

*IndiaFoxtEcho*  
*VISUAL SIMULATIONS*

**M-346 MASTER**  
FOR MICROSOFT FLIGHT SIMULATOR



USER MANUAL

*User manual version 1.0.7*  
*Product version 1.0.7*  
*Release build compiled February 14<sup>th</sup> 2024*

## REVISION HISTORY

Version 1.0.7

14/02/2023

### MINOR UPDATE

- Improved Taxi/Landing light code
- Added support for IndiaFoxtEcho Companion Package
- Added AoA and VV tape indicators on HUD
- Added SEPK indication on HUD
- Fixed multiple bugs in Flight Director symbology
- FCS RESET will now actually reset the MSFS fly-by-wire ("Carefree" caption will show)
- Automatic trim is now linked to the landing gear lever and landing gear position, and it is disabled if gear is down (as in the real plane)
- FCS will revert to DIRECT LINK mode if airspeed is below 75 knots

Version 1.0.6

### WEAPONS!

### GENERAL UPDATE

- Added weapons models: AIM-9 and GBU-12 (non-Marketplace copies only)
- Fixed multiple modeling mistakes in canopy and added missing details
- Vastly increased canopy polycount
- Canopy retextured and fully remapped
- Fixed minor mistake in rear cockpit glareshield
- Fixed modeling and AO mistake in ejection seats, and improved textures
- Fixed Oxygen flag not working properly in rear cockpit
- Fixed pedal animation travel at high speeds
- Improved canopy scratches and reflections
- Added NWS functionality
- Fixed graphics on HUD bank scale
- Minor tweaks to HUD/VV alignment
- Fixed incorrect decal on 243 Emergency panel
- Minor fixes to M-346FA Camo livery
- Minor improvement to pylon launchers materials
- Engine control logic will not try auto-relight if there is no fuel

Version 1.0.5 – 28/05/2023

### 100 ANNI UPDATE

- Added special color for 100th Anniversary of Italian Air Force
- Fixed bug preventing ladders, wheelchocks and remove-before-flight ribbons to appear.
- Redone thumbnails for uniformity
- Added RSV patches to pilots
- Redone canopy animation to use native variables
- Added rear cockpit opening control
- Improved glass material rendering of digital displays
- Fixed bug in EMER / DEGR warning light visibility in rear cockpit
- Minor improvements on canopy sealing model
- Replaced code with default template on following components:
  - Landing gear
  - Parking Brake
  - Rudder Trim
  - Flaps Lever

Version 1.0.4 – 13/04/2023

### HELLENIC AIR FORCE UPDATE

- Added Hellenic Air Force Livery
- Fixed rendering of clock glass material
- Solved minor issues in HUD and HMD altitude text formatting for smaller digits
- Changed MTOW for M-346 to 9500 Kg (according to flight manual)
- Fixed minor glitch in glass texture
- Restored functionality of external center tank

### Version 1.0.3 – 21/01/2023

#### GENERAL UPDATE

- Reduced fly-by-wire autotrim reaction time
- Improvements to canopy geometry and polycount
- Fixed minor incorrect AO rendering in pilot left console
- Minor cleanup of external model polygons
- Fixed bug in automatic Pitot Heat activation
- Fixed bug causing HMD brightness to reset the LENG knob to IDLE/START
- Reworked left throttle mouse area for easier access to left panel switches
- Added HOTAS mouse areas for future implementation / modding
- Added "Airbrake" mouse area functionality
- FCS RESET button now resets all trim axes and FCC switch
- Fixed bug preventing PARS "RETARD" caption from showing correctly
- Fixed bug preventing PARS disconnection if stick in manually moved beyond 75% travel
- Added "100,000 hours" Italian Air Force special color
- Improved modeling of ATU module

### Version 1.0.2 – 7/12/2022

#### SU-11 UPDATE WITH SEPARATE M-346FA MODEL

- Fixed bug causing incorrect ejection seat safety interlocks
- If copilot is not present, plane ejection sequencer is now automatically set to "solo"
- M-346 and M-346FA models are now separated, like IRL wingtip rails cannot be mounted on M-346.
- Added M-346FA primer livery
- Draft implementation of Autopilot control on MFD-ADI mode
- Added COM/NAV/TACAN/IFF input on MFD-CNI mode
- Added COM/VOR/ILS/TACAN selection from list on MFD-CNI mode
- Reworked automatic de-icing
- Added missing collision mesh for VR
- Fixed bug preventing COM1/COM2 audio selection
- Fixed minor graphics glitches in MFD-CHECKLIST page
- Removed special characters in MFD-CHECKLIST page (hopefully this solves rendering issues on XBox)
- Fixed minor bug preventing TACAN mode update in some cases
- Fixed minor bug preventing correct TACAN channel to show if Y mode is selected
- Fixed minor bug causing COMM1 and COMM2 switches to be set to OFF in certain conditions
- Fixed minor bug causing CNI page not to report IFF status correctly
- Increased polycount of in-flight refuel probe
- Added basic Head Mounted Display
- Reverted to "fly-by-wire from flaps = 1" FCS option for better landing behavior
- Reworked drag coefficients for the transonic region

### Version 1.0.1 – 10/10/2022

#### Minor update

- Fixed bug in Pointer 1 orientation in VOR mode
- Fixed incorrect fuel tank configuration
- Added VR stick configuration and collision mesh
- Removed T-100 livery
- Fixed bug preventing assistance customization from working
- Tweaks to landing lights, cockpit and strobe effects (courtesy of user kdfw)
- Added missing pedestal lights
- Redone AI sound package
- Added Prandtl Glauert singularity effects
- Flight model changes: improved lateral stability, reduced flaps lift coefficients, tweaks to drag coefficients
- Improvements to tires behavior
- Added automatic de-icing system
- Added Mach cone and sonic boom sound effects
- Fixed minor bug preventing VS adjustments in SC mode

### Version 1.0.0 – 2/10/2022

#### INITIAL RELEASE

## WELCOME

The Alenia Aermacchi M-346 Master is a military twin-engine transonic trainer aircraft. Originally co-developed with Yakovlev as the Yak/AEM-130, the partnership was dissolved in 2000 and Alenia Aermacchi proceeded to separately develop the M-346 Master, while Yakovlev continued work on the Yakovlev Yak-130. The first flight of the M-346 was performed in 2004. The type is currently operated by the air forces of Italy, Israel, Singapore, and Poland.

## MINIMUM HARDWARE REQUIREMENTS

Due to the high-detail model and textures, we suggest to use the M-346 on systems that meet or exceed the following requirements:

CPU: 3.5GHz quad core processor or better  
GPU: at least 8Gb dedicated memory, Nvidia 1060 or better recommended  
RAM: 8.0Gb minimum  
Hard Disk: 3.0Gb required for installation

## INSTALLATION

**IMPORTANT – IF YOU ARE MANUALLY UPGRADING YOUR PACKAGE FROM A PREVIOUS VERSION, PLEASE DELETE THE PREVIOUS VERSION FIRST!**

This package is distributed both on the Microsoft Marketplace, Orbx and other vendors.

If you have purchased the package through the Marketplace or through Orbx Central or SimMarket application and you have followed the on-screen instructions, no further action is required from your end. The plane should be available in the aircraft selection menu as the other default planes and should be automatically updated.

If you have purchased the package from an external vendor and the aircraft is provided as a .zip file without any installer, just unzip the content of the file into your COMMUNITY folder. The exact location of the folder will depend on your selection when you have installed Microsoft Flight Simulator. Once you have indicated where your COMMUNITY folder is, just follow the on-screen instructions.

If you have purchased the package from an external vendor and the product comes with an .exe installer, just follow the instructions on the screen. You may be asked to locate the COMMUNITY folder. The exact location of the folder will depend on your selection when you have installed Microsoft Flight Simulator. Once you have indicated where your COMMUNITY folder is, just follow the on-screen instructions.

**NOTE: If you do not know where the community folder is located, you can follow this procedure:**

**Go to Options / General.**

**1. Click on "Developers" which you will find at the bottom of the list on the left.**

**2. Switch Developers Mode on.**

**3. On the Dev Menu select Tools / Virtual File System.**

**4. The community folder location can be found under "Watched Bases"**

**NOTE: If the copying the folder in the Community folder fails because of the fact that file names are too long you can proceed as follows:**

**1. Extract the package folder on your desktop or in any known and easily acceptable location.**

**2. Rename the package folder from "indiafoxtecho-m346" to anything short and recognizable such as "M346" or just "346"**

### 3. Place the renamed package folder in the Community folder

Alternatively for **EXPERT WINDOWS USERS ONLY**, it is possible to edit the "LongPathsEnabled" entry in the Windows registry key:

**HKEY\_LOCAL\_MACHINE\SYSTEM\CurrentControlSet\Control\FileSystem**

Once the aircraft is installed in the Community folder, it will be available in the aircraft selection menu next time you start Flight Simulator. If Flight Simulator was running during the install process, you need to close it and restart it for the aircraft to appear.

### IMPORTANT NOTE ON THE FLIGHT MODEL

Please note that the M-346 flight model is designed to work with the new Flight Simulator flight model (Options->General->Flight Model->MODERN) . This is the default option for Microsoft Flight Simulator and it should be your setting unless you have changed it.

However, some users may have changed the flight model to "LEGACY" in order to use older FSX-derived add-on planes – in this case you must revert to the "MODERN" flight model.

With the modern flight model, the M-346 should behave well and be quite stable and easy to fly within the regular flight envelope – although it may exhibit a some instability in extreme flight or weather conditions.

### CREDITS

Luca Festari.....	Original 3D model
Camillo Perinciolo.....	Additional 3D modeling
Nicolò Carraro.....	Textures and liveries
Giuseppe Didiano.....	Flight model
Dino Cattaneo .....	Development lead, additional 3D modeling, additional texturing, coding, Project management

M-346 text description taken from Wikipedia.

We'd like to thank the Beta testing Team and everyone who supported this project and IndiaFoxtEcho.

For questions, support and contact please write an email to [indiafoxtecho@gmail.com](mailto:indiafoxtecho@gmail.com) or contact us on Facebook <https://www.facebook.com/Indiafoxtecho-594476197232512/>

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### ABOUT THIS MANUAL

While we worked to make this package a realistic and complete rendition of the M-346 trainer aircraft, some simplifications had to be made and there are some minor inaccuracies. For this reason, this package should be considered a **RECREATIONAL ONLY** package and **THIS MANUAL SHALL NOT BE CONSIDERED A SOURCE FOR REAL-WORLD INFORMATION OR OPERATION OF THE F-35 AIRCRAFT.**

### UPDATES

We will try our best to keep the product updated and squash significant bugs as soon as possible. Updates are typically deployed as new installers/packages and will be available from your distributor. Updates must be manually installed unless the product is purchased through the Microsoft Marketplace, Orbx Central or SimMarket.

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## **LICENSE RESTRICTIONS**

**This M-346 rendition for Microsoft Flight Simulator is provided solely for non-professional use. Please contact IndiaFoxyEcho Visual Simulations for inquiries about professional applications.**

**NOTICE Although this manual and the simulated aircraft closely resemble their real-world counterparts in many aspects, neither should be used as source of real-world information about the aircraft. This package is not endorsed or supported by the real world aircraft manufacturer or by any Armed Service.**

## SPECIAL FEATURES AND FUNCTIONALITIES IN THE SIMULATION

This chapter highlights some special functionalities in the simulation which may deviate from normal Microsoft Flight Simulator implementation and/or are unique to this aircraft. Also, uncommon key assignments and control functionalities are highlighted.

### SPECIAL VISIBILITY CONDITIONS

While the real M-346 can be loaded with a variety of weapons and pods, including air-to-air missiles and laser guided bombs, in the simulation the external model can only be fitted with external fuel tanks and "smokewinders". The refuel probe can be removed, if the user prefers so. The model also features wheelchocks, covers, streamers and crew access ladder.

To enable SMOKEWINDERS, a (minimum) load of 220 lbs must be applied to STA1, 2, 6 or 7. Once installed the WING LIGHT control will enable/disable the smoke. STA 1 and STA 7 will work only on FA variant.

To enable EXTERNAL FUEL TANKS, a (minimum) load of 350 lbs must be applied to STA3, 4\* or 5

To enable the PYLONS ONLY, a (minimum) load of 50 lbs must be applied to STA 2,3,5 or 6.

To enable wingtip launchers, a (minimum) load of 50 lbs must be applied to STA 1 or 7 (FA only)

To make the REFUEL PROBE disappear, a load of 0 lbs must be applied to the "PROBE" load station.

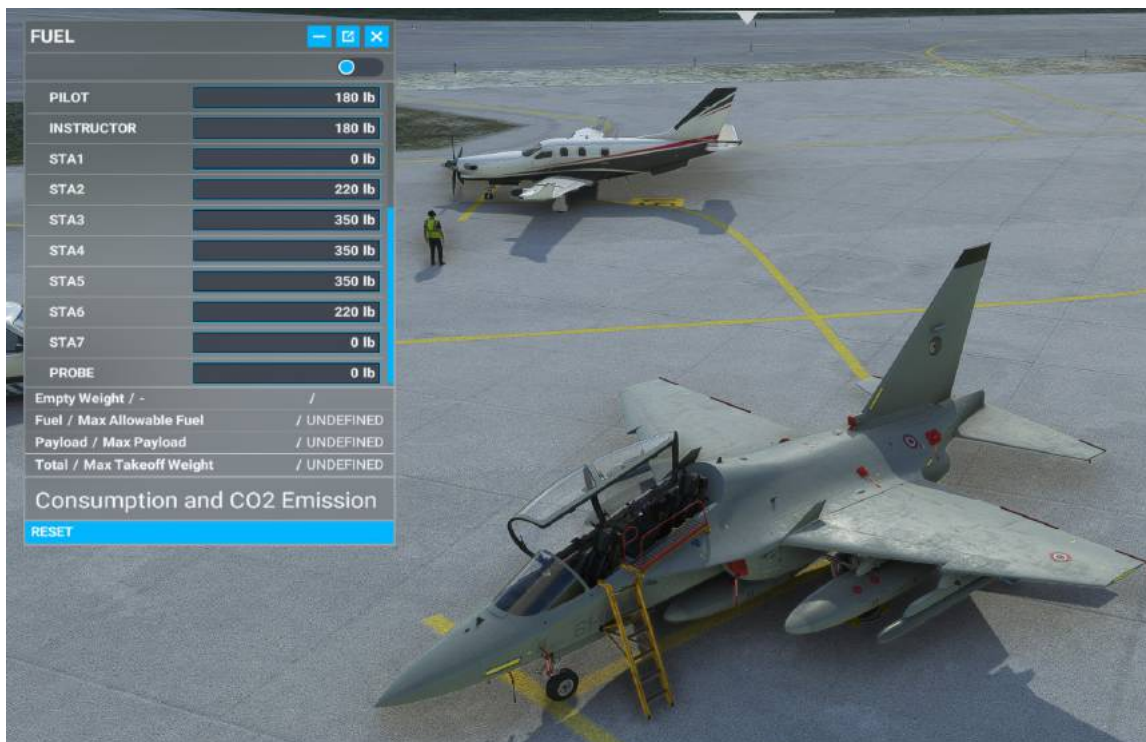
Pilot figures will disappear if the plane if the associated load station is set to 0 lbs, or if the plane is on the ground and the engines are on or the electrical switches are on or parking brake is set

Streamers and covers will appear if plane is on the ground, parking brake is set, electrical switches are off and engines are off.

Crew access ladder will appear if streamers are visualized and canopy is open.

\* External tanks on STA 3, 4 and 5 can be loaded with fuel. To load fuel tanks on those station fuel must be loaded on tanks EXTERNAL1 (STA 3), EXTERNAL2 (STA 5) and CENTER3 (STA4).

Note that fuel can be loaded in those tanks at any time, but it will immediately removed if fuel tanks are absent.



## PRESET LOADOUTS AND WEAPON CONFIGURATION

Starting from version 1.0.6, the model includes cosmetic weapons, which can be made to appear with the following token weight:

AIM-9 SIDEWINDER (Wingtip launchers and/or outer wing pylons): 210 lbs

GBU-12 LASER-GUIDED BOMB (underwing pylons): 550 lbs

Typical aircraft loadouts can be configured automatically as follows:

- SET THE MASS SELECTOR TO STBY
- SELECT THE SMS PAGE (ACCEPT-REJECT-RELOAD options will appear)
- SELECT "REJECT" to cycle between different loadouts.





## **M-346 MODEL VARIANTS**

Starting from version 1.0.2 the package includes two separate model: the M-346 and the M-346FA (Fighter Attack) models.

### **M-346**

The basic model is meant to represent both the “vanilla” M-346 update and the M-346FT (“Fighter Trainer”) configuration, which is a multirole variant capable of switching between training and combat operations. New features include a new tactical datalink system and different armament capability, but do not include physical changes to the hardware.

NOTE: THE BASE M-346 MODEL DOES NOT HAVE WINGTIP LAUNCHERS, so although STA1 and STA 7 will show in the configurator they have no functionality.



### **M-346FA**

The FA is the multirole variant capable of air-to-air and air-to-surface combat with a 3 tonne payload spread over 7 hardpoints, advanced Grifo 346 radar, countermeasures and features to limit radar visibility. Note that the radar is INOP in the initial MSFS rendition.



## THE AIRCRAFT

The M-346 is a two-engine, tandem-seat, transonic (supersonic in dive) aircraft manufactured by Leonardo Aircraft Division S.p.A., Venegono Superiore (Varese) (ITALY). The aircraft is a Lead-in Fighter Trainer (LIFT) that allows student pilots to develop knowledge, skills and habits needed for effective exploitation of modern combat aircraft. The aircraft is powered by two 2850 kg thrust Honeywell F124-GA-200 turbofan engines housed in the rear fuselage section and separated by a longitudinal fireproof wall.

## AIRCRAFT DIMENSIONS

The maximum dimensions of the aircraft, under normal conditions of mass, shock-absorbers compression and tires inflation, are as follows:

- Wing span . . . . . 9,720 m
- Fuselage length . . . . . 11,490 m
- Height to top of vertical stabilizer . . . . . 4,980 m

## AIRCRAFT GROSS MASS

The basic empty mass of the aircraft including unusable fuel, hydraulic fluid and oil is approximately 5300 kg, and with full internal F-34 fuel is approximately 7300 kg.

## GENERAL ARRANGEMENT

The aircraft features a full-authority, quadruple-redundant, fly-by-wire flight control system providing artificial stability with enhanced flying and handling qualities throughout the flight envelope. Its carefree handling capability minimizes pilot's effort in achieving the required performance. Pitch control is provided by two independently-operated, fully-movable, horizontal stabilators and by inboard trailing edge flaps (TEF). Roll and yaw controls are provided by outboard ailerons and by the rudder. The vertical stabilizer is a conventional structure housing a VHF/UHF antenna in the tip fairing. The aircraft avionics system is based on two, dual-redundant, digital data busses.

The fuselage forward section houses an electromagnetic-transparent radome, the nose, the cockpits and the nose landing gear. The cockpits are enclosed by an electro-mechanically actuated canopy which is hinged on the fuselage right side. The two ejection seats are staggered in height to ensure maximum visibility from the rear cockpit. A steer-by-wire nose wheel steering system allows directional control of the aircraft on the ground at all speeds and under crosswind conditions. The fuselage center section houses the integral fuel tank, equipment bays, the main landing gear and the air intake ducts. An hydraulically-actuated

airbrake is mounted on the upper side of the central fuselage, just behind the cockpit. A hard-point for the carriage of an external store pylon is provided at the fuselage centerline station.

The fuel is stored in three internal tanks: one fuselage tank in the fuselage center section and two wing tanks.

The fuselage rear section houses the power plant, the jet pipe and other equipment bays, and provides attachment for the horizontal stabilators and the vertical stabilizer. A tail cone closes the fuselage rear end.

An aircraft-mounted auxiliary power unit (APU) allows aircraft operation independently of ground facilities and provides electrical power to the aircraft systems.

The wing houses integral fuel tanks and is equipped with hard-points for the carriage of underwing pylons and missile wing tip pylons. Automatic flaps on the wing leading edge (LEF), in addition to inboard flaps (TEF) and outboard ailerons on the wing trailing edge, provide optimum wing camber at all angles of attack.

## COCKPIT LAYOUT

For a detailed layout of the cockpit panels and controls refer to the figures in the following pages.

## FLIGHT CONTROL SYSTEM

The M-346 incorporates a full-authority quadruplex digital fly-by-wire flight control system which, in combination with the optimized aerodynamic configuration of the aircraft, provides for full manoeuvrability and controllability at very high angle of attack (in excess of 30° degrees). The flight control system, incorporating a HOTAS design philosophy, is equipped with adjustable angle of attack and g-force limitations; when combined with its wide performance envelope, this allows the M-346 to effectively mimic the flight performance of various fighter aircraft operated by trainee pilots or to progressively increase difficulty levels, thus raising the training effectiveness. A pilot activated recovery system is present which, when pressed, conducts an automatic recovery by returning the aircraft to a steady and level flight path.

A digital avionics system, modelled on its counterparts on board the latest generation of military aircraft such as the Saab JAS-39 Gripen, the Lockheed Martin F-22 Raptor and the Eurofighter Typhoon, is incorporated, making it suitable for all stages of advanced flight training and thus reducing the use of combat aircraft for training purposes. A modular avionics architecture is employed, allowing for new equipment and systems to be incorporated and increasing the type's growth potential. The M-346's glass cockpit is representative of the latest generation cockpit and is compatible with night vision goggles; it has three color LCD multifunctional displays, a head-

up display, and an optional helmet-mounted display. A voice command system is also present, which is integrated with functions such as the navigation system. The communication systems include VHF/UHF transceivers, IFF transponder, and traffic collision avoidance system (TCAS).

#### EMBEDDED TACTICAL TRAINING SYSTEM

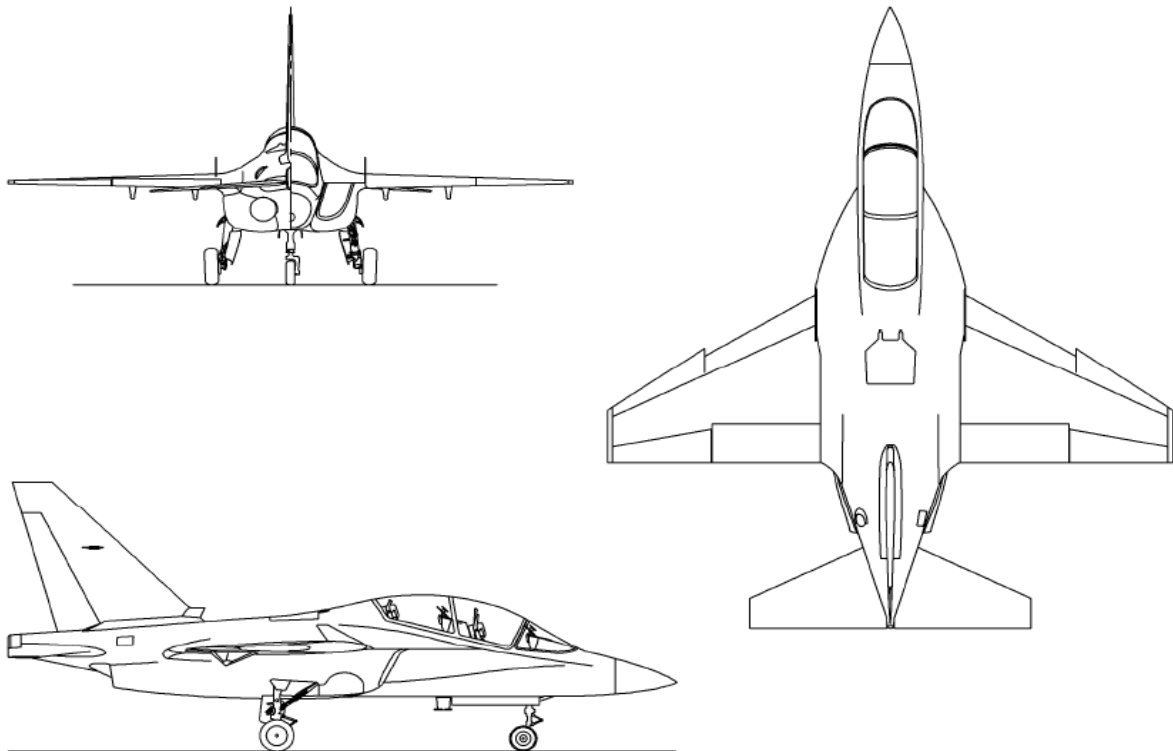
A key feature of the M-346 is the embedded tactical training system (ETTS). The ETTS is capable of emulating various equipment, such as radar, targeting pods, weapons, and electronic warfare systems; additionally, the ETTS can interface with various munitions and other equipment actually being carried on board. The system can act in a standalone mode, in which simulated data and scenario information is loaded prior to takeoff, or in a network, during which data is received and acted upon in real time from ground monitoring stations via the aircraft's datalink. For post-mission evaluation and analysis purposes, accumulated data, such as video from the optional helmet mounted display, can be extracted and reviewed. Alenia Aermacchi also offer an Integrated Training System (ITS), combining the M-346 with a ground-based training system as part of a wider syllabus towards qualifying pilots.

