AZBAM

FLIGHT MANUAL

RAZAIR-A1-HAR7/9-NFM-001

Harrier

Gr. 7&9

WARNING!

THIS MANUAL
IS NOT TO BE USED
FOR REAL AIRCRAFT TRAINING PURPOSES

RAZBAM FLIGHT MANUAL
for the
BAe HARRIER GR.7
&
BAe HARRIER GR.9

RAZAIR A1 HAR7/9 NFM 001

ACKNOWLEDGMENTS

We at RAZBAM want to acknowledge the work done by our team:

Ron Zambrano **Project Lead**
Larry Zambrano **Coder**
Metal2Mesh Studio **3D design**
Hank Essers **Texturer**
Military Sound Studio **Sounds**

And those who gave us advice and information sorely needed. We thank you from the bottom of our hearts.

INTRODUCTION

Thank you for your purchase of RAZBAM's BAe Harrier GR.7 and GR.9 models. We at RAZBAM have worked to deliver to you the most accurate model of this fascinating aircraft and we promise you that you will enjoy flying it.

The Hawker Siddeley Harrier, known colloquially as the "Harrier Jump Jet", was developed in the 1960s and formed the first generation of the Harrier series of aircraft. It was the first operational close support and reconnaissance fighter aircraft with vertical/short takeoff and landing (V/STOL) capabilities and the only truly successful V/STOL design of the many that arose in that era. It was exported to the United States as the AV-8A, for use by the US Marine Corps (USMC), in the 1970s.

The British Aerospace/McDonnell Douglas Harrier II is a second generation vertical/short takeoff and landing (V/STOL) jet aircraft used previously by the Royal Air Force (RAF) and, between 2006 and 2010, the Royal Navy (RN). The aircraft was derived from the McDonnell Douglas AV-8B Harrier II, which itself was a development of the Hawker Siddeley Harrier. Initial deliveries of the Harrier II were designated in service as Harrier GR.5; subsequently upgraded airframes were redesignated accordingly as GR.7 and GR.9.

Both the RAF and RN operated the Harrier II as a ground attack platform; the Harrier II was also capable of being operated from the Invincible class aircraft carriers. The Harrier II flew combat missions in Kosovo, Iraq, and Afghanistan. In December 2010, budgetary pressures led to the early retirement of all Harrier IIs from service. The decision to retire was controversial as there was no immediate fixed wing replacement in its role; in the long term the Harrier II is to be replaced by the Lockheed Martin F-35 Lightning II.

The package that you have purchased contains both the GR.7 and GR.9 models.

DISCLAIMER

This manual was created with the specific goal to help you fly the RAZBAM Harrier GR.7 and GR.9 **model aircraft** for FSX/Prepar3D Flight Simulators for PCs. It cannot be used as a training syllabus for real aircraft.

We have not included on purpose the technical charts and computational aids that the pilots of the real aircraft need to safely operate it.

This manual is to be used for entertainment purposes only.

CONTROL CONFIGURATION

The Harrier GR.7/GR.9 is a military aircraft that makes extensive use of HOTAS (Hands On Throttle And Stick). Many functions are only HOTAS available, so you need to map the following events:

Throttle and Nozzles:

Action	FSX Event	Keyboard*
Throttle	General Throttle events	
Nozzles	General Propeller events	Ctrl+F1, Ctrl+F2, Ctrl+F3,Ctrl+F4

Communications (Radios):

Action	FSX Event	Keyboard*
Radio Selection	Hoist Select	Ctrl + Shift + B
Radio receive all toggle	Clutch (on/off)	Shift + .
Tanker Aircraft request	Tail Wheel (lock/unlock)	Shift + G

Armament • Weapons Release/Launch:

Action	FSX Event	Keyboard*
Weapons Release	Cabin alert - Seatbelts (on/off)	
Gun		Button 1

Armament • A/A Weapons Selection:

Action	FSX Event	Keyboard*
ADEN Guns	Hoist Cable (Lower)	J
Sidewinder (Boresight Mode)	Hoist Cable (Raise)	K

Armament • ECM expendables:

Action	FSX Event	Keyboard*
CHAFF	Rotor Brake	Ctrl + B
FLARES	Tow Rope (release)	Shift + Y

Notes:
* These are default keyboard assignments. It can differ with your current setup.
* The Gun can only be fired if there is a joystick present.

SWITCHES NAVIGATION

The Harrier's cockpit instruments have several types of switches, pushbuttons, knobs and levers. Usually you only have to click with your left mouse button on the switch to have it change its position, but there are several that have multiple positions that move back and forth. For these multiple position switches and knobs you have to left click to go forward and right click to go backwards.

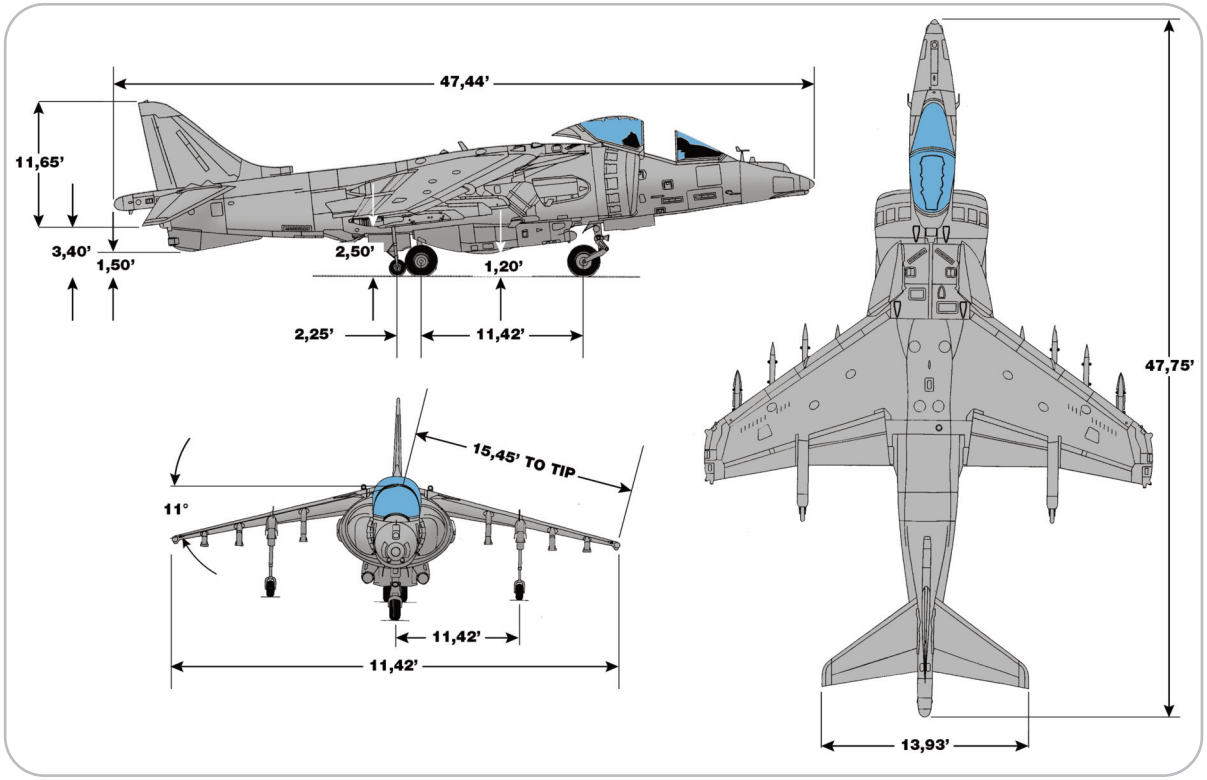
The following is a chart of the different switches and knobs found on the cockpit and how to navigate them.

Switch	Type	Navigation
	2-Position Switch	Left-Click changes the position.
	3-Position Switch	Left-Click moves forward. Right-Click moves backwards. *Example:* *Left-Click: ALTER AUTO DP PRIM.* *Right-Click: DP PRIM AUTO ALTER.*
	Multi position Knob	Left-Click moves forward. Right-Click moves backwards. *In some knobs, clicking on the center wheel will move them forward and backwards as well.*
	Pushbutton	Left-Click changes the position.
	Rotating knob	Knob Left-Click moves forward. Right-Click moves backwards. Center when moves both forward and backwards faster.

AIRCRAFT

The HARRIER attack aircraft is a transonic, single cockpit, single engine, jet propelled day/night tactical fighter built by British Aerospace. The aircraft is powered by a Rolls Royce turbofan engine. Four exhaust nozzles can be positioned and controlled for vertical/short takeoff and landing (V/STOL) operation. The aircraft features shoulder mounted swept back wings with trailing edge flaps and ailerons.

PRINCIPAL DIMENSIONS



Engine

This version of the HARRIER is powered by a Rolls Royce F402-RR-408A engine with water injection to provide a thrust boost. The F402-RR-408 series engine, with water injection, develops a nominal thrust of 22,200 pounds when not using the water injection.

Aircraft Controls

INSTRUMENTS PANEL

The Harrier has a glass cockpit with two CRT based Multi Purpose Color Display (MPCD) that display the information required by the Pilot.

Fig. 1
Main Instrument Panel

1. UP FRONT CONTROL (UFC).
2. OPTION DISPLAY UNIT (ODU).
3. ENGINE DISPLAY PANEL.
4. MASTER ARMAMENT PANEL.
5. MASTER ARM PANEL.
6. LEFT MULTI PURPOSE COLOR DISPLAY (LMPCD).
7. RIGHT MULTIPURPOSE COLOR DISPLAY (RMPCD).
8. HUD CONTROL PANEL.
9. FUEL CONTROL PANEL.
10. ANALOG FLIGHT INSTRUMENTS.
11. ARMAMENT CONTROL PANEL (ACP).
12. MISCELANEOUS CONTROL PANEL.
13. ELECTRONIC WARFARE PANEL (EWP).
14. HEAD-UP DISPLAY (HUD).

1. TRIM PANEL.
2. AFCS PANEL.
3. THROTTLE QUADRANT.
4. FUEL PANEL.
5. EXTERNAL LIGHTS CONTROL PANEL.
6. PILOT SERVICES PANEL.
7. ELECTRICAL PANEL.
8. RADIO SET CONTROL (RCS).
9. AMPLIFIER CONTROL (ACNIP).
10. INTERIOR LIGHTS CONTROL PANEL.
11. ENVIRONMENTAL CONTROL PANEL.

Fig. 2
Lateral Panels

THE UP-FRONT CONTROL (UFC) AND THE OPTION DISPLAY UNIT (ODU).

The Up-Front Control is and the Option Display Unit are the major interface units for control of avionic subsystems. The UFC consists of Three LCD displays, 15 function buttons, two radio volume controls, two radio channel rotary controls, a 10 key data entry keyboard and a rotary brightness control knob.

The UFC provides control of the following systems:

- Flight plan navigation
- TACAN
- IFF (Transponder)
- Radar Altimeter (RADALT)
- UHF Radios
- ILS
- Weapons Delivery Options

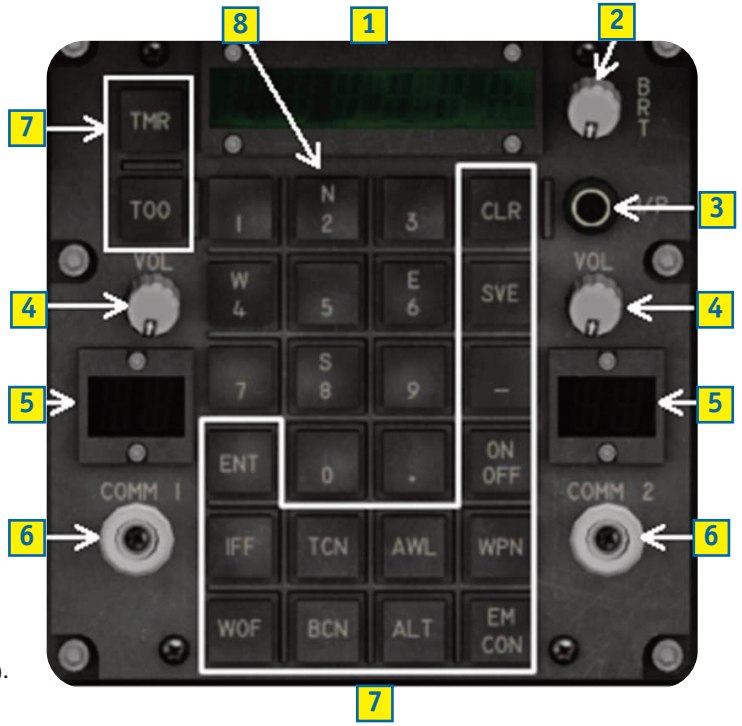


Fig. 3 Up Front Control (UFC).

1. SCRATCHPAD DISPLAY. A Green LCD screen where the selected function data can be read.

2. BRT Knob. It turns on both the UFC and ODU. It also sets the keyboard brightness.

3. I/P Button. Non Functional.

4. RADIO VOLUME Knob. One for each radio receiver. The Left one controls Radio 1; the right one controls Radio 2. Non Functional since there is no volume control in FSX.

5. SELECTED RADIO CHANNEL. One for each radio. Display the current frequency channel on both radios, or M if the radio is in manual mode (default).

6. RADIO CHANNEL SELECTOR Knob. One for each radio. You can change channels by either clicking on it or by using the mouse wheel.

7. Function Buttons. Selects the aircraft function for display/configuration:

- **A.** TMR: TIMER. Selects the UFC stopwatch functions.
- **B.** TOO: TARGET OF OPORTUNITY. Allows the input of a unknown target location into the active flight plan..
- **C.** CLR: Clear. Clears the SCRATCHPAD.
- **D.** SVE: Non Functional.
- **E.** – (DASH): Resets the UFC, deselecting the functions and clearing the SCRATCHPAD. Works like the ESC key.
- **F.** ON/OFF: Turns On or Off the selected system.
- **G.** ENT (ENTER): Saves the data in the SCRATCHPAD into the selected computer function.
- **H.** IFF: Selects the IFF (transponder) system.
- **I.** TCN: Selects the TACAN system.
- **J.** AWL: Selects the ALL WEATHER LANDING SYSTEM. In the case of this aircraft, selects the ILS.
- **K.** WPN: Selects the WEAPONS system.
- **L.** WOF: Allows to input a WAYPOINT OFFSET location into the active flight plan.
- **M.** BCN: Selects the BEACON system.
- **N.** ALT: Selects the LOW ALTITUDE WARNING system.
- **O.** EMCON: EMISSION CONTROL switch. Places all active emitters into standby mode for maintaining radio silence. The Radios are not affected by this switch.

8. Numeric Keyboard. Allows the input of information to the computer for the selected function.

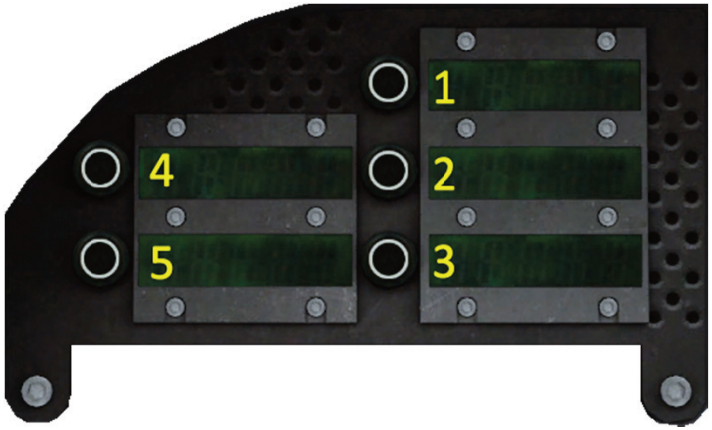


Fig. 4
Option Display Unit (ODU)

The Option Display Unit (ODU) consist of 5 LCD screens with a button on the left side of each one. The ODU extends the UFC functionality by displaying all available options for any selected function. The pilot only need to click on the button at the left of the LCD screen to select (and in some cases deselect) an option.

MULTI-PURPOSE COLOR DISPLAY (MPCD)

The aircraft has two multi-purpose color displays (MPCD). The MPCD's display system data, sensor and weapons information in color format. The MPCDs have 20 peripheral push buttons by which the pilot can control the weapons system, sensor and data to be displayed. Legends are positioned adjacent to each pushbutton to advise the pilot of the modes and options selectable for operation of the onboard radar, FLIR, navigation and weapons systems.

The pushbuttons are numbered from 1 thru 20 counterclockwise from the upper button on the left side of the display to the left button on the top of the display (Fig 5).

Button 8, the center button in the bottom of the display, always selects the Main Menu, except when the main menu is already displayed in which case it will show the emergency pages. The use of the various displays and options are described in other parts of the manual where the affected(s) system is covered.

To turn ON the MPCDs you have to click on either the OFF/NGT or DAY/AUT switches.

To turn it OFF, you have to click on the OFF/NGT switch.

Fig. 5
MPCD Button Assignation

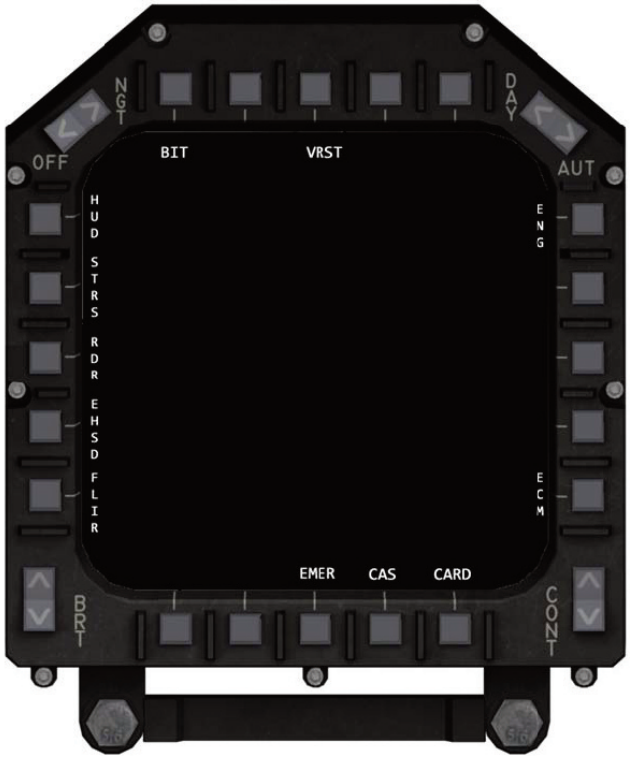


Fig. 6
MPCD Main Menu

The MPCD Main Menu has the following options:

1. **HUD**: Opens the HUD page where you can select whether to use TRUE or MAG Heading.
2. **STRS**: Opens the Stores page where you can see the aircraft's weapons load and select which one to use.
3. **RDR**: Opens the radar page. It initializes on A/G radar in the synthetic aperture map (MAP) mode. Only one radar mode can be active at any time.
4. **EHSD**: Opens the Horizontal Situation Display and INS pages. For it to be active the INS must be in either in NAV, IFA or GYRO modes. SEA and INS GND modes will display the alignment pages.
5. **FLIR**: Will open the FLIR page. In FSX a 2D FLIR gauge will appear on the upper left corner with the external camera view. In Prepar3D the camera view will appear in the MPDC.
6. BLANK.
7. BLANK.
8. **EMER**: Opens the emergency instruction pages. If any other option has been selected this becomes the MENU option that enables you to return to the main menu.
9. **CAS: Non Functional.**
10. **CARD: Non Functional.**
11. **ECM**: Opens the Electronic Warfare page.
12. BLANK.
13. BLANK.
14. BLANK.
15. **ENG**: Opens the Engine Data page.
16. BLANK.
17. BLANK.
18. **VRST: Non Functional.**
19. BLANK.
20. **BIT: Non Functional.**

ENGINE CONTROLS

The throttle quadrant is located on the left console.

