Martin Baker ERM6 ejection seats with the Mk 10. It compensates the lost capacities with cannon pods and drop tanks.

The undercarriage wheelbase (with clean aircraft and fully loaded) is 4.87 m.

The main role of the rear pilot in the Mirage F1 BE is instruction, though he/she can be of real help to the front pilot manipulating the radar and providing additional situational awareness, which is really important in any flight, but specially in a combat environment.

Figure 10-1 Mirage F1 BE

When flying online, in a multiplayer session, two players can take advantage of the multicrew implementation. They can occupy the front and rear seats and take control, ask for control or share control of the aircraft.

When they share control, each pilot's inputs (flight stick, rudder and throttle) are summed algebraically.

The way that aircraft control priority options work is as follows:

- Pilot: When the user occupying the pilot seat presses the J key he will immediately get control of the aircraft. However, when the user occupying the instructor seat presses the J key, a window opens for the user occupying the pilot seat to accept or deny the request to get control of the aircraft.
- Instructor: When the user occupying the instructor seat presses the J key he will immediately get control of the aircraft. However, when the user occupying the pilot seat presses the J key, a window opens for the user occupying the instructor seat to accept or deny the request to get control of the aircraft.

- Ask always: When any of the users, occupying the pilot or the instructor seat, presses the J key, a window opens for the other user, occupying the other seat, to accept or deny the request to get control of the aircraft.
- Equally responsible: When any of the users, occupying the pilot or the instructor seat, presses the J key, he will immediately get control of the aircraft.

These options can be configured in the Mission Editor as shown in the image below.

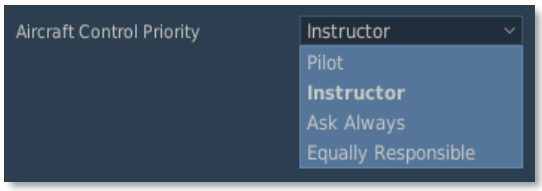


Figure 10-2 Mirage F1 BE

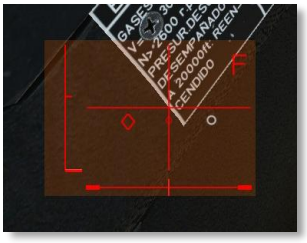
Additionally, both users can have control of the aircraft simultaneously using the Combined Flight Controls Mode, described below. In this case, as already mentioned above, each pilot's inputs (flight stick, rudder and throttle) are summed algebraically.

Combined Flight Controls Mode

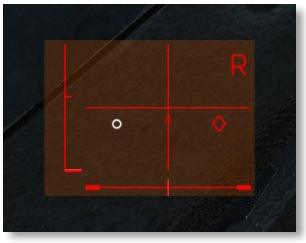
This mode permits both users to share control of the airplane at the same time. It sends the algebraic sum of flight controls positions from both seats to the Flight Model, with a limit of full travel. The way that front and rear throttle synchronization works is as follows: the last throttle moved for more than 10% of full range will take control.

This feature is optional, there is a command to toggle Combined Flight Controls Mode on and off. Only the pilot that has control of the aircraft at that moment can activate or deactivate this mode.

The Controls Indicator window has specific symbols displayed when the Combined Flight Controls Mode is enabled (The “C” letter is displayed when Combined Flight Controls Mode is enabled). This, together with a “Priority Seat” indication (“F” or “R” letters), helps to see what is going on with flight controls on both cockpits and who has control (“F” and “R” are always displayed, disregarding whether the mode is enabled or not).

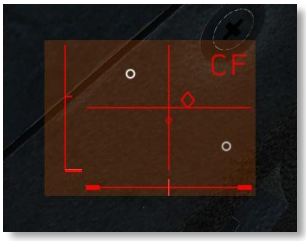


FORWARD PILOT PRIORITY



REAR PILOT PRIORITY

Figure 10-3 Front Pilot’s Controls Indicator Window with Combined Flight Controls Mode disabled



SHARED PRIORITY

Figure 10-4 Front Pilot’s Controls Indicator Window with Combined Flight Controls Mode enabled

Symbology	
C	Combined Flight Controls Mode enabled
F	Forward pilot priority
R	Rear pilot priority
White circle	Own control position
Grey circle	Other pilot’s control position
Red diamond	Combined or real control position

Figure 10-5 Label shown when Combined Flight Controls Mode is activated

The fuel tanks arrangement and capacities are described in the picture below.