#### COMBAT CAPABILITIES

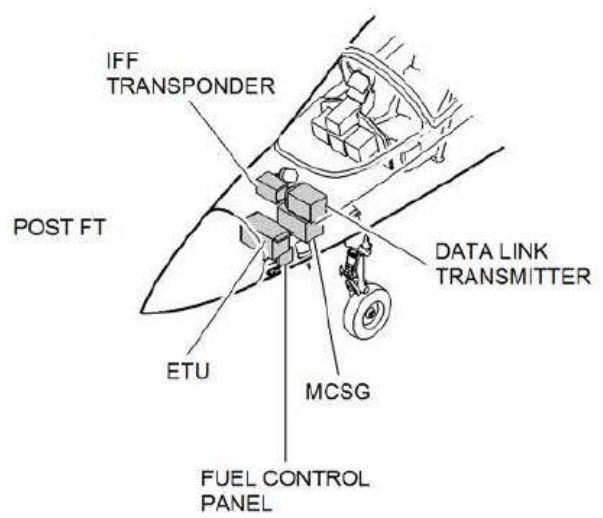
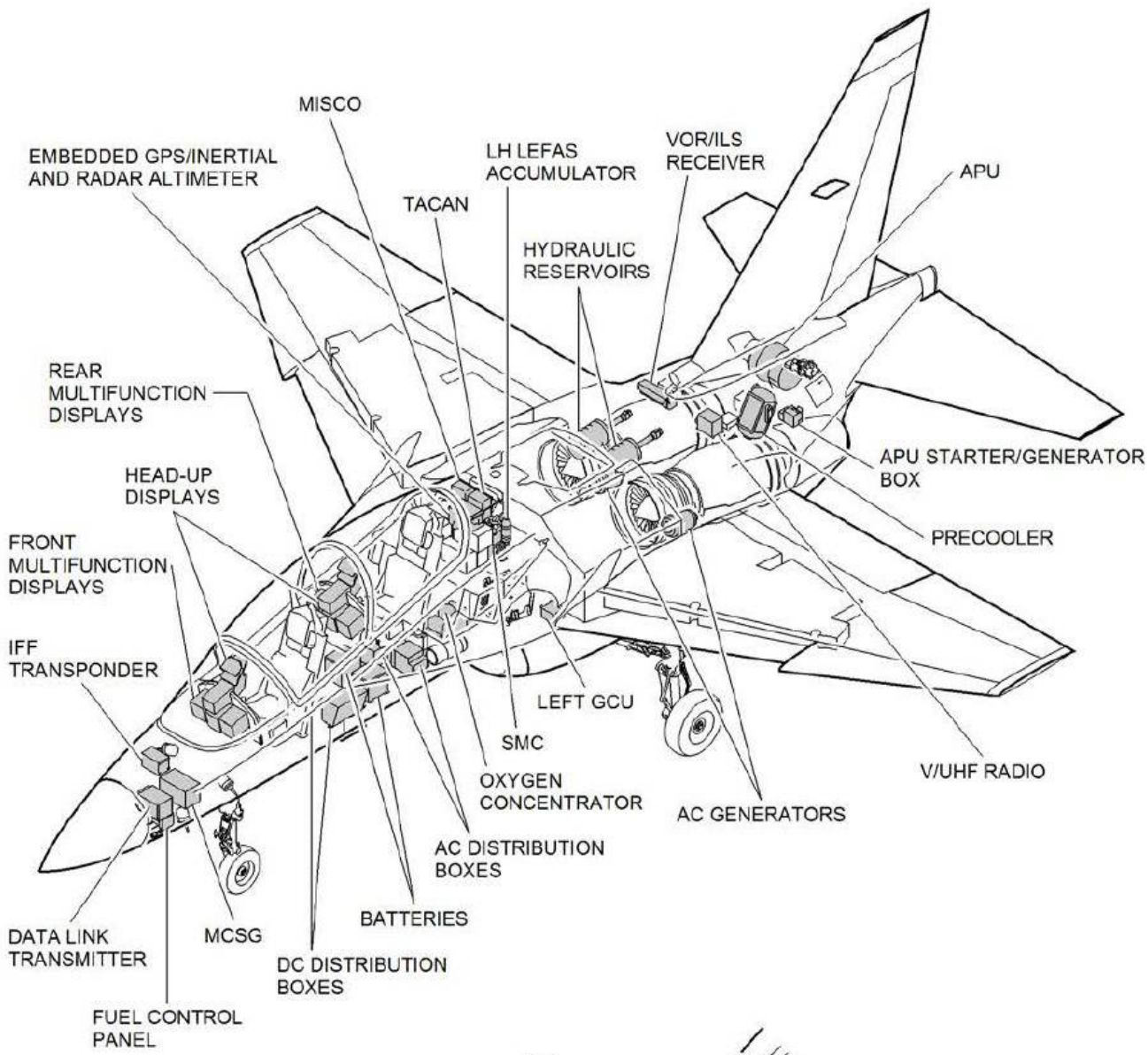
The M-346 is equipped with a total of five hardpoints

(with potential for additional wingtip-mounted missile rails) , capable of carrying external loads up to 3,000 kg while maintaining a high thrust-to-weight ratio; stores management data can be presented upon any of the multifunction displays in the cockpit. The radar cross-section of the M346 in a standard configuration is reportedly 20 square meters; this can be reduced to a single square meter by installing a low-observability kit which has been developed for the type. Other self-protection systems that can be fitted include a radar warning receiver, flares and chaff dispensers. Other equipment that is optionally installable upon the M-346 includes targeting pods, a tactical datalink, and multi-mode fire-control radar.

Combat missions can be performed by the M-346, having been designed to be rapidly reconfigured in the field into a combat aircraft capable of performing ground attack, anti-shipping, and aerial combat missions, in a "homeland security" capacity. Various munitions can be carried, including a 12.7mm gun pod, IRIS-T or AIM-9 Sidewinder air-to-air missiles, various air-to-surface missiles, anti-ship missiles, free-fall and laser-guided bombs and rockets, reconnaissance pods, and electronic warfare pods; weapon aiming is performed using the helmet mounted display and the multifunction displays. All main systems are duplicated, and the flight system reconfigurable, to increase survivability and functionality in the event of battle damage being sustained.

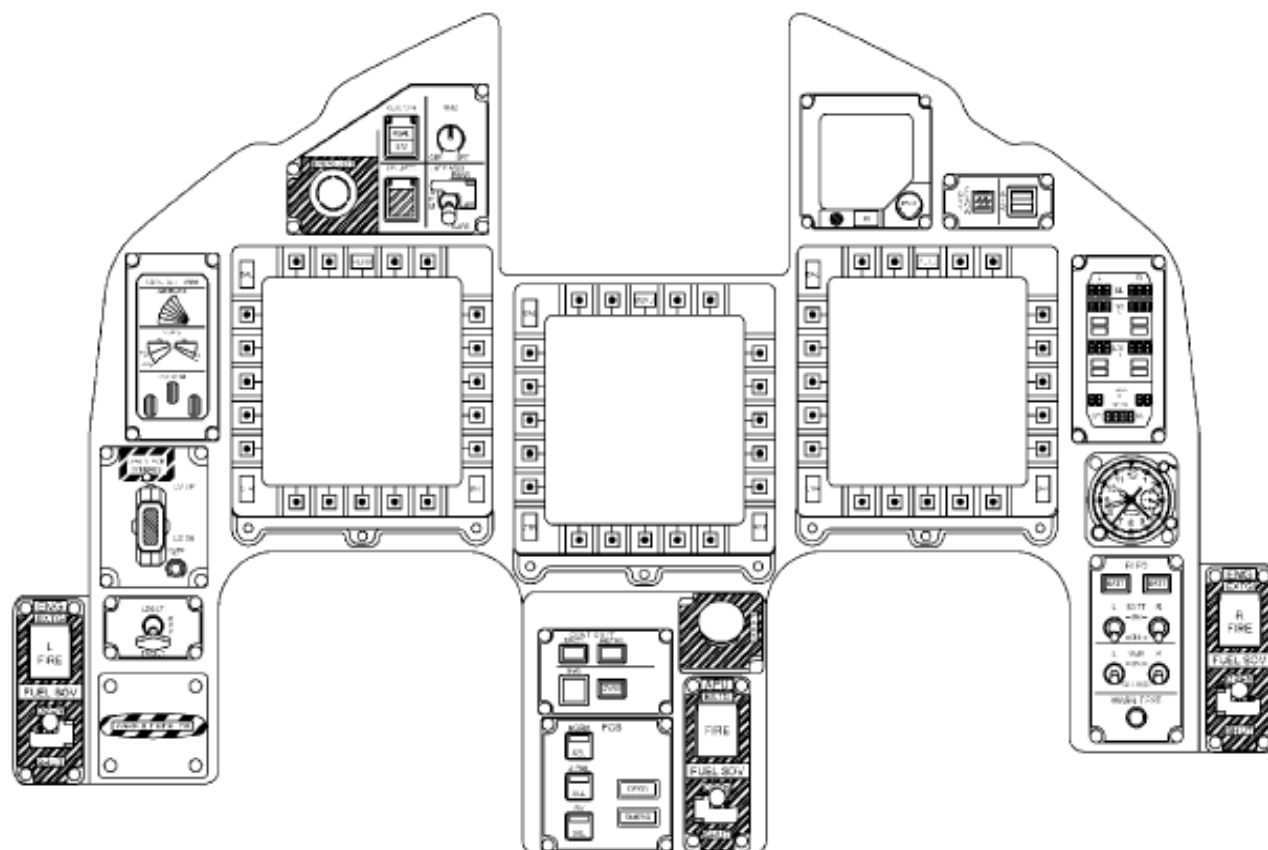


# GENERAL ARRANGEMENT



# FRONT INSTRUMENT PANEL

## CENTRAL PANEL

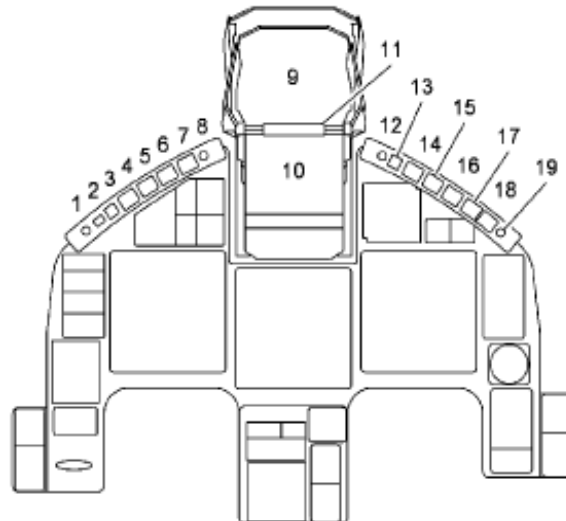
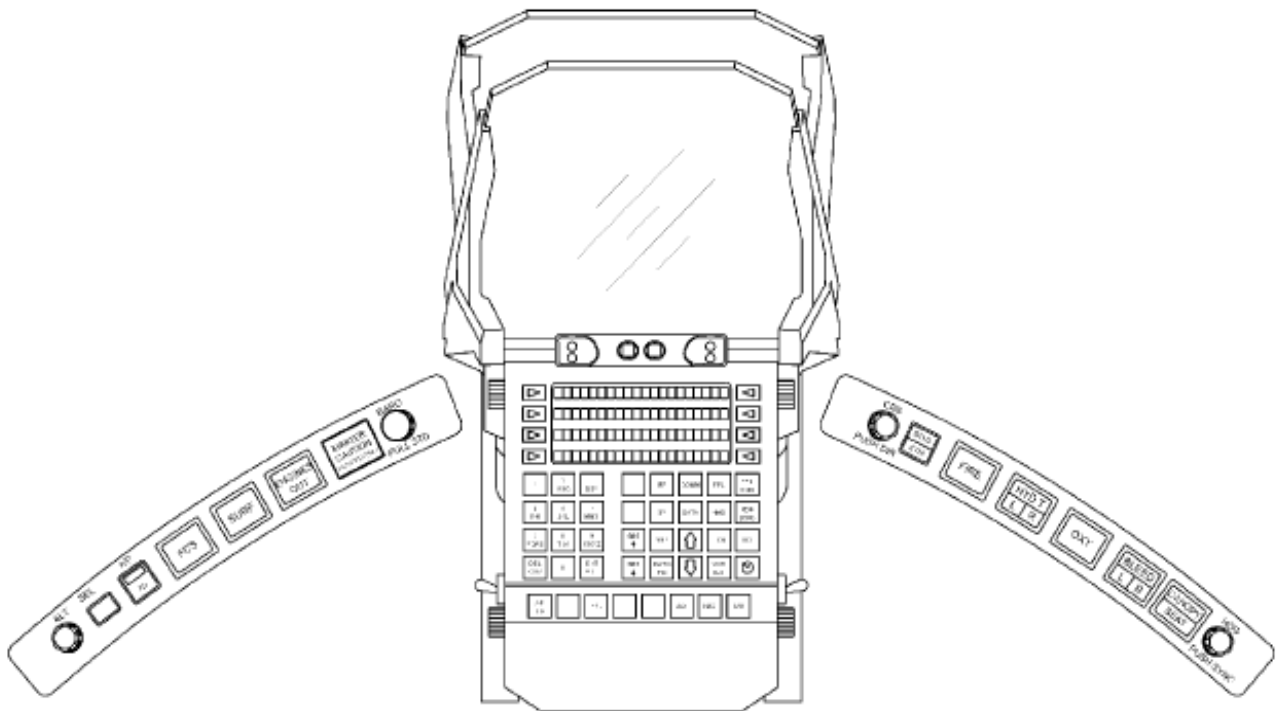


1. EMERG JETT PUSH-BUTTON
2. REAL/SIM PUSH-BUTTON LIGHT
3. HMD KNOB
4. LATE ARM SWITCH
5. SEL JETT PUSH-BUTTON
6. GET HOME DISPLAY (GHD)
7. OXYGEN FLOW INDICATOR
8. AIR REFUELING PUSH-BUTTON LIGHT
9. MULTIFUNCTION DISPLAY (MFD)
10. ENGINE/FUEL DISPLAY PANEL (EFD)
11. CLOCK
12. ELECTRICAL CONTROL PANEL
13. WARN TEST PUSH-BUTTON
14. R ENG EXTG PUSH-BUTTON LIGHT
15. R ENG FUEL SOV SWITCH
16. CONTROL SHIFT PANEL
17. NVG/CVRT CONTROL PANEL
18. FCS CONTROL PANEL
19. PARS PUSH-BUTTON
20. APU EXTG PUSH-BUTTON LIGHT
21. APU FUEL SOV SWITCH
22. PEDAL ADJUSTMENT HANDLE
23. L ENG EXTG PUSH-BUTTON LIGHT
24. L ENG FUEL SOV SWITCH
25. PARK & EMER. BK HANDLE
26. LANDING AND TAXI LIGHT SWITCH
27. LANDING GEAR CONTROLS
28. LANDING GEAR LIGHTS (THREE GREENS) (CSD)
29. FLAPS INDICATORS (CSD)
30. AIRBRAKE INDICATOR (CSD)
31. TAKE OFF TRIM INDICATOR (CSD)



## FRONT INSTRUMENT PANEL

### HUD, GLARESHIELD PANELS

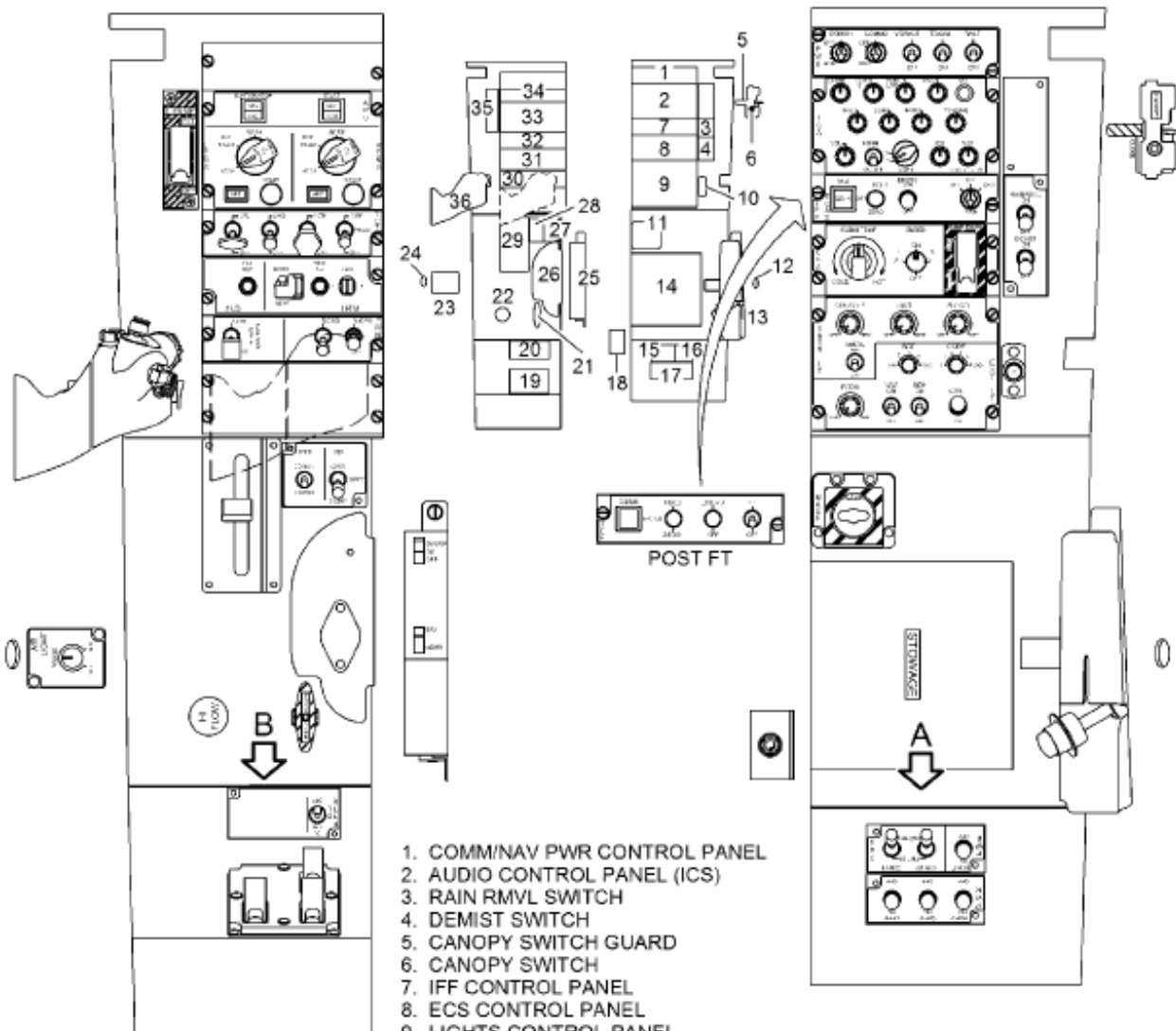


- |                                     |                                     |
|-------------------------------------|-------------------------------------|
| 1. ALT SEL KNOB                     | 11. TRACKER REFERENCE UNIT (TRU)    |
| 2. ALT SEL LIGHT                    | 12. CRS KNOB                        |
| 3. A/P FD PUSH-BUTTON LIGHT         | 13. STEERING MODE PUSH-BUTTON LIGHT |
| 4. FCS WARNING LIGHT                | 14. FIRE WARNING LIGHT              |
| 5. SURF WARNING LIGHT               | 15. HYD T WARNING LIGHT             |
| 6. ENGINES OUT WARNING LIGHT        | 16. OXY WARNING LIGHT               |
| 7. MASTER CAUTION PUSH-BUTTON LIGHT | 17. BLEED WARNING LIGHTS            |
| 8. BARO KNOB                        | 18. CANOPY / SEAT WARNING LIGHTS    |
| 9. PILOT DISPLAY UNIT (PDU)         | 19. HDG KNOB                        |
| 10. UP-FRONT CONTROL PANEL (UFCP)   |                                     |

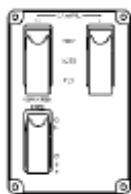
# FRONT CONSOLES

LEFT

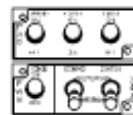
RIGHT



**B**



**A**

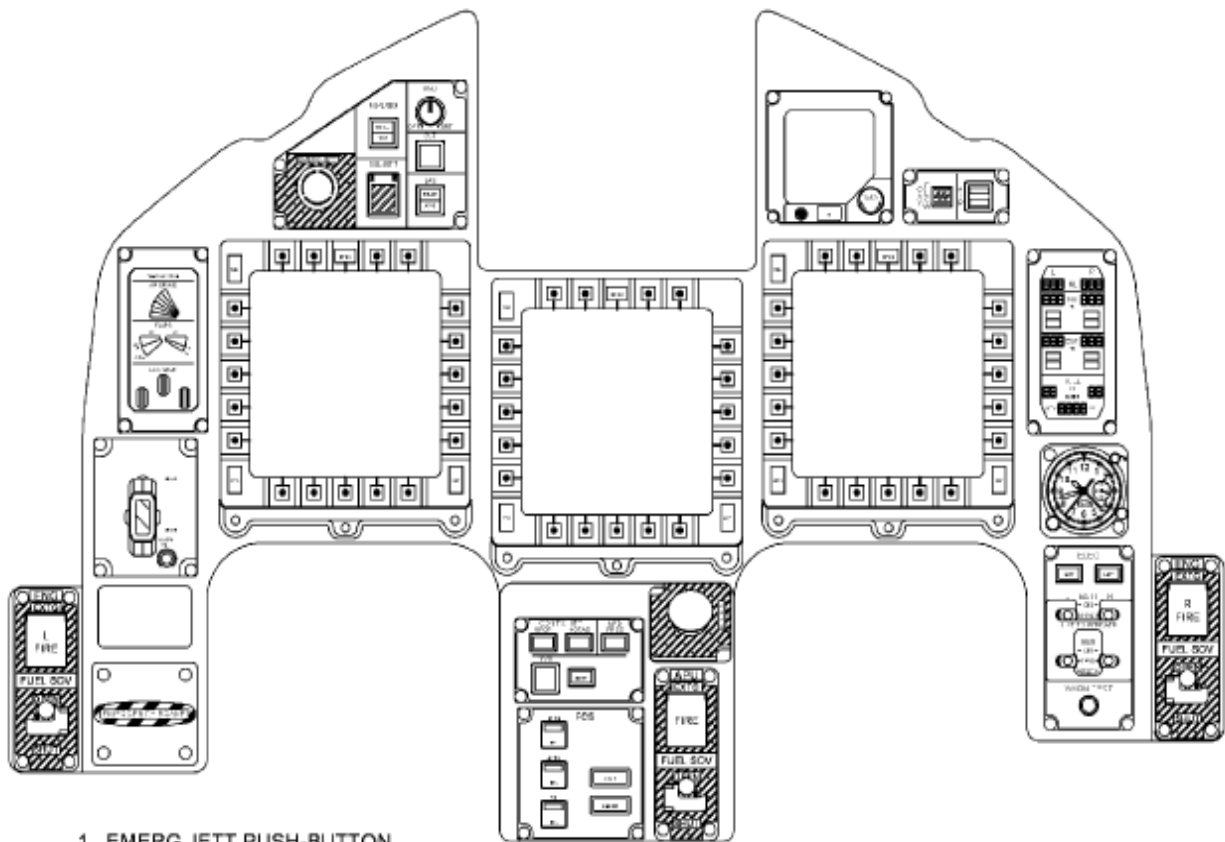


1. COMM/NAV PWR CONTROL PANEL
2. AUDIO CONTROL PANEL (ICS)
3. RAIN RMVL SWITCH
4. DEMIST SWITCH
5. CANOPY SWITCH GUARD
6. CANOPY SWITCH
7. IFF CONTROL PANEL
8. ECS CONTROL PANEL
9. LIGHTS CONTROL PANEL
10. SEAT FIRING HANDLE  
SAFETY PIN STOWAGE
11. MASTER ARMAMENT SWITCH
12. HANDCRANK SOCKET  
FOR CANOPY OPENING
13. RAM AIR SCOOP HANDLE
14. MAP CASE
15. COMM 1 & 2 GUARD FREQUENCY  
CONTROL PANEL
16. VOICE PWR CONTROL PANEL
17. MFD PWR CONTROL PANEL
18. SEAT ADJ SWITCH
19. GROUND SERVICE CONTROL PANEL
20. ETTS DL CONTROL PANEL
21. EMERG LDG GEAR HANDLE
22. ANTI-G VALVE PUSH-BUTTON (HI-FLOW)
23. A/R LIGHT CONTROL PANEL
24. HANDCRANK SOCKET FOR  
HOOKS UNLATCHING
25. OXYGEN REGULATOR
26. HMD CONNECTION  
(UNDER THE COVER)

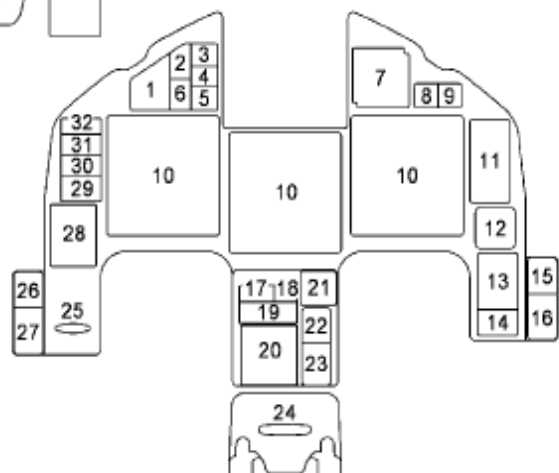
27. RF CONTROL PANEL
28. PTT CONTROL PANEL
29. FLAPS LEVER
30. GPS ZERO-MCSG-IN/GPS  
CONTROL PANEL
31. FCS/TRIM CONTROL PANEL
32. TCT CONTROL PANEL
33. ENGINES CONTROL PANEL
34. APU CONTROL PANEL
35. F PUMP SWITCH
36. ENGINE THROTTLES

# REAR INSTRUMENT PANEL

## CENTRAL PANEL



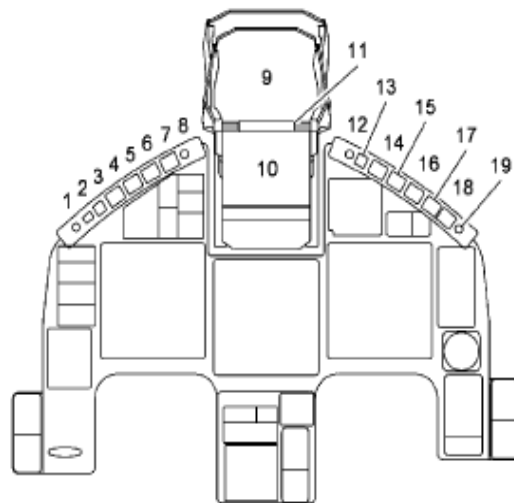
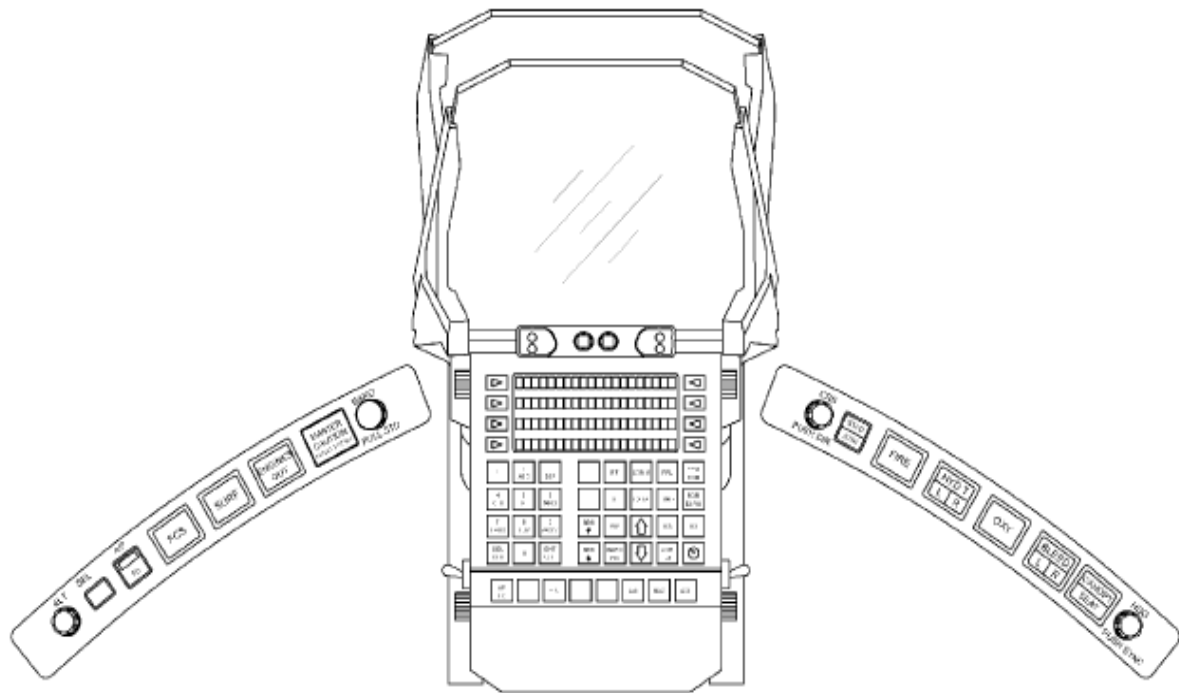
1. EMERG JETT PUSH-BUTTON
2. REAL/SIM INDICATOR
3. HMD KNOB
4. CUT PUSH-BUTTON LIGHT
5. LAS LIGHT
6. SEL JETT PUSH-BUTTON
7. GET HOME DISPLAY (GHD)
8. OXYGEN FLOW INDICATOR
9. AIR REFUELING PUSH-BUTTON LIGHT
10. MULTIFUNCTION DISPLAY (MFD)
11. ENGINE/FUEL DISPLAY PANEL (EFDP)
12. CLOCK
13. ELECTRICAL CONTROL PANEL
14. WARN TEST PUSH-BUTTON
15. R ENG EXTG PUSH-BUTTON LIGHT
16. R ENG FUEL SOV SWITCH
17. CONTROL SHIFT PANEL
18. MFD MODE PUSH-BUTTON LIGHT
19. NVG/CVRT CONTROL PANEL
20. FCS CONTROL PANEL
21. PARS PUSH-BUTTON
22. APU EXTG PUSH-BUTTON LIGHT
23. APU FUEL SOV SWITCH
24. PEDAL ADJUSTMENT HANDLE
25. EMERGENCY BRAKE HANDLE
26. L ENG EXTG PUSH-BUTTON LIGHT
27. L ENG FUEL SOV SWITCH
28. LANDING GEAR CONTROLS
29. LANDING GEAR LIGHTS (THREE GREENS) (CSD)
30. FLAPS INDICATORS (CSD)
31. AIRBRAKE INDICATOR (CSD)
32. TAKE OFF TRIM INDICATOR (CSD)