Throttle Control Lever

The throttle is controlled by a lever in the outboard portion of the throttle quadrant.

Nozzles Control Lever

The nozzles are controlled by a lever in a quadrant inboard of the throttle. When the lever is fully forward against a stop at the front end of the quadrant the nozzles are fully aft, and they rotate down as the lever is moved aft. The engine datum is at 1.5° of the fuselage datum. The nozzle angle for hovering is therefore 85° from the engine datum. A nozzle braking position at 98.5° can be selected. The selected nozzle angle is indicated on a scale alongside the stop. If the flaps switch is in STOL, the flaps move with the nozzles. Refer to flaps in this section.

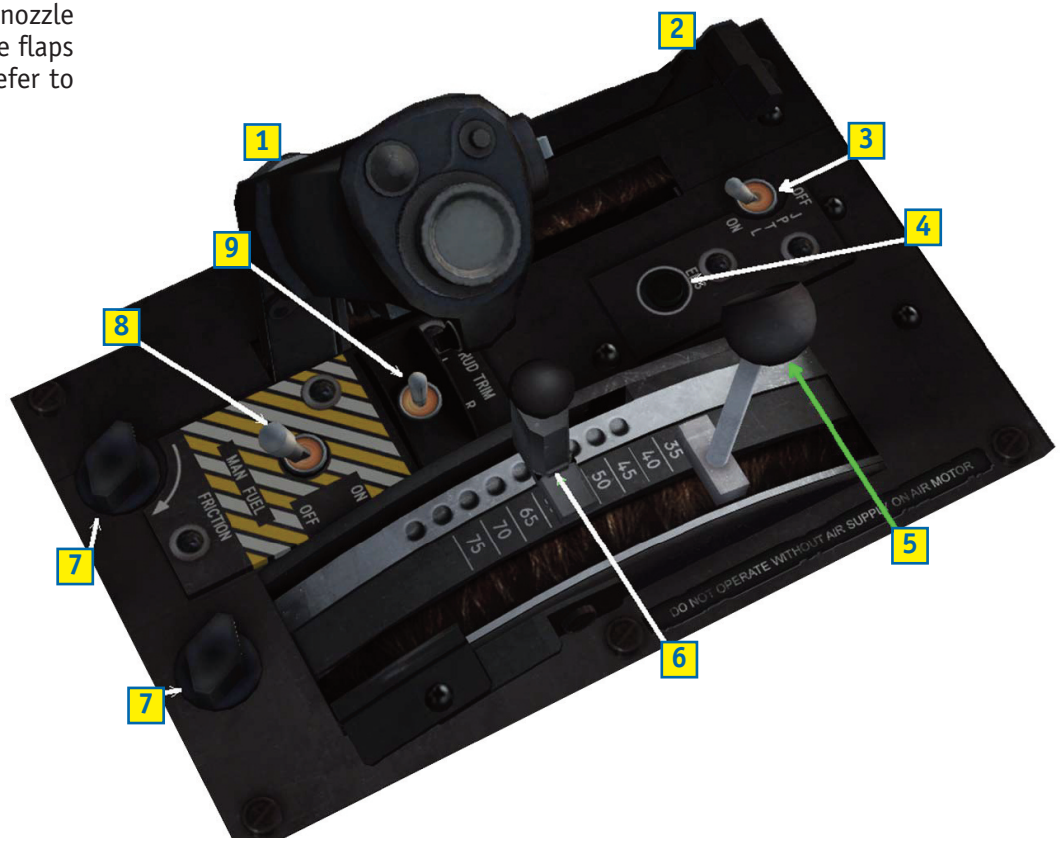
1. THROTTLE LEVER.
2. PARKING BRAKE LEVER.
3. JPT LIMITER (JPTL) SWITCH.
4. ENGINE MANAGEMENT SYSTEM (EMS) SWITCH.
5. NOZZLES LEVER.
6. STO STOP LEVER.
7. THROTTLE AND NOZZLES FRICTION KNOBS.
8. MANUAL FUEL CONTROL SWITCH.
9. RUDDER TRIM SWITCH.

Fig. 7
Saitek X 65F Throttle Quadrant

Throttle and Nozzle Joystick/Throttle Configuration

The aircraft makes use of a special configuration to control both the engine throttle and the nozzles. To configure a throttle lever in a joystick you must use the: **Throttle Axis** (which moves ALL throttles) instead of the **Engine 1 Throttle Axis**. The Aircraft Control Module seeks and traps the movement of the general throttle lever instead of the engine 1. This is not an issue when you are using a single lever throttle but you may experience problems with engine power if you are using a multi lever throttle system like the *Saitek X 65F* (Fig. 7) configured for a specific engine.

For these types of controls we suggest that you map one lever to the **Throttle Axis** and the other one to the **Propeller Axis** so you can control both Throttle and Nozzles.



ENGINE DISPLAY PANEL (EDP)

The EDP is on the right side of the main instruments panel. The EDP has six drum type indicators for display of reaction control system duct pressure, fuel flow, stabilator trim position, engine rpm, jet pipe temperature (JTP) and water quantity. A dial type indicator displays nozzle position.

Fig. 8
Engine Display Panel (EDP)

1. **DUCT PRESSURE INDICATOR** The duct pressure indicator displays reaction control system duct pressure in pounds per square inch. It displays units, tens and hundreds.
2. **FF INDICATOR** The Fuel Flow indicator displays engine fuel flow in pounds per minute. It displays units, tens and hundreds.
3. **STAB INDICATOR** The Stabilator Position Indicator displays stabilator position in degrees nose up or nose down. It displays units and tens on the right two drums. The left drum displays a vertical arrow pointing either up or down on the left drum.
4. **TACHOMETER** The tachometer displays engine speed in percent rpm. It displays tenths, units, tens and hundreds.
5. **JPT INDICATOR** The Jet Pipe Temperature indicator displays JPT in °C. It displays units, tens and hundreds.
6. **H_2O INDICATOR** The water quantity indicator displays pounds of water remaining in units of ten. The tens and hundreds digits change.
7. **NOZZLE POSITION INDICATOR** Thenozzle position indicator displays nozzle position in degrees. The scale is graduated in units of ten and the range is from 0° to 120°.
8. **BRIGHTNESS KNOB** Controls the EDP's light illumination.

Engine MPCD Display

Engine displays available on the MPCDs include compressor rpm, fan rpm, corrected fan rpm and JPT. To select the engine display, press MENU then ENG (See fig.9).

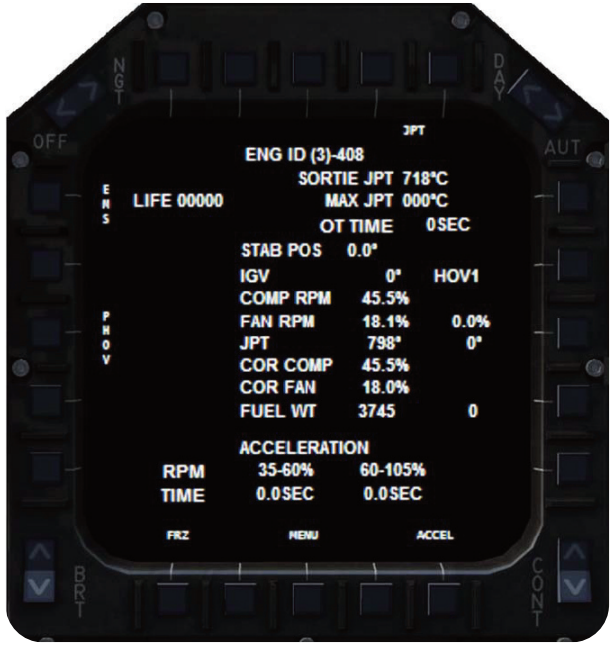


Fig. 9
Typical Engine Display (MPCD)

FUEL SYSTEM

The fuel system consists of seven integral tanks (five fuselage tanks and two internal wing tanks). Provisions are made for four externally mounted (droppable) tanks.The tanks are divided into two feed groups: the left feed group consists of the left external tanks (when installed), left internal wing tank, left and right front tanks and the left center feed tank. The right feed group consists of the right external tanks (when installed), right internal wing tank, rear tank and right center feed tank. Also there is a retractable refueling probe for air refueling.

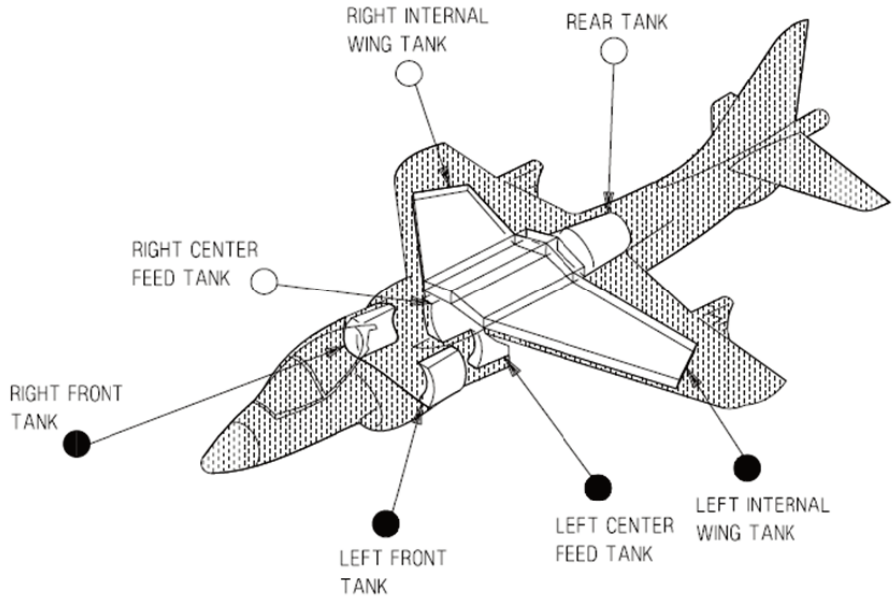


Fig. 10
Fuel Tanks Position

Fuel Tank Assignation

The following are the FSX fuel tanks assignation to each aircraft tank.

INTERNAL TANKS			
Fuel Group	**Aircraft Tank**	**FSX Tank**	**Capacity** (US Gallons)
Left Fuel Group	Left Internal Wing	Left Aux	362.5
	Left Center Feed	Center 2	47.0
	Left Front	Left Main	80.5
	Right Front	Right Main	80.5
Right Fuel Group	Rear Tank	Center 3	161.0
	Right Center Feed	Center 1	47.0
	Right Internal Wing	Right Aux	362.5

EXTERNAL TANKS			
Fuel Group	**Aircraft Tank**	**FSX Tank**	**Capacity** (US Gallons)
Left Feed Gr.	Left Outboard	External 1	300.0
	Left Inboard	Left Wing Tip	282.0
Right Feed Gr.	Right Inboard	Right Wing Tip	282.0
	Right Outboard	External 2	300.0

Total internal fuel capacity is 1,141 US Gallons.
Total auxiliary fuel capacity is 1,104 US Gallons.

ATTENTION

There is a disconnect between how the real aircraft uses fuel and how FSX determines fuel must be used. FSX consumes fuel in the following order:

- **a. External 1 & 2 (Outboard External Tanks L & R)**
- **b. Wing Tips L & R (Inboard External Tanks L & R)**
- **c. Aux Tanks L & R (Internal Wing Tanks L & R)**
- **d. Main Tanks L & R (Feed Tanks L & R)**

Also as soon as the FSX internal tanks begin to be used, FSX also uses the center tanks in the following order:

Center 3 (Rear Tank) -> Center 2 (Left Center Feed) -> Center 1 (Right Center Feed)

This may cause the Fuel Warning Lights to come on although there is still plenty of fuel left in the wing tanks.

Fuel Shutoff Handle

The fuel shutoff handle has positions of ON and OFF and is located on the left wall just aft of the left console. When the handle is OFF, the aircraft fuel system is isolated from the engine.

Boost Pumps

There are four electrically operated fuel pumps. They can be turned on/off by clicking on their respective PUMP switches in the Fuel Control Panel (FCP). A L or R PUMP caution light, on the caution light panel, comes on any time the associated pump is offline.

Fuel Flow Proportioner

The function of the fuel flow proportioner is to equalize the flow of fuel from the two feed groups. The system is controlled by the FUEL PROP switch in the FCP in the left console. A PROP caution light comes on if the proportioner is shut off.

Fig. 11
Fuel Control Panel

Wing Fuel Dump

External and internal wing fuel may be dumped in flight by selecting the DUMP position on the wing fuel dump switches. When dump is selected, fuel is dumped overboard through fuel dump outlets in the wing tips. Fuel continues to dump until internal wing tanks are empty, the switches are placed to NORM, or if BINGO fuel level is reached. Fuel will be dumped only with the aircraft in the air.

Air Refueling System

The aircraft has a retractable air refueling probe installed above the left air inlet. An A/R switch, READY, LEFT and RIGHT lights provide control and indications for the air refueling system. At night the probe and drogue are illuminated by a probe light. Refueling stops after all tanks are full.

The **A/R Switch** is on the FUEL Panel in the left console. The switch has three positions: IN, OUT and PRESS

IN	Retracts the probe.
OUT	Extends the air refueling probe.
PRESS	Starts the air refueling process. Fuel will flow into the internal tanks.

The READY light is on the windshield arc. When the A/R switch is placed to the OUT position, the READY light comes on after the probe extends and locks. When refueling begins, the light goes out. After refueling, the light comes on and stays on until the A/R switch is placed to IN and the probe is fully retracted and locked.

Fig. 12
READY, LEFT and RIGHT
Advisory lights.

The LEFT and RIGHT Full advisory lights are on the windshield arc. The lights will come on when the A/R switch is clicked to the PRESS position and fuel begins to flow into the internal tanks of each group. The lights turn off when the tanks are full and there is no fuel flow.

Fig. 13
READY Air refueling light

Fig. 14
LEFT and RIGHT Air refueling lights

Air refueling can only be accomplished if the aircraft is in a stable configuration with no more than 2 degrees pitch either Up or Down and no more than 2 degrees of bank to either side. Fuel flows at a rate of 2,070 lbs per minute.

Fig. 15
Fuel Quantity Indicator Panel

CALLING TANKER AIRCRAFT

The pilot can request a tanker aircraft at any time during the flight. A VC-10 KC-1 tanker code name *TEXACO* will appear 50 nm from present aircraft position. The tanker will fly a 30x60 nm racetrack pattern for as long as its internal fuel holds or until dismissed by the pilot.

To request the tanker you must press the **Tail Wheel (lock/unlock)** key (the default value is Shift + G).

TEXACO will announce its arrival with a message that will appear at the top of your screen, indicating bearing to aircraft, distance, altitude and indicated speed. Pressing again the **Tail Wheel (lock/unlock)** key will dismiss the tanker.

To search for the tanker you must use the TACAN system (see the COMMUNICATIONS – NAVIGATION EQUIPMENT AND PROCEDURES section for instructions to operate the TACAN):

1. Activate the TACAN System.
2. Set the TACAN to the A/A mode.
3. Follow the TACAN steering cues in both the HUD and HSI to locate the tanker.

ATTENTION

Although the VC-10 KC-1 is a large aircraft, it won't be visible until your distance is about 8 nmiles. Follow the steering cues or you will never locate the aircraft.

The Fuel Quantity Indicating System

The fuel quantity indicating system provides readings, in pounds, of usable feed group and usable total fuel (Fig. 14).
The fuel quantity indicator is on the right main instrument panel. It has four display windows, a BINGO set knob and an ON/OFF indicator. The window labeled TOT, continuously displays total usable fuel in increments of 100 pounds. The

windows labeled L and R, display left and right usable fuel in the corresponding feed group in increments of 50 pounds. The window labeled BINGO displays the set fuel quantity that activates the BINGO caution light. The BINGO set knob is used to set the BINGO window in increments of 100 pounds. The selector switch provides individual tank monitoring of the left and right feed groups and a test (BIT) of the indicator. The ON/OFF indicator displays the word OFF if the indicator is off.

The fuel quantity selector switch has the following seven positions:

BIT A spring loaded position that starts built in test of the system. When BIT is selected, the fuel quantity indicator displays 1400 in the L window, 2400 in the R window, 3800 in the TOT window.

FEED Fuel remaining in respective center feed tank is displayed.

TOT Total fuel remaining in respective feed groups is displayed.

INT Fuel remaining in internal tanks of respected feed group is displayed.

WING Fuel remaining in respective internal wing tank is displayed.

INBD Fuel remaining in respective inboard external tank is displayed.

OUTBD Fuel remaining in respective outboard external tank is displayed.

BINGO Caution Light

A BINGO caution light, on the left main instrument panel, comes on when the fuel level reaches a preset value controlled by the pilot. An adjustable fuel quantity indicator may be set to any value up to 9,900 pounds.

ELECTRICAL POWER SUPPLY SYSTEM

The electrical power supply system consists of a main generator, an emergency generator (APU), a battery and a power distribution (bus) system.

Electrical power is supplied by a main generator and an emergency generator (APU). During normal operation the main generator powers the entire electrical system. The APU acts as a backup for the main generator and will power the critical buses after main generator failure. The APU is also used on ground alert to recharge the battery.

Fig. 16
Electrical Power Supply Panel

Generator Warning Light

A generator warning light, labeled GEN, is on the warning/threat lights panel on the instrument panel. The light comes on whenever the main generator is off the line.

Generator Control Switch

The generator control switch is located on the electrical panel. It is a 3 position switch.