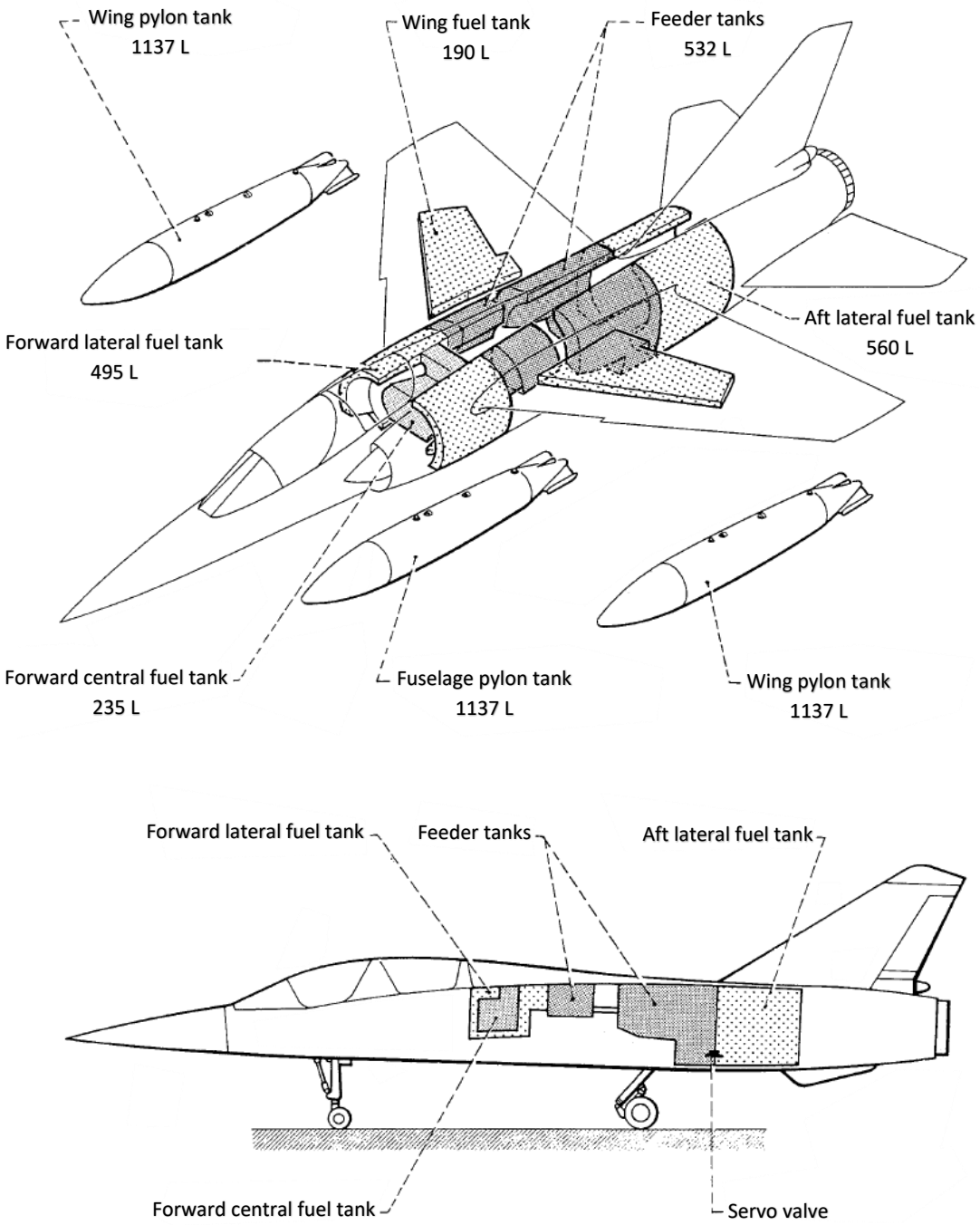


Figure 10-6 Fuel Tank Arrangement

10.2 COCKPIT CONTROLS AND INDICATORS

The systems in the Mirage F1 BE front cockpit present an arrangement similar to that of the Mirage F1 CE, with the exception of the selector unit, which purpose is to provide priority to the front or rear cockpit over several systems (radio, navigation and radar).