## REAR INSTRUMENT PANEL

### HUD, GLARESHIELD PANELS

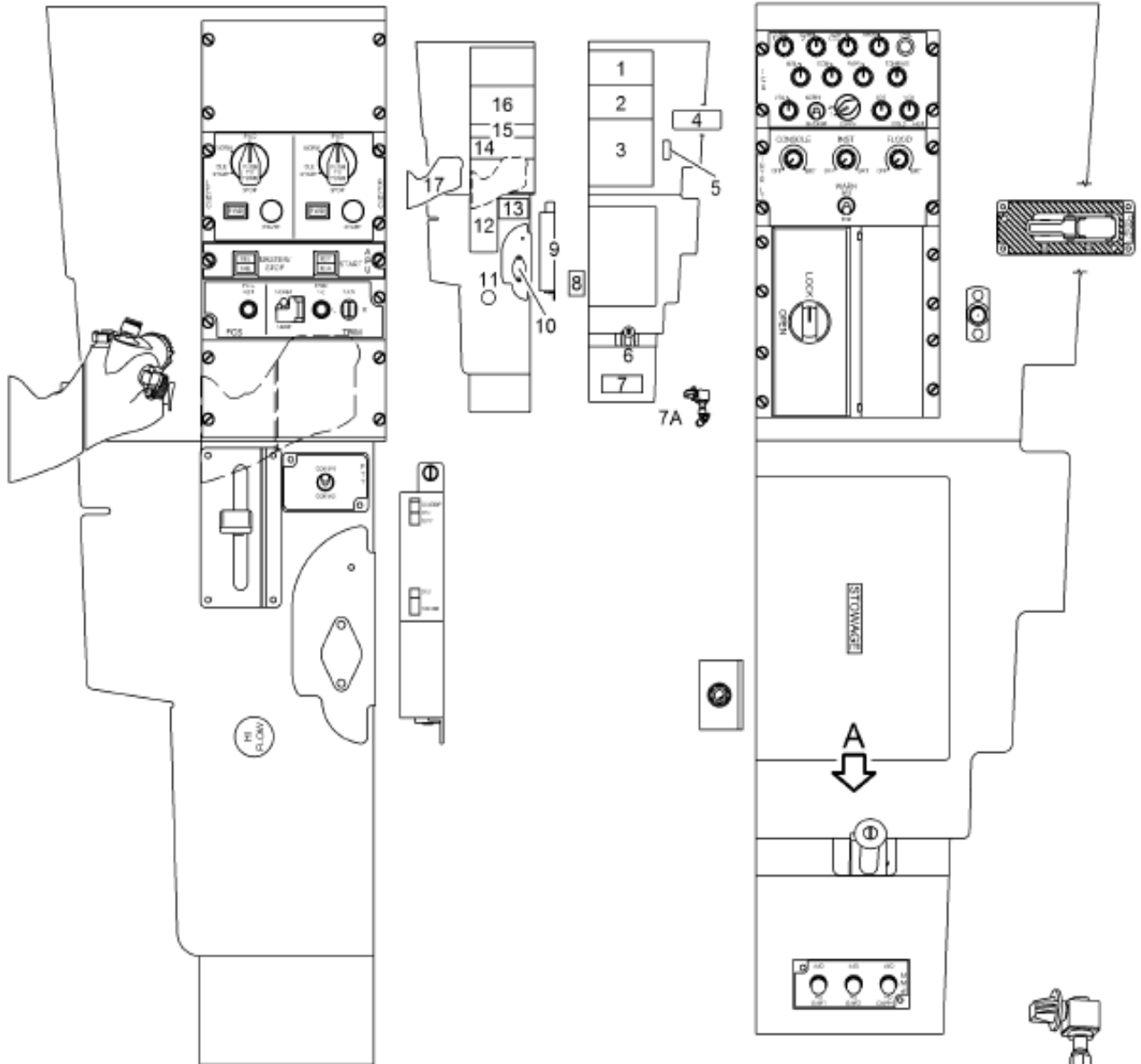


- |                                     |                                     |
|-------------------------------------|-------------------------------------|
| 1. ALT SEL KNOB                     | 11. TRACKER REFERENCE UNIT (TRU)    |
| 2. ALT SEL LIGHT                    | 12. CRS KNOB                        |
| 3. A/P FD PUSH-BUTTON LIGHT         | 13. STEERING MODE PUSH-BUTTON LIGHT |
| 4. FCS WARNING LIGHT                | 14. FIRE WARNING LIGHT              |
| 5. SURF WARNING LIGHT               | 15. HYD T WARNING LIGHT             |
| 6. ENGINES OUT WARNING LIGHT        | 16. OXY WARNING LIGHT               |
| 7. MASTER CAUTION PUSH-BUTTON LIGHT | 17. BLEED WARNING LIGHTS            |
| 8. BARO KNOB                        | 18. CANOPY / SEAT WARNING LIGHTS    |
| 9. PILOT DISPLAY UNIT (PDU)         | 19. HDG KNOB                        |
| 10. UP-FRONT CONTROL PANEL (UFCP)   |                                     |

# REAR CONSOLES

LEFT

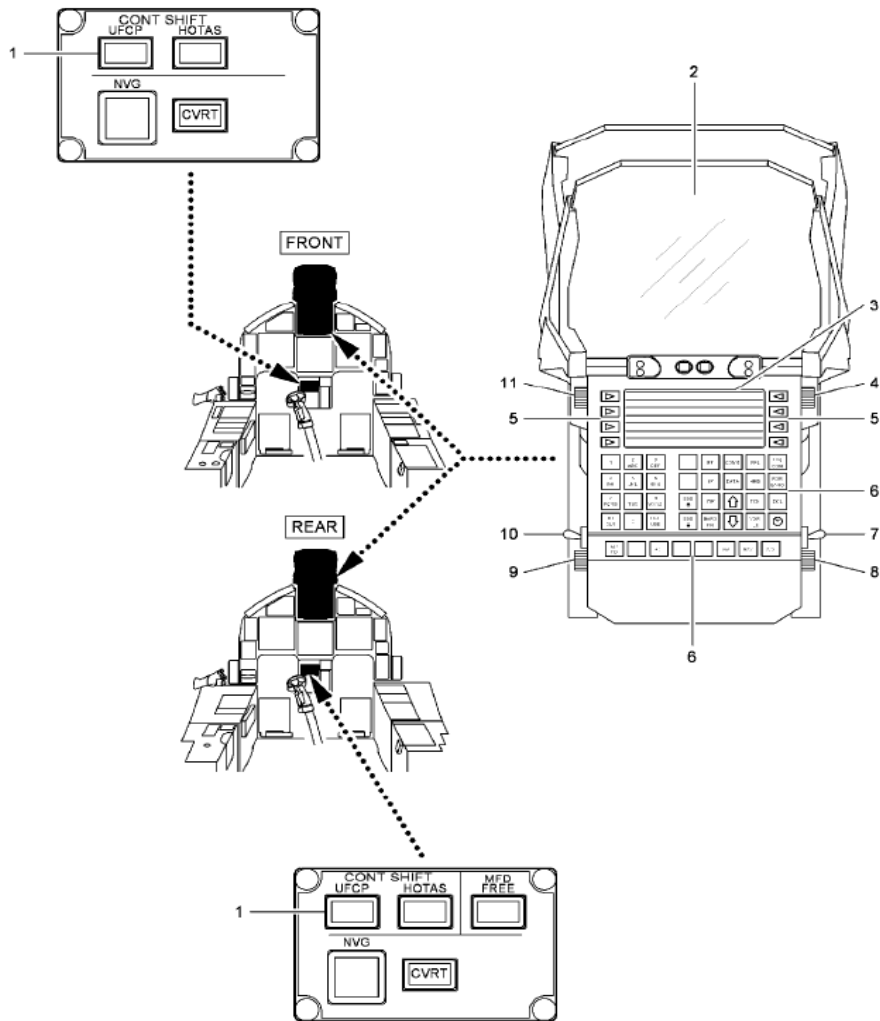
RIGHT





- |  |   |
|--|---|
| 1. AUDIO CONTROL PANEL (ICS)                 | 10. HMD CONNECTION<br>(UNDER THE COVER)   |
| 2. LIGHTS CONTROL PANEL                      | 11. ANTI-G VALVE PUSH-BUTTON<br>(HI FLOW) |
| 3. DIGITAL VIDEO AND<br>DATA RECORDER (DVDR) | 12. FLAPS LEVER                           |
| 4. CANOPY ORIDE SWITCH                       | 13. PTT CONTROL PANEL                     |
| 5. SEAT FIRING HANDLE<br>SAFETY PIN STORAGE  | 14. FCS/TRIM CONTROL PANEL                |
| 6. ISS CONTROL LEVER                         | 15. APU CONTROL PANEL                     |
| 7. MFD PWR CONTROL PANEL                     | 16. ENGINES CONTROL PANEL                 |
| 7A. CANOPY SEAL DEFLATING VALVE<br>(POST FT) | 17. ENGINE THROTTLES                      |
| 8. SEAT ADJ SWITCH                           |   |
| 9. OXYGEN REGULATOR                          |   |

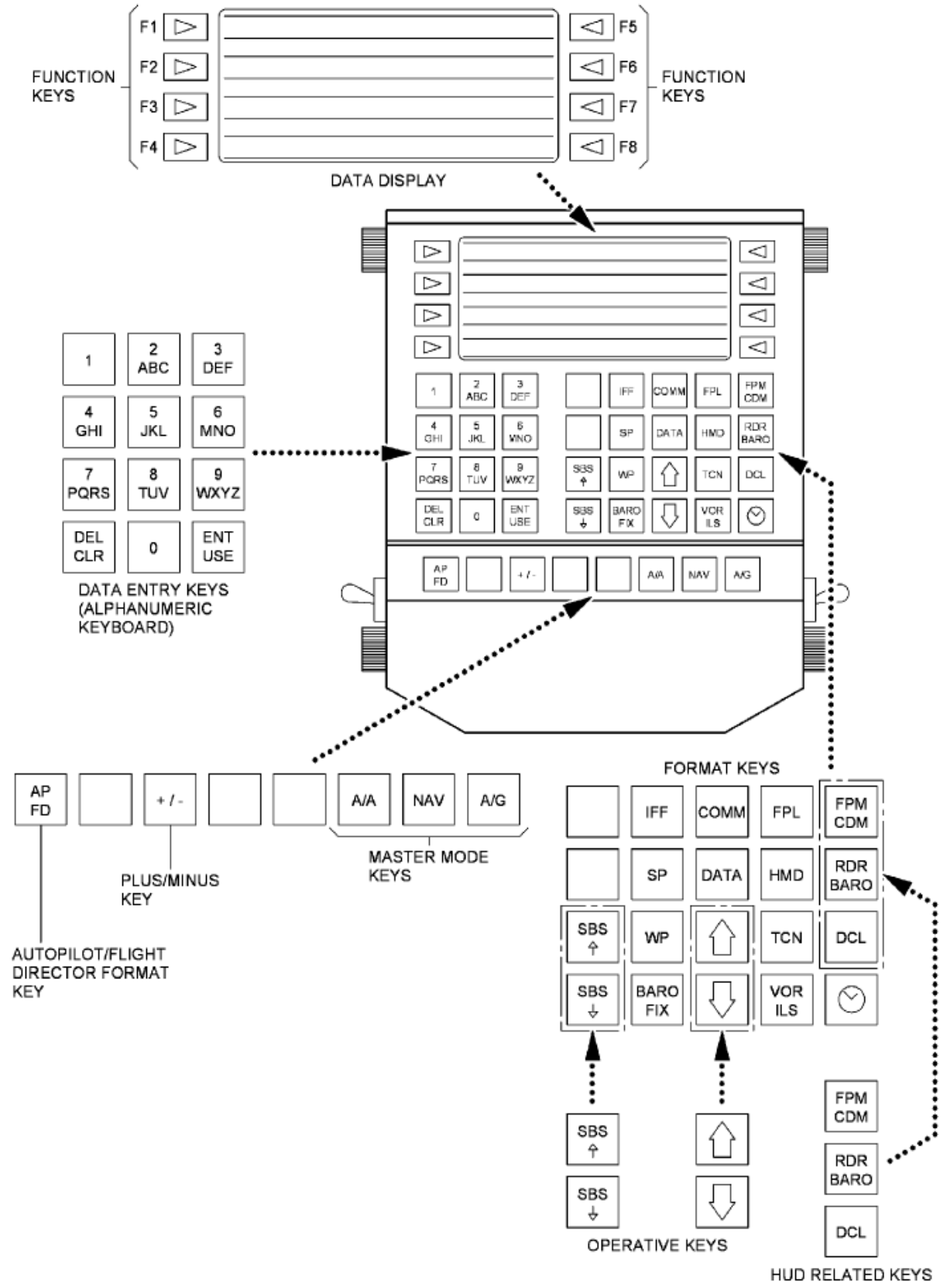
A



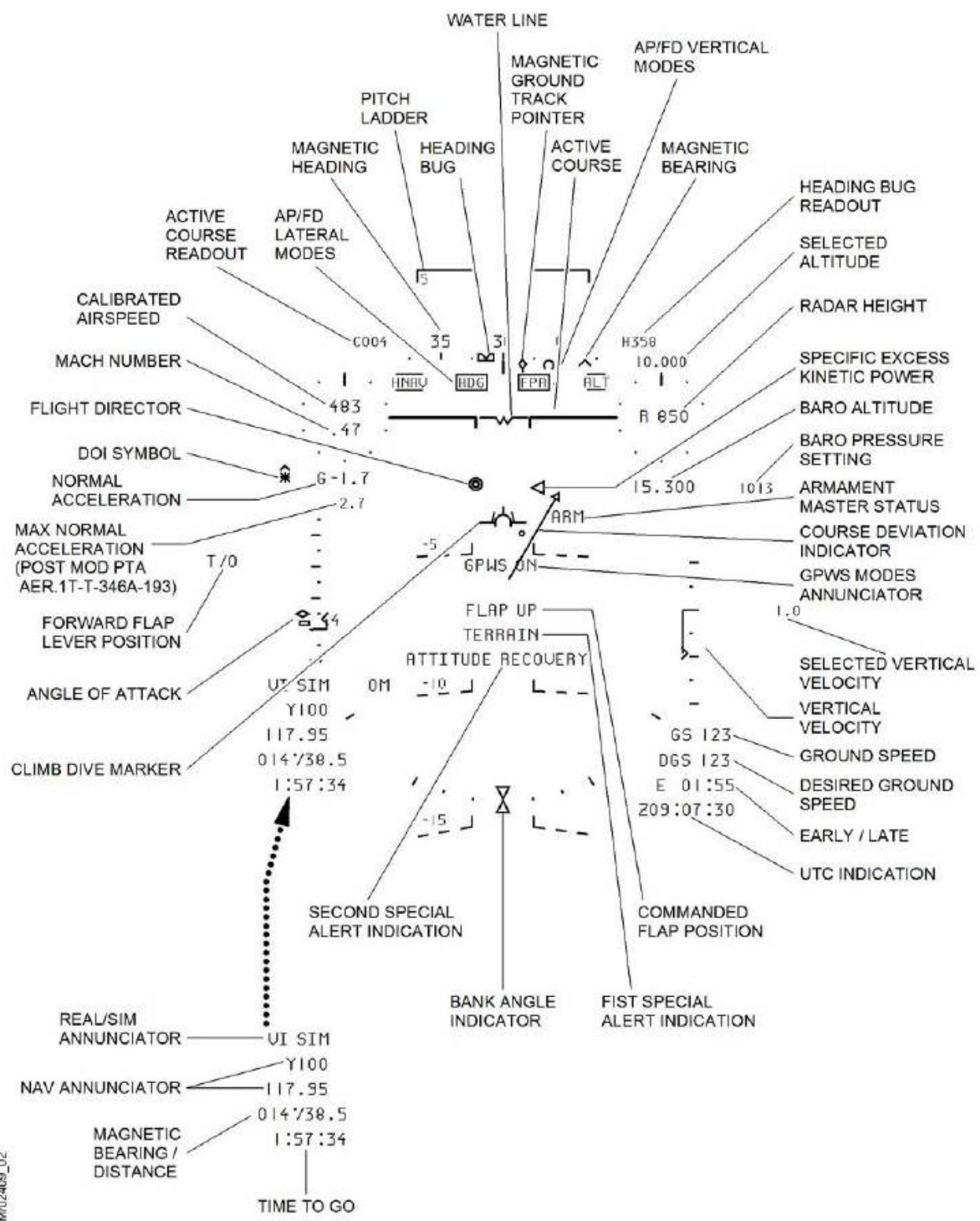


CONTROL/INDICATOR	POSITION	FUNCTION
1. UFCP push-button light	Pressed and illuminated	Control of the UFCP is available in the relevant cockpit.
2. PDU (optical group)		Displays navigation and attack symbology by superimposing it on real world scene as seen by the pilot through the combiner glass.
3. UFCP display		Displays formats, pages and data selected via UFCP keyboard and left/right function keys.
4. DISPLAY CONTR knob	Rotated	Adjusts the brightness of the UFCP display.
5. Left/right selector keys  	Pressed	Each key performs different functions/selections which depend on the specific format, page and data displayed on the adjacent display row.
6. UFCP keyboard		Allows format and mode selection, data entering, deletion and editing, flight plan scrolling and PDU symbology selection and declutter (for details, refer to figure 1-107).
7. SBS switch	ON	Selects the Stand by Sight (SBS); the HUD removes the normal symbology and displays the SBS reticule.
	OFF	The SBS reticule is deselected; the HUD displays the normal symbology.
8. RASTER CONTR knob	Rotated	Inoperative.
9. RASTER BRT knob	Rotated	Inoperative.
10. POWER switch	ON	Energizes the HUD.
	OFF	De-energizes the HUD.
11. STROKE BRT knob	Rotated	Adjusts the brightness of PDU stroke symbology.

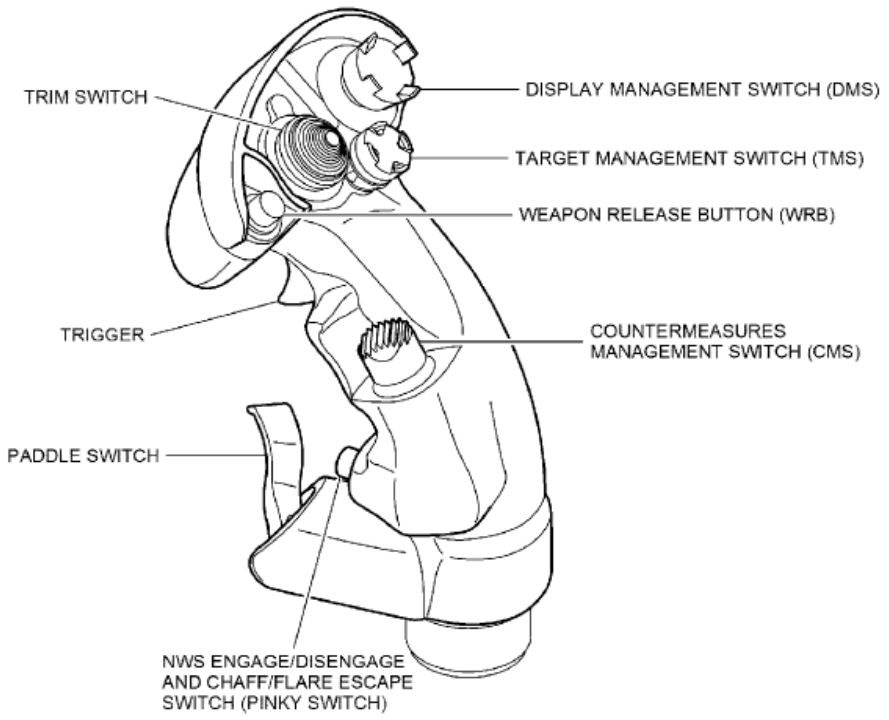
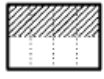
# UP-FRONT CONTROL PANEL (UFCP)