GEN Allows main generator to come on line when all conditions are correct.
OFF Removes main generator from the line.
TEST Position used for ground test (INOP).

Auxiliary Power Unit (APU)

An emergency generator, referred to as the APU, is installed as a backup for the main generator. With the battery switch to BATT and the engine start switch to OFF, placing the APU GEN switch to ON will start the APU. The APU will then power all of the buses in the electrical system, provided the main generator is off the line. If the APU is turned on before take off and the main generator is operating, the APU will automatically shut down when the aircraft reaches 325 knots. If the APU is turned on while airborne there is no automatic shutdown speed.

The APU can be operated on a standby mode by turning it on while on the ground or in the air with the main generator operating. If the main generator comes off the line, the APU automatically comes on the line. If the generator comes on the line, the APU reverts to standby status.

APU Caution/Advisory Lights

Two lights on the caution/advisory lights panel are associated with the operation of the
APU. The APU GEN caution light comes on whenever the emergency generator system malfunctions with the APU switch in the ON position. The APU advisory light comes on whenever the APU is operating.

APU Generator Switch

The APU GEN switch on the electrical panel controls operation of the APU. It is a 3 Position switch.

OFF Terminates APU operation. (Default Position)
ON With battery switch in BATT, turns on the APU.
RESET Resets APU's functions.

Battery Switch

The aircraft has a 28 volt emergency battery. When the aircraft is on the ground and the main generator and APU are off the line, the battery provides power for a selected group of instruments. It is a 3 Position switch.

BATT Battery is connected and powering selected systems.
OFF Battery is disconnected and there is no electrical power in the aircraft.
ALERT Battery is connected and reduced set of systems are powered.

LIGHTING

EXTERIOR LIGHTS

Exterior lights are controlled from the exterior lights panel and the trim panel.

The exterior lights consist of the following: Position lights, formation lights, anti collision lights, landing/taxi lighs and the air refueling probe light.

Fig. 17
Exterior Lights Panel

Fig. 18
Landing Light Switch
(TRIM Panel)

Position Lights

Three position lights are provided: a red light on the left forward wing tip, a green light on the right forward wing tip, and a white light on the tail of the aircraft. The position lights are controlled by the POS lights switch on the exterior lights panel.

Anti Collision Lights

Two anti collisions lights are provided. One light is on the upper fuselage near the midpoint between the tail and the canopy. The other light is on the lower fuselage just forward of the tail section. The anticollision lights are controlled by the ANTI COLL lights switch.

BRT Lights illuminate at full intensity.
DIM Lights illuminate at reduced intensity.
OFF Lights are off.

Formation Lights

Twelve formation lights are provided. One light on each side of the vertical tail fin, one on each side of the fuselage just forward of the tail section, on each upper wing tip aft of the position lights, two on the upper fuselage just aft of the canopy and two on each side of the fuselage just below the canopy. The formation lights are controlled by the FORM lights knob which provides variable lighting between OFF and BRT.

Fig. 19
Exterior Lights at night
(Full brightness).

Landing/Taxi Lights

There are two landing lights, both on the nose gear strut. The APPROACH landing light that provides full brilliance during landings and the HOVER light that provides less brilliant lights for hovering. The approach landing lights is controlled by the main landing light switch on the trim panel. The main landing gear must be down and locked for the approach light to operate.

APPROACH (APRCH) Full brightness illumination.
HOVER (HVR) Mid brightness illumination.
OFF Lights are off.

The auxiliary landing light is controlled by the AUX switch. It controls the HOVER light for use as a taxi light.

INTERIOR LIGHTS

Interior lights are controlled from the interior lights control panel. On this model all lights are NVG compatible.

Fig. 20
Interior Lights Panel

Instruments Lights

Integral and light panel lighting for the main instrument panel is controlled by the INST PNL knob which provides variable lighting between OFF and BRT.

Console Lights

Integral and light panel lighting for the left and right instrument panel is controlled by the CONSL knob which provides variable lighting between OFF and BRT.

Fig. 21
Console Lights On

Fig. 22
Instruments Lights On

Fig. 23
Console and Instruments Lights On

Floodlights

Three console floodlights are .above each console and two on each side of the windshield arch. The console floodlights and instruments floodlights are night vision goggle (NVG) green. The lights are controlled by the FLD knob which turns them ON and oFF

Fig 24
Floodlights On

Fig. 25
Exterior view with
Floodlighs On

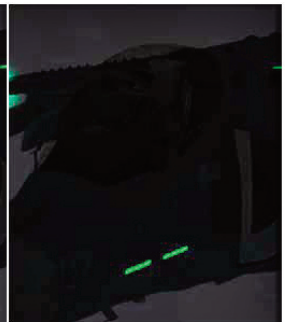


Fig. 26
Exterior view with
Floodlights Off

ATTENTION

Some switches functionality can be affected when the Floodlights are On. If you experience difficulties operating them, turn the Floodlights Off and try again.

Compass/Lights Test Switch

The COMP/LTS TEST switch is provided to control the standby compass light and test the warning/caution/advisory lights.

COMP The compass light is on, provided CONSL knob is out of oFF position.
OFF Compass light and test function are off.
LTS TEST Warning/Caution/advisory lights come on.

HYDRAULIC POWER SUPPLY SYSTEM

Hydraulic power is generated by two engine driven hydraulic pumps and is distributed by two independent 3,000 psi hydraulic systems; Hyd 1 and Hyd 2.

TOP Brake Pressure.
BOTTOM Hydraulic Pressure Systems No. 1 and No. 2

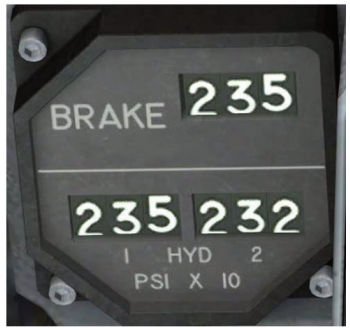


Fig. 27
Hydraulic Pressure
Indicators

FLIGHT CONTROL SYSTEM

PRIMARY FLIGHT CONTROLS

The primary flight controls are the stabilator, rudder and ailerons for aerodynamic control and a reaction control system for jetborne control. The stabilator, rudder and ailerons are hydraulically powered.

Aileron and Stabilator Trim

The aileron and stabilator trim switches are located in the control stick. To use them, you must use FSX keyboard combination for AILERON and Elevator

Action	FSX Event	Keyboard*
Stabilator Trim (Down)	Elevator Trim (down)	7
Stabilator Trim (Up)	Elevator Trim (up)	1
Aileron Trim (Left)	Aileron Trim (left)	Ctrl + 4
Aileron Trim (right)	Aileron Trim (right)	Ctrl + 6

Rudder Trim

The rudder trim consist of a trim switch on the throttle quadrant in the left console. The switch is spring loaded to the center position. Left or right clicking on the switch will trim to the left or right respectively.

Trim Indicators

The indicators for aileron, stabilator and rudder trim can be found in the trim panel and in the EDP.

Fig. 28
Aileron and Rudder Trim indicators.

Fig. 29
Stabilator trim indicator.

SECONDARY FLIGHT CONTROLS

Secondary controls are the flaps, drooped ailerons and speedbrake.

Flaps

The aircraft has a single set of trailing edge flaps. Flap positioning is provided by the flap controller in accordance with switch selection by the pilot. There are three modes available: STOL (25° to 62°), AUTO (0° to 25°) and CRUISE (5°).

Fig. 30
Flaps Controls and Indicators.

Fig. 31
Flaps controls location.

Flaps Power Switch

The flaps power switch is located on the Landing Gear Control Panel (LGCP).

OFF Shuts off power to the Flaps system.
ON Activates the Flaps Controller. Flap position is determined by the selected flaps mode.
RESET Resets Flaps Controller logic.

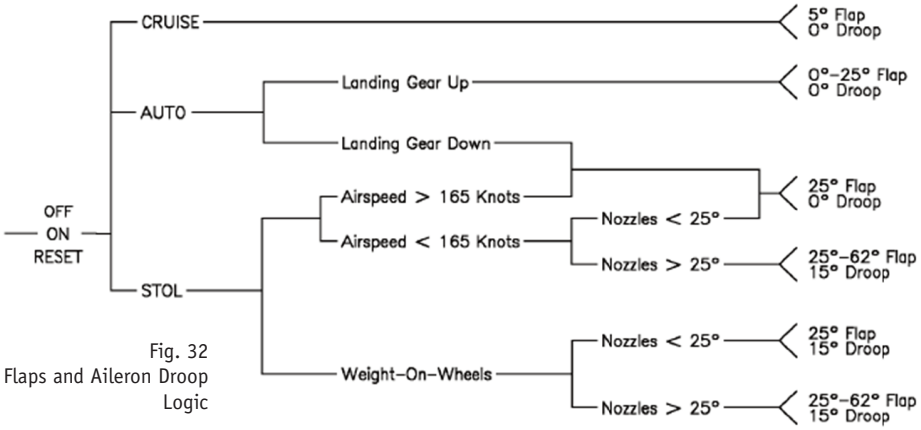


Fig. 32
Flaps and Aileron Droop Logic

Flaps Mode Select Switch

The flaps power switch is located on the Landing Gear Control Panel (LGCP). See Fig 32 for flaps logic.

STOL Provides 25° flaps if airspeed is over 165 knots. Below 165 knots. flaps are scheduled from 25° to 62° as nozzles are rotated from 25° to 50°. Below 165 knots with nozzles over 25°, provides 15° aileron droop. With weight on wheels, aileron drops 15°.
AUTO With the landing gear up, flaps are scheduled from 0° to 25° as a function of Mach number, airspeed and angle of attack. With the landing gear down, provides 25° flaps even if an AUT FLP caution is present.
CRUISE Provides 5° flaps all the time.

Flaps Position Indicator

The flaps position indicator is located on the Landing Gear Control Panel. Flaps position is shown in the HUD in the VSTOL mode.
STO Advisory Light: The green STO advisory light indicates when the flaps mode switch is in the STOL position.

Aileron Droop

Aileron droop operation requires no pilot action. Inflight, with the flaps mode switch in the STOL
position, the ailerons droop 15° when airspeed is below 165 knots and nozzles are over 25°.

Aileron DROOP Light

The aileron DROOP light on the caution/advisory lights panel comes on when the ailerons are drooped.

Speedbrake

The speedbrake is hinged on the fuselage underside, aft of the main landing gear. With the landing gear up, the speedbrake has a maximum travel of 66°. With the landing gear handle down, the speedbrake is set at 25° regardless of any previous selection. Since the control for the speedbrake is on the throttle, it can only be activated by using the default FSX keyboard assignment for Spoilers.

STABILITY AUGMENTATION AND ATTITUDE HOLD SYSTEM (SAAHS)

The two basic SAAHS modes of operation are the stability augmentation system (SAS) mode and the automatic flight control (AFC). The mode selection controls are located on the SAAHS panel on the left console just forward of the throttle nozzle quadrant.

Fig. 33
SAAHS Panel.

Stability Augmentation System (SAS)

The three SAS mode selection controls are the PITCH, ROLL and YAW switches, which engage the stability augmentation in the corresponding aircraft axes.

Automatic Flight Control (AFC)

The two AFC mode selections are the AFC and ALT HOLD switches. All three SAS switches must be engaged in order to engage the AFC mode selection switches. The AFC mode will disengage as soon as the landing gear touchdown on landings.
The AFC switch has three positions which provide the following functions:

AFC Engages the AFC (autopilot).
OFF AFC mode is off.
RESET Momentary Position. SAAHS resets (turns off al SAS switches).

The ALT HOLD switch has two positions which provide the following functions:

ALT HOLD Engages altitude hold option of AFC mode.
OFF Altitude hold is off.

The AFC switch must be engaged and the NAV mode of the INS must be selected in order to engage the ALT HOLD switch. The AFC mode may be disengaged by turning the AFC switch off. Disengaging the AFC switch will also cause the ALT HOLD to return to the OFF position. Disengaging any of the three SAS switches will disengage the AFC mode, both the AFC and ALT HOLD will return to the OFF position if they are engaged.

AFC Mode – AFC Switch only engaged

When the AFC switch is engaged and the ALT HOLD switch is in the OFF position, the AFC system will provide pitch attitude hold, roll attitude hold and heading hold.
Attitude hold will engage in the ±30° pitch range.

AFC Mode – AFC and ALT HOLD Switches engaged

The ALT HOLD switch permits selection of altitude hold in place of pitch altitude hold in the AFC mode.

LANDING SYSTEMS

The landing systems consist of the landing gear, nose wheel steering, brakes anti skid and lift improvement device system (LIDS).

Landing Gear System

The aircraft is equipped with a fully retractable landing gear that consist of a nose gear, a main gear with twin wheels in tandem with the nose gear, and two single wheel wing gears. The nose gear retracts forwards and the main gear retracts aft and is partially enclosed in a fairing assembly just inboard of the ailerons.

Fig. 34
Landing Gear Control Panel

Landing Gear Position Indicators

The landing gear position indicators are on the lower left main instrument panel. The N (nose), L (left wing gear), R (right wing gear) and M (main gear) green indicators come on when the respective gear is down and locked. The N, L, R and M amber indicators will come on when the respective gear is in transit between the UP and DOWN positions.

LDG Gear Emergency Battery

The LDG emergency battery is located on the left console below the landing gear position indicators. The battery is a one shot device for the emergency extension of the landing gear. The battery is activated by clicking on the lever. The lever will come up and will remain locked in that position until it is reset after the flight.

Lift Improvement Device System (LIDS)

The lift improvement device system (LIDS) is part of the landing gear system.
The LIDS is composed of fixed strakes and a retractable fence. The fence normally extends and retracts with the landing gear, but it can be retracted with the LIDS switch.

LIDS Switch

The LIDS Switch is located on the pilot's service panel on the left console.

RET Retracts LIDS fence.
NORM LIDS fence operate normally.

Brake System

The twin wheel main landing gear is equipped with hydraulic operated brakes. An anti skid system and parking brake are also incorporated into the brake system. Two pressure indicators adjacent to the inboard side of the caution lights panel provide information on brake accumulator pressure and applied brake pressure.

Parking Brake

The parking brake handle is located outboard of the throttle. When the throttle is in idle the handle can be moved into the parking detent. Advancing the throttle past 40% will release the handle from the detent position.

Anti Skid System

The anti skid system is selected by the ANTI SKID switch located on the landing gear/flaps control panel.

FLIGHT INSTRUMENTS

Standby Attitude Indicator

The standby attitude indicator is a self contained gyro horizon type instrument.
An OFF flag appears whenever the unit is caged or power is lost.

Standby Altimeter

The standby altimeter displays altitudes from 0 to 50,000 feet. The altimeter is a counter pointer type. The counter drum indicates altitude in thousands of feet from 00 to 99. The long pointer indicates altitudes in 50 foot increments with one full revolution each 1000 feet.
A knob and window permit setting the altimeter to the desired barometer setting. This setting is also used by the air data computer and displayed on the HUD.

Standby Angle Of Attack Indicator

The standby angle of attack (AOA) indicator is on the main instrument panel. When electrical power is interrupted, the word OFF appears in a window in the face of the indicator.

Standby Airspeed Indicator

The standby indicator displays airspeed from 20 to 700 knots. The indicator contains two pointers and a single scale graduated from 1 through 10.
The thin pointer indicates speed from 0 to 100 knots.
The thick pointer represents airspeeds from 100 to 1000 knots.

Standby Vertical Velocity Indicator

The standby vertical velocity indicator displays rate of ascent or descent on a scale of 0 to ± 6000 feet per minute.

Slip Indicator

The slip indicator contains an inclinometer ball.

Standby Magnetic Compass

A conventional aircraft magnetic compass is installed to the left of the main instruments panel. It is located on the canopy left archway.

Clock

A standard 12 hour clock is installed in the cockpit on the
right side of the main instruments panel glare shield.

Note: The clock is usually hidden by the main instruments panel cover. Track IR user can see it by inclining their head to the right.

Stopwatch

A mechanical stopwatch is located to the left of the main instruments panel glare shield. The stopwatch contains one pushbutton for starting and stopping and one pushbutton for resetting.

HEAD UP DISPLAY (HUD)

The head up display (HUD) is on the top of the main instrument panel. The HUD is the primary flight control, weapon status and weapons delivery display for the aircraft under all selected conditions. The HUD receives attack, navigation, situation and steering control information and projects symbology on the combining glass for head up viewing. Symbology is unique to the master mode selected.

The HUD displays collimated symbology projected into the pilot's forward field of view. The controls for the HUD are below the upfront control.

Fig. 35
HUD Control Panel

HUD Symbology Reject Switch

This switch has three positions; NORM, REJ 1 and REJ 2. With the switch placed to NORM (default position), the normal amount of symbology is provided for all HUD displays. Placing the switch to REJ 1 or REJ 2 changes the HUD symbology in the different modes.

HUD Symbology Brightness control

This knob is used to turn on the HUD and he varies the symbology display intensity.

HUD Symbology Brightness Selector Switch

This is a three position toggle switch with positions of DAY, AUTO and NIGHT.

Video Brightness Control

This control is a rotary knob used to adjust the brightness of the HUD raster video. It is used to control the intensity of FLIR video.

Video Contrast Control (Non Functional)

This control is a rotary knob used to adjust the contrast of the HUD raster video.

Altitude Switch

This is a two position toggle switch with positions for BARO and RDR. This switch is used to select either radar altitude (RDR) or barometric altitude (BARO) for display on the HUD.

Fig. 36
NAV Mode HUD Display

Fig. 37
VSTOL Mode HUD Display

HUD Symbology

There are four HUD master modes, each one with its unique symbology; NAV (Navigation), VSTOL (vertical/short takeoff and landing), A/G (air to ground attack mode) and A/A (air to air attack mode).

Navigation Master Mode

Navigation master mode is selected by clicking on the NAV mode pushbutton on the main instrument panel. In the navigation mode, primary flight information is presented on the HUD and aircraft horizontal situation is provided on the EHSD display in the MPCDs. Three navigation steering modes are provided and selectable from the EHSD display: a) waypoint steering, 2) TACAN steering and 3) AWLS steering. Waypoint steering provides great circle steering to a selected flight plan waypoint. TACAN steering provides the same capability to the selected TACAN station. AWLS steering provides localizer and glideslope steering to the selected ILS station.