The rear cockpit includes a few additional systems while others are absent, and several present a different arrangement or are just repeaters of the front cockpit.

The landing gear, flaps, throttle and brake chute levers in both cockpits are mechanically linked to each other.

Their location in the cockpit is highlighted in the images below with orange diamonds.

Similarly, the location of some relevant instruments and switches that present a different cockpit arrangement is highlighted with yellow diamonds.

	Location of systems that differ from Mirage F1 CE
	Location of instruments and switches that present a different arrangement from Mirage F1 CE

Figure 10-7 Front Cockpit Main Instrument Panel

1 TV CAMERA

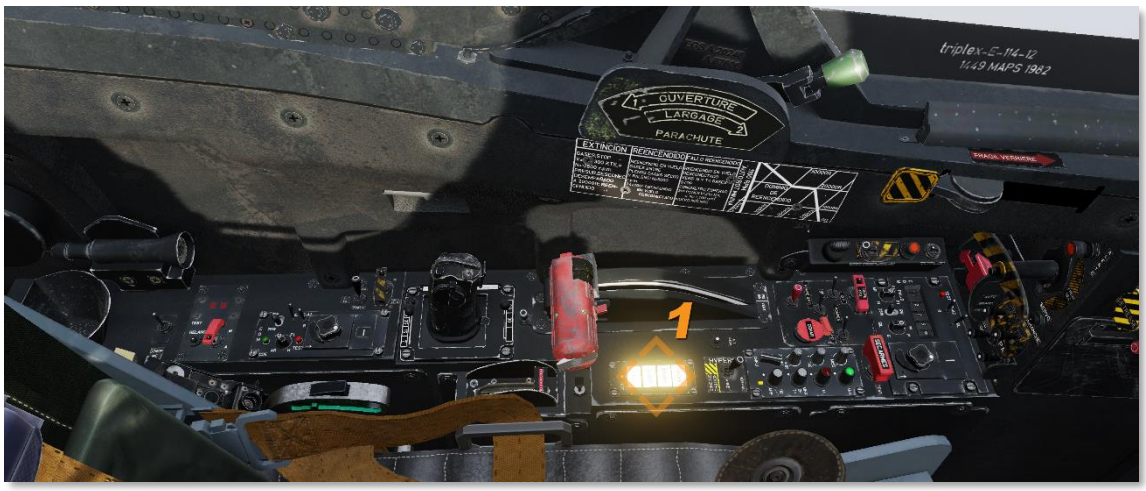


Figure 10-8 Front Cockpit Left Side Panel

1 SELECTOR UNIT

Figure 10-9 Front Cockpit Right Side Panel

Figure 10-10 Rear Cockpit Main Instrument Panel

1 SIGHT REPEATER	*4 SIGHT REPEATER CONTROL PANEL*
2 SIGHT CAMERA	*5 FUSELAGE INDICATORS SELECTED LIGHT*
3 ARMAMENT MASTER REPEATER INDICATOR	*6 AUTOPILOT INDICATOR REPEATER UNIT*

Figure 10-11 Rear Cockpit Left Side Panel

1 HIGH-LIFT DEVICES PRIORITY SWITCH	*5 (C + M OR SW) R DESELECTION BUTTON*
2 SELECTOR UNIT	*6 ANTI-SKID (SPAD) SWITCH*
3 AIRBRAKE PRIORITY SWITCH	*7 LP MAIN COCK SWITCH*
4 EMERGENCY REGULATION PRIORITY SWITCH	*8 TRIM INDICATOR*