# HUD SYMBOLOGY - NAV AND APP SUB-MODES

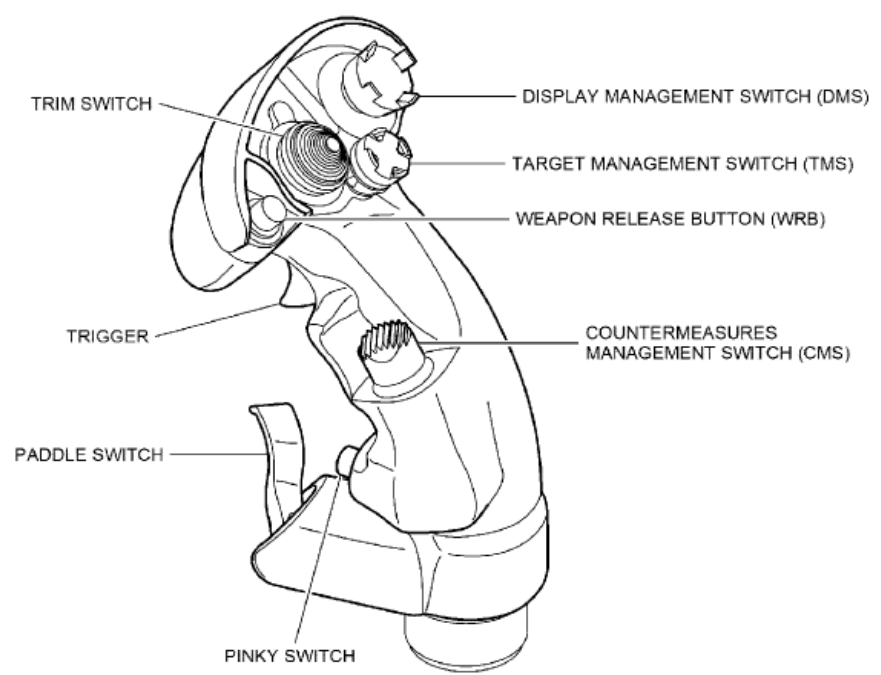


CONTROL STICK - PRE MOD PTA AER.1T-T-346A-193



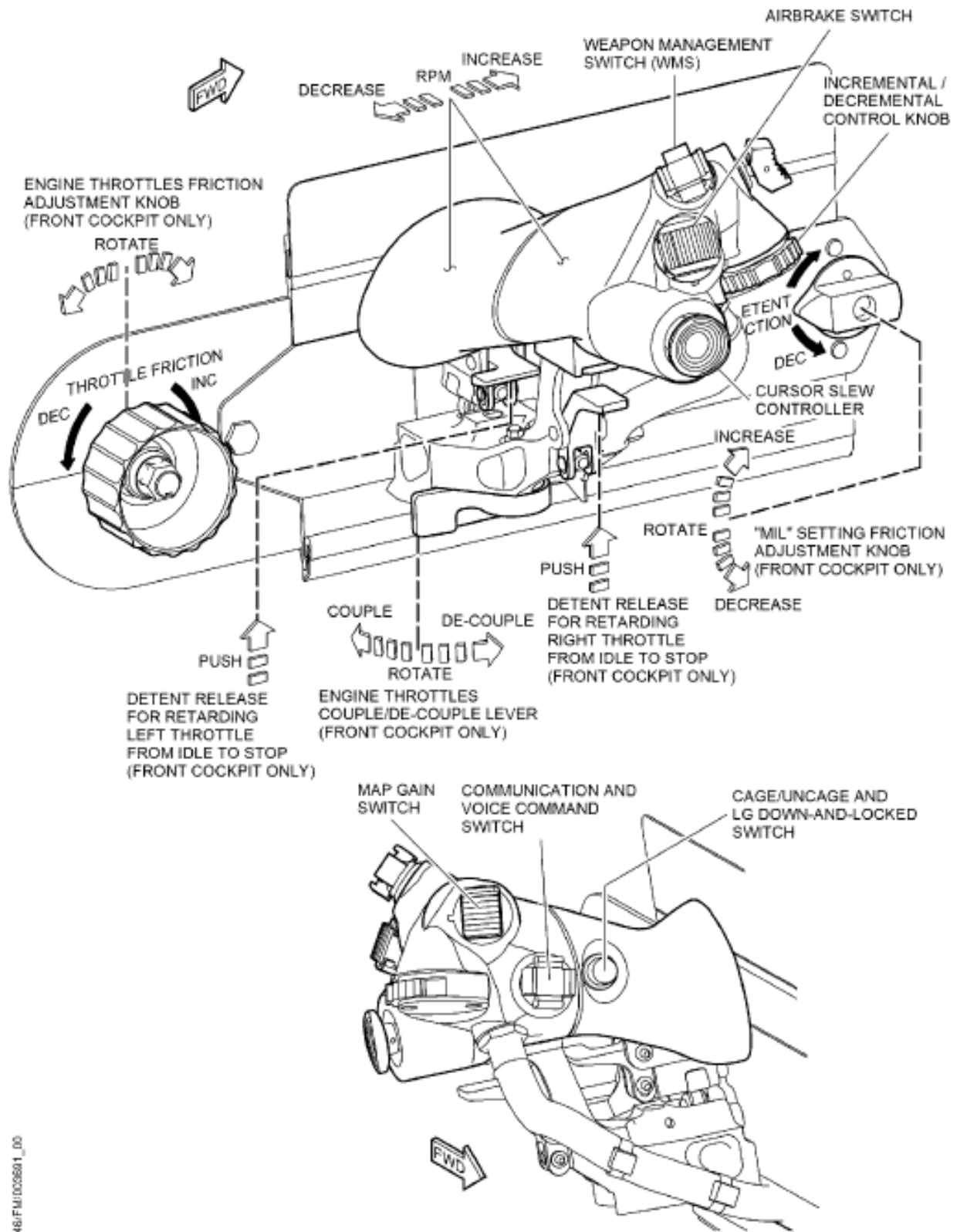
346/FM/03689\_00

CONTROL STICK - POST MOD PTA AER.1T-T-346A-193

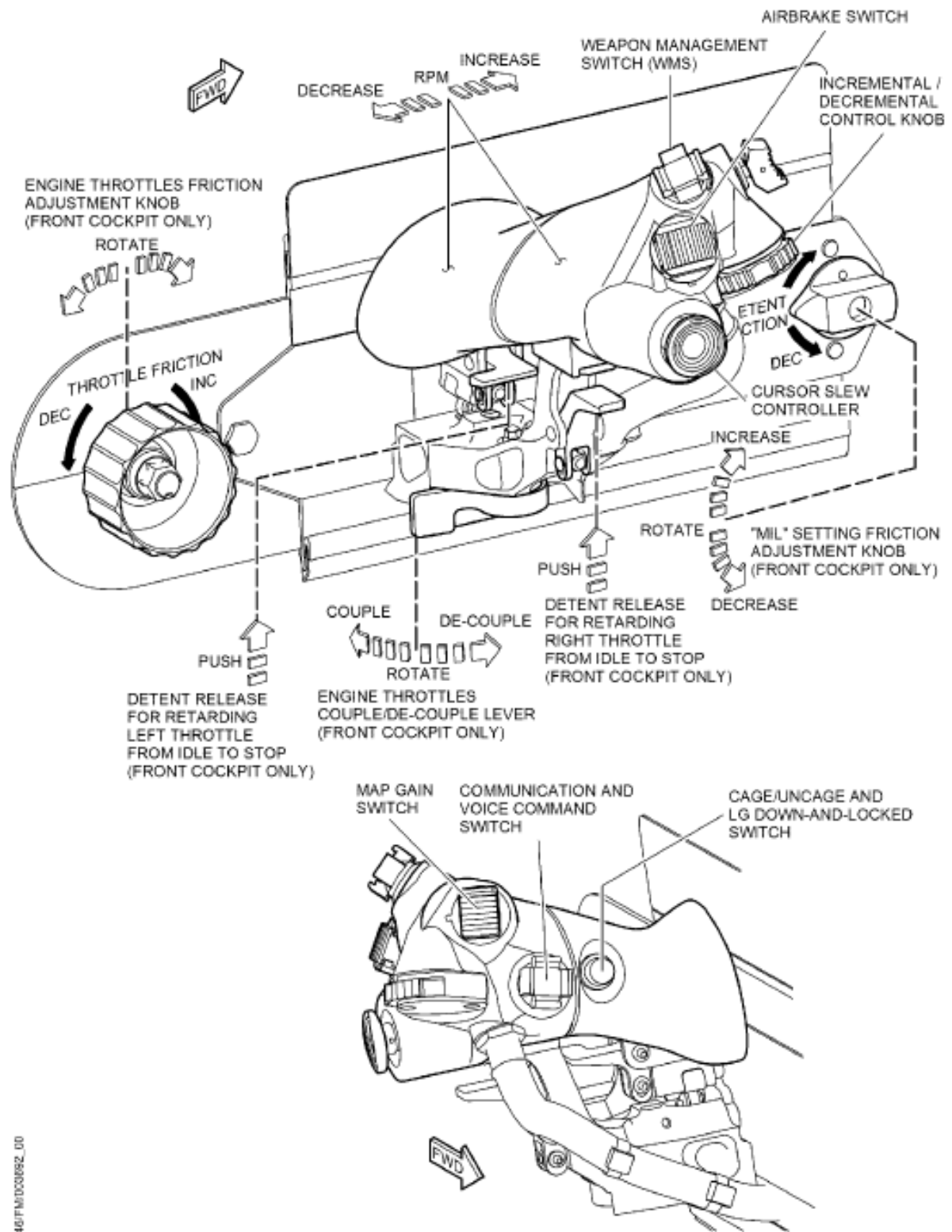


346/FM/03690\_00

**ENGINE THROTTLE - PRE MOD PTA AER.1T-T-346A-193**



**ENGINE THROTTLE - POST MOD PTA AER.1T-T-346A-193**





## AVIONICS SYSTEM

Avionics system integration is based on a modular architecture. Integration is achieved by using a dual redundant databus network controlled by a primary databus controller. If the primary bus controller fails, a back-up bus controller automatically takes over. The primary interface between avionics system and pilot(s) is provided by HOTAS controls and integrated flight displays: MFD, HUD/HMD, GHD, UFCP.

In the simulation, HOTAS and HMD are not implemented, and the only pilot interfaces are the HUD, the GHD, the MFDs and the UFCP:

### GLARESHIELD PANELS

Two glare shield panels located under the left and right glare shields of each cockpit include the controls for the manual selection and insertion of the following navigational data:

- Altitude (ALT)
- Baro pressure (BARO).
- Course (CRS)
- Heading (HDG)

The ALT knob allows the selection of an altitude value (ASEL) to be used as reference for vertical navigation. The BARO knob is used to enter the desired Baro pressure setting.

The CRS knob is used to enter a Magnetic Course setting.

The HDG knob allows the selection of a Magnetic Heading value.

### INTEGRATED FLIGHT DISPLAYS

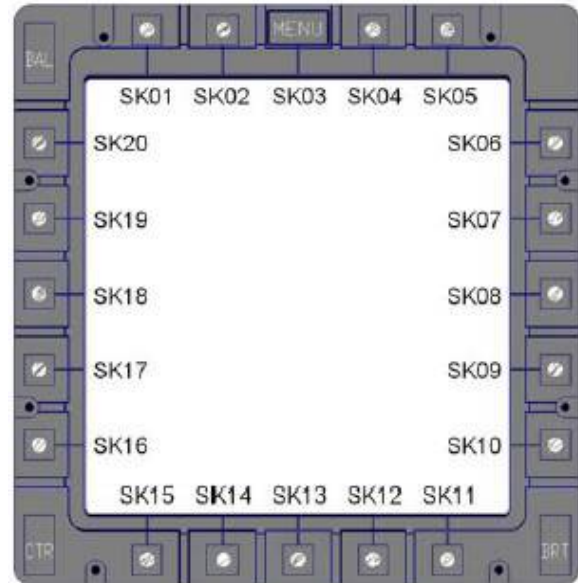
Each cockpit is fitted with three Multifunction Displays (MFDs), a Get Home Display (GHD), a Pilot Display Unit (PDU) and an Up-Front Control Panel (UFCP). In addition, each pilot can wear a Helmet Mounted Display (HMD). All these units create an integrated display system providing the pilot with the required navigation, attack and aircraft attitude information and permit selection, control and monitoring of aircraft systems and weapons. They convert system information received from the data bus, active bus controller and/or flight computers into graphic symbology for display.

### MULTIFUNCTION DISPLAY (MFD)

Each cockpit is fitted with three identical, NVG compatible MFDs allowing the display of different formats selectable by the pilots. Each MFD is provided with a 5-inch, square, flat, active matrix, color, LCD screen having 20 selection soft-keys located around the screen frame. An embedded graphic processor (Smart technology) generates the graphic symbology related to the selected format. Each MFD is connected to the avionics system through the MIL-STD-15538 digital data bus and is controlled by the MCSG or, in case of MCSG failure, by the MISCO. A video interface allows the MFDs to display external video signals (HUDR format, digital maps and ETTS format sym-

bology). If an MFD is unable to support external video (i.e., no synchronization signal or MFD video mixer board failure) the MFD attempts to display its internally generated synthetic symbology to allow the pilot to switch to another format.

Format selection and data entering is performed through the twenty keys fitted around the screen frame. Each key takes up the function detailed in the screen legend displayed next to the relevant key. The keys may also be identified by numbering them SK01 to SK20, starting from the upper left key and proceeding clockwise along the MFD frame, as follows:



#### NOTE:

In real life, the MFDs in the front and rear cockpits can be operated independently. In this simulation, front and rear cockpit MFDs are permanently linked (see "mimic mode" below)

Each MFD allows the selection and display of the following formats:

- FCS (Flight Control System information, Surface configuration, Landing Gear configuration)
- CNI (Communication, Navigation and Identification Main Page)
- STATUS (Aircraft systems status information)
- ETTS
- FCR (Fire Control Radar)
- TGP (Targeting Pod)
- WPN (Weapon status)
- EWS (Electronic Warfare System)

- HSD (Horizontal Situation Display)
- SYS (Engine, Hydraulic, Fuel and Caution)
- SP (Steerpoint lists)
- MAP/TSD (Geographic Map / Tactical Situation Display)
- HSI (Horizontal Situation, NAV Source and Bearing 2 Magnetic Bearing and Range)
- CADI (Attitude sphere, Air data/ADI+HSI)
- IN/GPS (Embedded GPS/Inertial. information)
- DVDR (DVDR Management Page)
- HUDR (Color HUD Video Camera video signal).
- NDS (Impact points and scoring data information in simulated A/G attacks)
- SMS (Stores Management System)
- DTM (DTM management).
- CHKLST (Checklist)
- FAIL TRAIN (Failure simulation training)

Some formats have only one-level pages, other formats have multi-level pages. All selections within a format/page are performed through the keys on the screen frame. Each key can perform various functions depending on the particular format/page displayed. The function taken on by each key is briefly explained by the legend appearing on the display, next to the relevant key, when the key becomes available. The MENU key (SK03) is reserved for the selection of the menu format, which is divided into two page levels: level 1 (MENU) and level 2 (MENU2).

An MFD PWR control panel located on the right console houses the MFDs ON/OFF switches. Each MFD can be switched ON independently, and the same format (or video signal) can be displayed on more than one MFD or on all MFDs simultaneously.

After power application, all MFDs in the front and rear cockpits operate in MIMIC mode by default. In mimic mode, any selection performed on an MFD in the cockpit in control is replicated on the corresponding MFD of the other cockpit where the mimic mode has been selected.

In the real world the MFDs in the front or rear cockpit can be set to FREE mode of operation through a dedicated push-button light labelled MFD FREE located on the central instrument panel. In the cockpit where MFD FREE mode is selected, the MFDs can be set to any format independently of the formats dis-

played on the MFDs in the other cockpit. The only exception is the SYS format. In fact, when the SYS format is selected in the front or rear cockpit, it is also displayed on the corresponding MFD in the other cockpit, even if MFD FREE mode was selected. From then on, any further selection relevant to the SYS format is replicated on the corresponding MFD of the other cockpit as in mimic mode. If MFD FREE mode is selected, subsequent selections of formats other than the SYS format in the front or rear cockpits cause the MFDs to revert to the independent mode of operation again.

#### NOTE:

MFD FREE mode is not available in this simulation.

#### MFD OPERATION

When the MFD is energized, it performs the power-up BIT (PBIT). After successful completion of the PBIT, the MFD performs an initial set up at the end of which the following formats are displayed:

- Left MFD (both cockpits): SYS.
- Center MFD (both cockpits): CADI.
- Right MFD (both cockpits): HSI

#### MENU LEVELS 1 AND 2

The MENU key is always active in all MFD formats and pages to allow the cyclical display of Menu level 1 and level 2.

Menu level 1 is displayed by pressing the MENU key (SK03) once.

Menu level 2 is displayed by pressing the MENU key twice.

When the MENU key is pressed, the format-selection key legends are displayed for 7 seconds only, then a time-out mechanism removes the menu presentation in the absence of any selection.

The figure below depicts Menu Level 1:



The figure below depicts Menu Level 2:

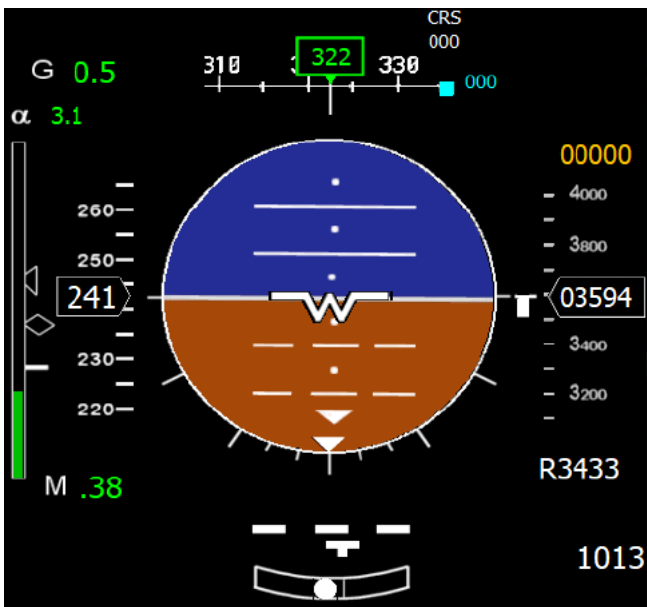


### CADI FORMAT

The CADI format provides Attitude Director indications with the addition of a reduced set of horizontal navigation information.

The CADI format is selectable by pressing the CADI key from Menu level 1 or level 2.

Below is an example of CADI format:



### HSI FORMAT

The HSI format is selected by pressing the HSI key from MFD menu level 1 or 2.

The HSI format provides, in a graphic form, an electronic Horizontal Situation Indicator with rotating compass and alphanumeric data information.

Pressing SK16 while in HSI format allows the pilot to select the NAV SOURCE. In real life, pressing this key

will cause a specific page format to appear which allows the pilot to select one of the following sources of navigation information: TACAN ILS, VOR, ILS, VOR DME, ILS DME, VOR UNCPL, ILS UNCPL, TACAN, EGI.

In this simulation, pressing the SK16 key will cycle between the following navigation sources:

- VOR / VOR-ILS → VOR ILS will be automatically selected if the selected frequency is an ILS. When this mode is selected, the autopilot system is driven by NAV1.

- EGI → In this mode, the source of navigation information is the GPS flight plan. When this mode is selected, the autopilot system is driven by the GPS flight plan.

- TACAN → In this mode, the source of navigation information is the P3D TACAN system. NOTE: this mode provides only limited navigation information: entering the equivalent NAV frequency and using VOR mode is preferred.

The NAV SOURCE information and pointers are displayed in GREEN in the HSI and in other formats.

Pressing SK10 while in HSI format allows the pilot to select the BEARING 2 data source. Similarly to NAV SOURCE, and unlike in real life, pressing the button will cycle between VOR, EGI and TACAN data.

The BEARING 2 information and pointers are displayed in YELLOW in the HSI and other formats.

Below is an example of the HSI format:



### MAP/TSD (Digital Map / Tactical Situation Display) Format

The MAP/TSD format provides a graphic representation of navigation and tactical information superimposed or not on a geographical map. Two different types of format presentation are

available and can be selected by pressing SK13:

- MAP
- TSD

The MAP presentation consists of a color (RGB) map digital video image. In the simulation this is generated by the HTML5/JS mapping.

The TSD presentation consists of a graphic representation of color, synthetic, tactical navigation and mission information.

In the simulation, this format is mostly driven by information coming from the simulator GPS service and therefore relevant declutter controls are provided.

Below is an example of the TSD format:

Within the TSD page:

SK19 and SK20 allow the selection of the MAP/TSD visualization range.

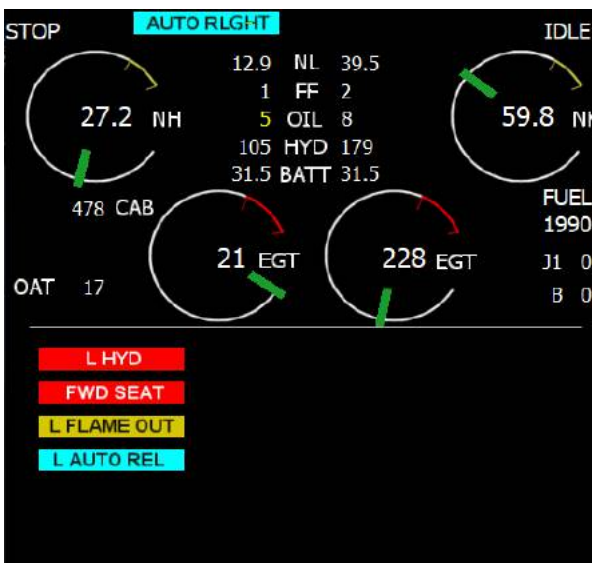
SK6 and SK7 allow the selection of the current waypoint within the flight plan. NOTE: unlike the real-world aircraft, this simulation does not distinguish between Steer Points and Waypoints.

### SYS FORMAT

The SYS format consists of three different pages: SYS Main page, Pilot's Action page and Fuel page.

#### NOTE:

The Pilot's Action page is not implemented in this simulation.



### SYS Main Page

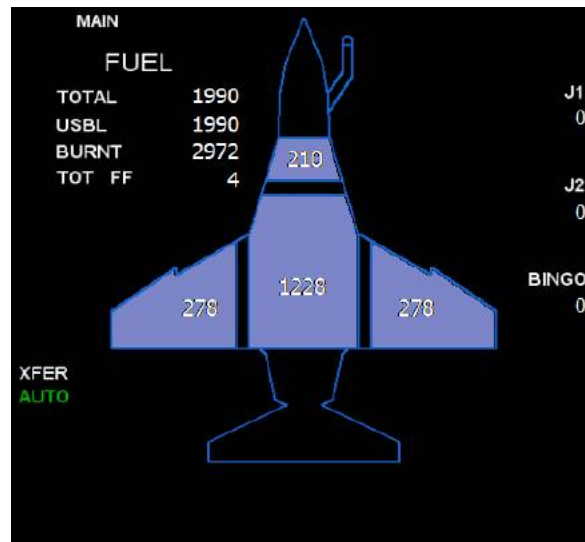
The SYS Main page is the first page displayed when the SYS key is pressed from menu level 1 or 2. The SYS Main page is divided into an upper and a lower half: the upper half provides graphic and alphanumeric information on engine, oil, fuel and hy-

draulic systems, batteries voltage, outside air temperature and cabin pressure altitude; the lower half displays any active warning, caution or advisory alerts.

### Fuel Page

The Fuel page is displayed from the SYS Main page by pressing the key next to the FUEL indication (SK07). It provides detailed fuel information and a pictorial representation of the aircraft, its internal fuel tanks, vent valve position and failure state.

### STATUS FORMAT



The STATUS format provides avionics equipment status and global Database status. It consists of the following pages: STATUS 1, STATUS 2,

### DATABASE STATUS.

STATUS 1 Page STATUS 1 page is the format main page. It is displayed when the STATUS key is pressed from Menu level 1. STATUS 1 page provides, on a two-column list, the equipment ident with associated status legend. The following is an example of STATUS1 page, showing equipment idents and possible relevant status:

As a general rule, the equipment status is provided by the following legends:

- GO (green legend) - equipment ready status.
- NOGO (red legend) - equipment NOGO status.
- N/A (not available) (amber legend) - all buses not available or equipment N/A status.
- TEST (white legend) - equipment TEST is in progress.

Below is the typical appearance of the STATUS format:

STATUS 1			
MCSG . . . . .	GO	MISCO BBC . . . . .	GO
ETTS BOARD. . . .	GO	MISCO1. . . . .	GO
ETTS D/L. . . . .	GO	MISCO2. . . . .	GO
FCC A . . . . .	GO	SMC1 . . . . .	GO
FCC B . . . . .	GO	SMC2 . . . . .	GO
FCC C . . . . .	GO	IFF . . . . .	GO
FCC D . . . . .	GO	RADIO1 . . . . .	GO
IN . . . . .	GO	RADIO2 . . . . .	GO
GPS . . . . .	GO	RALT . . . . .	GO
FWD PDU . . . . .	GO	AFT PDU . . . . .	GO
FWD UFCP. . . . .	GO	AFT UFCP . . . . .	GO
FW HMD. . . . .	GO	AFT HMD. . . . .	GO
FWD L MFD. . . . .	GO	AFT L MFD . . . . .	GO
FWD C MFD. . . . .	GO	AFT C MFD . . . . .	GO
FWD R MFD. . . . .	GO	AFT R MFD . . . . .	GO
FWD CSD. . . . .	GO	AFT CSD . . . . .	GO
FWD GHS . . . . .	GO	AFT GHS . . . . .	GO
FWD EFDP. . . . .	GO	AFT EFDP . . . . .	GO
STATUS 2		DB STATUS	TEST

### Normal Procedures

The Normal procedures page is displayed at the first selection of the CHKLST format or, if the Emergency Procedures page is displayed, by pressing the NORM PROC key (SK16).

The first time the Normal Procedures page is entered, the first procedure of the active flight phase is selected and the relevant details displayed.

The lower half of the Normal Procedures page displays the following information:

- A list of normal procedure titles arranged chronologically and relevant to the selected flight phase.

- A selector box which can be moved to highlight the desired title.

In the lower half of the page, the following keys are available:

- EMERG PROC (SK16) - Selects the Emergency procedure page.

- GND (SK15) - (Ground flight phase) Selects the Normal Ground Procedures. When selected, the key label is boxed.

- TAKEOFF (SK14) - (Take-off flight phase) Selects the Normal Takeoff Procedures. When selected, the key label is boxed.

- IN-FLT (SK13) - (In-flight flight phase) Selects the Normal In-Flight Procedures. When selected, the key label is boxed.

- LDG (SK12) - (Landing flight phase) Selects the Normal Landing Procedures. When selected, the key label is boxed.

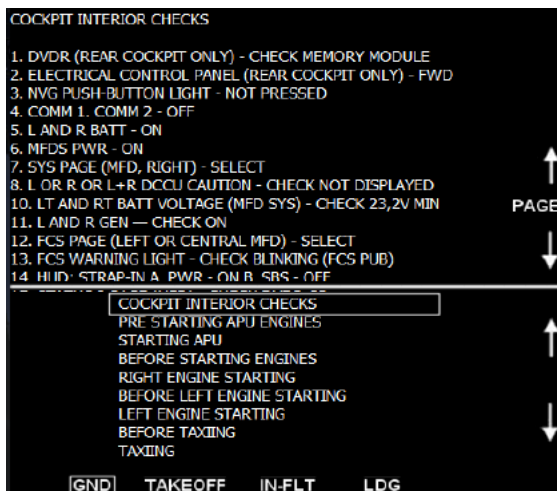
### CHECKLIST FORMAT (CHKLST)

#### CAUTION

CHECK THAT THE CHECKLIST DATABASE LOADED IN THE MFD IS UP DATED TO THE LATEST ISSUE OF THIS FLIGHT MANUAL / PILOTS' CHECKLIST BEFORE FLIGHT. ALWAYS REFER TO THE LATEST ISSUE OF THIS FLIGHT MANUAL / PILOTS' CHECKLIST IN CASE OF DISCREPANCY/MISALIGNMENT.

The CHKLST format provides Normal and Emergency procedures divided into the main flight phases of "Ground", "Take-off", "In-flight" and "Landing". For each flight phase, a list of procedures allows the pilot to select and display the details of the desired procedure. The CHKLST format is selected by pressing the CHKLST key (SK10) from menu level 2. The first time the format is selected, the Normal procedure page is displayed. When the format is exited, the last selected procedure and details thereof are retained and presented at the next format selection.

The checklist format appears as follows:



### Emergency Procedures

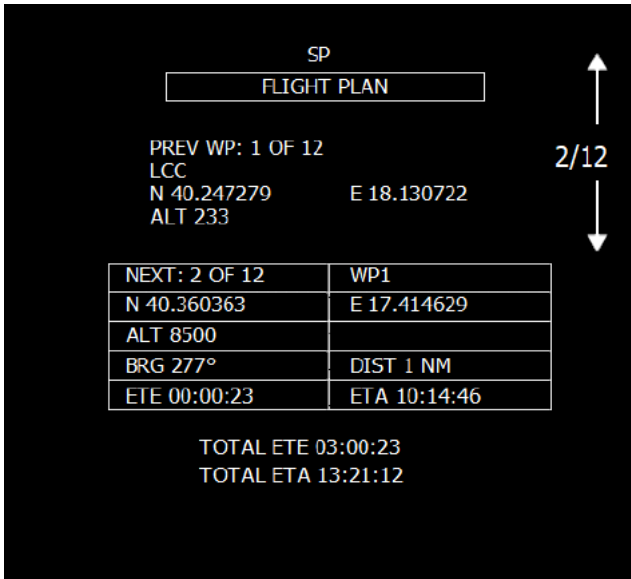
The Emergency Procedures are not implemented in this simulation.

### STEER POINT (SP) FORMAT

The Steerpoint format is selected by pressing the SP key (SK12) from the MFD Menu level 1 or level 2. The SP format provides information on navigation points and flight plan nodes loaded in the navigation database.

In this format, pressing SK6 and SK7 allow the selection of a specific steerpoint within the flight plan.

NOTE: In this simulation, there is no substantial difference between a steer point and a GPS flight plan



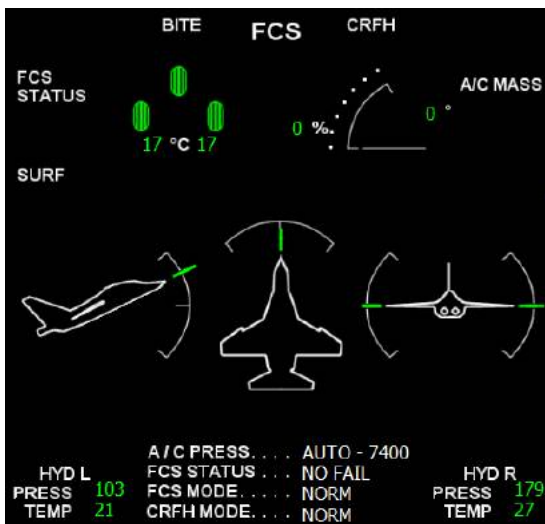
waypoint.

### FCS FORMAT

The FCS format is selected from Menu level 1 by pressing the FCS key. It provides both general and specific information on the FCS system through the following pages:

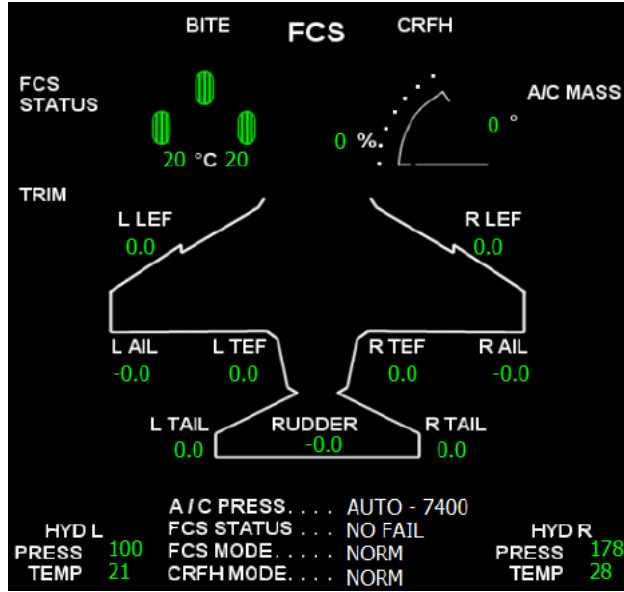
- FCS TRIMS
- FCS SURFACES
- FCS POWER UP BITE (not pilot selectable)

The FCS TRIMS page is the default page displayed at format selection. It provides indication of airbrake and trim settings, take-off trim selections, landing gear position, LDG brakes temperature, FCS selections and hydraulic systems pressure and temperature. The FCS SURFACES page, which is selected pressing the SURF key (SK19), besides duplicating the indications of airbrake setting, take-off trim selection, landing gear position, LDG brakes temperature, FCS selections and hydraulic systems pressure and temperature, it provides indications of the surface deflection.