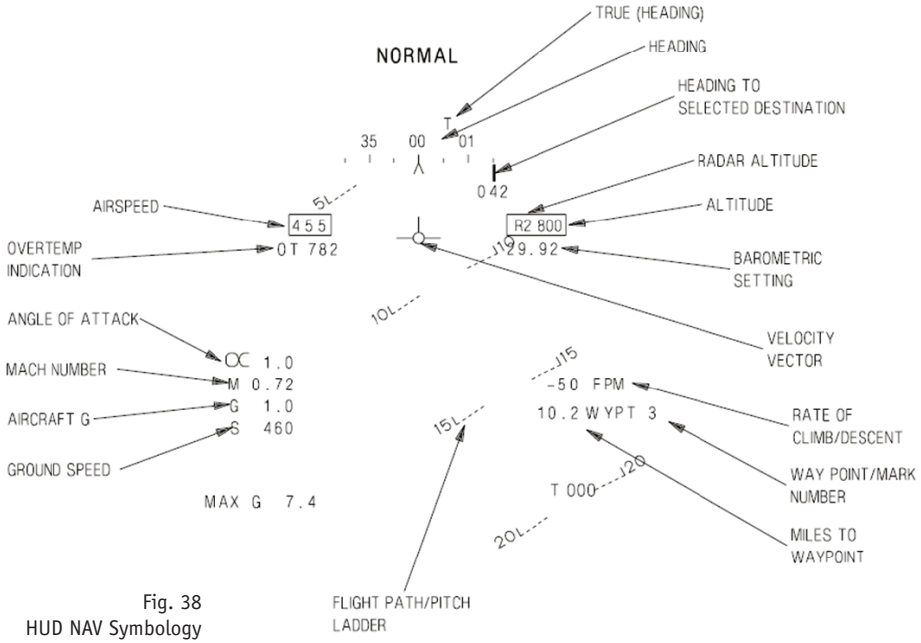


Fig. 38
HUD NAV Symbology

- **Heading** The aircraft true heading is indicated on the moving 360° scale. True heading is the initial heading and a "T" appears on the HUD display. If magnetic heading is desired, you must select the HUD option in the MPCD and then click on the TRUE labeled pushbutton. The box is removed from around the TRUE legend and the T is removed from the HUD display. The actual aircraft heading is directly above the caret.
- **Airspeed** Calibrated airspeed is provided in the box on the left side of the HUD.
- **Altitude** The altitude presented on the b ox on the right side of the HUD may be either barometric or radar altitude depending on the setting of the altitude switch on the HUD. When the altitude switch is in the BARO position, barometric altitude is displayed. When the altitude switch is in the RDR position, radar altitude is displayed and is identified by an R next to the altitude. If the radar altitude becomes invalid, barometric altitude is displayed and a flashing B appears to the right of the box indicating barometric altitude. The flashing B remains until either radar altitude becomes valid again or the altitude switch is placed on BARO.
- **Barometric setting** The Kollsman barometric setting used to calibrate the altimeter is displayed below the altitude box.
- **Angle of Attack (AOA)** Angle of Attack in degrees is displayed at the left center of the HUD.
- **Mach Number** The aircraft Mach number is displayed immediately below the angle of attack.
- **Aircraft G** Normal acceleration (G) is displayed immediately below the AOA.
- **Groud Speed** Ground Speed (S) is displayed immediately below the aircraft G.
- **Maximum G** Maximum normal acceleration (MAX G) attained. It is displayed below the ground speed.

- **Velocity Vector** The velocity vector (VV) provides the pilot with an outside world reference with regard to actual aircraft flight path. The VV represents the point towards which the aircraft is flying (aircraft flight path). In the NAV master mode, the VV is always caged to the vertical center line of the HUD. A ghost VV is displayed at the true VV position if that position is more than 1° from the caged position.
- **Flight Path/Pitch Ladder** The vertical flight path angle of the aircraft is indicated by the position of the VV in the flight path/pitch ladder. The horizon and flight path/pitch angle lines represent the horizon and each 5° angle between plus and minus 30° and each 10° between 30° and 90°.
- **Waypoint Number** This number indicates the currently active waypoint.
- **True Heading** The letter T is displayed when true heading is selected on the MPCD. If there is no T, magnetic heading is being displayed. True heading is the default selection.
- **Rate of Climb/Descent** This number indicates the feet per minute that the aircraft is climbing or descending. A minus sign indicates the aircraft is descending.
- **Range** The distance in nautical miles to the active waypoint, selected TACAN or ILS station is displayed here.
- **Heading Marker** The heading marker (bug). Indicates relative bearing to the active waypoint or selected TACAN station. The heading marker position varies along the heading scale and will peg at the scale limit.
- **Overtemp (OT) Indicator** If the JPT exceeds the engine threshold value, the maximum JPT recorded is displayed beneath the airspeed box.
- **Auxiliary Heading** The auxiliary heading is displayed in all master modes and is a repeat of the HUD aircraft heading. A T is displayed if true heading is being displayed.

VSTOL Master Mode

VSTOL master mode is selected by clicking on the VSTOL mode pushbutton on the main instrument panel. With VSTOL selected, two options are displayed on the ODU. They are NRAS (nozzle rotation airspeed) and PC (pitch carets). Basic flight data of heading, airspeed, altitude, steering, etc. are displayed and function the same as described in the NAV master mode. Additional and different functions in the VSTOL mode are described in the following paragraphs.

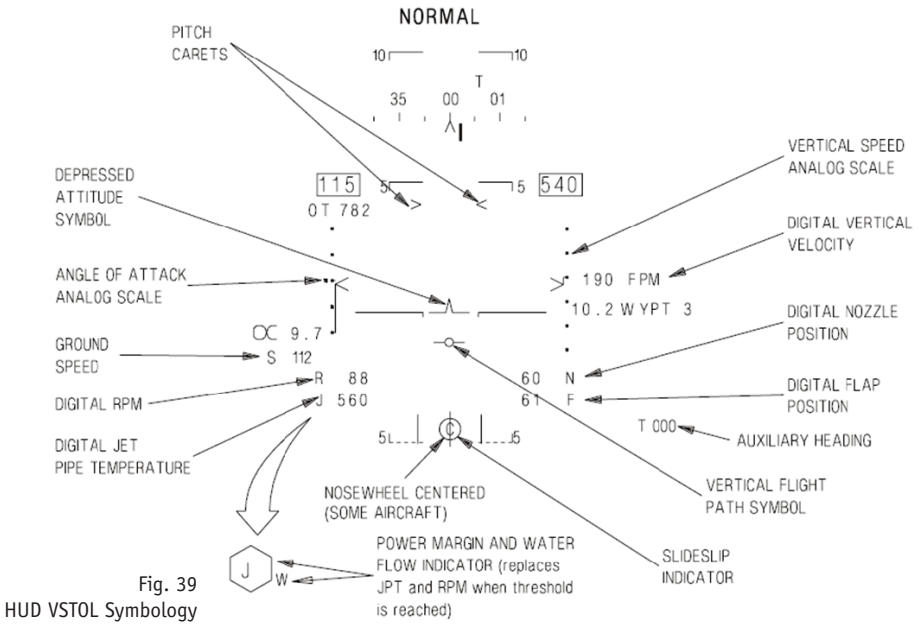


Fig. 39
HUD VSTOL Symbology

- **Vertical Speed Analog Scale** The vertical speed analog scale provides trend information during climb and dives. The scale range is +1500 to 2000 feet per minute with gradautions at +1000, +500, 0, 500, 1000 and 1500 feet per minute.
- **FPM (feet per minute)** Digital vertical velocity is displayed in feet per minute with a limit of ±9950 fpm and a resolution of 10 fpm.

- **N (nozzle)**. Digital nozzle position is displayed in degrees.
- **F (flap)**. Digital flap position is displayed in degrees.
- **Vertical Flight Path Symbol (VFPS)**. The VFPS is caged laterally and above 60 knots provides climb and dive angle information. Below 60 knots, the VFPS indicate vertical speed in feet per minute. When referenced against the flight path/pitch ladder, 1° of displacement from the horizon line equals 100 fpm vertical speed.
- **Sideslip Indicator**. Sideslip is indicated by the horizontal movement of the sideslip ball in relation to three vertical lines.
- **Power Margin Display and W**. The power margindisplay replaces the JPT and RPM display when JPT is approximately 60° below maximum JPT or when RPM is approximately 6% below maximum RPM. The display is a growing hexagon around the letter J or R.with each completed side representing 10°C JPT or 1% RPM The W is displayed when water injection is selected and water is flowing.

- **J (jet pipe temperature)**. Digital jet pipe temperature (JPT) is displayed in degrees celcius.
- **R (RPM)**. Digital engine RPM is displayed in percent.
- **S (ground speed)**. Digital ground speed is displayed in knots.
- **Angle of Attack Analog Scale**. The AOA analog scale has a range of +25° to 5° AOA with graduations at +20°, +15°, +10° (double dot), +5°, 0° and -5°.
- **Depressed Attitude Symbol (Witches Hat)**. The depressed attitude symbol is fixed at 8° below the water line. When the horizon bar of the flight path/pitch ladder is aligned with the depressed attitude symbol, the aircraft is at the proper hover attitude.
- **Pitch Carets (PC) Cue**. The pitch carets initialize at 14° and provide a cue for pitch. The cues are adjustable form 0° to 30° in 1° increments. When VSTOL mode is selected, the PC option is displayed on the ODU. The carets are set by clicking on the PC option, typing the desired degrees of pitch (0° thru 30°) on the UFC and then clicking on ENT. The pitch carets are referenced to the depressed attitude symbol and move with the pitch ladder.
- **Nozzle Rotation Airspeed (NRAS)**. With VSTOL mode selected, the NRAS cue is set by clicking on the NRAS option in the ODU, typing the desired airspeed (up to 160 knots) on the UFC, then clicking ENT. The airspeed display is boxed when the set airspeed is reached.

WARNING/CAUTION/ADVISORY LIGHTS AND TONES

The warning/caution/advisory lights and displays systems provide visual indications of normal aircraft operation and system malfunctions affecting safe operation of the aircraft. The lights are on various system instruments and control panels in the cockpit. Eleven green warning lights located to the right of the UFC and below the yellow MASTER WARNING light indicate a hazardous condition requiring immediate action. Six green priority caution lights are located to the left of the UFC and below the red MASTER CAUTION. The other green caution lights are on the caution/dvisory light panel.

All caution lights indicate the existence of an impending dangerous condition requiring attention but not necessarily immediate action. Illumination of a priority caution light may require immediate corrective action in certain flight conditions. The green advisory lights indicate safe or normal configuration, condition of performance, operation of essential equipment or information for routine purposes. The advisory lights are on the caution/advisory light panel and on various other panels throughout the cockpit.

MASTER WARNING AND MASTER CAUTION LIGHT

The yellow MASTER WARNING light on the right side of the UFC comes on flashing and is accompanied by the appropriate voice warning when a warning light comes on. The red MASTER CAUTION light on the left side of the UFC comes on flashing and is accompanied by the appropriate voice warning when any caution light on the right console caution/advisory light comes on. Either master light will go out when it or the other master light is pressed (reset), and will cause all flashing warning or caution lights to go from flashing to steady. Pressing either master light will also silence the current voice warning.

Voice Warnings

Voice warnings are provided in conjunction with certain warning/caution lights in place of special tones.

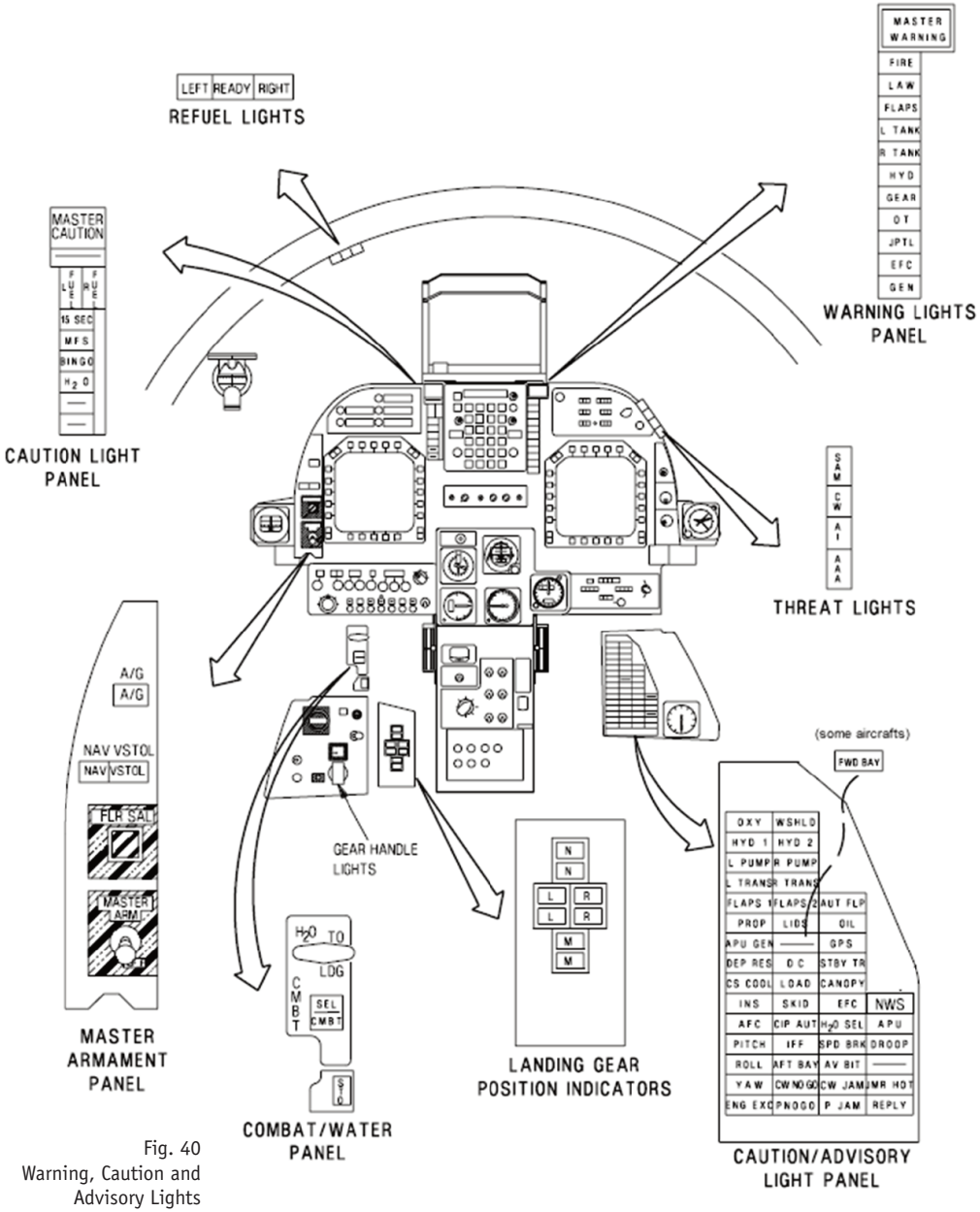


Fig. 40
Warning, Caution and Advisory Lights Locations

Ground Proximity Warning System (GPWS)

GPWS is a safety backup system that alerts the aircrew of an impending controlled flight into terrain (CFIT) condition. The GPWS can be enabled/disabled by clicking on the Option 4 ODU display when the ALT option is selected in the UFC.

GPWS provides unambiguous directive aural and visual cues to the aircrew for each potential CFIT condition. A HUD recovery cue indicating the correct direction to recover the aircraft and voice warning are provided.

Fig. 41
GPWS HUD Warning Symbology

The recovery cue is a steady arrow. The on/off condition of the arrow is warning dependent. The arrow displayed on the HUD shows the direction of the horizon. The recovery cue is displayed over the existing data on the HUD. When the potential CFIT condition no longer exists, the recovery cue is removed from the HUD.

Operating Limitation

We at RAZBAM have worked to model this aircraft as close as possible to the original, including the aircraft/system limitations that must be observed during normal operations.

ENGINE LIMITATIONS

RATING	LIMITATIONS		
	MAXIMUM % RPM	MAXIMUM JPT °C	COMBINED TIME LIMITS
SHORT LIFT WET	120.0	800	15 SEC
SHORT LIFT DRY	113.5	780	1.5 MIN
NORMAL LIST WET	116.0	780	2.5 MIN
NORMAL LIFT DRY	111.0	765	10 MIN
COMBAT	111.0	750	15 MIN
MAXIMUM THRUST	109.0	710	
MAXIMUM CONTINUOUS	102.0	645	UNLIMITED
IDLE	28.4 – 29.0	545	UNLIMITED
STARTING		475	MOMENTARILY

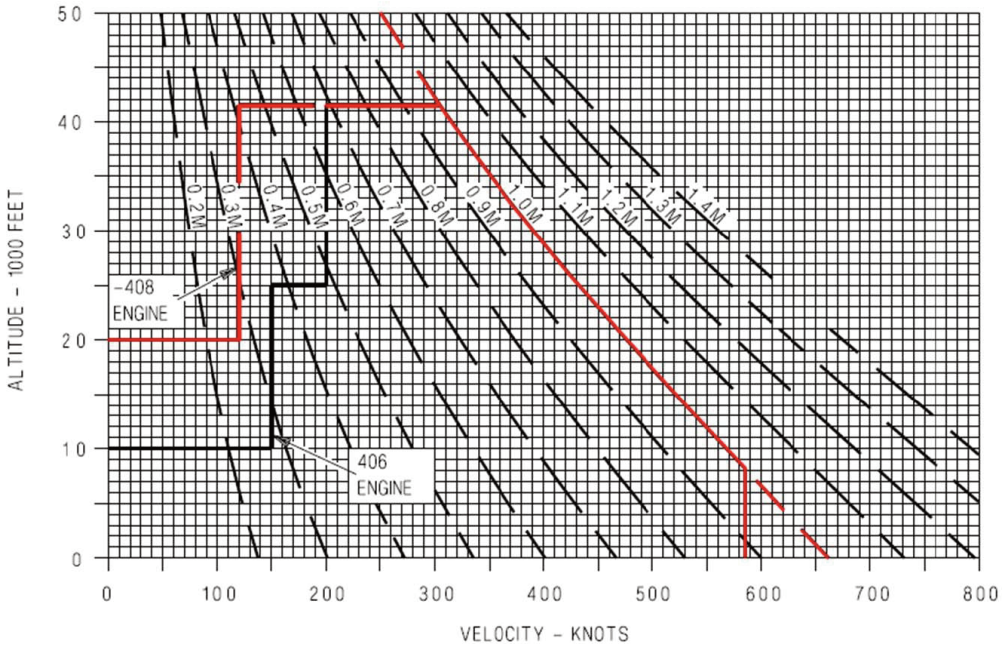
AIRSPEED LIMITATIONS

The maximum permissible airspeeds for flight in smooth or moderately turbulent air with landing gear, flaps retracted, and the speed brake retracted is shown in figure 39. The maximum permissible airspeed/Mach number, whichever is less: 585 KCAS / 1.0 IMN

Airspeed limitations for various systems are as follows:

1. Flaps: STOL – 300 Knots; CRUISE – 0.87 Mach.
2. Landing gear operation – 250 Knots.
3. Landing gear locked down – 250 Knots.
4. Landing gear emergency extension – 210 Knots.
5. One hydraulic system inoperative – 500 Knots.
6. Canopy open – 40 Knots.
7. Wheels in contact with ground – 180 Knots ground speed.
8. Lids fence extended – 200 Knots.
9. Air refueling probe extended – 300 Knots.