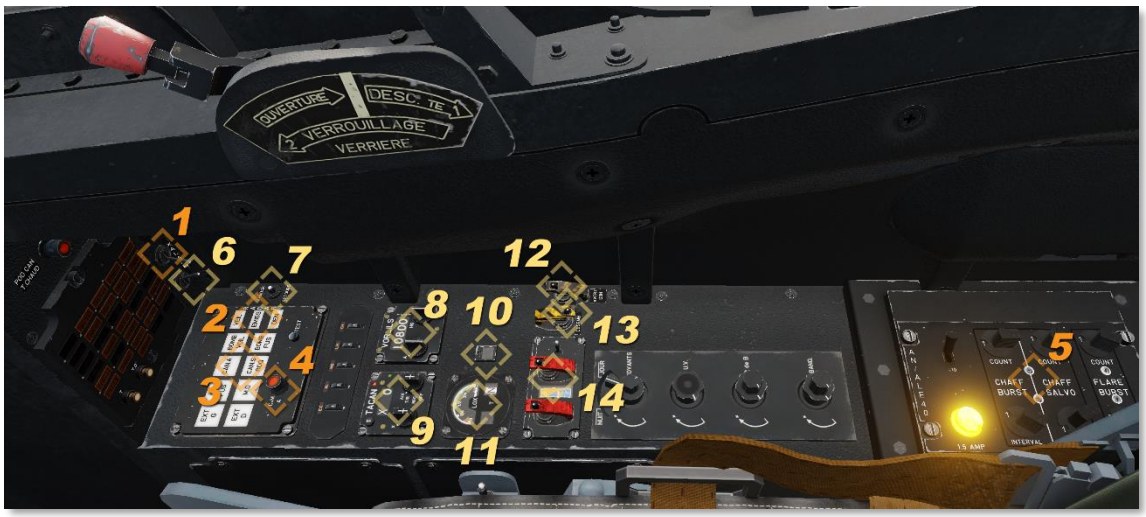


Figure 10-12 Rear Cockpit Right Side Panel

1 OXYGEN WARNING CUT-OFF SWITCH	*7 RADAR EMERGENCY TRANSMISSION BUTTON*
2 ARMAMENT REPEATER PANEL: RADAR SELECTION INDICATING LIGHTS	*8 VOR-ILS CONTROL UNIT*
	9 TACAN CONTROL UNIT
3 ARMAMENT REPEATER PANEL: ARMAMENT SELECTION INDICATING LIGHTS	*10 VOR/TACAN MODE REPEATER INDICATOR*
	11 OXYGEN INDICATOR
4 (C + M OR SW) R LIGHT	*12 WARNING HORN SWITCH*
5 AN/ALE-40 PROGRAMMER	*13 DEMIST SWITCH*
6 STANDBY HORIZON SWITCH	*14 AIR CONDITIONING CONTROL UNIT*

10.3 PRIORITY CONTROLS

Selector unit

The selector unit (or commutation unit), installed in both cockpits, permits either pilot to get control of the TACAN, the radar, the radios and the VOR/ILS systems. When depressing each of the pushbuttons the corresponding light illuminates, indicating that the transfer of that system's control has been achieved and, therefore, the cockpit with the illuminated pushbutton has control. To transfer control to the other cockpit, the pushbutton on the other cockpit has to be depressed.

When the aircraft is energized, priority is given automatically to the front cockpit.

NOTE: Mind that radio transmission and volume is controlled independently by the intercom of each cockpit.

Pushbuttons brightness is controlled with the day/night selector switch or with the light and panel lighting rheostat, when the first one is in the night position.

The selector unit includes the following controls:

- TACAN priority pushbutton: When depressed, the pushbutton illuminates and the corresponding cockpit takes control of the TACAN unit.
- RADAR priority pushbutton: When depressed, the pushbutton illuminates and the corresponding cockpit takes control of the radar.
- V/UHF priority pushbutton: When depressed, the pushbutton illuminates and the corresponding cockpit takes control of the radio. Note that the UHF radio (red radio) control panel is not installed in the rear cockpit, so that radio can't be set, though the pilot can transmit and receive through it using the intercom.
- V/ILS priority pushbutton: When depressed, the pushbutton illuminates and the corresponding cockpit takes control of the VOR/ILS unit.
- Commutation panel test button: tests pushbutton lights of that panel.