The typical appearance of the FCS TRIMS page is as follows:

The FCS surfaces appears as follows:

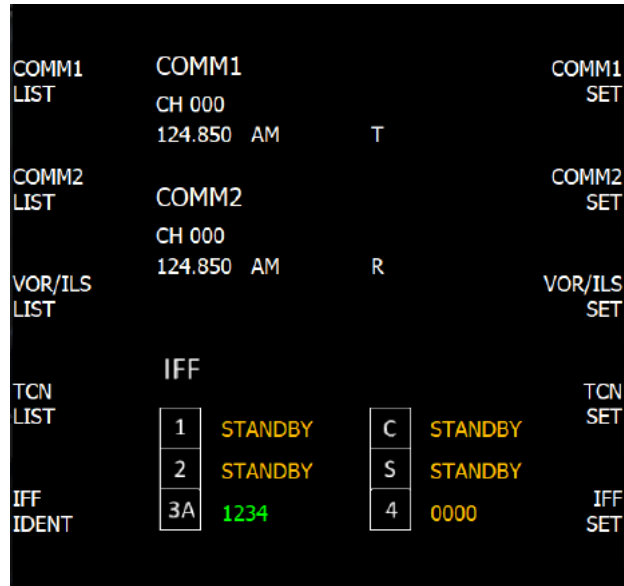


### CNI FORMAT

The CNI format is selected by pressing the CNI key from the MENU level 1.

This format provides information about currently selected COMM and NAV frequencies, as well as IFF transponder settings.

The typical appearance of the page is as follows.



NOTE: in the real plane, this page also provides an alternate method of entering communication and navigation frequencies and codes. This is not supported in the simulation – which implements only CNI control through the UFCP interface.

### IN/GPS FORMAT

The IN/GPS format is selected by pressing the IN/GPS key from the MENU level 1. The typical appearance of the IN/GPS page is as follows:

IN/GPS		
EGI POSITION	N 40.266778	E 18.105681
ATU LATITUDE	N 40.266778	
EGI MAG HDG	317	
ATU MAG HDG 0	317	
EGI TRUE HDG	321	
EGI MAG VAR	4	
ATU MAG VAR	4	IFA
MSL ALT		
IN MODE	STANDBY	
GPS MODE	SPS	
ATU MODE	GO	
TRK SAT.	1	
EST.ERROR	100 M	
DAY	2017:05:30	
UTC	08:14:36	

The IN/GPS page also allows the pilot to perform the EGI alignment procedure – which however has been included solely for procedural purposes: the procedure has no effect on the navigation system accuracy in the simulation.

#### OTHER FORMATS

In addition to the formats described above, the MFD system also provides the following formats:

**FAIL TRAIN** – This page allows the deactivation of some avionic functions to simulate in-flight failures. Currently, the simulation supports MFD, HUD, VOR, EGI and TACAN failures. The other failure modes can be selected but will not affect the simulation. Note that, in real life this system is typically operated by the instructor – and has no impact on the rear cockpit MFDs and avionics.

**NDS** – Not implemented in the simulation

**DVDR** – Not implemented in the simulation

**HUDR** – Not implemented in the simulation

**DTM** – Not implemented in the simulation

**ETTS** – Not implemented in the simulation

**FCR** – The FCR format provides basic A/A radar functionality. This page is not implemented in the initial release.

**EWS** – The EWS format provides basic RWR functionality as well as information about countermeasures. This page is not implemented in the

initial release.

**TGP** – The TGP format provides TFLIR imagery if the pod is mounted. This page is not implemented in the initial release.

**SMS** – this page reports the status of the aircraft stores. If the MASS selector is not LIVE, the REJECT button allows the user to change the loadouts (between preselected configurations).

#### HEAD-UP DISPLAY (HUD)

The HUD is the primary flight reference. It is installed at the center of the main instrument panel in the front and rear cockpits. The HUD provides all the information required for flight management and weapon aiming by superimposing the symbology generated by the MCSG on the real world scene, as seen by the pilot through the combiner glass of the PDU.

The HUD consists of a pilot display unit (PDU) and an Up Front Control Panel (UFCP). The PDU receives video signals generated by the MCSG in order to display navigation, approach and attack information through a dedicated symbology focused at infinity and superimposed on the real world scene. The MCSG is the graphic controller: it generates PDU deflection signals, control signals and video composite signals. In case of failure of the MCSG, the HUD automatic symbology is lost since the MISCO, which becomes the active bus controller, does not provide the graphic controller function. In this case, a standby reticule within the PDU can be manually selected for weapon aiming purposes by means of the control knob in the right side of HUD.

The front HUD is electrically powered by the left 28 V DC essential bus (PDU) and left 28 V DC ground bus (UFCP); the rear HUD is electrically powered by the right 28 V DC essential bus (PDU) and right 28 V DC ground bus (UFCP).

#### Up-Front Control Panel (UFCP)

The UFCP is installed at the center of the main instrument panel, below the PDU, in the front and rear cockpits. It allows the pilot to control and monitor navigation, communication, identification, radio navigation and attack data via a front keyboard and a LED dot matrix display.

The LED display is arranged in 4 rows of 20 characters each. Four selector keys on each side of the display are directly linked to the related row to provide control of the displayed data as follows:

- data displayed on the left side of a row are selected by the left function key

- data displayed on the right side of a row are selected by the right function key.

The UFCP keyboard has 35 keys and space provision for 5 additional keys. According to the different functions controlled by the keys, they can be divided into the following groups:

- Format keys
- HUD related keys
- Operative keys
- Master mode keys
- Data entry keys.

Interaction of UFCP with HUD symbology is limited to the selection of CDM/FPM/WATERLINE/CDM+FPM, the decluttering function, timer management and master mode selection (A/A, NAV, A/G).

The format keys allow the selection of the following UFCP formats, which enable the pilots to control and monitor the related systems/functions:

- IFF
- Steerpoint
- Waypoint
- Baro Fix
- Communication
- Data
- Flight Plan
- Helmet Mounted Display (provision)
- TACAN
- VOFI/ILS
- Time (Stopwatch / Rolex)
- Autopilot/Flight Director.

**NOTE:**

In the simulation, a number of UFCP functions have been simplified or omitted. At launch, the following functions are not implemented: BARO FIX, Helmet Mounted Display.

**NOTE:**

The simulation embraces the standard Flight Simulator X. There is no difference, for the simulation, between waypoints and steerpoints. All steerpoints are waypoints within an MSFS flight plan. A flight plan HUD Operation

must be created with the default MSFS flight planned for navigation functions to work.

The first format displayed by default at UFCP power-up is the communication format (COMM1/COMM2). When a format is selected by pressing the relevant key, the format main page is displayed. Some formats have a 10-second time out whereby, if no further selections and/or data insertion is sensed for a time period of 10 seconds, the selected format and page are exited and the main page relevant to the COMM1/COMM2 format is automatically displayed.

#### Operation of Stand-by Sight (SBS)

Setting the SBS switch located on the right side of the UFCP to the ON position causes the HUD to remove the normal (automatic) symbology and to display a stand-by sight reticule.

The SBS reticule is positioned by default at 105 mrad (6 deg) above the HUD optical center. Adjustment of SBS position in the vertical range from 6 deg to -9 deg is possible in steps of 1 mrad (0,06 deg) by means of the SBS UP and SBS DOWN keys.

#### UFCP Operation

##### UFCP KEYBOARD

The mode of operation of the alphanumeric keyboard is a function of the data to be entered. It usually operates in the conventional alphanumeric mode although, for some data, keyboard operation can be toggled between the predictive text mode T9 (text on 9 keys) and the conventional alphanumeric mode A/Z.

##### UFCP FUNCTION KEYS

The display lateral keys (function keys) are used to change/set the data displayed on the row next to each key. From top to bottom, the keys on the left side of display are conventionally numbered F1 to F4, while the keys on the right side of display are numbered F5 to F8:

##### FORMAT AND PAGE CHANGE

Selected formats can be changed at any time by pressing the desired format selection key on the UFCP keyboard; all operations in progress will be immediately aborted.

Sometimes, formats may have a +PAGE and/or MENU key (usually F4 key) which displays a lower level page allowing access to further, more detailed functions of the selected format. Likewise, a -PAGE and/or MAIN key (usually F8 key) allows access to a higher level page or to the main page, respectively, which manages more general functions



Different formats can be presented on HUD according to the selected mode of operation. Some of the symbols presented on the screen are common to all formats regardless of the selected mode.

The HUD has three main modes of operation:

- Navigation mode (NAV)
- Air-to-Air attack mode (A/A)
- Air-to-Ground attack mode (A/G).

In the navigation mode, two sub-modes are available:

- En route navigation (NAV)
- Approach (APP)

The NAV sub-mode is automatically selected if the landing gear is in the UP position and the navigation source is different from ILS, ILS DME, TACAN ILS or ILS UNCPL.

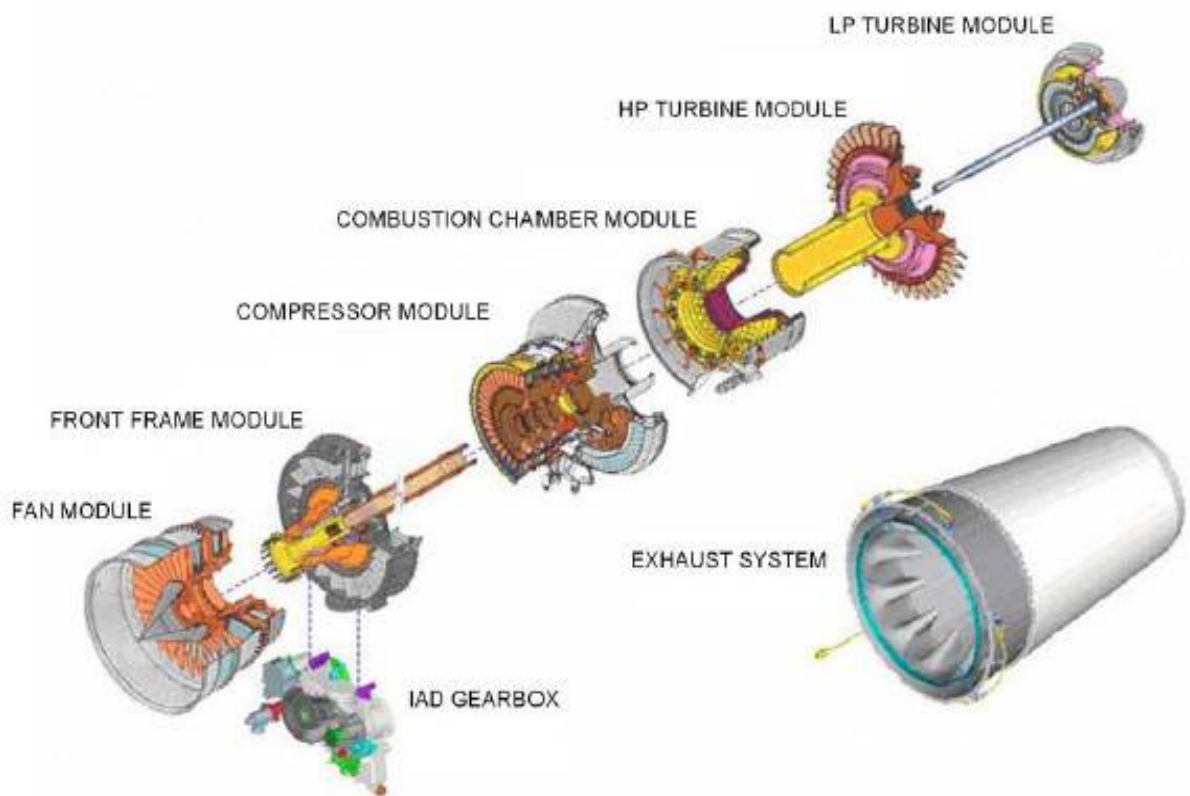
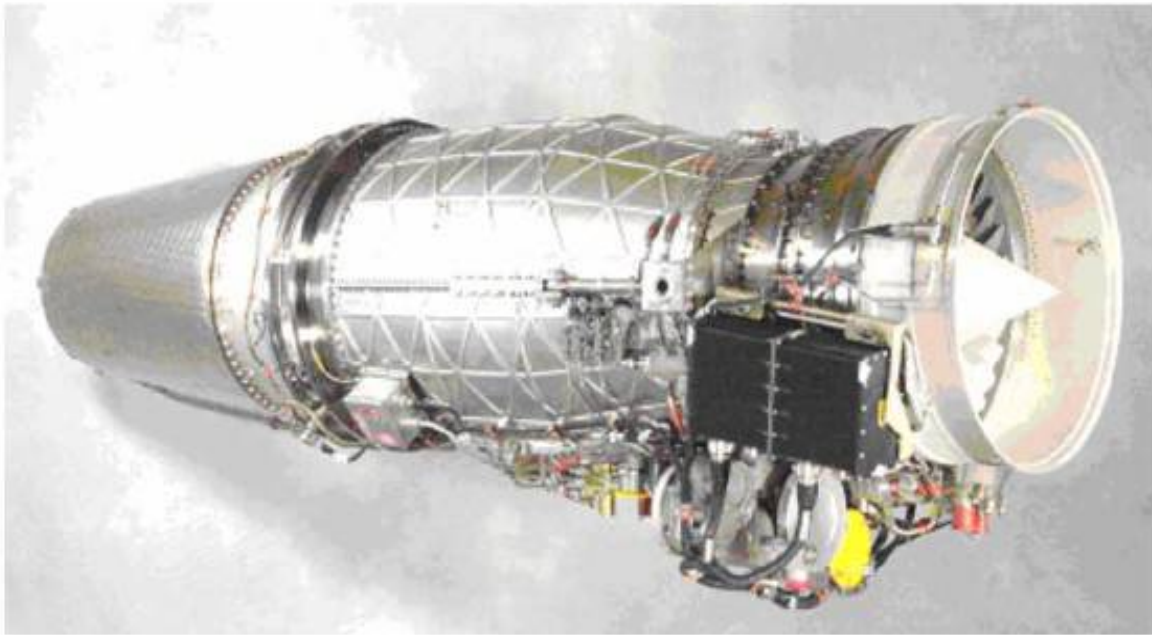
The APP sub-mode is automatically selected if the landing gear is in DOWN position or the navigation source is ILS, ILS DME, TACAN ILS or ILS UNCPL.  
NOTE

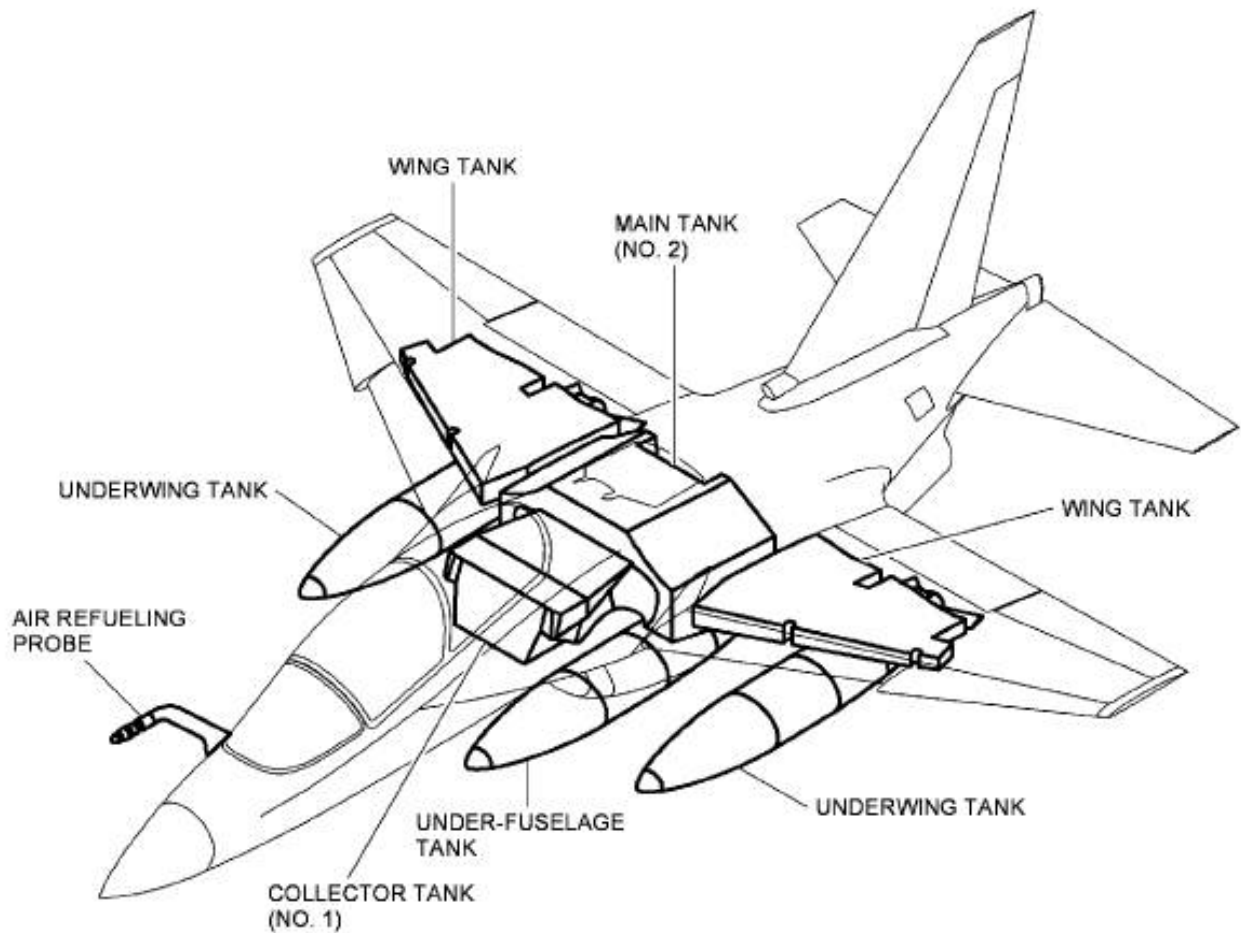
Before takeoff, the HUD is set to the NAV sub-mode even if the landing gear is down.

#### Selection of HUD Formats

The formats related to the three main modes of operation of the HUD can be selected through the A/A, NAV and A/G master mode keys on the UFCP keyboard (figure 1-102), which respectively select the air-to-air, navigation and air-to-ground mode. The navigation format is the default format; it is initially displayed on HUD in the absence of any pilot's selection.

# HONEYWELL F124 TURBOFAN ENGINE



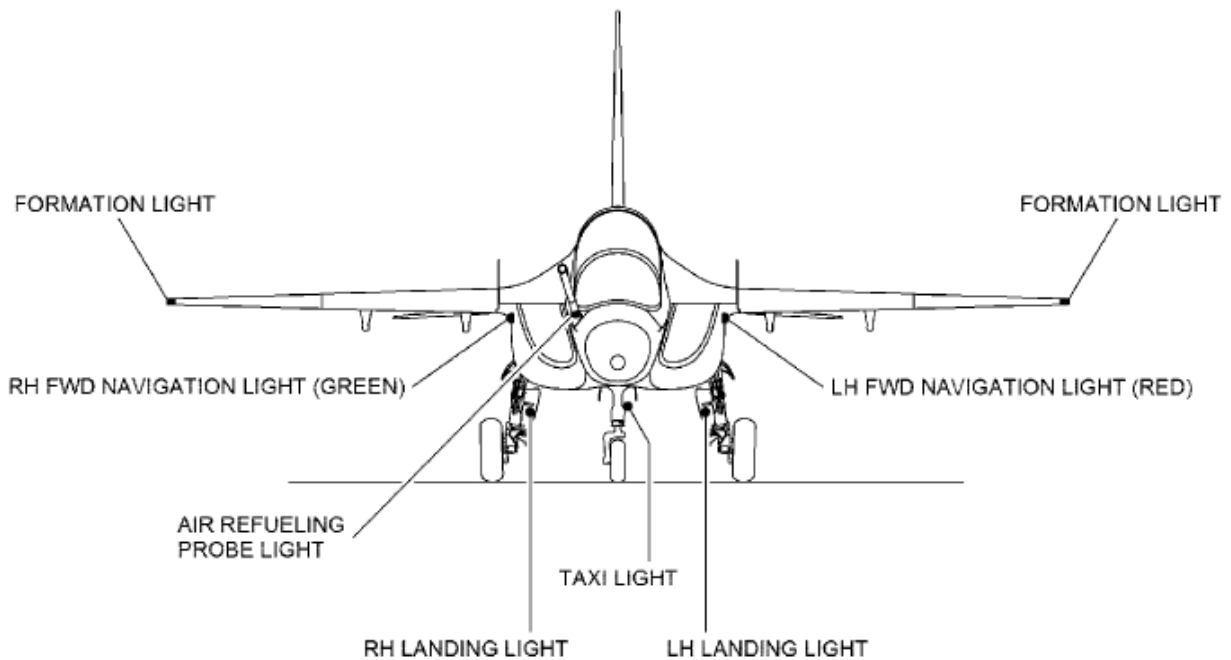
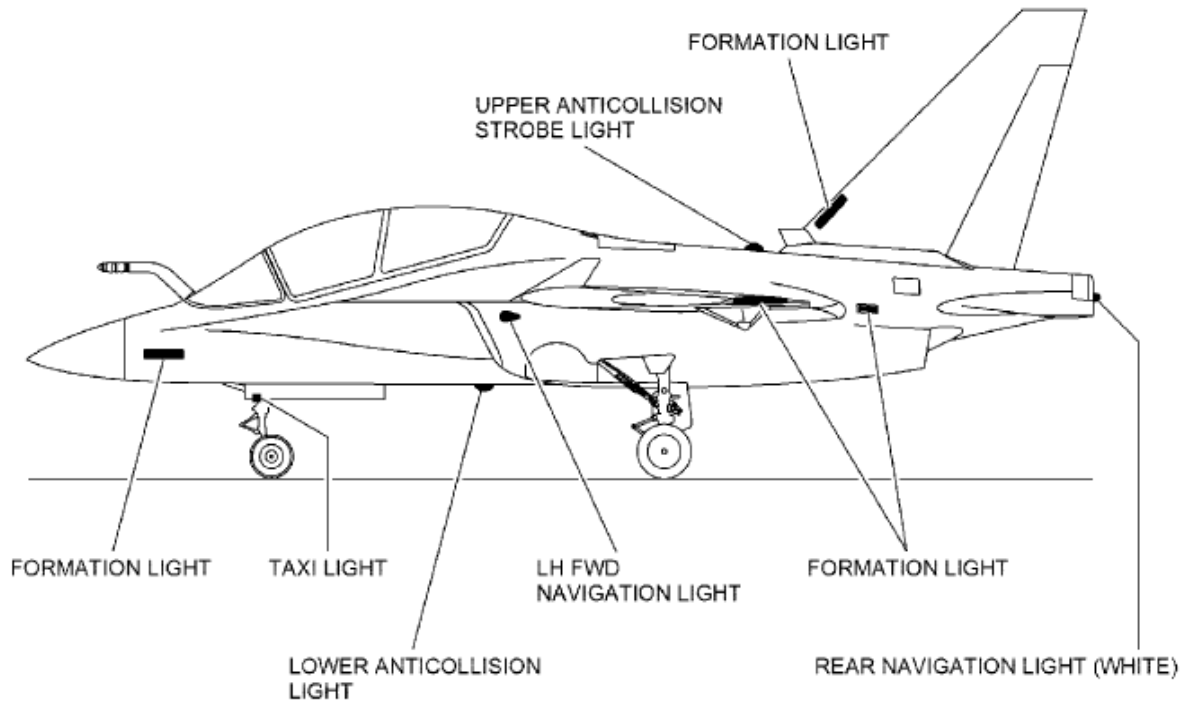


**NOTE**

- These figures are estimates only. The fuel mass is based on a fuel density of 0,8 kg/dm<sup>3</sup> (nominal density).
- Density of F-34 fuel may range from 0,775 to 0,840 kg/dm<sup>3</sup>.