Fig. 42
Airspeed Limitations



PROHIBITED MANEUVERS

1. Vertical takeoff with asymmetric load/stores greater than 45,000 in-lbs.
2. STO with asymmetric load/stores greater than 85,000 in-lbs or CTO with asymmetric load/stores greater than 100,000 in-lbs.
3. Shipboard STO with asymmetric load/stores greater than 57,250 in lbs.
4. AUTO flaps – SL with more than 148,000 in lbs asymmetry, or STOL flaps – SL with more than 85,000 in-lbs asymmetry.
5. VL with asymmetric load/stores greater than 80,000 in-lbs.
6. Takeoff with less than 10° nozzles until wingborne.
7. Spin
8. Under 1 g for more than 15 seconds.
9. Overriding aileron high speed stop
10. Roll over 360°.
11. In accelerating or decelarting transition:
12. Rearward or sideward translation above 30 knots.
13. Thrust Vector Control (TVC) above 30,000 feet MSL at AOA above onset of stall warning or at less than 0g.
14. Flight above onset of stall warning with more than 60,000 in lbs asymmetry.
15. Abrupt simultaneous stabilator, rudder or aileron inputs with more than 90,000 in lbs asymmetry.
16. Wingborne flight at any speed with more than 148,000 in lbs asymmetry, or flight above 0.88 Mach with more than 90,000 in lbs asymmetry. For asymmetries above 90,000 in lbs. maneuvering limit is 5g, 10° AOA or stall warning, whichever occurs first.
17. Departure above 250 Knots.
18. Rudder deflection above 0.80 Mach
19. Intentional stalls, tailslides, departures, spins or flops.
20. Airspeeds less than 120 KCAS in nose high conditions.
21. Rolling maneuvers in excess of 180° at more than 1g.

AOA LIMITATIONS

AOA limit versus Mach number with flaps AUTO, SAS OFF and nozzles 0° is shown in figure 40.

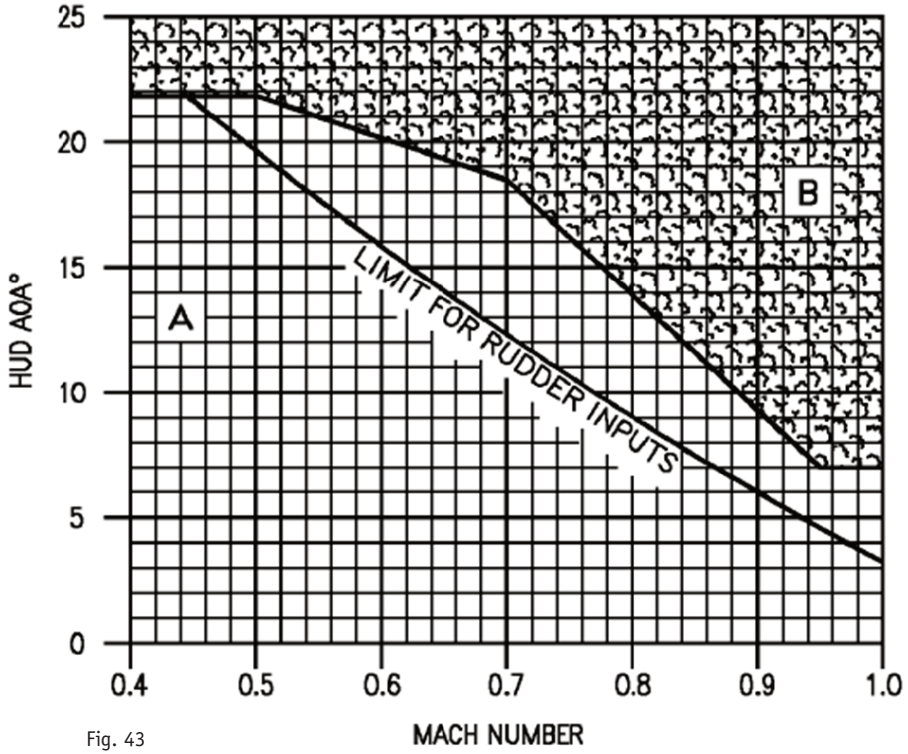


Fig. 43
AOA Limits Flaps AUTO SAS OFF Nozzles 0°

WEIGHT LIMITATIONS

Maximum gross weight for taxi and takeoff is 32,000 pounds. Avoid abrupt maneuvering and hard braking at taxi gross weights above 29,750 pounds. Maximum gross weight for landing is 26,000 pounds.

ACCELERATION LIMITATIONS

1. The maximum permissible acceleration in the takeoff and landing configuration is 0.0g to +2.0g's.
2. The maxium permissible acceleration in smooth air with flaps AUTO or CRUISE with empty pylons oar air to air loads is shown in figure 41. An air-to-air load is two AIM-9 on outboard pylons and a gun.

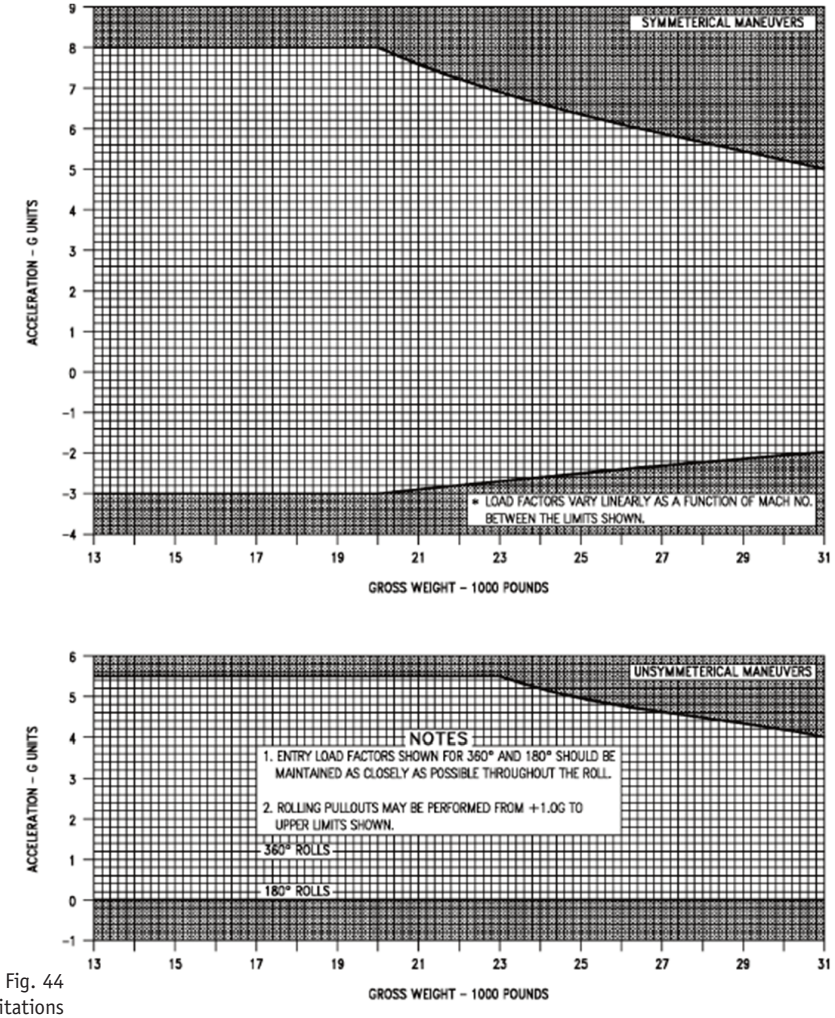


Fig. 44
Acceleration Limitations

CROSSWIND LIMITATIONS

Paved runway (minimum width 100 feet). For wet runway operation, reduce crosswind limits by 5 knots.

Glossary

CTO: Conventional Takeoff.
STO: Short Takeoff.
RVTO: Rolling Vertical Takeoff.
VTO: Vertical Takeoff.

A. Takeoffs
1. CTO (day or night) – 20 knots.
2. STO > 120 knots (day or night) – 15 knots.
3. STO ≤ 120 knots (day or night) – 10 knots.
4. RVTO
   Day – 10 knots.
   Night – 5 knots.
5. VTO (day or night) – 10 knots.

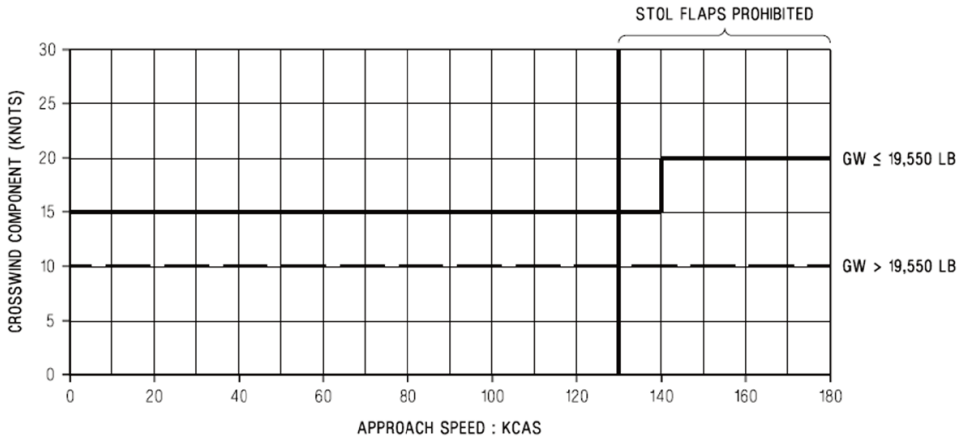
B. Landings
1. Approach speeds ≥ 140 knots.
   Day – 10 knots.
   Night – 5 knots.
2. Approach speeds ≤ 140 knots.
   Day – 10 knots.
   Night – 5 knots.
3. Gross weights > 19,550 pounds, all approach speeds (day or night) – 10 knots.
4. Refer to figure 42 for crosswind landing capability.

ARRESTING GEAR LIMITATIONS

The aircraft is cleared to taxi over a supported gear wire up to a maximum speed of 5 knots. The aircraft may cross an unsupported tensioned arresting gear wire at any speed, engine rpm or nozzle angle if the wire lies flat on the runway or deck.

SYSTEMS LIMITATIONS

1. **Global Positioning System (GPS)**
   GPS is for tactical use only and does not meet FAA standard for enroute or terminal phase of flight.
2. **All Weather Landing System (AWLS)**
   Use of AWLS (ILS) is limited to weather minimum of 400 foot ceiling and 1 nm visibility.
3. **Automatic Flight Controls (AFC)**
   3.1 Use of basic attitude hold mode above 0.85 Mach is prohibited.
   3.2 Use of altitude hold (ALT) below 500 feet AGL is prohibited.
   3.3 Use of control stick steering in pitch with ALT engaged is prohibited.
4. **Canopy**
   4.1 Canopy open with wind over 40 knots is prohibited.
   4.2 Canopy open with rpm over 70% is prohibited.
5. **Nozzle/Flap Limitations**
   During normal in flight operations, with the exception of air refueling, use of STOL flaps is limited to nozzle positions greater than 25°.
6. **APG-65 Operations**
   Use of terrain avoidance mode of radar in instrument meteorology conditions is prohibited.



NOTE

1. LIMITS SPECIFIED ARE FOR SMOOTH, PREPARED HARD SURFACES.
2. VALID FOR AIRCRAFT GROSS WEIGHTS LESS THAN 19,550 POUNDS, FOR AIRCRAFT GROSS WEIGHTS IN EXCESS OF 19,550 POUNDS, THE CROSSWIND COMPONENT AT ALL TOUCHDOWN SPEEDS SHALL NOT EXCEED 10 KNOTS.
3. MAXIMUM CRAB ANGLE AT TOUCHDOWN SHALL BE LESS THAN 10 °.
4. MAXIMUM ROLL ANGLE AT TOUCHDOWN SHALL BE LESS THAN 3.5 °.
5. FOR WET RUNWAY CONDITIONS/NIGHT OPERATIONS, MAXIMUM CROSSWIND COMPONENT SHALL BE REDUCED BY 5 KNOTS.
6. MAXIMUM AIRSPEED FOR STOL FLAP LANDING IS 130 KCAS. APPROACH AIRSPEED IN EXCESS OF 130 KNOTS SHALL USE AUTO FLAP SETTINGS.

CAUTION

LANDING WITH CRAB ANGLES IN EXCESS OF 10 ° MAY RESULT IN STRUCTURAL DAMAGE TO OUTRIGGER LANDING GEAR.

Fig. 45
Crosswind Landing Capability

THE HARRIER GR.7/GR.9 is a very complex aircraft. Its characteristics require that pilots meet a set of operating criteria to be able to successfully fly it. Do not expect to able to master this aircraft from the first flight. It takes practice before you can enjoy this aircraft to the full. The following criteria are a subset of the requirements that pilots of the actual aircraft must meet before being qualified.

Aircraft Indoctrination

OPERATING CRITERIA

MINIMUM FLIGHT QUALIFICATIONS

To be considered qualified to operate the aircraft, the pilot must have more than 50 hours in the model and must have flown at least 10 hours and made five takeoffs and landing in model within the last 60 days.

CEILING/VISIBILITY REQUIREMENTS

Prior to the pilot becoming instrument qualified in the airplane, field ceiling visibility and operating area weather must be adequate for the entire flight to be conducted in a clear air mass according to the Visual Flight Rules. After the pilot becomes instrument qualified, the following weather criteria apply:

Time-in-Model (hr)	Ceiling/Visibility (ft)/(nm)
0 to 50	500/1
50 and above	Field minimums or 200/0.5 whichever is higher.

To achieve instruments qualification the pilots must meet the following criteria:

1. Have a minimum of 10 hours in model.
2. Completed 2 intruments sorties.
3. Completed 2 satisfactory TACAN penetrations.

REQUIREMENT FOR VARIOUS FLIGHT PHASES

A. Night
Not less than 10 hours in model.

B. Cross Country
Have a minimum of 50 hours in model for lead or single aircraft.
Have a minimum of 20 hours in model for wingman.
Have an instruments qualification in model.

C. Ship Qualification
Each pilot will have a minimum of 50 hours in model for day qualification and 100 hours in model for night qualifications.

ATTENTION
THIS SECTION IS NOT TO BE USED FOR REAL AIRCRAFT TRAINING PURPOSES.

Normal procedures

SHORE BASED PROCEDURES

These are the procedures that must be followed before and after a flight. The procedures listed here are a subset of the ones followed by pilots of the actual aircraft. Those procedures that cannot be performed in the simulator have been omitted.

AFTER ENTERING COCKPIT

1. .....Canopy: OPEN.
2. .....Ejection seat arming handle: UP (SAFE).
3. .....Fuel shutoff handle: OFF.
4. .....H_2O dump: OFF.
5. .....Exterior lights: AS REQUIRED.
6. .....Left and right wing dump switches: NORM.
7. .....Left and right boost pump switches: NORM.
8. .....FUEL PROP: ON
9. .....Throttle: OFF
10. ...JPTL switch: ON.
11. ...Manual fuel switch: OFF.
12. ...Parking brake: ON.
13. ...SAS: SET
    a. Pitch: ON.
    b. Roll: ON.
    c. Yaw: ON.
14. ...Q-feel switch: ON.
15. ...Landing light switch: OFF
16. ...ANTISKID switch: ON.
17. .....Landing gear handle: DOWN.
18. ...LDG EMER BATT: CHECK (white not showing).
19. ...Flaps switches: AUTO and OFF.
20. ...Water switch: OFF.
21. ...MASTER ARM: OFF.
22. ...Armament Control Panel: SAFE/NORM.
23. ...IR Cool switch: OFF
24. ...LMPCD, RMPCD, HUD and COMM: AS DESIRED.
25. ...Clock. SET
26. ...LST/FLIR: AS DESIRED.
27. .....INS mode selector knob: OFF.
28. ...QP Switch: AUTO.
29. ...MC switch: AUTO.
30. ...ECM Control panel:
    a. RWR: AS DESIRED.
    b. Expendables: OFF.
    c. ECM: OFF.
31. ...Battery switch. OFF.
32. ...Generator switch: ON.
33. ...ACNIP panel: AS DESIRED.
34. ...IFF: NORM.
35. ...Internal Lights Panel: AS DESIRED.
36. ...ECS Panel
    a. Temperature controller: AUTO.
    b. Aft Bay equip switch: ON.
    c. DEFOG switch: NORM.
    d. Cabin pressure switch: NORM.

PRE-START

1. .....Battery switch: BATT.
2. .....Warning and Caution Lights: TEST and RESET.
3. .....Brakes: CHECK.
4. .....Landing gear indicator: 4 GREEN.
5. .....Throttle quadrant check
6. .....Fuel Panel: CHECK QUANTITY/BIT
7. .....Canopy caution lights: CHECK.

If APU power is to be used:

8. .....APU generator switch: ON.
9. .....APU advisory light: ON.
10. ...APU GEN light: OUT.
11. ...Canopy: AS DESIRED.

STARTING ENGINE

1. .....Canopy: CLOSED.
2. .....DECS power: CHECK.
    a. DECS enable switch: OFF.
    b. EFC warning, EFC caution and JPTL warning lights: ON.
    c. DECS enable switch: ON.
    d. EFC warning, EFC caution and JPTL warning lights: OFF.
    e. Fuel shutoff handle: ON.
    f. EFC switch: CYCLE.
    g. EFC switch: POS 1.
3. .....Parking brake: ON.
4. .....Throttle: OFF.
5. .....Nozzles: AFT TO 10°.
6. .....Engine start switch: ENG ST.
7. .....Throttle IDLE.
8. .....Engine start switch.
    CHECK OFF PRIOR TO 15%
9. .....Idle RPM: CHECK. 30.4 to 32.0% RPM.
10. ...JPT: CHECK. 547°C MAXIMUM.
11. ...HYD 1 and HYD 2 pressure:
    C HECK. 3000 ± 200 psi.
12. ...Brake accumulators: CHECK. 3000 ± 200 psi.
13. ...Brake pressure: CHECK. 2700 psi minimum.
14. ...Nozzles: AFT TO 10°.
15. ...Warning and Caution lights:
    TEST and RESET.
16. ...Landing gear indicators: 4 GREEN.
17.....LMPCD, RMPCD, HUD, COMM: AS DESIRED.
18. ...RMPCD: SELECT ENG PAGE.
19. ...Canopy: AS DESIRED.