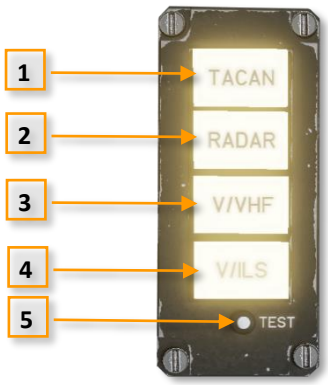


Figure 10-13 Selector Unit

1 TACAN PRIORITY PUSHBUTTON
2 RADAR PRIORITY PUSHBUTTON
3 V/UHF PRIORITY PUSHBUTTON
4 V/ILS PRIORITY PUSHBUTTON
5 COMMUTATION PANEL TEST BUTTON

High-lift devices priority switch

This switch, located in the rear cockpit, has three position: AR (arriere, rear), AV (avant, front) and RENT SEC (rentrée en secours, emergency retraction).

- AR: In this position, combat flaps/slats are controlled from the rear cockpit only.
- AV: The switch returns to this position when closing the guard. There is no control of auto-slats or combat flaps/slats from the rear cockpit.
- RENT SEC: Emergency retraction of flaps and slats.

Figure 10-14 High-Lift Devices Priority Switch and Guard

Airbrake priority switch

The airbrake priority switch (labelled AF), located in the rear cockpit, permits:

- With guard closed (switch in the forward position):
  - Extension of the airbrakes by any cockpit airbrakes control switch, provided that none of the airbrakes control switches is in the extended and locked position.
  - Their retraction, without any action on both airbrakes control switches, if none of the airbrakes control switches is in the extended and locked position.
- With guard open and switch in the aft position:
  - Retraction or extension, only by the rear airbrakes control switch, independently of the position of the front cockpit airbrakes control switch.
  - Retraction, without any action on the rear airbrakes control switch, independently of the position of the front cockpit airbrakes control switch.

Figure 10-15 Airbrake Priority Switch (Under Guard)

Emergency regulation priority switch

The engine emergency regulation priority switch in the rear cockpit has three position: ARR. (arriere, rear), neutral and ARRET (off).

- ARR.: Rear cockpit priority.
- Neutral: Front cockpit priority.
- ARRET: Emergency regulation to off on both cockpits.

Figure 10-16 Emergency Regulation Priority Switch and Guard

10.4 SIGHT REPEATER

Description

The sight repeater presents in the rear cockpit what the front pilot sees in his sight.

The sight in the front cockpit is recorded with a TV camera, and presented in the rear cockpit with a repeater TV in black and white.

The image is reflected in a mirror and presented to the pilot.

Controls

The sighr repeater includes the following controls:

- Brightness adjustment knob.
- Contrast adjustment knob.
- Color filter switch.
- Density filter switch.
- Power ON-OFF switch.

Figure 10-17 Sight Repeater Control Panel

1 BRIGHTNESS ADJUSTMENT KNOB
2 CONTRAST ADJUSTMENT KNOB
3 DENSITY FILTER SWITCH
4 ON-OFF SWITCH
5 COLOR FILTER SWITCH

10.5 SIGHT CAMERA

The camera records the front cockpit sight view; it is mounted in the rear cockpit in the two seater version. The recording starts when depressing the gun firing trigger or the bombs, rockets, missiles and sight recorder button. Not implemented in this simulation.

The sight camera includes the following controls and indicator:

- Day/night brightness switch for the film remaining indicator lights.
- Test button.
- Retard selection knob.
- Cartridge ejection button.
- Film remaining indicator lights.

Figure 10-18 Sight Camera

1 DAY/NIGHT BRIGHTNESS SWITCH
2 TEST BUTTON
3 RETARD SELECTION KNOB
4 EJECT BUTTON
5 FILM REMAINING INDICATOR LIGHTS

10.6 ARMAMENT REPEATER PANEL

Description

This panel includes a set of lights that illuminate when the corresponding weapon or radar mode is selected in the front cockpit.

The weapon modes are described in the armament panel section.

The radar modes are ARRET (off), VEIL (standby) and EMISS (transmission).

Lights brightness is controlled with the day/night selector switch or with the light and panel lighting rheostat, when the first one is in the night position.

Panel elements:

- Armament selection lights: illuminate when the corresponding weapon or radar mode is selected in the front cockpit.
- Radar lights: illuminate when the corresponding radar mode is selected.
- (C + M or SW) R light: see (C + M or SW) R light below.
- Lights test button: tests the panel lights, except the (C + M or SW) R light.