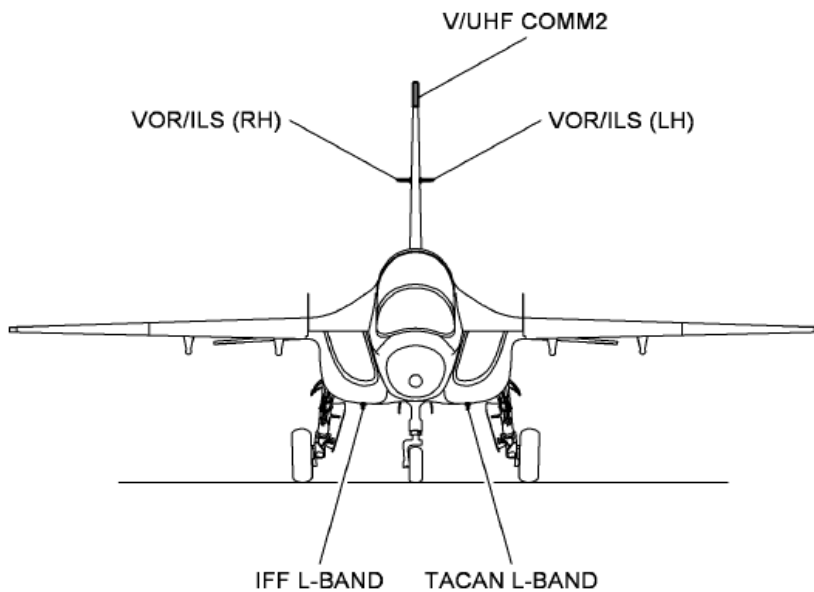
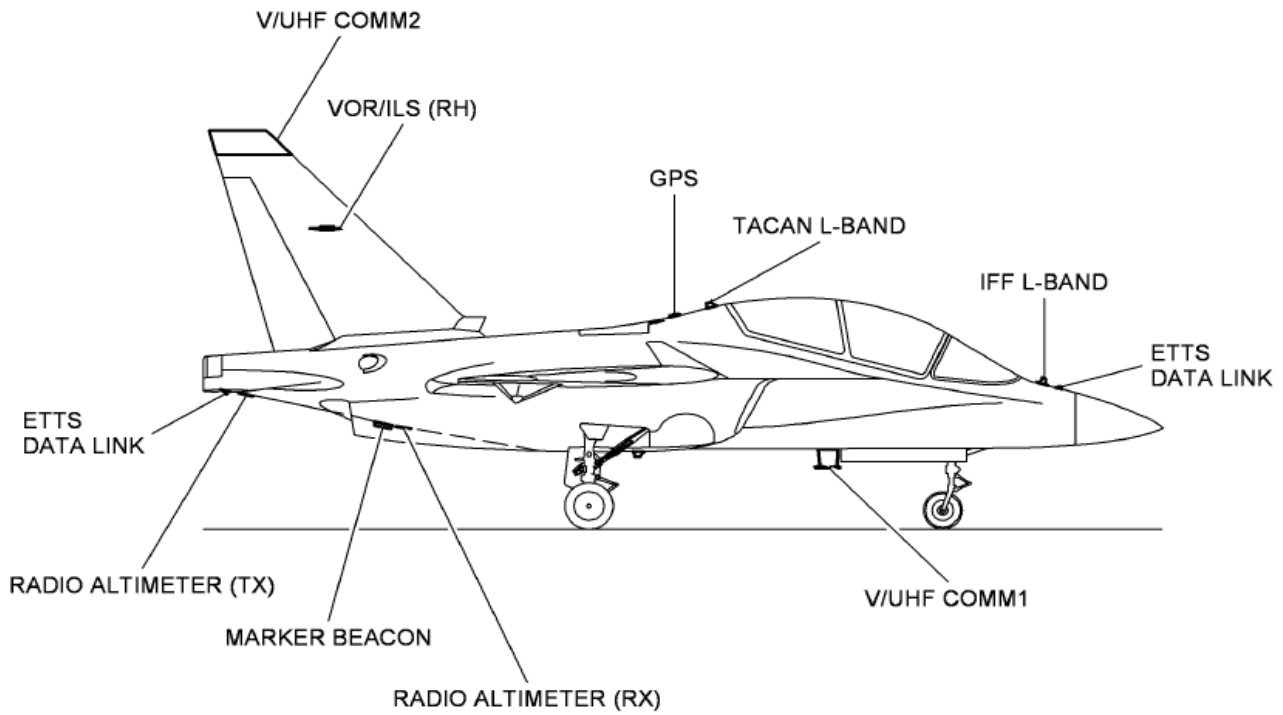
TANKS	USABLE FUEL (AFTER PRESSURE REFUELING)	
	VOLUME	NATO F-34 (JP8) (0,8 kg/l)
	Liters	kg
COLLECTOR TANK (No 1)	260	210
MAIN TANK (No 2)	1540	1230
TOTAL FUSELAGE TANKS	1800	1440
WING TANK (2)	350 X 2 (700)	280 X 2 (560)
TOTAL INTERNAL TANKS	2500	2000
EXTERNAL TANKS (3)	630 x 3 (1890)	500 x 3 (1500)
TOTAL FUEL	4390	3500

# EXTERIOR LIGHTS

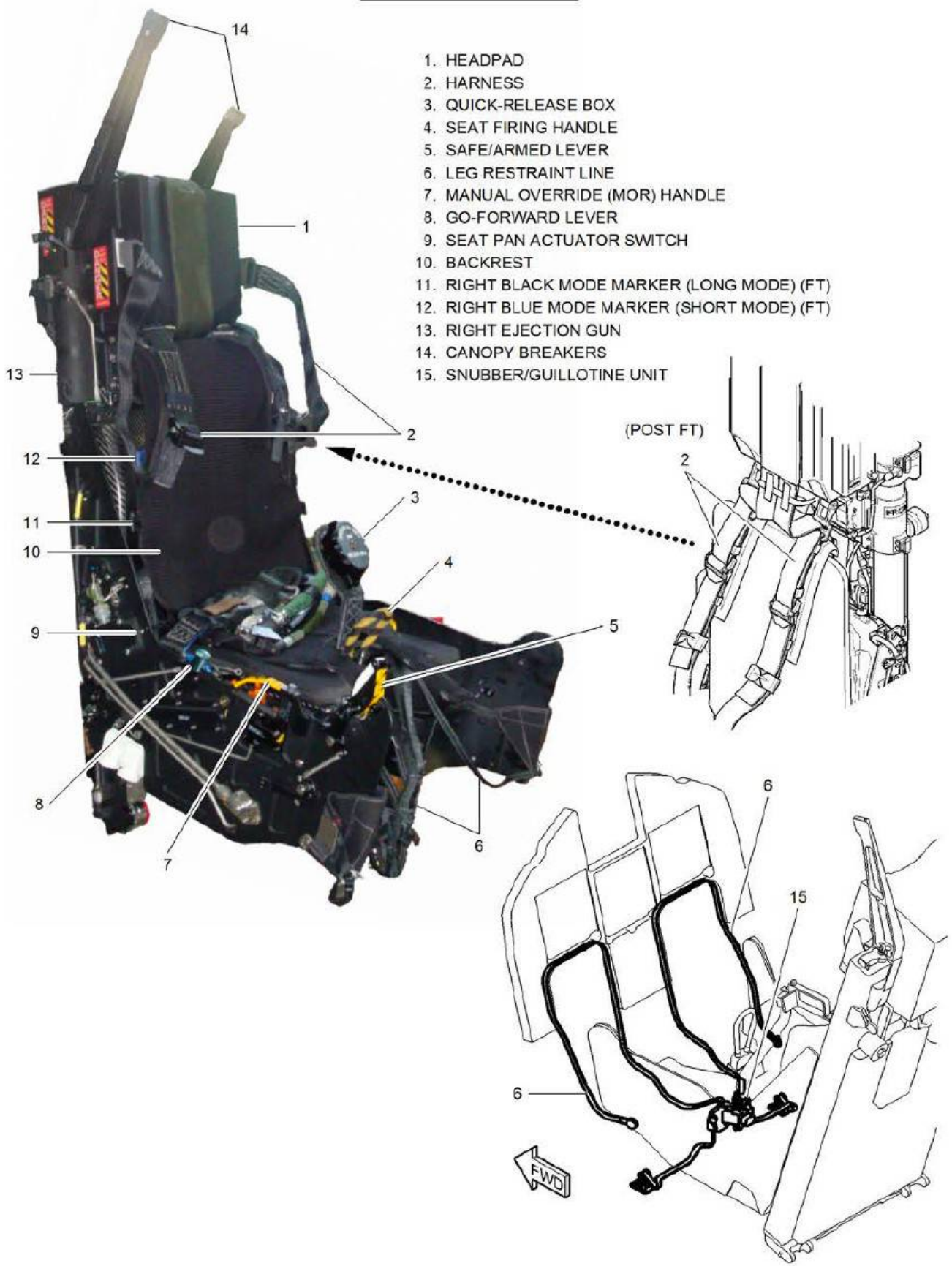


# AVIONICS EQUIPMENT

## ANTENNAS LOCATIONS



# EJECTION SEAT



1. HEADPAD
2. HARNESS
3. QUICK-RELEASE BOX
4. SEAT FIRING HANDLE
5. SAFE/ARMED LEVER
6. LEG RESTRAINT LINE
7. MANUAL OVERRIDE (MOR) HANDLE
8. GO-FORWARD LEVER
9. SEAT PAN ACTUATOR SWITCH
10. BACKREST
11. RIGHT BLACK MODE MARKER (LONG MODE) (FT)
12. RIGHT BLUE MODE MARKER (SHORT MODE) (FT)
13. RIGHT EJECTION GUN
14. CANOPY BREAKERS
15. SNUBBER/GUILLOTINE UNIT

(POST FT)

FWD

## **NORMAL PROCEDURES**

### TABLE OF CONTENTS:

- Preflight Checks
- Pre Starting APU/Engines
- Starting APU
- Starting Engines
- Before Taxiing
- Taxiing
- Before Takeoff
- Takeoff
- After Takeoff
- Climb
- After Landing
- At Parking
- Level-Off and Cruise
- Air Refuelling Procedures
- PARS Activation and Operation
- Descent
- Before Landing
- Instrument Approach
- Touch and Go / Go Around
- Aerobraking
- Landing
- After Landing
- At Parking

### **WARNING**

**Although this simulation is designed for a medium/high-fidelity rendition of the real-world aircraft, real-world checklists and operation instructions have been significantly modified. DO NOT USE ANY INFORMATION OF THIS MANUAL AS SOURCE FOR REAL-WORLD AIRCRAFT OPERATION OR INFORMATION**

### NOTE

Checklists items or other information reported in *Italics* have no effect in the simulation and are reported for realism and educational purposes only.

## **PREFLIGHT CHECKS**

### **BEFORE EXTERIOR INSPECTION**

1. Check Aircraft Form for aircraft status and proper servicing – Check configuration and “repair and refuel” options in the airplane configurator (shift+4)
2. Ejection seat lever – Check SAFE
3. Seat shoulder harness – Check correctly prepared
4. Publications - Check to ensure that all required navigational publications are on board.

### **CAUTION**

**IT IS ALLOWED TO CARRY IN THE COCKPIT ONLY ITEMS STRICTLY RELATED TO THE FLIGHT, I.E. CHECKLIST, SOFT KNEE-PAD, FLIP PUBLICATIONS AND IFR AND VFR CHARTS.**

5. Ground services control panel - All switches guarded

6. Flaps lever (front cockpit) - According to flaps position

7. Flaps lever (rear cockpit) - FWD

8. Landing gear handle - LG DN

### **Night Operations**

#### NOTE

*The oxygen regulator is not illuminated by dedicated light. Use cockpit utility light or flood lights to locate it during night operations.*

1. COMM/NAV PWR control panel:

a. COMM 1 or COMM 2 - GND

2. INTR LT:

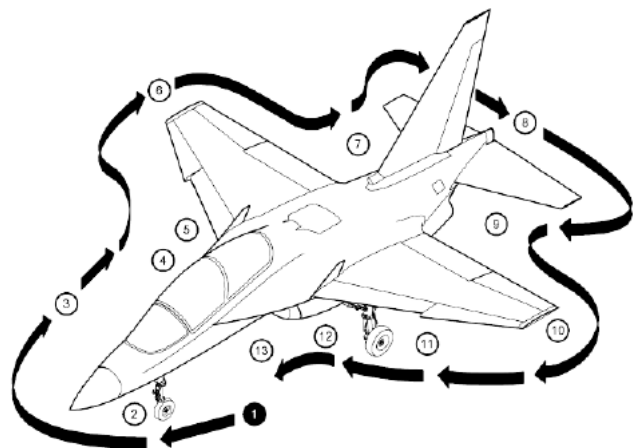
a. FLOOD - ON, adjust brightness

3. Reading lights:

a. ON (downward position)

b. Adjust brightness

### **EXTERIOR INSPECTION**



*The exterior inspection procedure is based on the assumption that maintenance personnel have met all preflight and postflight requirements specified in the applicable technical publications. The pilot will not therefore repeat the same inspections, except for some safety-critical items. During the exterior inspection, the aircraft should be checked for general conditions, wheels chocked, access doors and*

filler caps secured, and for hydraulic, oil, and fuel leaks as well as for the specific items specified below:

1. FRONT FUSELAGE (Left Side)

- IMFPs (2) - Unobstructed
- Formation light » Condition
- Upper IFF antenna - Condition
- Front ETTS data link antenna - Condition
- Ground refuelling door – Closed

2. NOSE LANDING GEAR

- Nose landing gear bay and doors - Condition
- Taxi light - Condition
- Safety lock - Removed
- Shock absorber - Extension
- Tire - Condition and inflation
- Torque links – Engaged

3. FRONT FUSELAGE (Right Side)

- Upper TACAN antenna - Condition
- Air refuelling probe (if installed) - Condition
- IMFPs (2) - Unobstructed
- Static ports - Condition
- Formation light - Condition
- Windshield and canopy - Condition
- Ram air scoop - Closed and condition
- Canopy severance external handle - Stored and condition
- Engine air intake - Clear and condition
- ECS air intake - Clear and condition
- Navigation light - Condition
- Door 126BT (right battery) – Closed

4. CENTER FUSELAGE RIGHT (Lower Side)

- V/UHF COMM 1 antenna – Condition
- Lower anti-collision light - Condition
- ECS heat exchanger exhaust - Clear and condition
- tion

5. RIGHT MAIN LANDING GEAR

- Landing gear bay and doors - Condition
- Landing light - Condition
- Lower anti-collision light - Condition
- Safety lock - Removed
- Shock absorber - Extension
- Tire - Condition and inflation

6. RIGHT WING

- Vertical strake - Condition
- Leading edge flap - Condition
- Formation light - Condition
- Aileron - Condition
- Trailing edge flap - Condition
- Underwing pylon (if installed) - Security, condition and safety handle on SAFE
- Underwing fuel tank (if installed) - Security

and  
condition

7. CENTER/REAR FUSELAGE (Right Side)

- Lower IFF antenna - Condition
- Lower bay ventilation scoop - Condition
- Lower generator ventilation scoop - Condition
- Upper bay ventilation grid - All sectors open, condition
- ECS precooler duct - Clear and condition
- Upper anti-collision light - Condition
- GPS antenna - Condition
- Airbrake - Condition
- Fuselage formation light - Condition
- Vertical stabilizer formation light - Condition
- APU exhaust - Condition
- Right engine bay door - Closed
- Right engine jet pipe - Condition

8. AFT FUSELAGE

- Navigation light - Condition
- Rudder - Condition
- Stabilators - Condition
- Fuel vent - Clear
- VOR/ILS antennas - Condition
- ECS precooler exhaust Clear and condition
- Q V/UHF COMM 2 antenna - Condition

9. CENTER/REAR FUSELAGE (Left Side)

- Lower TACAN antenna - Condition
- Lower bay ventilation scoop - Condition
- Lower generator ventilation scoop – Condition
- Upper bay ventilation grid - All sectors open, condition
- Left engine jet pipe - Condition
- Fuselage formation light - Condition
- Fin formation light - Condition
- Left engine bay door - Closed
- APU air intake - Clear
- Marker Beacon antenna - Condition
- Radar altimeter antennas - Condition
- Rear ETTS data link antenna - Condition

10. LEFT WING

- Trailing edge flap - Condition
- Aileron - Condition
- Formation light - Condition
- Leading edge flap - Condition
- Vertical strake - Condition
- Underwing pylon (if installed) - Security, condition and safety handle on SAFE
- Underwing fuel tank (if installed) - Security condition

11. LEFT MAIN LANDING GEAR

- Landing gear bay and doors - Condition
- Landing light - Condition
- Safety lock - Removed
- Shock absorber - Extension



- *Tire - Condition and inflation*
12. **CENTER FUSELAGE LEFT (Lower Side)**
    - *V/UHF COMM 1 antenna - Condition*
    - *Lower anti-collision light - Condition*
    - *ECS heat exchanger exhaust - Clear and condition*
    - *Ventral pylon (if installed) - Security, condition*
    - *safety handle on SAFE*
    - *Ventral fuel tank (if installed) - Security and condition*
    - *Luggage pod - Security and condition*
  13. **FRONT FUSELAGE (Left Side)**
    - *Navigation light - Condition*
    - *Door 147AT (canopy opening and external power connection) - Closed*
    - *Avionics ram air scoop - Closed and condition*
    - *Engine air intake - Clear and condition*
    - *ECS air intake - Clear and condition*
    - *Canopy severance external handle - Stored condition*
    - *Door 125BT (left battery) — Closed*

#### **REAR COCKPIT CHECKS FOR SOLO FLIGHT**

1. Ejection seat:
  - a. Ejection seat lever - Check SAFE
  - b. Seat safety pin - Check installed in the seat
  - c. *Check that the survival pack, seat belt and harness, communication lead, normal and emergency oxygen hoses are properly fastened.*
2. *Utility light – Secured*
3. *Reading lights - OFF (stowed position)*
4. Supply OXY lever - OFF
5. Flaps lever - FWD
6. *MFDs PWR – OFF in real-world. In the simulation, the front and rear MFDs formats and controls are linked.*
7. TRIM - NORM (guarded)
8. *Engines control panel – FWD – Rear cockpit engine controls are not functional in the simulation.*
9. *HUD PWR – OFF in real-world. In the simulation, the front and rear MFDs formats and controls are linked.*
10. Electrical control panel - FWD (guarded)
11. FUEL SOV (three switches) - OPEN (guarded)

12. CANOPY ORIDE SW - FWD (guarded)
13. INTR LT - All knobs OFF
14. DVDR - Check removable memory module in place and locked
15. Map case cover - Closed
16. ISS control lever - INDP or REAR

#### **WARNING**

**ON AIRCRAFT PRE MOD PTAAER.13-IT16D-106 DO NOT USE "BOTH" AND "REAR" POSITIONS. THEY ARE NOT CLEARED.**

**WITH THE ISS CONTROL LEVER SET TO "INDP", NO TIME DELAY IS PRESENT IN THE FRONT SEAT BETWEEN HARNESS RETRACTION AND SEAT EJECTION. SEVERE INJURIES MAY BE SUFFERED IN CASE OF IMPROPER PRE-EJECTION POSTURE.**

**WITH THE ISS CONTROL LEVER SET TO "REAR" (POST MOD PTA AER.13-IT16D-106 AND POST FT), A TIME DELAY OF 0,54 SEC IS PRESENT IN THE FRONT SEAT BETWEEN HARNESS RETRACTION AND SEAT EJECTION AS A RESULT, GROUND CLEARANCE WILL CHANGE.**

17. CANOPY SEAL deflating valve - INFLATE and lockwired

#### **COCKPIT INTERIOR CHECKS**

A thorough cockpit interior preflight shall be accomplished prior to each flight. Switch positions designated "as desired" allow pilot preference in switch control positioning. "As required" indicates that the position of those switches will differ with mission requirements. If no specific requirement exists, pilot preference may be used. Normally, those avionics switches designated "as desired" or "as required" should be OFF for start.

#### **CAUTION**

**DO NOT PLACE ANY ITEM ON THE GLARESHIELD, AS WINDSHIELD SCRATCHING IS PROBABLE. INTERIOR INSPECTION**

1. DVDR (rear cockpit only) - Check removable memory module in place and locked

#### **NOTE**

**If the MCSG is powered with the removable memory module not inserted, no database will be loaded in the MCSG.**

2. Electrical control panel (rear cockpit only) - FWD

(guarded)

3. NVG push-button light - Not pressed
4. COMM 1. COMM 2 - OFF
5. L and R BATT - ON

**NOTE:**

*The L BATT and R BATT switches must be set to ON at the same time (within 7 sec from each other) to avoid DCJB PBIT failure. In the simulation, both switches are operated together.*

6. MFDs PWR - ON
7. SYS page (MFD, right) - Select
8. L or R or L+R DCCU caution - Check not displayed

If L or R or L+R DCCU caution is displayed:

9. L and R BATT - OFF
10. Perform a new power up

If L or R or L+R DCCU caution is still displayed:

11. Flight – Abort

If L or R or L+R DCCU caution is not displayed (after step 8. or 10.):

11. Left and right battery voltage (MFD SYS page) - Check above 23,2

**NOTE**

The batteries voltage check shall be done as soon as the indication appears on the MFD, disregarding transient values due to equipment power up.

If batteries voltage is out of range:

12. Flight - Abort

If voltage is out of range but you decide to continue:

12. *External electrical power:*

a. *Connect*

b. *L and R BATT lights - Check OFF*

*External electrical power is not available in the simulation. If batteries are discharged, the start procedure and the flight must be aborted, and a new flight must be set in the simulator.*

In any case:

13. L and R GEN — Check ON

**NOTE**

During aircraft PBIT the R BLEED and L BLEED warning lights blink twice. The blinking indicates that the PBIT has been successfully performed.

If on-board batteries are the only source of electrical power, APU starting shall be performed within 5 minutes of aircraft power-up to ensure that the available battery capacity is at least 50%.

14. FCS page (left or central MFD) - Select

15. FCS warning light - Check blinking (FCS PUB)

**NOTE**

The FCS warning light normally blinks for about 60 sec, then stays OFF. An FCS warning light not blinking during power up is an early indication of FCS PUB NOGO condition.

16. HUD: Strap-In (FT)

a. PWR - ON

b. SBS - OFF

17. STATUS 2 page (MFD) - Check DVDR GP

**NOTE**

If DVDR N/A is displayed perform a new aircraft power-up.

18. GPS ZERO-MCSG-IN/GPS control panel:

a. GPS ZERO - NORM

b. MCSG - MCSG

**NOTE**

*At MCSG switch ON, the MCSG reads the center-off position (zero value) of the Cursor Slew Controller on the front and rear engine throttles. To prevent a wrong reading, the Cursor Slew Controller must not be moved the first 60 seconds after MCSG switch ON.*

c. IN/GPS - IN/GPS

19. FCS warning light - Check OFF

20. *Checklist databases (MFD) - Check updated to the latest issue of this Flight Manual /Pilots' Checklist*

**CAUTION**

**ALWAYS REFER TO THE LATEST ISSUE OF THIS FLIGHT MANUAL/PILOTS' CHECKLIST IN CASE OF DISCREPANCY/MISALIGNMENT.**

21. CADI page (MFD) – Select

## EGI Alignment

1. IN/GPS page (MFD) – Select
2. If present position data shown are not correct:
  - a. DATA - EGI SET page on UFCP - Select
  - b. Latitude and longitude data - Enter
3. GC alignment - Select (after UTC data and time correctly displayed)
4. HSI or CADI format - Press NAV key when READY is displayed on the MFD

### NOTE:

NAV DEGRADED will be available within approximately 1 min 20 sec and 2 min 30 sec.

In this simulation the procedure is entirely optional, and has no impact on the navigation accuracy - also it is NOT requested to enter data in the UFCP.

## Seat Strap-in

### WARNING:

**DO NOT PUT SAFETY EQUIPMENT STRAPS OR LINES THROUGH OR AROUND THE SEAT FIRING HANDLE. IF YOU PUT SAFETY EQUIPMENT STRAPS OR LINES THROUGH OR AROUND THE SEAT FIRING HANDLE, YOU CAN INITIATE ACCIDENTAL EJECTION. ACCIDENTAL EJECTION CAN KILL OR CAUSE INJURY.**

### NOTE:

*Flying helmet can be donned either during the strap-in sequence or at the end of it at pilot discretion.*

*When using the Beaufort Lite Jacket, the plate must be removed from the seat left harness by the ground crew, in order to avoid possible interference during the strap-in and seat operations.*

1. Seat safety pin - Remove from seat and stow in the right console
2. SEAT ADJ - Align to the Reference Eye Position

### NOTE

*The Reference Eye Position is achieved when the top of the HUD combiners are aligned.*

### WARNING

**ALIGNMENT TO REP ENSURES PROPER HELMET-TO-CANOPY CLEARANCE IN CASE OF EJECTION.**

3. Rudder pedals - Adjust as required

### CAUTION

**PULL OUT THE PEDAL ADJUSTMENT HANDLE ALIGNED TO ITS SLIDING AXIS WITHOUT BENDING IT. INCORRECT HANDLE ACTUATION MAY CAUSE DAMAGE TO THE PEDAL ADJUSTMENT MECHANISM.**

4. Connect anti-g hose to anti-g suit connector
5. Connect the quick release connector of the life-jacket to the PSP lowering line connector located on the seat pan left side. Reduce the slack of the life-jacket attachment strap
6. Oxygen hose - Ensure routed outside the left lap strap
7. On ejection seat:
  - a. Make sure that the go forward lever is in the forward (unlocked) position

*b. Put the quick-release box for the negative-g strap in position between your legs. Make sure that the routing of the crotch strap is aft of (not through) the seat firing handle. Connect the harness straps to the QRB as follows:*

### WARNING

**DO NOT ROUTE THE CROTCH STRAPS THROUGH THE FIRING HANDLE. IF YOU ROUTE THE CROTCH STRAPS THROUGH THE FIRING HANDLE YOU CAN INITIATE ACCIDENTAL EJECTION. ACCIDENTAL EJECTION CAN KILL OR CAUSE INJURY.**

1. Put the lap straps in position over your thighs. Make sure that the routing of the left lap strap is over the PSP lowering line lanyard and that the routing of the anti-g hose is over the lap straps.
2. Put the shoulder straps in position with the lugs adjacent to the QRB
3. Pull the crotch straps forward and up between your legs with the comfort pad against your thighs. Make sure that the crotch straps are not crossed or twisted. Put the crotch straps up (inboard to outboard) through the D-ring on the lap straps. The left strap must be over the PSP lowering line. Put the shoulder straps lugs through the crotch straps end loop. Connect the shoulder strap lugs to the QRB

*c. Connect each shoulder strap lug to the QRB as follows:*

1. Press the QRB button and turn the cover approximately 15 deg clockwise or counter-clockwise. Push each shoulder strap lug into the related slot in

the QRB until you hear a click. This will indicate that the lug has engaged correctly

2. Return the cover to the center position and the button will return to the flush position. In this position the harness strap lugs are fully locked

3. Position the CRU60 support plate fully down next to the shoulder strap lug to allow correct shoulder strap tightening (applicable for Secumar life jacket only)

d. Fully tighten the lap straps symmetrically to make sure that the QRB is at the center of the harness

e. Fully tighten the shoulder straps as follows:

1. Whilst grabbing the shoulder harness from the buckles, lean forward and pull the shoulder harness above the shoulders so to make the harness adhere to the back and on your shoulders and avoid any hidden loose strap between the seat and the back (refer to figure A)

#### WARNING

**PULL THE TWO SHOULDER STRAPS AT THE SAME TIME AND SYMMETRICALLY. IF THE SHOULDER STRAPS ARE NOT PULLED AT THE SAME TIME, THE HPRU WEBBING CAN WIND INCORRECTLY INTO THE HPRU. AN INCORRECT WOUND WEBBING DURING EJECTION CAN CAUSE PILOT INJURIES.**



2. Whilst keeping the shoulder pad pulled, rest back to the seat and then fully tighten the shoulder straps

3. Move forward and check for freedom of movements



4. Lean forward and position the go-for-ward lever in

locked position

5. Move back to the resting position and try moving forward to verify the correct locking of the HPRU

6. To verify proper strap-in, the pilot shall check that the bar sliders are reachable by the corresponding hand and positioned at the shoulder top. In case the bar slider are not located at the shoulder top position, unlock the go forward lever, untighten the shoulder harness and repeat the strap-in sequence starting from step e.1

#### WARNING

**INCORRECT STRAP-IN MAY LEAD TO IMPROPER BODY RETRACTION AND RESTRAINT, CAUSING SEVERE PILOT INJURIES DURING EJECTION.**

7. Go-forward lever - As required



8. CRU60 - Connect to:

- plate (p/n Sierra 266-216) (applicable to Secumar life jacket only)

- Life jacket plate (applicable to Beaufort life jacket only)

9. Flying helmet - Fit

10. Mic/tel lead - Connect

11. Oxygen mask hose - Connect to the CRU60

12. CRU60 position - Adjust as required for comfortable oxygen hose routing (applicable for Secumar life jacket only)

13. ISS control lever (rear cockpit only) - As required



### Left Console

1. ETTS DL - OFF

2. EMERG LDG GEAR - In

3. A/R LIGHT knob - OFF

4. Front flaps lever - According to flaps position

5. Rear flaps lever - FWD

6. Throttles - Check free movement, adjust friction and set to STOP (NOTE: In the simulation, the throttles will not move from the STOP position if the engine selector knobs are set to STOP)

7. RF - NORM

8. TRIM - NORM

9. TCT:

a. D/L, DAS, FCR and TGP - OFF

10. Engine switches - Check STOP

11. Engines control panel (rear cockpit only) - FWD

12. FUEL PUMP - FLT (guarded)

13. APU - As required

14. Supply OXY lever - ON

15. Back-up OXY lever - NORM

### Instrument Panel

1. Left ENG FUEL SOV - OPEN (guarded)

2. Left ENG EXTG - Guarded

3. PARK & EMER. BK - Set

4. LDG/TAXI LT - OFF

5. LG handle red light - OFF

6. LG three green - ON

7. Flaps indicator - According to flaps position

8. EMERG JETT - Verify integrity

9. SEL JETT - Guarded

10. LATE ARM - SAFE (guarded)

11. REAL/SIM - As required

12. HMD - OFF

13. ALT SEL - As required

14. MASTER CAUTION - Press to reset

15. HUD Combiner and UFCP brightness - Adjust

16. Baro pressure - Set

17. GHD:

a. Attitude display - Check

b. Baro pressure - Set

18. A/R push-button indicator - OFF

19. Standby engine/fuel display - Correct indications consistent with SYS page indications

20. Clock - Check
21. WARN TEST - Press to test
22. Right ENG FUEL SOV - OPEN (guarded)
23. Right ENG EXTG - Guarded
24. MFDs - As required
25. CONT SHIFT panel - As required
26. NVG control panel - As required
27. APU EXTG - Guarded
28. APU FUEL - OPEN (guarded)
29. FCS control panel - Check proper indications

### Right Console

1. COMM/NAV PWR control panel:
  - a. RALT - OFF
  - b. Other switches - As required
2. Audio control panel:
  - a. NORM/BACKUP - NORM
  - b. VOL knob - As required
  - c. Transmission selector - As required
  - d. VOX - As required
3. CANOPY ORIDE SW (rear cockpit only) - FWD (guarded)
4. IFF - As required

#### NOTE

If mission does not require Mode 4 and Mode 5 operation, to avoid possible audio noise, set Mode 4 and Mode 5 indicators to OUT.