BEFORE TAXIING

1. .....INS: ALINGMENT.
2. .....IFF, TACAN, RADALT: ON/SET.
3. .....LST/FLIR switch: LST/FLIR.
4. .....RADAR switch: OPR.
5. .....Boost pumps: CHECK.
6. .....JPT limiters switch: CHECK.
7. .....Manual fuel switch: CHECK.
8. .....Water switch: CHECK THEN OFF.
9. .....FUEL PROP: CHECK THEN ON.
10. ...Trim: CHECK THEN SET.
11. ...Standby instruments: CHECK ATTITUDE INDICATOR – UNCAGED/ERECT.
12. ...Altimeter: SET BAROMETRIC PRESSURE.
13. ...Flaps: INITIATE (Flaps ON/AUTO).
14. ...Flaps switch: CRUISE.
15. ...LMPCD, RMPCD: CHECK PERFORMANCE.

16. ...Displays:
    - h. Initialize: Adjust cockpit lighting to lowest comfortable viewing level.
    - i. MPCD Controls:
    - b. 1. LMPCD: EHSD MAP.
    - b. 2. RMPCD: Radar Display.
    - j. FLIR Video: Adjust brightness.
    - k. HUD Controls: Adjust brightness.
    - l. UFC and ODU Controls: Adjust brightness.

17.....INS: CHECK STATUS PRIOR TO TAXI.

TAXIING

Aircraft directional control during taxi should be via nosewheel steering since no differential braking is available.

NOTE: The use of nozzle deflection between 45° and 60° for control of taxi speed is recommended.

WHEN READY TO TAXI:

1. .....Master mode: V/STOL.
2. .....Nozzles: 10°.
3. .....Flaps: CRUISE.
4. .....Anti-skid: CHECK.
    - a. Parking brake: OFF. Aircraft moves forward.
    - b. Stationary position with brake: MAINTAIN. Aircraft stops.
    - c. ANTISKID switch: TEST
        1) Brake relieves momentarily and aircraft moves forward. Brake returns and aircraft stops.
        2) Brake pressure drops below 145 psi as brakes relieves and increases as aircraft stops.

NOTE: Anti-skid check should be performed when clear of other aircraft or obstacles.

5. .....Brakes: CHECK.

TAXIING ON UNPREPARED SURFACES

On loose surface or snow, rpm and nozzle deflection should be kept at a minimum to reduce the danger of FOD and flaps should be in CRUISE position to prevent damage by debris.

PREPOSITIONING CHECKS

Pre-positioning checks may be completed in the chocks, while taxiing, or while marshalling.

1. .....CWAIVER checks:
    - C: Clock set/Combat thrust as desired.
    - W: Weapons programmed.
    - A: APG-65 SET.
    - I: IFF: SET.
    - VRS: AS DESIRED.
    - E: Electronic counter measures (ALE/ALQ/ALR): SET.
    - R: RADALT: SET.
2. .....Canopy: CLOSED/CHECK.
3. .....Seat: ARMED (Handle down).
4. .....Flight and standby instruments: CHECK.
5. .....APU: AS DESIRED.

6. .....ANTI-SKID: ON (LIGHT OUT).
7. .....Altitude Switch: AS DESIRED.
8. .....INS Knob: IFA/NAV.

TAKEOFF

Four methods of takeoff are possible. These are: Vertical Takeoff (VTO), Rolling Vertical Takeoff (RVTO), Short Takeoff (STO) and Conventional Takeoff (CTO). The method of takeoff is dependent upon tactical and other conditions and must be predetermined in order to perform the necessary calculations and properly configure the aircraft.

TAKEOFF CHECKLIST

The following takeoff checklist is used to configure the aircraft for all four takeoff methods. Although it is suitable for use in a wide variety of operating conditions, no single checklist can be written to encompass all types of austere operating conditions. Certain environmental conditions (i.e. ice, snow, FOD, etc.) may require modification of the established takeoff checklist.

NOTE: Each aircraft cockpit contains a takeoff checklist placard.

The content of these placards varies substantially from the takeoff checklist described in this manual.

The Takeoff Checklist consists of two parts. During the first part the aircraft is placed in the proper configuration. This configuration check is referred to as a One Finger check because it is initiated and confirmed by signaling with the index finger extended. During the second part of the takeoff checks, the pilot evaluates engine performance, flaps programming and nozzle movement as well as arming the water system, if required. This check is referred to as a Two Finger or Five Finger check depending on whether or not water is being used. Once the check is complete, the pilot indicates preparation for a dry takeoff by signaling with two extended fingers. If the takeoff will be wet, then five fingers are extended.

Pitch Carets (PC) are set at 14 for all takeoffs. This places the pitch carets at 6° of elevation with respect of the horizon bars in the V/STOL master Mode. This position indicates the desired post takeoff placement of the Depressed Attitude Symbol (or Witches Hat). This takeoff attitude is the level flight equivalent of 14° AOA. Trim for takeoff shall be 0° for both aileron and rudder. Shore based pitch trim shall be 2° Nose Down (ND). These trim settings are based upon rotation of the aircraft/nozzles at the calculated rotation airspeed while the stick remains guarded at the trimmed position. Use of additional airspeed in order to provide a performance pad will produce nose down pitching moments after rotation that will have to be arrested with aft stick deflections. Configuration of the NRAS, STO STOP, flaps and water as well as movement of the nozzles during the fight control check, will vary depending on the type of takeoff being performed.

Refer to specific takeoff procedures for additional details.

CONFIGURATION CHECKS (ONE FINGER CHECK):

1. .....Nozzle Rotation Airspeed (NRAS):
   AS REQUIRED
   a. Press V/STOL Master Mode button.
   b. Select NRAS option on ODU.
   c. Insert NRAS on the UFC.

2. .....Pitch Carets (PC): SET AT 14.
    a. Select PC on ODU.
    b. Insert 14 on the UFC.
3. .....STO Stop: AS REQUIRED
4. .....Trim: SET
5. .....Flaps: AS REQUIRED.
6. .....Warning/Caution Lights: OUT

ENGINE, WATER SYSTEM & FLIGHT CONTROL CHECKS (TWO/FIVE FINGERS CHECK):

7. .....Engine: CHECK.
    a. RMPCD: Select ENG
    b. Accelerate engine from idle to 60%
    c. Check acceleration time is within limits: 35 – 60% in 2.4 – 3.1 seconds.
    d. IGV: Check that they are on the band of 10° – 21° at 60%
8. .....Water: AS REQUIRED.
    a. Place water switch to TO and note RPM rise.
    b. Reset water switch and RPM.
9. .....Nozzle/flaps/duct pressure: CHECK
    a. Set nozzles momentarily to 50°.
    b. Check flaps for proper angle based on flap mode.
    c. Check duct pressure.
    d. Place nozzles at the takeoff position.

JETBORNE/SEMI-JETBORNE TAKEOFFS

All jetborne and semi-jetborne takeoffs begin with a takeoff procedure and end with an accelerating transition to wingborne flight. Conceptually, the transition point between the takeoff procedure and the accelerating transition procedure begins once the aircraft is off the ground, the wings are level and the vane is centered. At this point, attitude (AOA) can be safely increased and the Accelerating Transition can begin.

VERTICAL TAKE OFF (VTO)

If possible, VTO into the wind. Lateral control during the first few feet of a VTO is critical. Do not hesitate to make immediate, large and rapid control movements to counteract bank angles.

CONFIGURATION CHECKS (ONE FINGER CHECK):

1. .....Nozzle Rotation Airspeed (NRAS): NOT REQUIRED
2. .....Pitch Carets (PC): SET AT 14.
3. .....STO Stop: CLEAR (Bottom of the quadrant)
4. .....Trim: SET
5. .....Flaps: STOL.
6. .....Warning/Caution Lights: OUT

ENGINE, WATER SYSTEM & FLIGHT CONTROL CHECKS (TWO/FIVE FINGERS CHECK):

7. .....Engine: CHECK.
8. .....Water: AS REQUIRED.

9. .....Nozzle/flaps/duct pressure: CHECK
    a. Set nozzles momentarily to 50°.
    b. Check flaps at approximately 62°.
    c. Check duct pressure.
    d. Place nozzles at the Hover Stop and check angle.

INITIATE TAKEOFF:

10. ...Throttle: FULL.
11. ...Brakes: HOLD until airborne.
12. ...CHECK TOP END RPM and Water Flow (if armed).
13. ...During Liftoff ensure wings remain level. Hold heading and adjust attitude to prevent fore/aft drift.
14. ...When clear of ground effect (20-25 feet), gradually reduce power to establish a hover or when passing 50 feet and clear of obstacles, begin transition to wingborne flight.

.....Rolling Vertical Take Off (RVTO) An RVTO may be performed in those instances when a VTO is desired but the takeoff surface is deemed unsuitable. The RVTO requires approximately 100 feet of ground roll and should be made as nearly into the wind as possible.

CONFIGURATION CHECKS (ONE FINGER CHECK):

1. .....Nozzle Rotation Airspeed (NRAS): NOT REQUIRED
2. .....Pitch Carets (PC): SET AT 14.
3. .....STO Stop: 70°
4. .....Trim: SET
5. .....Flaps: STOL.
6. .....Warning/Caution Lights: OUT

ENGINE, WATER SYSTEM & FLIGHT CONTROL CHECKS (TWO/FIVE FINGERS CHECK):

7. .....Engine: CHECK.
8. .....Water: AS REQUIRED.
9. .....Nozzle/flaps/duct pressure: CHECK
    a. Set nozzles momentarily to STO Stop and check angle.
    b. Check flaps at approximately 62°.
    c. Check duct pressure.
    d. Place nozzles to 30°

INITIATE TAKEOFF:

10. ...NWS: ENGAGE.
11. ...Throttle: FULL.
12. ...Brakes: RELEASE.
13. ...Nozzles: STO STOP AS RPM PASSES 105%

14. ...During Liftoff ensure wings remain level. Hold heading and adjust attitude to prevent fore/aft drift.
15. ...Begin transition to wingborne flight.

SHORT TAKE OFF (STO)

STO can be used for the widest variety of aircraft configurations, weights and runway conditions provided that crosswinds remain within specified limits. Nozzle rotation airspeed (NRAS) and nozzle angle calculation can be performed.

CONFIGURATION CHECKS (ONE FINGER CHECK):

1. .....Nozzle Rotation Airspeed (NRAS): SET AS CALCULATED.
2. .....Pitch Carets (PC): SET AT 14.
3. .....STO Stop: SET AS CALCULATED.
4. .....Trim: SET
5. .....Flaps: AS DESIRED (STOL OR AUTO).
6. .....Warning/Caution Lights: OUT

ENGINE, WATER SYSTEM & FLIGHT CONTROL CHECKS (TWO/FIVE FINGERS CHECK):

7. .....Engine: CHECK.
8. .....Water: AS REQUIRED.
9. .....Nozzle/flaps/duct pressure: CHECK
   a. Set nozzles momentarily to STO Stop.
   b. Check flaps for proper angle based on flap mode.
   c. Check duct pressure.
   d. Place nozzles at 10°.

INITIATE TAKEOFF:

10. ...NWS: ENGAGE
11. ...Throttle: FULL.
12. ...Brakes: Release.
13. ...CHECK TOP END RPM and Water Flow (if armed).
14. ...Nozzles_ STO Stop as calculated.
15. ...During Liftoff ensure wings remain level.
16. ...Begin transition to wingborne flight.

ACCELERATING TRANSITION

Accelerating transition is the term used to describe transition from jetborne/semi-jetborne flight to wingborne flight. The accelerating transition begins once the aircraft is clear of ground effect and at an altitude sufficient to avoid obstacles and introduction of FOD onto the landing surface. A slight climb should be maintained throughout the transition maneuver.

WARNING: DURING ACCELERATING TRANSITIONS, ANGLE OF ATTACK MUST NOT EXCEED 15°. OVER ROTATION OR HIGH ROTATIONAL RATES MAY RESULT IN THE AOA RISING UNCONTROLLABLY EVEN WITH THE STICK FULL FORWARD.

1. .....Throttle: FULL
2. .....Set attitude – Witches Hat at the pitch carets (continue to maintain wings level).
3. .....Nozzles: Gradually rotate the nozzles aft.

NOTE: Steps 2 and 3 are performed simultaneously, so that the effective nozzle angle with respect to the ground does not increase when the attitude is being set.

ONCE WINGBORNE FLIGHT IS ACHIEVED

4. .....Reduce power in order to achieve normal dry lift rating or less (extinguish the 15 sec light) and stop water flow (if required).
5. .....Perform After Takeoff check or enter the landing pattern.

CONVENTIONAL TAKE OFF (CTO)

The CTO can be used when configuration or environmental conditions preclude use of any other takeoff type. The CTO is restricted to gross weights that will not cause the wheel/tire limitation speed of 180 KGS to be exceeded on the takeoff roll.

CONFIGURATION CHECKS (ONE FINGER CHECK):

a. Nozzle Rotation Airspeed (NRAS): SET NOSEWHEEL LIFTOFF SPEED.
b. Pitch Carets (PC): SET AT 14.
c. STO Stop: CLEAR
d. Trim: SET
e. Flaps: AUTO.
f. Warning/Caution Lights: OUT

ENGINE, WATER SYSTEM & FLIGHT CONTROL CHECKS (TWO/FIVE FINGERS CHECK):

g. Engine: CHECK.
h. Water: AS REQUIRED.
i. Nozzle/flaps/duct pressure: CHECK
   a. Set nozzles momentarily to STO Stop and check angle.
   b. Check flaps at approximately 25°.
c. Check duct pressure.
d. Place nozzles to 10°

INITIATE TAKEOFF:

j. NWS: ENGAGE.
k. Throttle: FULL.
l. Brakes: RELEASE.
m. Nozzles: STO STOP AS RPM PASSES 105%
n. At nosewheel liftoff speed: Gradually rotate with aft stick. Guard against over rotation.
o. During Liftoff ensure wings remain level.
p. Set attitude – Witches hat at the pitch carets.

FORMATION TAKEOFF

1. ....Formation Vertical Takeoff

Formation Vertical Takeoff is not recommended.

2. ....Formation Rolling Vertical Takeoff

Formation Rolling Vertical Takeoff Is not recommended.

3. ....Section STO

The Section STO provides the capability to launch a section of aircraft using the STO technique when conditions make the time required to execute a formation rendezvous unacceptable or undesirable (ie., low ceilings or poor visibility). Aircraft conducting Section STOs should be like configured (engine type and gross weight). Line up with a minimum lateral separation of one wingspan. The wingman shall be upwind with intakes forward of the leader's cold nozzles. The flight shall use the highest calculated NRAS and its corresponding nozzle rotation angle.

4. ....Section CTO

The Section CTO provides the capability to launch a section of aircraft using the STO technique when conditions make the time required to execute a formation rendezvous unacceptable or undesirable (ie., low ceilings or poor visibility). Aircraft conducting Section STOs should be like configured (engine type and gross weight). Line up with a minimum lateral separation of one wingspan. The wingman shall be upwind with intakes forward of the leader's cold nozzles. The flight leader should use the rotation speed of the heaviest aircraft.

5. ....Section Stream STO or Division Stream STO

When multiple aircraft need to be launched together, but ceilings and visibility are great enough to permit a rendezvous underneath, then a Section or Division STO can be used. Aircraft conducting Stream STO need not be identically configured. Line up on the runway with the flight lead on the downwind side with a minimum distance between aircraft of the calculated ground roll plus 300 feet. Each succeeding aircraft should be staggered diagonally.

On signal, all the aircraft roll simultaneously and perform individually computed STO. When safely airborne, the flight leader reduces power slightly to expedite the rendezvous.

WARNING: DO NOT ENTER THE JETWASH OF PRECEDING AIRCRAFT DURING CLIMBOUT.

- Flight Leader Transmits "LEAD (Left/Right side), STREAM STO, (calculated NRAS value), (Calculated STO STOP value), (Wet/Dry)."
- Flight Leader directs: "RUN 'EM UP"
- Flight Leader transmits: "ROLLING, ROLLING, GO"

AFTER TAKEOFF:

1. .....Landing Gear: UP
2. .....Flaps. AUTO. Selection of AUTO flaps shall be made when comfortably airborne at no less than 250 nozzle angle.
3. .....Nozzles: AFT
4. .....Water switch: OFF
5. .....STO Stop: CLEAR.

INFLIGHT

Periodic checks of engine displays, fuel quantity and instruments must be made to detect systems anomalies early on.

10,000 FOOT CHECK:

1. .....Fuel Transfer/Quantity
2. .....Cabin Pressure.

18,000 FOOT CHECK:

1. .....Altimeter: 29.92 SET
2. .....Cabin Pressure.
3. .....APU: Secure if conditions permit.

DESCENT

Do not exceed airframe limitations during descent. Perform the following checks before commencing descent:

1. .....STO Stop: CLEAR
2. .....Weather: CHECK.
3. .....Instruments: CHECK.
4. .....Fuel: CHECK.
5. .....Temperature: PREHEAT/DEFOG (as required).
6. .....APU: AS REQUIRED.

LANDING

The break speed is 350 KCAS. The standard break interval is 2 seconds. At the break, appñy bank angle, retard the throttle and extend speed brake. Once below 250 KCAS, complete the Landing Checklist. Four methods of landind are possible. These are Vertical Landing (VL), Rolling Vertical Landing (RVL), Slow Landing (SL) and Conventional Landind (CL).

A decelerating transition from wingborne flight is used to place the aircraft in position for a VL or a RVL. All other landing types use a standard pattern approach to landing. On all rolling landings (CL. SL, RVL) the recommended landing attitude is to place the depressed attitude symbol (Witches Hat) on to 2° above the horizon bar. Pilots should expect turbulence and random trim changes when the aircraft enters ground effect as jet efflux strikes various airframes surfaces. The aircraft must be actively flown all the way to the ground. Power Nozzle Braking (PNB) is normally used for most roll on landings; however, the aircraft can be stopped using wheel brakes alone.

LANDING CHECKLIST

The following landing checklist is used to configure the aircraft for all four of the landing methods.

NOTE: Each aircraft cockpit contains a landing checklist placard. The content of these placards varies substantially from the checklist described in this manual.

1. .....Gear: DOWN.
2. .....Flaps: AS REQUIRED (nozzles 25° or greater prior to selecting STOL flap)
3. .....STO Stop: CLEAR.
4. .....Duct Pressure: CHECK.
5. .....Brake Pressure: CHECK.
6. .....Water: AS REQUIRED.

IF WATER IS TO BE USED:

a. Water Switch: T/O (check for RPM rise)
b. Throttle: FULL.
c. Check for green water flow or W in HUD.
d. Water switch: AS REQUIRED.