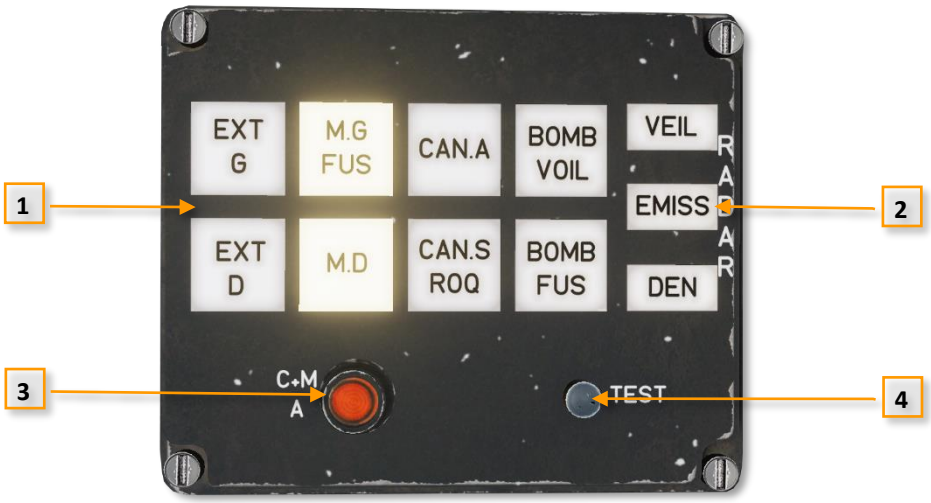


Figure 10-19 Armament Repeater Panel

1 ARMAMENT SELECTION LIGHTS
2 RADAR LIGHTS
3 (C + M OR SW) R LIGHT
4 LIGHTS TEST BUTTON

10.7 AUTOPILOT INDICATOR REPEATER UNIT

This panel is a repeater of the autopilot indications in the front cockpit.

It includes the following controls and indicators:

- Test button: tests the indicator lights.
- Indicator lights: these lights are repeaters of the front cockpit autopilot indications.
- Intensity control: this knob adjusts indicator lights brightness.

Figure 10-20 Autopilot Indicator Repeater Unit

1 TEST BUTTON
2 INDICATOR LIGHTS
3 INTENSITY CONTROL

10.8 ARMAMENT MASTER REPEATER INDICATOR

This indicator, located in the rear cockpit main instrument panel, shows:

- Green when the armament master switch in the front cockpit is set to OFF.
- Red when the armament master switch in the front cockpit is set to ON.

Figure 10-21 Armament Master Repeater Indicator

VOR/TACAN MODE REPEATER INDICATOR

This indicator, located in the rear cockpit right console, shows:

- VOR when the VOR-ILS/OFF/TACAN selector in the front cockpit is set to VOR-ILS.
- TAC when the VOR-ILS/OFF/TACAN selector in the front cockpit is set to TACAN.
- White when no mode is selected (VOR-ILS/OFF/TACAN selector in the front cockpit is set to 0).

Figure 10-22 VOR/TACAN Mode Repeater Indicator

10.9 MISCELLANEOUS SYSTEMS

Fuselage indicators selected light

When this blue light is on, it means that the front cockpit feeder tank / fuselage selector switch is in the F (fuselage) position.

Figure 10-23 Rear Fuel Gauge

1 FUSELAGE INDICATORS SELECTED LIGHT

Oxygen warning cut-off switch

This switch cancels the oxygen alarm that activates when there is no oxygen supply in the rear cockpit (rear pilot not breathing through the oxygen mask for a few seconds). It would be generally needed to set the switch to the cancel position in case of solo flight.

Figure 10-24 Oxygen Warning Cut-Off Switch

(C + M or SW) R light

This light, located in the rear cockpit armament repeater panel, illuminates when the (C + M or SW) R mode is selected.

Figure 10-25 (C + M or SW) R Light

(C + M OR SW) R deselection button

This button, located in the rear cockpit left console, has the same function as the (C + M or SW) R mode deselection switch in the front cockpit, commands deactivation of (C+ M or SW) R mode.

Figure 10-26 (C + M OR SW) R Deselection Button

Standby horizon and oxygen warning cut-off switches cover

This cover is used in solo flights to keep the standby horizon and the oxygen warning cut-off switches in the off (down) position.