5. Air conditioning:
  - a. CABIN TEMP - Adjust
  - b. BLEED - ON
  - c. CABIN PRESS - ON (guarded)
6. RAIN RMVL - OFF
7. DEMIST - OFF
8. INTR LT - As required

9. EXT LT - All switches OFF
10. 243 COMM 1 and 2 switches - NORM
11. MFD PWR - Check ON
12. Ram air scoop - CLOSED
13. Canopy hand crank - Stowed
14. (Post FT) CANOPY SEAL deflating valve (rear cockpit only) - INFLATE and lockwired

### PRE STARTING APU ENGINES

1. BCN - ON
2. HUD (after MCSG on line) - Check symbology
3. DVDR - As required

#### NOTE

If recording is required, check that recording time is decreasing, otherwise select REC.

4. Left and right battery voltage (MFD SYS page)- Check above 23,2 V

If batteries voltage is equal or below 23,2 V:

5. Flight - Abort

5 Continue normal engine starting sequence with external air or with APU

#### NOTE

If engine starting is performed with APU, the use of external AC electrical power for APU starting is recommended to prevent further batteries discharge. When the first engine is stabilized at IDLE and external AC electrical power is disconnected:

6. GEN relevant to running engine and both TRUs - Check on line (L or R GEN and L+R TRU cautions not displayed). Assure continuously on line for 22 min before performing Takeoff procedures.

#### WARNING

IN CASE BATTERIES VOLTAGE IS EQUAL OR BELOW 23,2 V, IF THE TAKEOFF IS PERFORMED BEFORE THE END OF 22 MIN OF CHARGE PERIOD, BATTERIES AUTONOMY REQUIRED IN CASE OF ELECTRICAL FAILURE IS NOT GUARANTEED.

#### NOTE

- In case batteries voltage is equal or below 23,2 V, normal procedures included Taxiing can be performed during the 22 min of

batteries charge period.

- The normal engines starting sequence with APU running or external air is the following:

- Right engine

- Canopy closing

- Left engine.

- If needed, the left engine could be started before the right engine, (in this case, if the canopy is maintained open, loose cockpit items must be secured or stowed).
- The external electrical power (if connected) must be disconnected before left engine starting.
- When operating on ground with APU running, the AV AIR T caution may be activated depending on environmental conditions. The caution activation probability increases at outside air temperature below 15 °C. If required, use engine throttle setting between 70 and 75 % NH to maintain adequate cockpit temperature with APU OFF.

#### WARNING

IF LEFT ENGINE IS STARTED FIRST, DO NOT TAXI WITH LEFT ENGINE ONLY. WITH LEFT ENGINE ONLY, THE PEDAL BRAKES FUNCTION IS NOT AVAILABLE UNTIL RIGHT ENGINE IS STARTED.

#### CAUTION

A MAXIMUM OF THREE CONSECUTIVE ENGINE GROUND START ATTEMPTS CAN BE MADE ALLOWING THE COMPLETE RUNDOWN OF THE ENGINE BEFORE THE NEXT ATTEMPT. AFTER THREE ATTEMPTS, AN ATS COOLING PERIOD OF AT LEAST 20 MINUTES MUST BE ALLOWED BEFORE ANY FURTHER ATTEMPT.

### **STARTING APU**

#### WARNING

PRIOR TO APU STARTING MAKE SURE THAT THE APU DANGEROUS AREAS CLEAR OF PERSONNEL AND EQUIPMENT.

#### CAUTION

NORMAL START A MAXIMUM OF THREE CONSECUTIVE APU START ATTEMPTS CAN BE MADE ALLOWING 3 MINUTES BETWEEN APU STOP COMMAND AND THE NEXT ATTEMPT. AFTER THREE NORMAL STARTS, A STARTER

MOTOR COOLING PERIOD OF AT LEAST 30 MINUTES MUST BE ALLOWED BEFORE ANY FURTHER ATTEMPT.

HUNG OR ABORTED START AFTER AN UNSUCCESSFUL APU START, A SECOND START ATTEMPT MAY BE MADE 3 MINUTES AFTER THE PREVIOUS ONE.

AFTER TWO HUNG OR ABORTED START ATTEMPTS, A STARTER MOTOR COOLING PERIOD OF AT LEAST 30 MINUTES MUST BE ALLOWED BEFORE ANY FURTHER ATTEMPT.

#### NOTE

- If on-board batteries are the only source of electrical power, APU starting shall be performed within 10 minutes of aircraft power-up to ensure that the available battery capacity is at least 50%.
- Inform ground crew of the impending APU starting.
- Monitor APU start with ground crew.
- APU is ready for starting the engines when the RUN light is steady ON.

1. APU MASTER/STOP - Press

2. SEL light - Check ON

3. RDY light - Check ON (within 2 sec)

3. APU START - Press

4. APU RUN light - Check flashing

#### NOTE:

- During APU starting, L and R BATT lights are OFF and L and R BATT DSC cautions are displayed.

When APU is ready:

6. APU RUN light - Check steady ON

7. External electrical power - Signal ground crew to disconnect (if required)

8. L and R BATT DSC cautions - Check not displayed

9. L and R MAIN BUSES on line – Check

10. Cautions - Check

#### NOTE:

The brief activation of "OXY" warning light, OXYGEN



warning and OBOGS caution, shortly after the oxygen is available following APU/engine starting, is normal.

**NOTE**

11. Left and right battery voltage (MFD SYS page) - Check between 25 and 28 V.

In case of engine starting without APU the following cautions/advisories will be briefly activated:

If batteries voltage is out of range:

- L or R FUEL P caution during first engine start;

12. Flight - Abort

- ICE SENSOR caution shortly after first engine start;

**External Store Configurations Acceptance**

- L or R BLEED OFF advisories after second engine start.

**NOTE**

At the first flight of the day, delay external store configuration acceptance after FCS IBITE completion.

In case of engine starting with APU, L or R BLEED OFF advisories may be briefly activated after second engine start if APU is shut down within 8 sec from second engine start completion..

1. SMS page - Select

**RIGHT ENGINE STARTING**

2. MASS – STBY

**CAUTION**

**NOTE:**

SMC takes approximately 30 to 50 sec to power up and make configurations available on the SMS page (MFD).

DO NOT ATTEMPT/CONTINUE ENGINE STARTING, OR SHUTDOWN AFFECTED RUNNING ENGINE, IF ONE OR MORE OF THE FOLLOWING CAUTIONS ARE DISPLAYED:

3. Configurations - Check

- L or R ATS

If INVALID indication is displayed:

- L or R ATS LIMIT

4. External store configuration editing - Perform to load the correct configuration

- L or R ATS OVSP

If INVALID indication is still displayed:

- L or R ATS VALVE

5. MASS - SAFE for a minimum of 3sec, then STBY

- L or R ENG BATT

**NOTE**

- L or R ENG LANE

If condition persists, abort flight.

- L or R FADEC DEG

After configurations check, if INVALID indication is not displayed:

- L or R FADEC T

6. ACCEPT key - Press to accept each displayed configuration in sequence (real, SIM1 and SIM2)

- FIRE EXTG

- L or R RPM LOCK

- UCB

**STARTING ENGINES**

- DC FUEL P.

**WARNING**

ALWAYS COMPLY WITH THE RELEVANT EMERGENCY PROCEDURE FOR COMPLETE ACTIONS/CHECKS REQUIRED IN ANY FAILURE CONDITION.

- PRIOR TO ENGINES STARTING MAKE SURE THAT THE ENGINES DANGEROUS AREAS SHOWN IN FIGURE 2-2 ARE CLEAR OF PERSONNEL AND EQUIPMENT.
- MAKE SURE THAT THE AREAS AROUND THE FLIGHT CONTROLS ARE CLEAR OF PERSONNEL. MOVING SURFACES CAN CAUSE INJURIES TO PERSONNEL.

1 RH throttle – IDLE

2 R ENG mode switch - IDLE/START

3 APU/External air - Available

**CAUTION**

DO NOT DELAY ENGINE START AFTER EXTERNAL AIR IS MADE AVAILABLE BY THE GROUND CREW. PROLONGED USE OF EXTERNAL AIR BEFORE START MAY DAMAGE THE CAU.

4. Right engine START push-button - Press when green light ON

5. Green light - Check flashing

6. Right engine instruments - Check

7. Right hydraulic pressure – Check 207+/-7 bar within 20% NH

8. External air (if used) – At 40% NH, request ground personnel to stop air supply.

**CAUTION**

- ABORT ENGINE START BY MOVING THE ENG MODE SWITCH TO STOP IF:

- EGT DOES NOT INCREASE WITHIN 20 SEC

- OIL PRESSURE DOES NOT INCREASE WITHIN 20 SEC

- EGT IS APPROACHING THE OPERATING LIMIT (871 °C) AND RISING RAPIDLY

- HYDRAULIC PRESSURE VALUE IS NOT 207+/-7 bar WITHIN 20% NH

- NH DOES NOT INCREASE TO IDLE AFTER ENGINE LIT

- NH AND/OR NL INFORMATION ARE NOT DISPLAYED ON SYS MFD PAGE.

- DO NOT OPERATE THE CANOPY DURING ENGINE STARTING WITH APU; OTHERWISE THE APU MAY SURGE OR PERFORM AUTOMATIC SHUTDOWN.

9. R GEN - Check on line

10. L and R TRU - Check on line

11. L and R BATT lights - Check OFF

12. Cautions - Check

13. Left and right battery voltage (MFD SYS Page) - Check between 27,5 and 31,5 V

If batteries voltage is out of range:

14 Flight - Abort

Otherwise:

14. RH ENG mode switch - NORM (when stabilized at IDLE)

If APU is not running:

15. RH throttle - Set between 75% and 80% NH for 5 sec, then IDLE

**CAUTION**

IF THIS TEMPORARY ENGINE NH INCREASE IS NOT PERFORMED, WHEN REQUIRED, AFTER THE START OF EACH ENGINE, POSSIBLE CAU DAMAGE MAY OCCUR.

**BEFORE LEFT ENGINE STARTING**

1. Check the correct operation of the mask and of the oxygen system.

**NOTE**

- The brief activation of "OXY" warning light, OXYGEN warning and OBOGS caution, shortly after the oxygen is available following APU/engine starting, is normal.

2. Canopy - Closed. Do not lower the canopy switch guard

**CAUTION**

DURING LEFT ENGINE STARTING THE CANOPY CAN BE MAINTAINED OPEN. TO PREVENT DAMAGE FROM FOD, STOW OR SECURE LOOSE COCKPIT ITEMS PRIOR TO STARTING.

**NOTE**

During canopy actuation, the air conditioning flow is temporarily interrupted.

3. Air conditioning - Check air flow

4. External electrical power and air- Disconnected (if applicable)

5. External store configurations acceptance - Perform (if required)

**LEFT ENGINE STARTING**

1. LH throttle — IDLE

2. L ENG mode switch - IDLE/START

If APU or external air is used:

**CAUTION**

DO NOT DELAY ENGINE START AFTER EXTERNAL AIR IS MADE AVAILABLE BY THE GROUND CREW. PROLONGED USE OF

EXTERNAL AIR BEFORE START MAY DAMAGE  
THE CAU.

If cross bleed air is used:

3. RH throttle – Set at about 80% NH

In all cases:

4. START push-button of left engine - Press when green light ON

5. Green light - Check flashing

6. Left engine instruments - Check

7. Left hydraulic pressure - Check 207+/-7 bar within 20% NH

If external air is used:

8. External air supply - At 40% NH, request ground personnel to stop air supply

If cross bleed air is used:

8. RH throttle - IDLE when L ENG NH 2 40% rpm

In all cases:

**CAUTION**

- ABORT ENGINE START BY MOVING THE ENG MODE SWITCH TO STOP IF:

- EGT DOES NOT INCREASE WITHIN 20 SEC

- OIL PRESSURE DOES NOT INCREASE WITHIN 20 SEC

- EGT IS APPROACHING THE OPERATING LIMIT (871 °C) AND RISING RAPIDLY

- HYDRAULIC PRESSURE VALUE IS NOT 207 :7 bar WITHIN 20% NH

- NH DOES NOT INCREASE TO IDLE AFTER ENGINE LIT

- NH AND/OR NL INFORMATION ARE NOT DISPLAYED ON MFD SYS PAGE.

- DO NOT OPERATE THE CANOPY DURING ENGINE STARTING WITH APU; OTHERWISE THE APU MAY SURGE OR PERFORM AUTOMATIC SHUTDOWN.

9. L GEN - Check on line

10. L and R BATT lights - Check OFF

11. Cautions - Check

After starting the second engine, the air conditioning airflow is temporarily interrupted.

12. Air conditioning - Check air flow

13. APU MASTER/STOP - Press (if necessary) after air flow is restored.

14. LH ENG mode switch - NORM (when stabilized at IDLE)

**NOTE**

The ETU is automatically switched ON after second engine starting.  
If the ETU is not required for mission:

15. ETU - PWR OFF

If the ETU is required for mission:

16. ETTS DL - DL ON 4

If APU is not running or has been stopped at the end of the engine start:

17. LH throttle - Set between 75% and 80% NH for 5 sec, then IDLE

**CAUTION**

IF THIS TEMPORARY ENGINE NH INCREASE IS NOT PERFORMED, WHEN REQUIRED, AFTER THE START OF EACH ENGINE, POSSIBLE CAU DAMAGE MAY OCCUR.

**BEFORE TAXIING**

1. Canopy switch guard - Lowered

2. CANOPY light - Check OFF

3. Anti-g valve push-button - Press to test

**NOTE**

On ground only, if NH speed decline due to engine surge bleed valve happens at the same time as a pilot commands a PLA reduction, the resulting NH deceleration could correctly trigger the AUTORELIGHT advisory for a few seconds. If AUTORELIGHT advisory is confirmed OFF, continue normal operations.

Before first flight of the day:

**NOTE**

If external stores configurations have been already accepted, set MASS switch to SAFE before performing FCS IBITE to avoid FCS STORES Fail safe condition.  
After IBITE completion set MASS switch to STBY and accept store configurations as required.

4. FCS page (MFD) - Select

## WARNING

MAKE SURE THAT THE AREAS AROUND THE FLIGHT CONTROLS ARE CLEAR OF PERSONNEL. MOVING SURFACES CAN CAUSE INJURIES TO PERSONNEL.

5. FCS IBITE - Start

6. IBITE STATUS - Check IBITE GO

### NOTE

During FCS IBITE all the indications on the upper half of the MFD SYS page will be blanked. If necessary, during IBITE refer to EFDP for engine/system indications.

7. FCS warning light - Check OFF

8. Wait for 10 sec

9. Configurations - Check

10. ACCEPT key - Press to accept displayed configuration

In all cases:

11. FCS control panel - Check NORM green light ON. All other lights OFF.

12. A/C MASS page - Select

13. AIRCREW - Check and set as required

### NOTE

If selection arrows are not displayed on MFD page, select a different menu page and then access the FCS Main page again to display them.

14. ROLE EQUIPMENT - Check and set as required

15. A/C MASS STATUS - Select AUTO

16. Aircraft mass - Check correct within +/-150 kg

## WARNING

IN CASE OF THE MASS MISMATCH IN EXCESS OF 150 kg, CONTROL LAWS GAINS WILL NOT BE COHERENT WITH AIRCRAFT ACTUAL MASS. AIRCRAFT OVERSTRESSING AND/OR DEGRADATION OF HANDLING QUALITIES MAY OCCUR.

If aircraft mass is not within +/-150 kg continue with the following step, otherwise go to step 20.:

17. MASS - SAFE then STBY

### NOTE

The FCS STORES caution will be displayed on MFD.

18. FCS IBITE - Repeat from step 4.

If aircraft mass is not within +/-150 kg again:

19. Flight - Abort

If aircraft mass is within +/-150 kg:

20. Flight controls - Check for freedom of movement

21. Flaps lever - UP / T/O / LAND, then T/O

22. Airbrake - Full OUT/IN

23. TRIM T/O - Press

24. TAKEOFF TRIM light (CSD) - Check ON

25. Communication and navigation equipment - Check

26. HUD - Set and check format

27. Altimeters - Set and check

28. BINGO and JOKER fuel - Set as required

29. EXT LT:

a. BRT - Level 3

b. Other switches - As required

30. TAXI LT - As required

31. ATU:

a. ATU latitude - Check correct (+/-10 deg)

b. ATU magnetic variation - Check correct +/-10 deg)

## CAUTION

ATU LATITUDE AND/OR MAGNETIC VARIATION OUT OF TOLERANCE VALUES MAY CAUSE AUTOTRIM AND PARS MALFUNCTION. If ATU latitude and/or magnetic variation are not correct:

32. Perform a new power up starting from Interior Inspection

33. ATU latitude and magnetic variation - Check correct (+/-10 deg)

In any case:

34. ATU MODE - Check GO

### NOTE

ATU MODE displays either MONITOR NOT ACTIVE

or ALIGN until IN/GPS has completed the alignment (NAV READY). If taxiing in IN/GPS DEG NAV mode is required, check ATU MODE displays MONITOR NOT ACTIVE prior to taxiing and GO when moved. Do not start taxiing while ATU MODE is ALIGN.

35. Chocks - Removed

36. NWS - Engage, select STHI

37. PARK & EMER BK - Released

### **TAXIING**

1. Brakes – Check

2. RALT – RALT

3. Flight and navigation instruments – Check and set (as required)

4. Emergency brakes - Check

### **BEFORE TAKEOFF**

1. Takeoff data – Review

2. Cockpit loose items - Check secured

3. Helmet Visor - Lowered

4. Oxygen flow – Check blinker

5. Flaps – Check T/O

6. Airbrake - IN

7. TRIM T/O light - Check ON

8. APU - OFF

If APU was still running before step 8 above:

9. LH/RH throttle - Set between 75% and 80% NH for 5 sec then IDLE.

### **CAUTION**

IF THIS TEMPORARY ENGINE NH INCREASE IS NOT PERFORMED WHEN REQUIRED AFTER APU STOPPING, POSSIBLE CAU DAMAGE MAY OCCUR.

in any case:

10. LDG/TAXI LT - As required

11. Harness - As required

12. SAFE/ARMED lever- ARMED

### **LINE UP CHECK**

1. IFF - As required

2. Warnings and cautions - OFF

3. NWS - STLO

4. MASS – LIVE

### **TAKEOFF**

1. Throttles - 80% NH

2. Brakes – Release

### **CAUTION**

DO NOT HOLD BRAKES ABOVE 80% NH TO AVOID TIRE SKIDDING.

### **AFTER TAKEOFF**

Retract landing gear when a positive rate of climb is verified by using outside visual cues, vertical velocity indicator and increasing altitude.

1. Landing gear- LG UP (< 250 KCAS / 0.4 IMN)

### **CAUTION**

ABRUPT PITCH MANEUUVRES DURING OR IMMEDIATELY AFTER (WITHIN 3 S AFTER THE LG HANDLE RED LIGHT GOES OFF) LG RETRACTION MAY CAUSE MISCORRELATION BETWEEN LEF DEFLECTION AND AOA INDUCING POSSIBLE OUTER WING FAIRING DAMAGE.

2. Flaps lever - UP (< 230 KCAS / 0.4 IMN)

3. LG handle red light - OFF

4. Throttles - As required

### **CLIMB**

Maintain the best climb speed for minimum time to altitude.

1. Oxygen flow - Check

2. Cabin press - Check

3. SYS page (MFD) - Check

4. Altimeters - As required

### **LEVEL-OFF AND CRUISE**

### **NOTE**

Transition to and from supersonic flight will cause slight bumps in cabin pressure schedule. This is due

to the shock wave interesting the reference pressure ports. This is a normal behaviour and does not represent a system malfunction.

1. Oxygen flow - Check
2. Cabin altitude – Check
3. Altimeters - Check
4. SYS page (MFD) - Periodically check

### **AIR REFUELING PROCEDURES**

ATP-56(A) “AIR TO AIR REFUELLING” (AJP 3.3.4.2) has been assumed as guideline for In-flight refuelling operations applying to all types of rendezvous (RV) procedures. Refer to this publication for correct manoeuvres. As far as wake turbulence is concerned, it is avoided by respecting Chapter 4, 402, b “Height Separation. Receivers are normally to join from below and are to maintain a minimum of 1000 ft height separation”

#### **NOTE**

During air refuelling the flow rate to refuel internal tanks is about 200 kg/min, whereas the flow rate to refuel each external tank, independently from their number and position, is about 50 kg/min.

### **JOINING**

1. LATE ARM - SAFE (guarded)
2. Fuel quantity - Check
3. IFF - STBY mode
4. TACAN - REC mode
5. EXT LT:
  - a. BCN - As required
  - b. NAV - As required
  - c. CVRT - As required
6. NVG push-button light - As required

If in MAN mass mode:

7. MEDIUM MASS CAT - Select

### **BEFORE CONTACT**

8. A/R push-button indicator - Press and check green light blinking then ON within 5 sec
9. Aircraft mass - Check
10. Fuel quantity - Check

11. A/R LIGHT knob - As required

### **AFTER AIR REFUELING OPERATION**

12. A/R push-button indicator - Press and check green light OFF

#### **NOTE**

A/C MASS and CAREFREE cautions will be displayed.

13. Check aircraft fuel quantity vs tanker transferred fuel

#### **NOTE**

The fuel check, intended as an integrity check and not an accuracy check, shall verify that the fuel content indicated by FCP is coherent with the expected fuel on board computed as: residual fuel + refuelled fuel - burnt during refuel (consider an average 20 kg/min during refuelling operation).

If the fuel data match:

14. Select AUTO mass mode (A/C MASS page)
15. A/C MASS and CAREFREE cautions - Check not displayed

If the fuel data do not match:

14. Select MAN mass mode and appropriate MASS CAT (A/C MASS page)
15. A/C MASS caution - Check not displayed

### **PARS ACTIVATION AND OPERATION**

In case of pilot vertigo or spatial disorientation, the PARS could be used as an automatic mean to recover to straight and level flight with small positive climb angle, from any attitude throughout the flight envelope, with minimum loss of altitude and time. The PARS is not provided with the auto-throttle function, therefore, to reduce the risk of envelope exceedance and to enhance recovery capability from extreme conditions (low-speed/ nose-high, high-speed/nose-down), specific alert symbology and audio messages are provided to the pilot to indicate the required throttle setting (MAX, hold, IDLE).

#### **WARNING**

PARS DOES NOT PROVIDE NEITHER TERRAIN AVOIDANCE NOR MINIMUM OR MAXIMUM SPEED PROTECTION.

1. PARS – Press

2. Throttles - Set as required by ATTITUDE RECOVERY special alert

When recovered:

3. Paddle switch - Press

#### NOTE

PARS also disengages if control stick is deflected more than 75% of full stroke, therefore allowing system override through immediate pilot action.

### **DESCENT**

1. Helmet visor - Lowered
2. Canopy DEMIST and CABIN TEMP - As required
3. EXT LT - As required
4. Altimeters - As required
5. SYS page (MFD) - Check
6. Communication and navigation equipment - As required

### **BEFORE LANDING**

See figures for landing pattern speeds.

1. Landing gear - LG DN (< 250 KCAS / 0.4 IMN)
2. LG three green - ON
3. LG handle red light - Check OFF
4. Flaps lever - As required:
  - T/O (< 230 KCAS / 0.4 IMN)
  - LAND (< 200 KCAS / 0.4 IMN)
5. Airbrake - As required
6. Approach airspeed - As required to maintain 10 deg AOA

#### NOTE

Reference airspeed is 117 KCAS at 6000 kg of aircraft mass. Add 4 KCAS every 500 kg of mass increment.

7. LDG/TAXI LT - As required
8. Harness - Locked

### **INSTRUMENT APPROACH**

#### **HOLDING, PENETRATION AND TACAN AP-**

### **PROACH (TYPICAL)**

#### **Holding Pattern (Any Altitude)**

1. Configuration – Cruise
2. Airspeed - 210 KCAS
3. Throttles - As required

#### **Penetration Descent and Turn**

4. Airspeed - 300 KCAS / 0,6 Mach
5. Airbrake - OUT
6. Throttles - 75% rpm

#### **Level-off**

7. Below 250 KCAS:
  - a. Landing gear - LG DN
  - b. Airbrake - IN
  - c. Flaps lever - T/O below 230 KCAS
  - d. Airspeed - 180 KCAS
  - e. Throttles - As required to maintain speed (approx. 80% rpm)

#### **Final Approach**

8. Flaps lever - LAND (when starting descent)
9. Airspeed - As required to maintain 10 deg AOA

#### NOTE

Reference airspeed is 117 KCAS at 6000 kg of aircraft mass. Add 4 KCAS every 500 kg of mass increment.