7. .....Warning and caution lights: CHECK.
8. .....Lights: AS REQUIRED.

DECELERATING TRANSITION TO A HOVER

Decelerating transitions for VLs are started from a key position approximately ½NM from the touchdown point (preferably downwind) at an altitude of approximately 310 feet AGL. This places the aircraft on a slightly descending flight path toward a point abeam the intended point of landing at approximately 150 feet AGL. From just prior to arrival at, this abeam position, the aircraft then crosses to hover directly over the intended point of landing.

APPROACHING 180:

1. .....Nozzles: 40° – 60°.
2. .....Flaps: Check programming and droop.
3. .....AOA: 10° – 12°.

OFF THE 180:

4. .....Adjust flight path with the stick.
5. .....Control AOA with throttle or nozzles.

AT THE KEY:

6. .....Set attitude: Witches hat on the horizon.
7. .....Nozzles: HOVER STOP
8. .....Minimize sideslip, ensure no more than 15° AOA and strive for 0° AOB until less than 30 knots. Increase power as required to maintain a shallow glideslope (approx. 3°) to arrive abeam the landing site at 150 AGL.

See Fig. 46 Vertical Landing - pag. 61

AT 60 KCAS:

9. .....Check for adequate performance margin. If more than two legs of the power hexagon then execute a waveoff.

10. ...Approaching landing site – Select ground references and monitor rate of closure. When closure is under control and below 30 knots, cross over the landing site while remaining at 150 feet AGL minimum until over a prepared surface. Flare slightly to stop, or use braking stop as required, and establish hover over the desired landing point.

THE HOVER:

The hover may be entered from a decelerating transition or a VTO. It is an interim period during which the aircraft is held relatively stationary at an altitude of 50 to 60 feet AGL.

1. .....Control height with small throttle changes.
2. .....Maintain position with ground references.
3. .....RPM/JPT WITHIN LIMITS.

VERTICAL LANDING (VL):

The vertical landing is commenced from a 50 to 60 foot AGL hover. Landing should be made pointing into the wind o minimize exhaust reingestion.

1. .....Start a slow descent with the throttle.
2. .....Monitor ground references.
3. .....Maintain heading and adjust attitude and roll as necessary to correct for drift.
4. .....Maintain positive rate of descent. Avoid stopping in ground effect. Some throttle reduction may be required if descent rate is slow since the aircraft will tend to stop in the area of minimum LIDS capability (5 to 10 feet).
   Additionally, surface winds in excess of 10 knots may degrade LIDS performance and may require a corresponding coarse power correction just prior to touchdown.

WHEN POSITIVELY DOWN:

5. .....Throttle: IDLE.
6. .....Brakes: APPLY.
7. .....Nozzles: AFT
8. .....Trim: 4° ND.
9. .....Water: OFF (if selected).

DECELERATING TRANSITION TO A ROLLING VERTICAL LANDING (RVL)

The RVL should be used when the landing surface isn't long enough to support a SL, but the landing area cannot support a VL because it is subject to damage from heating or is a source of FOD. A ground speed of 5 to 10 knots is sufficient to avoid overheating and damaging asphalt in good condition. However, a ground speed of 60 knots or higher will be required if FOD is a major concern. (At this speed objects blown up at touchdown will remain behind the intake suction doors.) Decelerating transitions for RVLs are started from a key position approximately ¾NM from the touchdown point at an altitude of approximately 310 feet AGL. The aircraft is flown on a slightly descending flight path (approx. 3°) until the touchdown point reaches the desired level of depression in the HUD.

At this point, flight path can be adjusted to ensure precise landing on centerline and at the desired point. Workload is increased slightly over the SL, particularly when making an approach into short runways or confined areas. Such approaches require both precise centerline control and accurate control of the touchdown point by variation of the glide slope. Care must be taken to avoid making a play for the intended point of touchdown or checking back on the stick in close as these actions inevitably increase sink rate and cause the aircraft to bounce or rock forward onto the nosewheel. Normally a glideslope of thee degrees will satisfy the need to control touchdown point and rollout distance. However, a steeper glideslope, up to 6 degrees, may be necessary when approaching over significant obstacles into fields short enough to dictate touchdown as close to the threshold as possible, if runway distance is critical and FOD potential is low, groundspeeds slower than 60 knots shouldbe considered.

APPROACHING 180:

1. .....Nozzles: 40° – 60°.
2. .....Flaps: Check programming and droop.
3. .....AOA: 10° – 12°.

OFF THE 180:

Adjust flight path with stick. Control AOA with throttle or nozzles.

AT THE KEY:

4. .....Set attitude: Witches hat on the horizon.
5. .....Nozzles: AS REQUIRED, adjust to maintain desired ground speed.
6. .....Minimize sideslip, ensure no more than 15° AOA.
7. .....Adjust power to intercept desired glideslope to touchdown point.

AT TOUCHDOWN:

8. .....Throttle: IDLE.
9. .....Nozzles: AS SET.
10. ...Brakes: APPLY.
11. ...Trim: MINIMUM 2° ND
12. ...Water: OFF
13. ...Nozzles: LESS THAN 60° WHEN SLOW.

SLOW LANDING (SL)

The SL may be used when the aircraft weight is too high for a VL or RVL or to reduce engine stress. There are four basic types of Slow Landings, the specific type being defined by a combination of flap position (STOL or AUTO) and whether the nozzles remain fixed during the approach or are varied as the primary means of airspeed control. These slow landing types are referred to as the AUTO Flap Fixed Nozzle Slow Landing (AFNSL), STOL Flap Fixed Nozzle Slow Landing (SFNSL), AUTO Flap Variable Nozzle Slow Landing (AFVNSL) and STOL lap Variable Nozzle Slow Landing (SFVNSL). Any of these four SL types can be modified at the in close position by application of Hover Stop or Braking Stop.

FIXED NOZZLE SLOW LANDING (FNSL)

The STOL Flap Fixed Nozzle Slow Landing (SFNSL) is the recommended slow landing technique. It is significantly easier to accomplish than a VNSL, requires less fuel for an approach and very nearly approximate the landing speeds of the variable nozzle approach. This approach is

normally used when crosswind condition precludes a landing below 140 KCAS or when dealing with high asymmetric store loadings. The same landing approach path is used for either technique (AUTO or STOL).

APPROACHING 180:

1. .....Nozzles: 40 – 60°.
2. .....Flaps: Check programming and droop.
3. .....AOA: 10 – 12°.

OFF THE 180:

4. .....Adjust flight path with stick.
5. .....Control AOA with throttle.

AT 30-50 FEET AGL:

6. .....Set attitude: Witches hat on 2° above the horizon.
7. .....Control ROD with throttle (200-400 fpm).

AT TOUCHDOWN:

8. .....Throttle: IDLE.
9. .....Nozzles: AS REQUIRED.
10. ...Trim: MINIMUM 2° ND
11. ...Throttle: AS REQUIRED (for PNB a maximum of 70%)

AT 60 KNOTS:

12. ...Throttle: IDLE.
13. ...Nozzles: HOVER STOP.
14. ...Brakes: APPLY.
15. ...Nozzles: LESS THAN 60° WHEN SLOW.

See Fig. 47 Fixed Nozzle Slow Landing (FNSL) - pag. 61

VARIABLE NOZZLE SLOW LANDING (VNSL)

The VNSL is used whenever the throttle needs to remain at a relatively constant setting throughout the approach. There are numerous reasons why the pilot might elect to set a constant power setting. In some cases the pilot may elect to set power when engine reliability is suspect. The same landing approach path is used for either technique (AUTO or STOL).

NOTE: AUTO flaps shall be used for VNSL if rpm is set less than 90%.

APPROACHING 180:

1. .....Nozzles: 40° – 60°.
2. .....Throttle:
   a. 80 – 100%
   b. Nozzles: AS REQUIRED TO ACHIEVE 8° – 10° AOA.
   c. Flaps: Check programming and droop

OFF THE 180:

3. .....Adjust flight path with stick.
4. .....Control AOA with nozzles.

AT 30-50 FEET AGL:

5. .....Set attitude: Witches hat on 2° above the horizon.
6. .....Control ROD with throttle (200-400 fpm).

AT TOUCHDOWN:

7. .....Throttle: IDLE.
8. .....Nozzles: AS REQUIRED.
9. .....Trim: MINIMUM 2° ND
10. ...Throttle: AS REQUIRED (for PNB a maximum of 70%)

AT 60 KNOTS:

11. ...Throttle: IDLE.
12. ...Nozzles: HOVER STOP.
13. ...Brakes: APPLY.
14. ...Water: OFF.
15. ...Nozzles: LESS THAN 60° WHEN SLOW.

See Fig. 48 Variable Nozzle Slow Landing - pag. 62

HOVER STOP/BRAKING STOP SLOW LANDING (HSSL/BSSL)

The HSSL/BSSL is used to minimize landing rollout distance. The HSSL is easily controllable with the rate of descent being most critical as airspeed bleeds off quite quickly (specially at high gross weights); therefore, the throttle must be adjusted to control the rate of descent. The BSSL method requires careful judgment and should be attempted only after considerable V/STOL experience.

Should the aircraft bounce, a nose up pitch may occur which will require full forward stick and nozzle and/or power reduction to correct.

CAUTION: DURING LANDINGS ABOVE 20,000 GROSS WEIGHT, WHEN THE NOZZLES ARE POSITIONED BEYOND 70° TO 75°, THE AIRCRAFT SINK RATE CAN BECOME DIFFICULT TO CONTROL AND MAY RESULT IN LANDING AT AN EXCESSIVE RATE OF DESCENT.

UTILIZE SLOW LANDING PROCEDURE UNTIL ENTERING GROUND EFFECT (10-20 FEET):

1. .....Set attitude: Witches hat on 2° above the horizon.
2. .....Nozzles: HOVER STOP.

JUST PRIOR TO TOUCHDOWN (2 TO 3 FEET):

3. .....Nozzles: BRAKING STOP (if desired).

AFTER TOUCHDOWN (IF HOVER STOP SELECTED):

4. .....Throttle: IDLE.
5. .....Nozzles: BRAKING STOP.
6. .....Trim: MINIMUM 2° ND.
7. .....Throttle: AS REQUIRED (for PNB a maximum of 70%)

AT TOUCHDOWN (IF BRAKING STOP SELECTED:

8. .....Throttle: AS REQUIRED (for PNB a maximum of 70%).
9. .....Trim: MINIMUM 2° ND

AT 60 KNOTS:

10. ...Throttle: IDLE.
11. ...Nozzles: HOVER STOP.
12. ...Brakes: APPLY.
13. ...Water: OFF.
14. ...Nozzles: LESS THAN 60° WHEN SLOW.

WAVEOFF FROM VERTICAL/SLOW LANDING

A waveoff may be required due to a fouled landing area, an unsatisfactory approach or insufficient power.

1. .....Throttle: FULL.
2. .....Nozzles: HOVER STOP.
3. .....Maintain 8 – 12° AOA or Hover Attitude
4. .....Begin transition to wingborne flight.

CONVENTIONAL LANDING (CL)

A standard CL, requires substantially greater distance to stop than a SL or RVL. Landing distance available is a critical consideration when performing a CL. No PNB CLs should be used unless as an emergency procedure.

APPROACHING 180:

1. .....Nozzles: AFT.
2. .....Flaps: Recheck in AUTO.
3. .....AOA: 10 – 12°

OFF THE 180:

4. .....Adjust flight path with stick. Control AOA with throttle or nozzles.
5. .....Control AOA with throttle.

AT 30 – 50 FEET AGL:

6. .....Set attitude: Witches Hat on to 2° above the horizon.
7. .....Control ROD with throttle.

AT TOUCHDOWN:

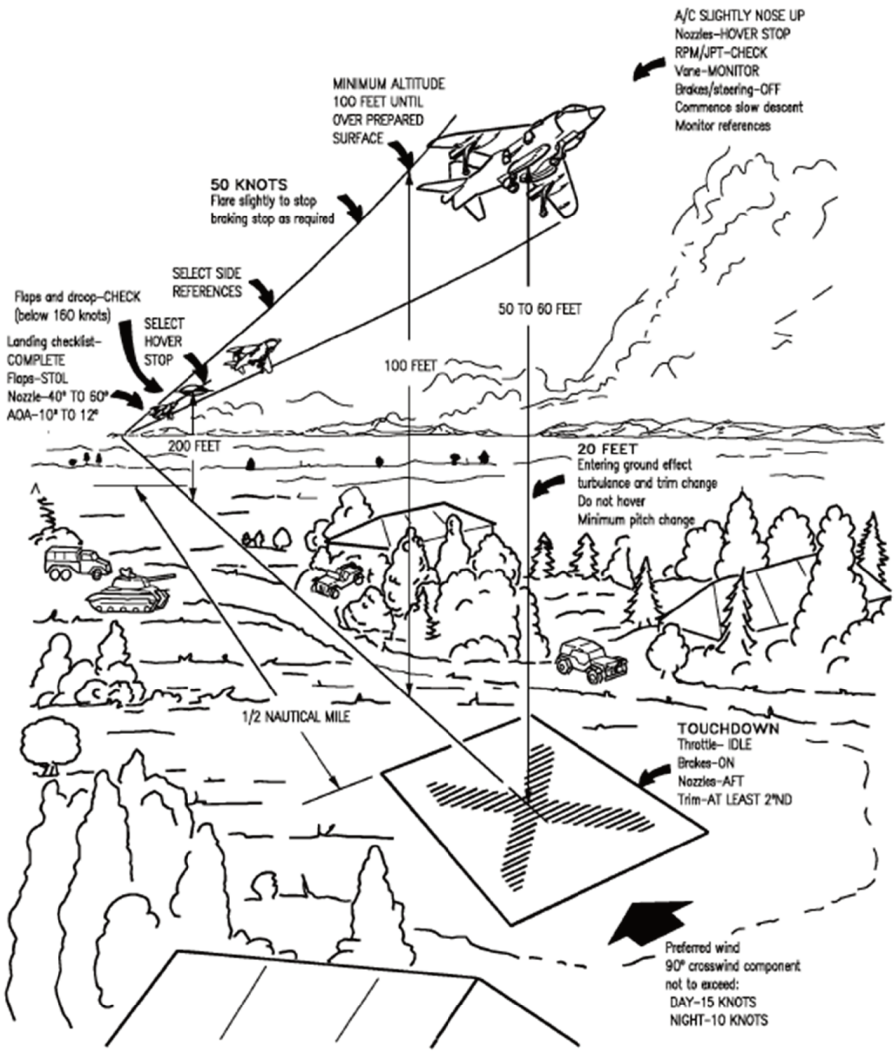
8. .....Throttle: IDLE.
9. .....Nozzles: AS REQUIRED.
10. ...Trim: MINIMUM 2° ND
11. ....Throttle: AS REQUIRED (for PNB a maximum of 70%)

AT 60 KNOTS:

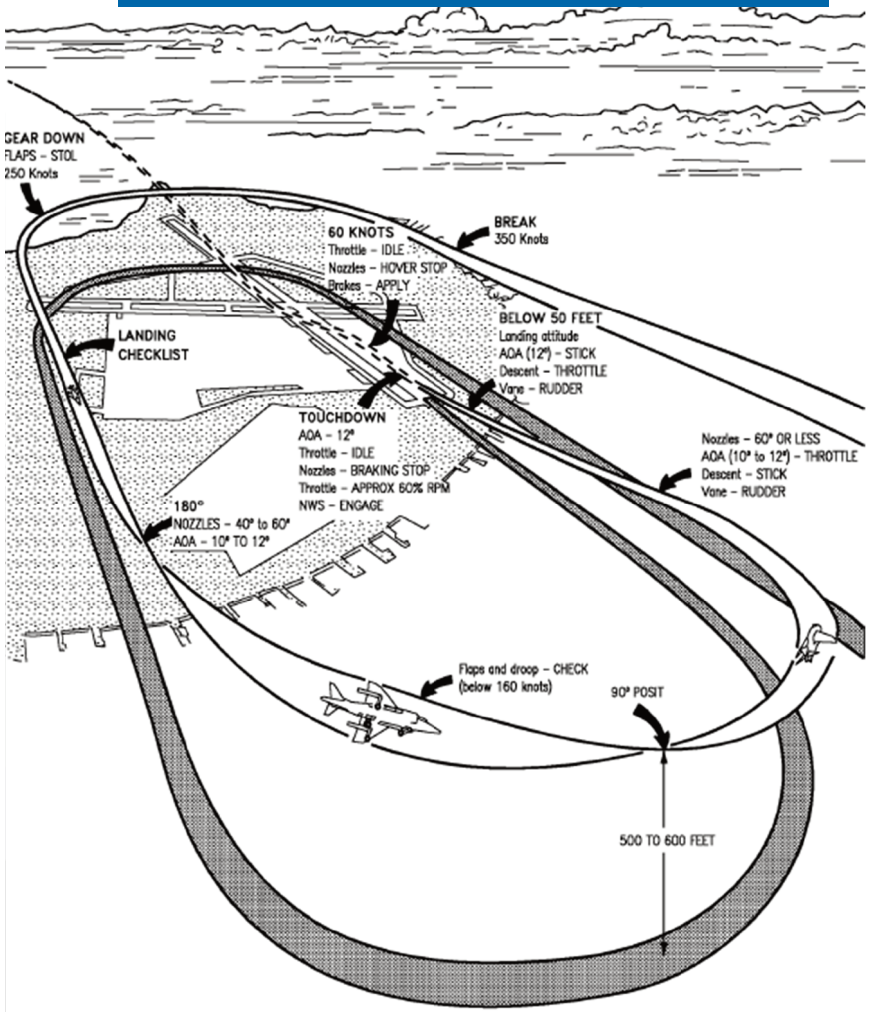
12. ...Throttle: IDLE.
13. ...Nozzles: HOVER STOP.
14. ...Brakes: APPLY
15. ...Water: OFF
16. ...Nozzles: LESS THAN 60° WHEN SLOW.