The cover is spring-loaded to the close position. When it is fully open, it is held in the open position by a metallic piece with chess pawn shape, provided that both the standby horizon and the oxygen warning cut-off switches are in the off position, otherwise the cover will return to the close position once released due to the effect of the spring force.

Figure 10-27 Standby Horizon And Oxygen Warning Cut-Off Switches Cover Closed

Figure 10-28 Standby Horizon And Oxygen Warning Cut-Off Switches Cover Open

AN/ALE-40 PROGRAMMER

Description

The AN/ALE-40 programmer is located, in the Spanish versions of the Mirage F1, in the left part of the cockpit, immediately behind the ejection seat; except in the Mirage F1 BE that is located in the right console of the rear cockpit. It is the element that generates the launch signals after the pilot's action or from the orders sent by the BARAX.

The programmer contains six selectors that allow to establish the number of cartridges and the time interval, when launching with the selector in MULT or PRGM.

The programmer is divided into two sections, one corresponding to chaff and the other to flares.

The section that regulates the launch of chaff has four selectors, located on the left and central part of the programmer:

- First two allow to set the number of cartridges (1, 2, 3, 4, 6 or 8) to be launched and the interval in seconds (0.1, 0.2, 0.3, 0.4).
- The next two regulate the repetition of the previous process a number of times (1, 2, 4, 8 or C), being C continuous, spaced a time measured in seconds (1, 2, 3, 4, 5, 8, R), R corresponding to the random repetition of the interval (3, 5, 2 and 4 seconds).

The section corresponding to flares, with two selectors, allows a flare launch program (1, 2, 4, 8 or C) to be carried out using the first selector, spaced a certain number of seconds (3, 4, 6, 8, 10) using the second selector.

There is also an amber fuse on the front face of the programmer that indicates the status of the programmer.

In case the amber fuse is lit, but glowing with a low intensity light, the operation of the controller may be erroneous.

The chaff burst interval reduction switch permits to divide the chaff launch time by ten.

To access the AN/ALE-40 programmer panel in single seaters, press the “RCtrl + Num0” key combination to lock the snap view and then press “Num5”. The canopy should be open, the aircraft stopped on ground and the engine off to manipulate the panel. Press “RCtrl + Num0” again to go back to normal view. “LWin + Num5” shows a snap view of the panel.

Operation with the BARAX

The Mirage F1 allows the operation of the AN/ALE-40 slaved to the BARAX.

The launch of six cartridges of chaff separated by 0.1 s can be programmed during the emission time of the jammer or at the end of that time.

The launching of flares continues to be at pilot's will.

Nevertheless, this operation is not implemented in this simulation.

Controls and indicators

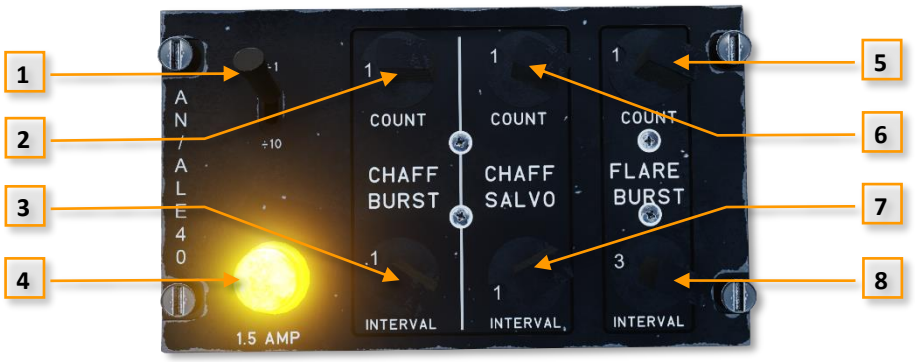


Figure 10-29 AN/ALE-40 Programmer

1 CHAFF BURST INTERVAL REDUCTION SWITCH
2 CHAFF BURST COUNT SELECTOR
3 CHAFF BURST INTERVAL SELECTOR
4 PROGRAMMER STATUS FUSE
5 FLARE BURST COUNT SELECTOR
6 CHAFF SALVO COUNT SELECTOR
7 CHAFF SALVO INTERVAL SELECTOR
8 FLARE BURST INTERVAL SELECTOR

Figure 10-30 AN/ALE-40 Programmer in a Single Seater Mirage F1

ANNEX III

SPECIAL EQUIPMENT

11.ANNEX III SPECIAL EQUIPMENT

11.1 BARAX RADAR JAMMER

Description

The BARAX system permits an active self-protection against ground or airborne fire-control radar threats. This is done by means of:

- The electromagnetic interdiction.
- The comparing and identification of the emitter.
- The threat jamming, based on an internal programmable library.