10. Landing gear - Check LG DN (three green ON)
11. Airbrake - As required
12. Throttles - As required (75% to 80% rpm)
13. LDG/TAXI LT - As required

#### **Go-around**

1. Throttles - MIL or MAX
2. Airbrake - IN
3. Landing gear - LG UP (with positive climb indications)
4. Flaps lever - UP below 230 KCAS

5. Throttles - Retard as required

### **RADAR APPROACH (TYPICAL)**

#### **Downwind**

1. Configuration - Cruise
2. Airspeed - 250 KCAS
3. Throttles - 75% to 80% rpm
4. Airbrake - IN

#### **Base Leg**

5. Airbrake - As required
6. Below 250 KCAS:
  - a. Landing gear - LG DN
  - b. Airbrake - IN
  - c. Flaps lever - T/O below 230 KCAS
  - d. Airspeed - 180 KCAS
  - e. Throttles - As required to maintain speed (approx. 80% rpm)

#### **Final Turn**

7. Airspeed - 180 KCAS
8. Landing gear - Check LG DN (three green ON)
9. Flaps lever - Check T/O
10. Airbrake - As required
11. Throttles - As required to maintain 140 KCAS (approx. 80% rpm)

#### **Final Approach (Glideslope)**

12. Flaps lever - LAND (when starting descent)
13. Airspeed - As required to maintain 10 deg AOA

#### **NOTE**

Reference airspeed is 117 KCAS at 6000 kg of aircraft mass. Add 4 KCAS every 500 kg of mass increment.

14. Landing gear - Check LG DN (three green ON)
15. Airbrake - As required
16. Throttles - As required (75% to 80% rpm)
17. LDG/TAXI LT - As required

#### **Go-around**

1. Throttles - MIL or MAX
2. Airbrake - IN
3. Landing gear - LG UP (with positive climb indications)
4. Flaps lever - UP below 230 KCAS
5. Throttles - Retard as required

### **ILS APPROACH (TYPICAL)**

#### **Approach to Glideslope**

1. Airbrake - As required
2. Below 250 KCAS:
  - a. Landing gear - LG DN
  - b. Airbrake - IN
  - c. Flaps lever - T/O below 230 KCAS
  - d. Airspeed - 180 KCAS
3. Flaps lever - LAND (before starting descent)
4. Airspeed - As required to maintain 10 deg AOA

#### **NOTE**

Reference airspeed is 117 KCAS at 6000 kg of aircraft mass. Add 4 KCAS every 500 kg of mass increment.

5. Landing gear - Check LG DN (three green ON)
6. Airbrake - As required
7. LDG/TAXI LT - As required

#### **Go-around**

1. Throttles - MIL or MAX
2. Airbrake - IN
3. Landing gear - LG UP (with positive climb indications)
4. Flaps lever - UP below 230 KCAS
5. Throttles - Retard as required

### **TOUCH AND GO / GO AROUND**



DAMAGE.

See figure for pattern speeds.

**Approach**

- 1. Airspeed - Corresponding to 10 deg AOA

**NOTE**

Reference airspeed is 117 KCAS at 6000 kg of aircraft mass. Add 4 KCAS every 500 kg of mass increment.

**On the runway**

**NOTE**

- During the ground run the engine throttles shall be kept at IDLE for no longer than 5 sec. If the throttles remain at IDLE more than 5sec, the engines speed will be reduced to ground idle setting. This will considerably increase the engine spool up time. In case of nose gear touch down, the ground idle will be set immediately.
- With the throttles at IDLE, a ground run longer than 5 sec will produce an engine speed transition to ground idle. Any subsequent weight ON/OFF wheel signal unsteadiness may produce the erroneous illumination of the ENGINES OUT warning approximately 10 sec after the first main wheels touchdown. To avoid such occurrence, the engine throttles should be kept at IDLE for no longer than 5 sec during the ground run.

- 2. Throttles - MIL (MAX if required)

- 3. Airbrake - Check IN

**NOTE**

In LAND configuration, during touch and go and/or bailed landing, below 100 KCAS and especially with forward CG, when applying full throttle the aircraft lowers the nose. It is recommended not to oppose derotation and allow the aircraft to accelerate to the computed takeoff speed.

When in positive climb

- 4. Landing gear - LG UP (< 250 KCAS / 0.4 IMN)

**CAUTION**

**ABRUPT PITCH MANEUVRES DURING OR IMMEDIATELY AFTER (WITHIN 3 s AFTER THE LG HANDLE RED LIGHT GOES OFF) LG RETRACTION MAY CAUSE MISCORRELATION BETWEEN LEF DEFLECTION AND AOA INDUCING POSSIBLE OUTER WING FAIRING**

- 5. LG handle red light – OFF

- 6. Flaps lever - UP (< 230 KCAS / 0.4 IMN)

**AEROBRAKING**

After touchdown the attitude can be gradually increased up to 15 deg AOA maximum, and the manoeuvre can be continued down to 85 KCAS minimum. Aerobraking shall be discontinued by lowering gently the aircraft nose. After nose wheel touchdown, maintain the pitch command in the neutral position and apply brakes as necessary. With the throttles at IDLE and the nose wheel off ground, the engines will transit from flight to ground idle 5 seconds after main wheels touchdown. Consider that aerobraking below 10 AOA is almost ineffective, and that tail strike will occur at approximately at 19 AOA.

**NOTE**

If during aerobraking a momentary weight-off-wheel condition occurs, the FADEC may increase the RPM from ground to flight idle, and an erroneous ENGINES OUT warning can occur. In such a case, discontinue the aerobraking manoeuvre, and check that the ENGINES OUT warning extinguishes.

After main wheels touchdown:

- 1. Pitch attitude - Maintain or increase up to 15 deg AOA max

- 2. Nose - Gently lower at 85 KCAS (aircraft mass below 8000 kg) or 95 KCAS (aircraft mass above 8000 kg) min

After nose wheel touchdown:

- 3. Pitch command - Neutralize
- 4. Wheel brakes - Apply as necessary

**LANDING**

**NORMAL LANDING**

If the runway length and conditions permit, aerodynamic braking may be carried out to conserve brakes and tires.

- 1. Rudder - Use for directional control
- 2. Brakes - As required

**CAUTION**

- 3. NWS - Engage below 70 kts and check STLO
- APPLY BRAKES GENTLY BELOW 10 KCAS TO AVOID TIRE SKIDDING.

## NOTE

NWS engagement may produce an uncommanded slight directional change depending on crosswind and the amount of pedal input. This is easily controllable with the directional control available with the NWS itself.

NWS engagement may produce an uncommanded slight directional change depending on crosswind and the amount of pedal input. This is easily controllable with the directional control available with the NWS itself.

## BALKED LANDING

### NOTE

During the ground run with the throttles at IDLE, the engines speed will be reduced to ground idle setting 5 sec after main wheels touchdown or upon nose gear touchdown. Engine spool up time to reach maximum thrust from ground idle is considerably longer than from flight idle.

1. Throttles - MAX
2. Airbrake - Check IN
3. Flaps lever - T/O
4. Rotate at computed approach speed

## CROSS-WIND LANDING

During cross-wind approach and landing use the following AOA:

Maximum recommended AOA:

- 15 deg with crosswind component up to 10 kts
- 12 deg with crosswind component between 10 and 20 kts.

Recommended approach AOA:

- 10 deg
- Use of LAND flaps is recommended.

The recommended technique for landing in a crosswind is to use a wing level crab until just before touchdown. Touchdown shall occur minimizing crab angle. Gradual use of rudder and aileron should be employed to align the aircraft fuselage to the runway centerline and to maintain wings level attitude. In crosswinds, the aircraft may drift downwind due to side loads imposed by the crosswinds or travel upwind due to insufficient directional control inputs availability.

As the airspeed decreases, increasing amounts of rudder and aileron are required to maintain track and wings level attitude. Immediately after touchdown, use rudder and differential brakes to maintain the runway centerline. NWS should be engaged below 70 kts ground speed.

### NOTE

## SHORT FIELD LANDING

### NOTE

The following procedures should be used anytime stopping distance is critical, whether due to a long, fast, heavy weight, or short field landing.

When stopping distance is critical, a normal approach should be made. Select IDLE at or slightly before touchdown. Touch down as near as possible to the approach end of the runway at 12 deg AOA. Lower nose wheel as soon as possible and apply maximum brakes. Perform NWS engagement as dictated by normal landing procedures.

## AFTER LANDING

### NOTE

- When left engine is shut off after landing (with right engine on), the following alerts are inhibited:

- TEF LOCKED caution
- L HYD LP advisory

- When right engine is shut off after landing (with left engine on), the following alerts are inhibited:

- LDG caution
- AIRBRAKE caution
- R HYD LP advisory

1. NWS – STHI

### CAUTION

SELECTION OF NWS STHI WITH FULL PEDAL DEFLECTION APPLIED WILL LEAD TO SUDDEN DIRECTION CHANGE IF PEDAL DEFLECTION IS NOT IMMEDIATELY DECREASED.

2. Ejection seat lever - SAFE. Check SEAT light ON
3. MASS - STBY
4. Flaps lever - T/O

5. Airbrake - IN
6. Canopy switch guard - Raise
7. TRIM T/O - Press
8. BRAKES 1 caution - Check not displayed
9. L ENG mode switch - IDLE/START then STOP

**WARNING**

DO NOT SHUTDOWN THE RIGHT ENGINE FIRST IF THE AIRCRAFT GROUND SPEED IS BELOW 5 kts. AT SPEED BELOW 5 kts ALTERNATE BRAKING SYSTEM IS NOT ARMED. NO PEDAL BRAKING FUNCTION WILL BE AVAILABLE UNTIL THE SPEED IS INCREASED ABOVE 5 kts AND ALTERNATE BRAKING SYSTEM IS ARMED. ONCE ALTERNATE BRAKING SYSTEM IS ARMED, FULL BRAKING CAPABILITY IS AVAILABLE.

EMERGENCY BRAKE IS ANYWAY AVAILABLE.

**NOTE**

The brief activation of L FUEL P caution audio after left engine shut off (R FUEL P if right engine is shut off first), is normal.

11. LDG/TAXI LT - As required
12. VOR/ILS - OFF
13. TACAN - OFF
14. RALT - OFF
15. IFF - OFF

**NOTE**

If APU is needed, start it according to the Starting APU (on ground) procedure

**AT PARKING**

1. LDG/TAXI LT - OFF
2. PARK & EMER BK - Set
3. APU - Stop
4. Canopy - Open

**CAUTION**

WAIT AT LEAST 7 SEC BETWEEN CANOPY

SWITCH GUARD RAISING AND CANOPY SWITCH ACTUATION TO ALLOW THE COMPLETE DEFLATION OF CANOPY AND WINDSHIELD SEALS.

5. Unstrap
- On ground crew signal:
6. R ENG mode switch - IDLE/START then STOP
  7. Throttles - STOP
  8. MASS - SAFE
  9. NVG push-button light - Not pressed
  10. EXT LT - OFF
  11. BCN light - OFF
  12. COMM 1, COMM 2 - OFF
  13. IN/GPS - OFF
  14. MCSG - OFF
  15. DVDR - STOP

**NOTE**

The final part of the video recording is not correctly saved if DVDR is not stopped before aircraft electrical shut-off.

16. Supply oxy lever- OFF
  17. L and R BATT - OFF
  18. Seat safety pin - Remove from right console and insert in the seat
- If in night operation:
19. Reading lights - OFF (stowed position)

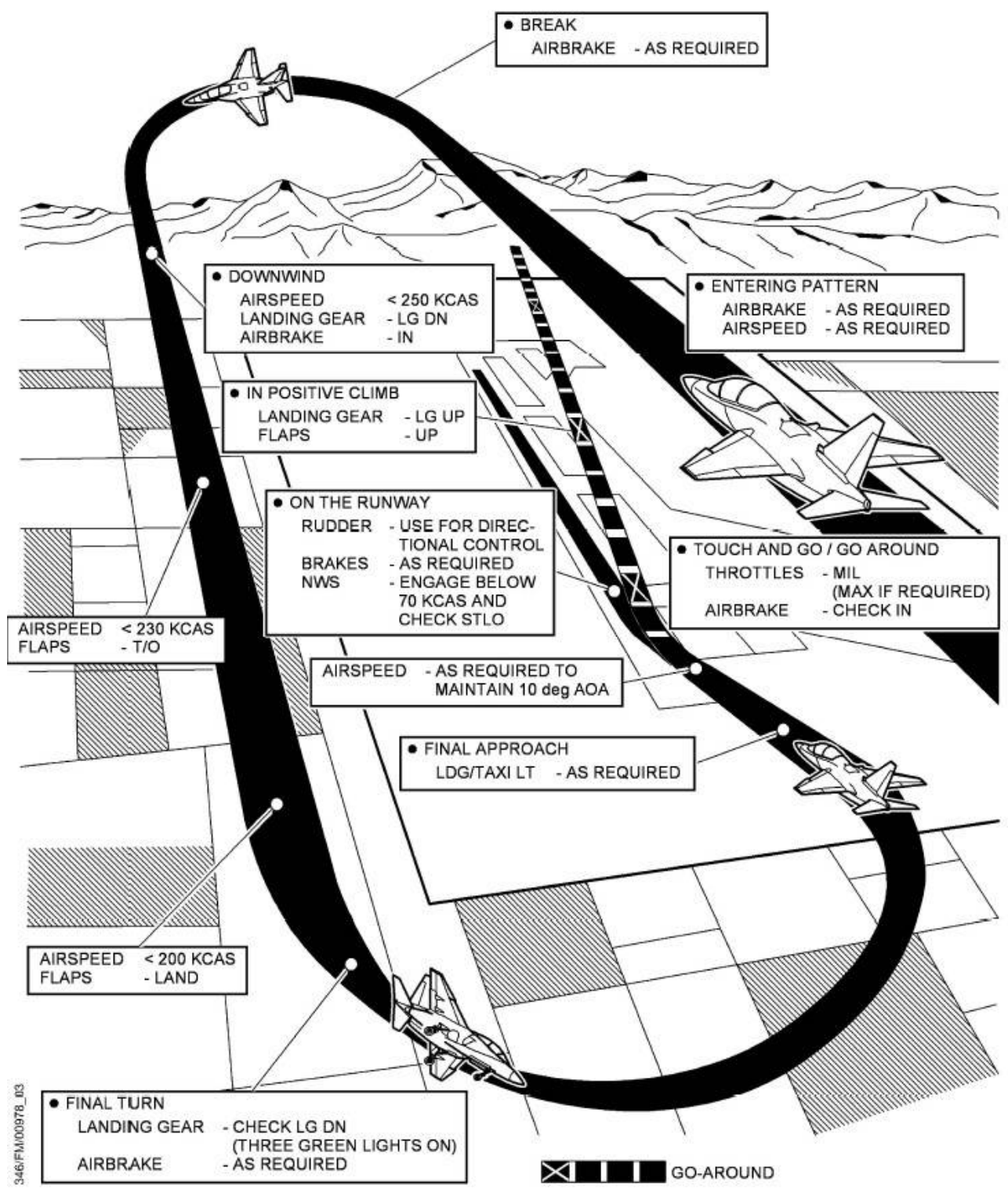
**NOTE**

In case of wind, refer to the following statements:

- Wind up to 50 kts: chocks required. No mooring required
- |
- Wind from 50 to 70 kts: canopy and doors closed. Mooring required
- Wind more than 70 kts: recover the aircraft in the hangar.

# LANDING AND GO AROUND

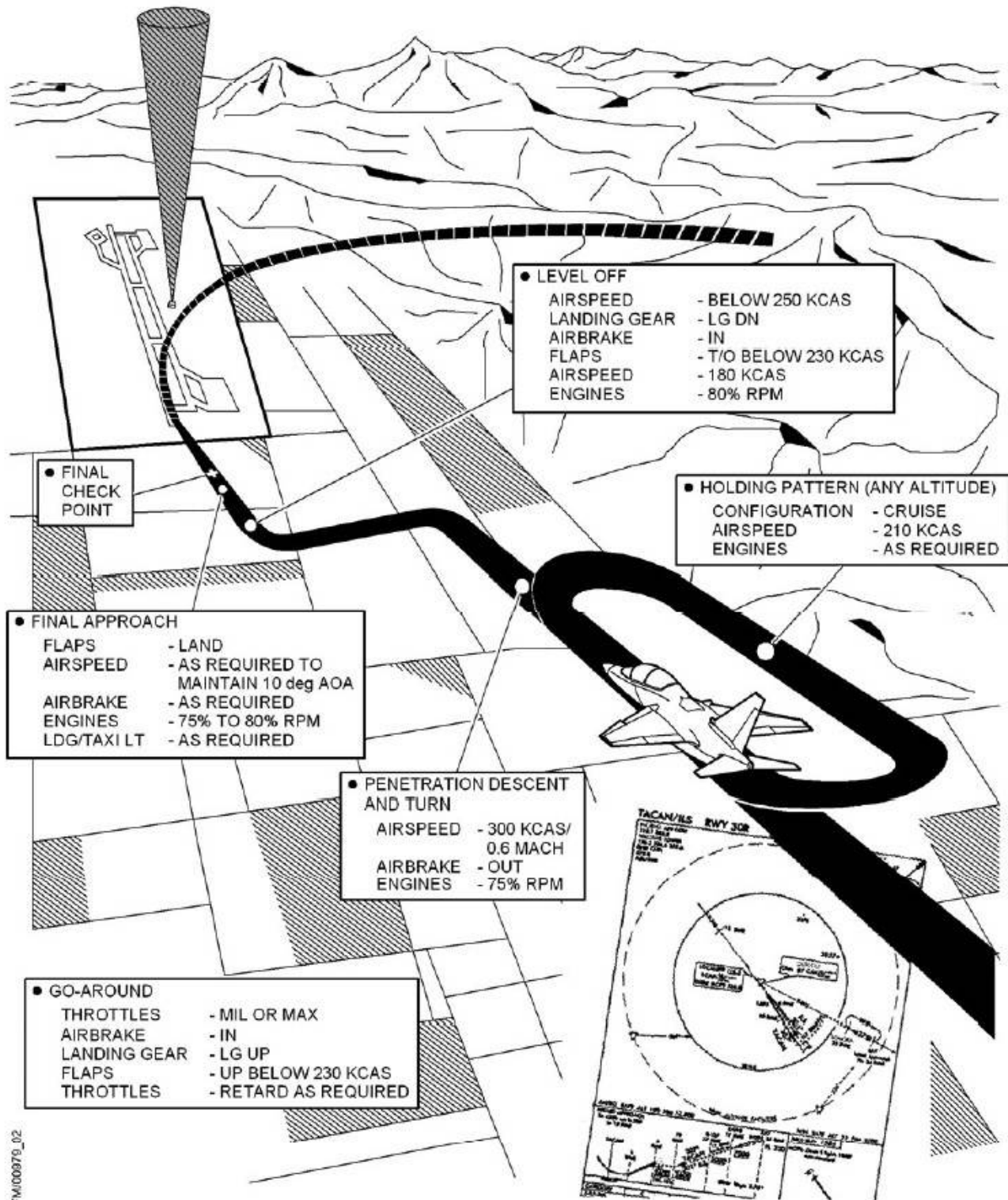
## TYPICAL



346/FM00978\_03

# HOLDING, PENETRATION AND TACAN APPROACH

TYPICAL



# RADAR APPROACH

## TYPICAL

● FINAL TURN  
 AIRSPEED - 180 KCAS  
 AIRBRAKE - AS REQUIRED  
 ENGINES - 80% RPM

● BASE LEG  
 AIRBRAKE - AS REQUIRED  
 AIRSPEED - BELOW 250 KCAS  
 LANDING GEAR - LG DN  
 AIRBRAKE - IN  
 FLAPS - T/O BELOW 230 KCAS  
 AIRSPEED - 180 KCAS  
 ENGINES - 80% RPM

● DOWNWIND  
 CONFIGURATION - CRUISE  
 AIRSPEED - 250 KCAS  
 AIRBRAKE - IN  
 ENGINES - 75% TO 80% RPM

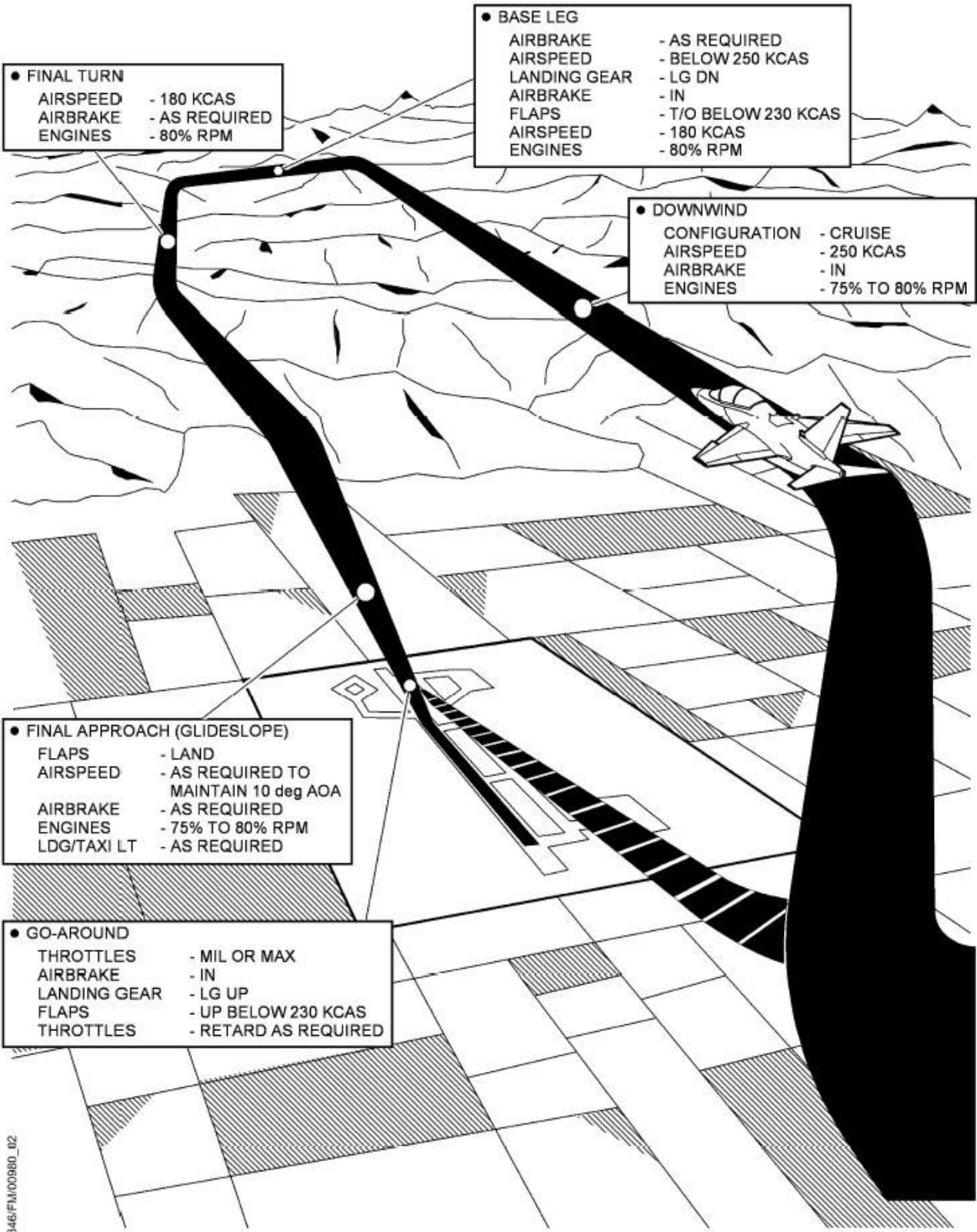
● FINAL APPROACH (GLIDESLOPE)  
 FLAPS - LAND  
 AIRSPEED - AS REQUIRED TO MAINTAIN 10 deg AOA  
 AIRBRAKE - AS REQUIRED  
 ENGINES - 75% TO 80% RPM  
 LDG/TAXI LT - AS REQUIRED

● GO-AROUND  
 THROTTLES - MIL OR MAX  
 AIRBRAKE - IN  
 LANDING GEAR - LG UP  
 FLAPS - UP BELOW 230 KCAS  
 THROTTLES - RETARD AS REQUIRED

346/FM/00980\_02

346/FM/00981\_04

OUTER MARKER





## FREQUENTLY ASKED QUESTIONS

*Q – How can you be sure that the simulation is realistic?*

**A –** This rendition of the M-346 has been extensively tested before release. Test team included real-world M-346 aircrews and engineers and their feedback on the behaviour of the aircraft was in general very positive. However some approximation and educated guesses had to be embraced in the development. In particular, due to MSFS fly-by-wire system limitations, the low speed and stall behaviors may be inaccurate.

*Q – Hey...I have flown the M-346 (or its simulator) and there are some significant differences! How could you miss those?*

**A –** This M-346 is, in our opinion, a relatively advanced simulation for individuals interested in the M-346 or military jet training in general. Also, we believe it is also good enough for cockpit familiarization and introduction to the real aircraft. However it is not a “full” study-level simulator and there are a number of changes and simplifications. Here is a (non-comprehensive) list of the major differences and omissions:

**Head-Up Display:** HSI, CDI and LOC information is fixed with respect to the waterline in the sim, but IRL (In Real Life) it should follow the CDM/FPM symbology.

**General Aircraft Interface:** at present the simulation only works by “clicking” the MFD/UFCP buttons, while IRL some functions can be activated by voice or HOTAS controls.

**UFCP:** several UFCP modes are simplified and some are missing – most of the missing modes have no impact on the current implementation of the systems.

**ETTS System** is not simulated – while this is a distinctive feature of the M-346, it would have required a lot of work...to get a simulation within the simulation...so we decided to leave it out.

**MFD (major discrepancies only):**

**HSD FORMAT:** This basically acts a map mode only, while IRL it integrates ETTS information.

**SMS FORMAT:** This format has been heavily modified for a number of gameplay reasons. Biggest differences is that, IRL, you MUST accept the configuration prior to take-off...otherwise the SMS will be locked.

**FCS FORMAT:** Some of the information displayed in this format are either not simulated or only estimated.

**STATUS FORMAT:** Some of the information displayed in this format are either not simulated or only estimated.

**CNI FORMAT:** MFD input modes not implemented.

**DVDR FORMAT:** Not implemented

**NDS FORMAT:** Not implemented

**SP FORMAT:** Much simplified. IRL the navigation system distinguishes between Steering Points (SP) and Waypoints (WP): WP (and nav aids) can be arranged in SP to generate a flight plan. The MSFS implementation is somewhat different, so that only one flight plan is present and it is composed by waypoints.

*Q – Isn't the roll rate too high?*

**A –** Actually, we believe the roll rate is pretty accurate according to the figures we have – at least below 400-450 kts. Above those speeds it is indeed too high (see FCS question).

*Q – Isn't the idle thrust too high? The aircraft moves on the ground with throttles at idle!*

**A –** Maybe... we have considered changing it, but in general we believe that engine performance in flight is realistic and well tuned...so we preferred to leave it as is for the moment.

*Q – The plane is not working! I cannot start the engines with Control+E! What is happening?*

**A –** The M-346 may not work with Control+E. It requires you to operate the APU and engine starters manually. See checklists for details.

*Q – What is the annoying “M A S S not live!” message? How can I make it stop?*

**A –** The message indicates that the MASS knob is not in the ARM position. You must set MASS to ARM before take off.

*Q – Where are the oxygen controls?*

**A –** They are located on the left side of the ejection seat.

*Q – What do the FWD SEAT and AFT SEAT caution messages mean?*

**A –** They mean that the ejection seats are not armed. You need to remove and stow the safety pins and set the seat arm switch to ARM. Each seat is operated independently and you need to arm both – or set the ejection sequence selector knob in the rear cockpit to “SOLO”.