The installation consists of:

- A BARAX pod that can be installed in the left or right outboard hardpoints.
- A control unit located in the main instruments panel.

Operation

When switching on the system, state selector in the ON position, starts a warming period of around 150 seconds. The duration of this preheating period depends on the equipment temperature. The fail light will illuminate and will go out when the equipment is warm.

The test button tests exclusively the panel lights.

Lights intensity is controlled with the day/night selector switch and the light and panel lighting rheostat, located in the lighting control box.

The emission ready korry should be pressed to activate threats jamming. The system will emit when the airplane is being detected. AV will illuminate if the threat is in the front sector and AR will illuminate if it is in the rear sector.

The system test is performed by setting the state selector in the TEST position. An emission is sent with a duration of about 1 second, this is done from the 4 antennas sequentially. The following happens while the switch is in the TEST position:

- fail light keeps on.
- AV illuminates steady if the test was positive and blinks if it failed.

Figure 10-1 BARAX Pod

Controls

- State selector: this switch has three positions (OFF, ON, TEST).
- Light test (LIT.): this button is used to test the panel lights.
- Emission ready korry: press this pushbutton to activate threats jamming, the button keeps pressed, press it again to deactivate jamming. It includes the E, AV and AR indications.
- Intensity emission knob: this knob regulates the emission intensity. Not implemented in DCS.

Indications

- FAIL light: this light illuminates in amber color when there is a system fail, while warming the system or when the test light is pressed.
- E (Emission): this light illuminates in green color when the system is emitting.
- AV (front, “avant”): this light illuminates in amber color when our airplane is being detected from the front sector.
- AR (rear, “arrière”): this light illuminates in amber color when our airplane is being detected from the rear sector.

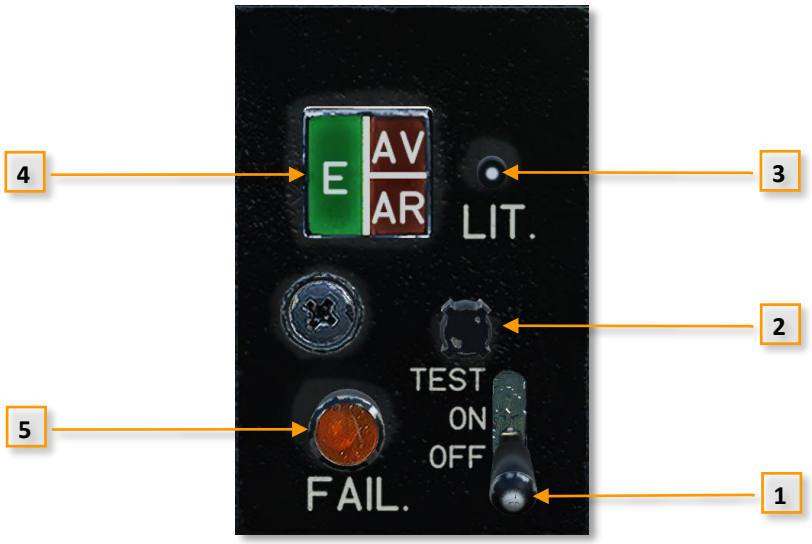


Figure 10-2 BARAX Control Unit

1 STATE SELECTOR
2 INTENSITY EMISSION KNOB
3 LIGHT TEST
4 EMISSION READY KORRY
5 FAIL LIGHT

CREDITS

12.CREDITS

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Testing:

Eagle Dynamics Testing Team and Closed Beta Testing Team

Mirage F1 photos:

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Ismael Jordá (www.ismaeljorda.com)

Music:

Nuell Martin

Liveries:

Aristide Woodley for Mirage F1 AZ liveries

LINKS

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