See Fig. 49 Conventional Landing - pag. 62

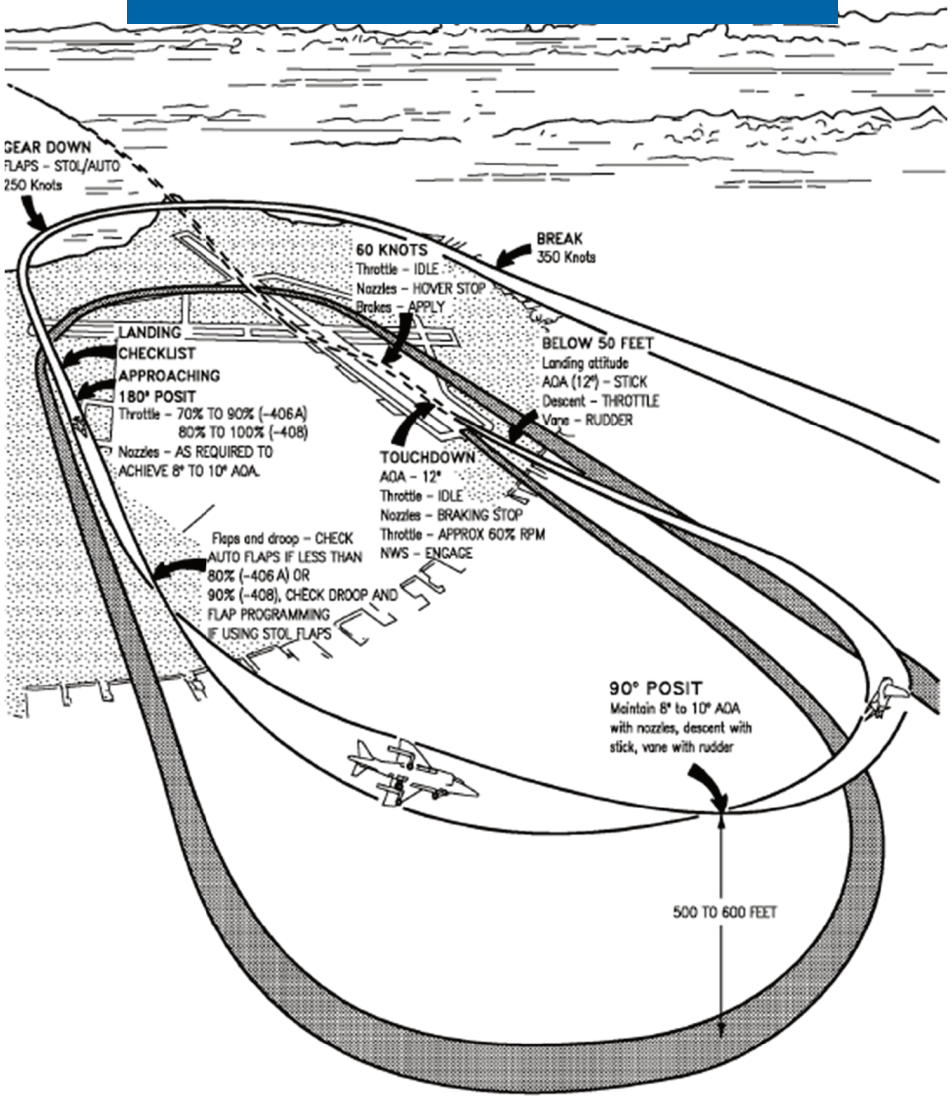
VERTICAL LANDING



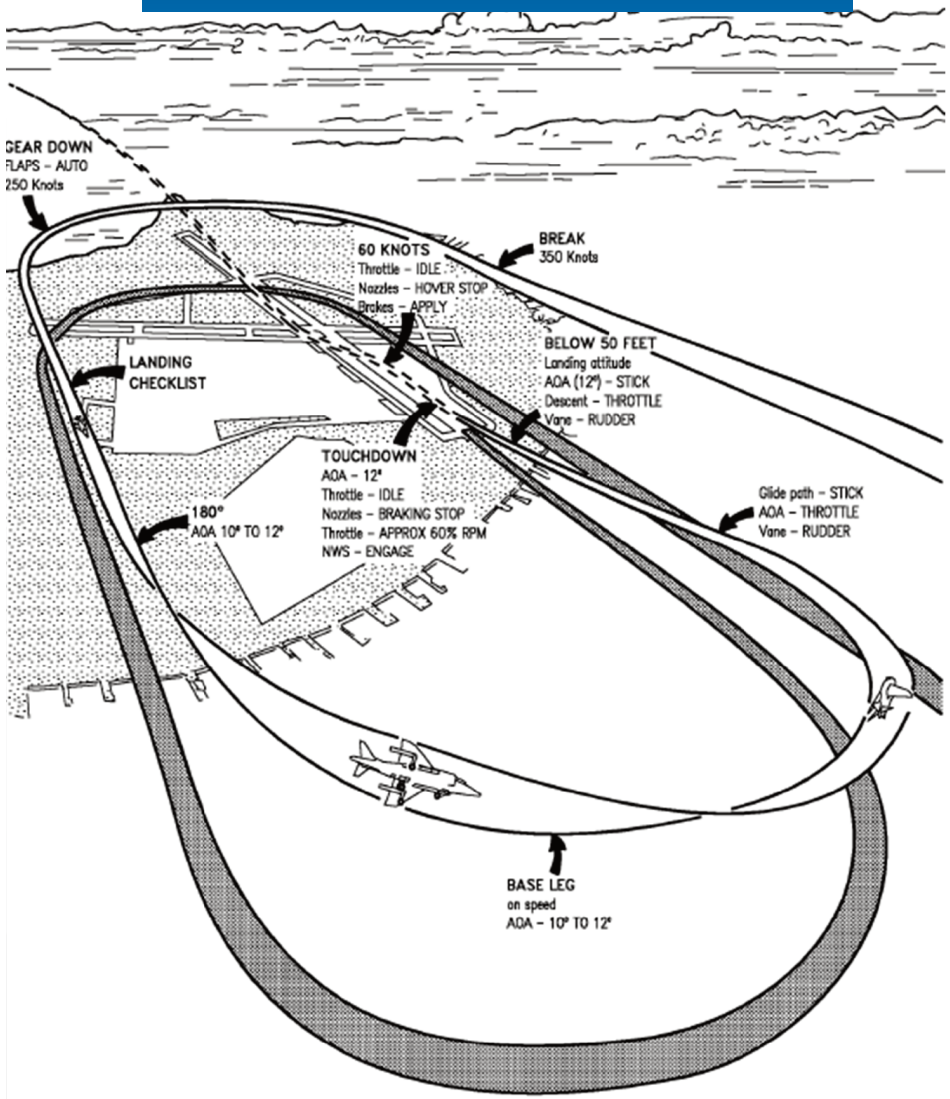
FIXED NOZZLE SLOW LANDING (FNSL)



VARIABLE NOZZLE SLOW LANDING



CONVENTIONAL LANDING



Comunication - Navigation Aquipment and procedures

COMMUNICATIONS

VHF/UHF COMMUNICATION SYSTEM

The UHF/VHF communication system provides air to air and air to ground communication over dual UHF/VHF radios. The system utilizes two ARC 210 radio transmitters/receivers and TSEC/KY 58 secure voice encoders.

Radio Communication

The ARC 210 radio provides transmission and reception of amplitude and frequency modulated (AM and FM) signals on frequencies spaced 25 kHz apart. The frequency range is 30 to 399.975 MHz.

> **NOTE:** Despite the capabilities of the real equipment, FSX radio communication frequencies are limited to the 118.00 to 136.975 MHz range.

Both radios (comm 1 and comm 2) utilize 26 preset channels in the primary mode, and a manual (M) channel. The present channels and manual channel frequencies are pilot entered.

Operating Modes

There are two radio control operating modes, Upfront Control (UFC) and Manual (MAN). They are selected by the MODE switch on the ACNIP.

UFC Mode

In the UFC mode, the radios are controlled by the Control Monitor Set (CMS) and the mission computer. The CMS consists of the UFC and the option display unit (ODU).

MAN Mode

In the MAN mode the radios are controlled via the V/UHF Radio Set Control (RSC) and ACNIP.

VHF/UHF Controls and Indicators

The comm 1 and comm 2 radios are operated by controls on the UFC, ODU, ACNIP RSC and the comm switch on the throttle grip.

Fig. 50
ARC 210 Radio
Set Control Unit

Fig. 51
Amplifier
Control ACNIP

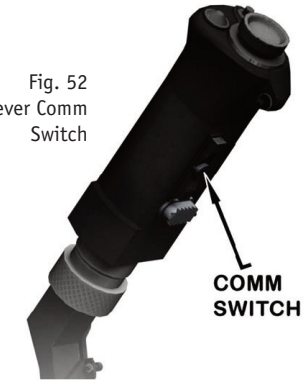


Fig. 52
Throttle Lever Comm Switch

Fig. 53
UFC Comm Controls

Upfront Control

The controls and indicators on the UFC are described in the following paragraphs.

Volume Control (Non Functional)

The VOL controls on the UFC adjust the volume in both UFC and MAN modes.

Channel Selection

Rotating the channel selector knob on the UFC selects one of the 27 preset or manual (M) channels for comm 1 and comm 2. The selected channel is displayed in the channel display window directly above the selector knob. A colon appears next to the preset channel that is used for transmissions. To select a channel you only have to click or use the wheelmouse. Left Click advances the channel to the next one, Right click returns to the previous one.

Frequency Selection

When clicking on either channel selector knob, the UFC scratchpad will display the assigned frequency, the ODU will display comm options and the UFC keyboard is enabled to enter a new channel frequency. The frequency and options remain displayed for 30 second or until another function is enabled (i.e.: TACAN, IFF, etc.) To activate you have to click with the Wheel mouse (third button).

Option Display Unit

Comm1 and comm 2 options are displayed on the ODU by pressing the respective COMM 1 or COMM 2 channel selector knob on the UFC. The options are displayed for 30 seconds or until another UFC function is selected.

Option 1. Pressing the Option 1 pushbutton scrolls between T/R and T/R+G.
Option 2. Remains blank.
Option 3. Activates/Disables the squelch function. A colon (:) appears on the left side of the option display window to indicate that the squelch is active.
Option 4. Pressing the Option 4 pushbutton selects PLN (plain), CIPH (cipher) or DLY (delay) KY 58 options.
Option 5. Pressing the Option 5 pushbutton selects cipher codes 1 thru 6. They are enabled only if the KY 58 is in either CIPH or DLY mode.

V/UHF Radio Set Control ARC–210

The RSC is located in the cockpit on the right console. The RSC is used in a similar way as the CMS to select and enter the desired radio operating parameters in the manual mode.

VOL Control and SQ Off Switch

VOL **Not used**
SQ OFF Activates/Disables squelch system. Non Functional.

Operational Mode Knob

ZRO **Not used**
OFF Turns RCS off.
TEST Selects internal BIT. The entire screen lights up.
T/R+G Selects Receiver/Transmitter and GUARD receivers.
T/R Selects Receiver/Transmitter only.

ADF **Not used.** The Harrier does not have an ADF receiver.
CHNG Allows to change the preset channels.
PRST

CHAN FREQ/NET/TIME Display

Displays digital readout of channel number, frequency, net (not used), time and mode.

CHAN/FREQ Control and CRSR Switch

Rotating CHAN/FREQ control changes the channel or frequency value depending on Frequency Mode selector.

LOAD/OFST Switch

When the Operation Mode Knob is in the CHNG PRST saves the current frequency in the selected channel.

Frequency Mode Knob

AJ/M **Not Used.**
AJ **Not Used.**
MAR Selects one of 57 preset maritime channels. Not Available.
PRST CRS Switch changes selected preset channel.
MAN CRS Switch changes the frequency for the selected channel.
243 Turns on receivers for the 243.000 Mhz emergency frequency. Not Available.
121 Turns on receivers for the 121.000 Mhz tactical frequency. If the Operational Mode Knob is in the T/R+G position, you will hear tactical communications between other aircrafts. See Appendix B for further information.

Ancillary Mode Pointer

The ancillary mode pointer (▶ **pushbutton**) positions pointer to select or deselect ancillary
mode option defined by – pushbutton.

Ancillary Mode Switch

The ancillary mode (– pushbutton) switch positions cursor under various mode options. Used with the ancillary mode pointer (▶ **pushbutton**) to select or deselect ancillary modes.

NOTE: Ancillary modes are ECCM modules that enables the ARC 210 radio set to avoid being jammed by enemy action.

Amplifier – Control (ACNIP)

The ACNIP is located in the cockpit on the right console, below the RCS. The switches used for VHF/UHF operation are the MODE switch, and the radio program switch (PRGM).

MODE Switch

UFC Radios controlled via the UFC and ODU. This is the default mode.
MAN Radios are controlled via the ACNIP and the V/UHF radio set control.

Radio Program Switch

This switch, labeled PRGM, selects which radio transmitter is working.

SECURE SPEECH SYSTEM (KY 58)

The secure speech system is used for ciphering (coding) or deciphering (decoding) audio routed through the KY 58 cipher unit No. 1 (KY 1) or KY 58 unit No. 2 (KY 2). The ACNIP also has the controls and indicators for the secure speech system.

Amplifier – Control (ACNIP)

The controls and indicators for the secure speech system which are on the ACNIP are the MODE switch, the baseband/diphase switches (2), the cipher zero norm switch, the remote variable load switch, the code/mode switches (2).

MODE switch

The switch is labeled MAN (manual) and UFC (upfront control). The UFC mode is the default position.

Baseband/Diphase switches

These switches, for either comm 1 or comm 2, have positions labeled DIPH (diphase) and BB (baseband).

Cipher Zero Norm switch

This switch has been repurposed; with the switch in the Cipher position, certain cockpit elements like the control stick will become invisible allowing access to blocked instruments/switches. With the switch in the Zero Norm position, the default position, the invisible elements become visible again.

Remote Variable switc

This switch has been repurposed; with the switch in the RV1 the MASTER CAUTION Lights panel become invisible, allowing access to the LMPCD right buttons (buttons 11 – 15). When the switch is in the RV2 position, the MASTER WARNING Lights panel becomes invisible, allowing access to the RMPCD left buttons (buttons 1 –
5). The button position is in the middle, making both light panels visible.

ATTENTION: IF THERE IS A SITUATION THAT WILL TURN ON EITHER A MASTER CAUTION OR A MASTER WARNING LIGHTS, THE RESPECTIVE PANEL WILL BECOME VISIBLE AND CANNOT BE MADE INVISIBLE UNTIL THE LIGHT TURNS OFF.

Code/Mode Switches

The code/mode switches (2) are used to select a desired KY 58 operating mode and code.

NAVIGATION

INERTIAL NAVIGATION SYSTEM

The inertial navigation system (INS) detects aircraft motion and provides acceleration, velocity, present position, pitch, roll and true heading to related systems.

INS Controls and Indicators.

The controls and indicators for the INS include the ODU, UFC, LMPCD, RMPCD and Miscellaneous Switch panel.

Fig. 54
INS Mode Selector Knob
(Miscellaneous Switch
Panel)

The miscellaneous switch panel contains the INS mode selector knob which selects the following modes of INS operation:

OFF	Power is removed from the INS
SEA	Selects INS sea align mode.
GND	Selects INS alignmode.

NAV Selects INS navigation mode. Mission Computer provides navigation steering.

IFA Selects In Flight Alignment. The navigation system is still operational.

GYRO When selected in flight, provides GYRO mode attitude (no true heading).

GB Gyro Bias calibration mode. Used by ground personnel only.

TEST Selects the test mode. Non Functional.

MPCD (both L and R) menu provides control for selection of displays on the MPCD and HUD. Pressing EHSD pushbutton provides a NAV electronic horizontal situation indicator/display on the MPCD.

Fig. 55
INS MPCD Main Menu
(INS OFF)

INS Alignment Procedures

The aircraft is simulated with the INS already aligned. We choose this option since the INS alignment procedures can be as long as 12 minutes. When the INS Mode Selector knob is placed in any of the ALIGN settings (SEA or GND) you will see the alignment display with an OK message.

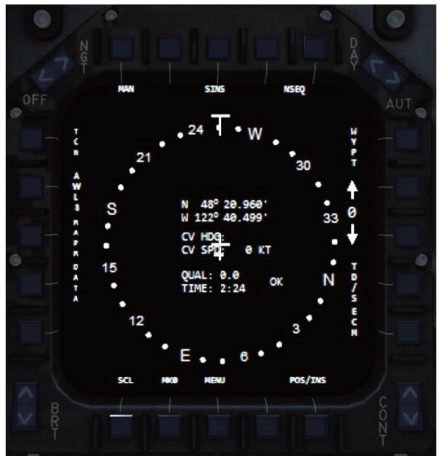


Fig. 56
INS SEA Align Screen

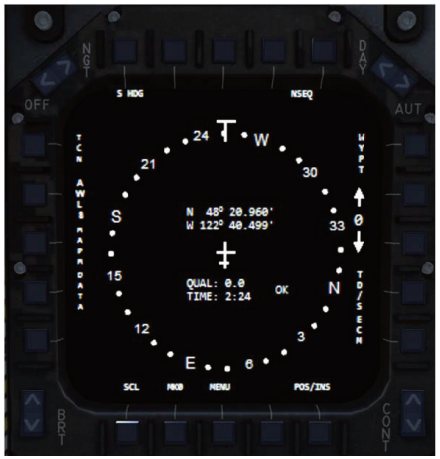


Fig. 57
INS GND Align Screen

INS NAV Mode

Once the INS is aligned, the INS Mode Selector knob must be clicked to the NAV setting. The Horizontal Situation Indicator (HSI) will change and become active.

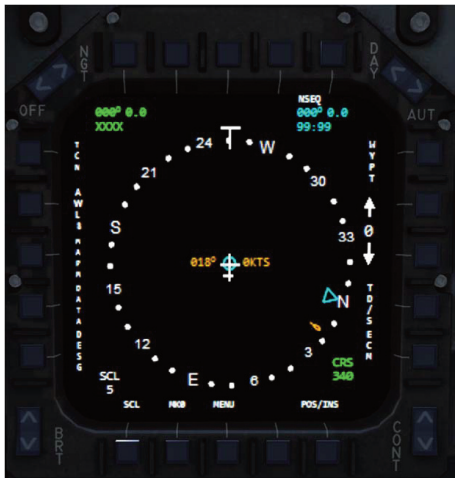


Fig. 58
INS NAV Screen (No Flight Plan Active)

Fig. 59
INS NAV Screen (Flight Plan Active)

The HSI information is color coded for a better recognition. TACAN data is green, NAV data is blue, Aircraft data is yellow, all other data is white.

The HSI has the following elements:

1. An aircraft silhouette located in the center and which represents the aircraft.
2. A compass rose centered on the aircraft silhouette.
3. TACAN data and symbols.
4. NAV (Waypoint) data and symbols.
5. Aircraft Ground Track and Speed data and symbols.

The distance between the center of the aircraft silhouette and the compass rose represents range in nautical miles. TACAN and NAV symbols will move between the edge of the compass rose and the center of the silhouette depending on their distance to the aircraft. The range scale can be adjusted to 5, 13, 25 or 100 nautical miles.

The compass rose lubber line indicates current aircraft heading. If the lubber line resembles a “T” then true heading is being displayed. If the lubber line resembles an “I” then magnetic heading is displayed.

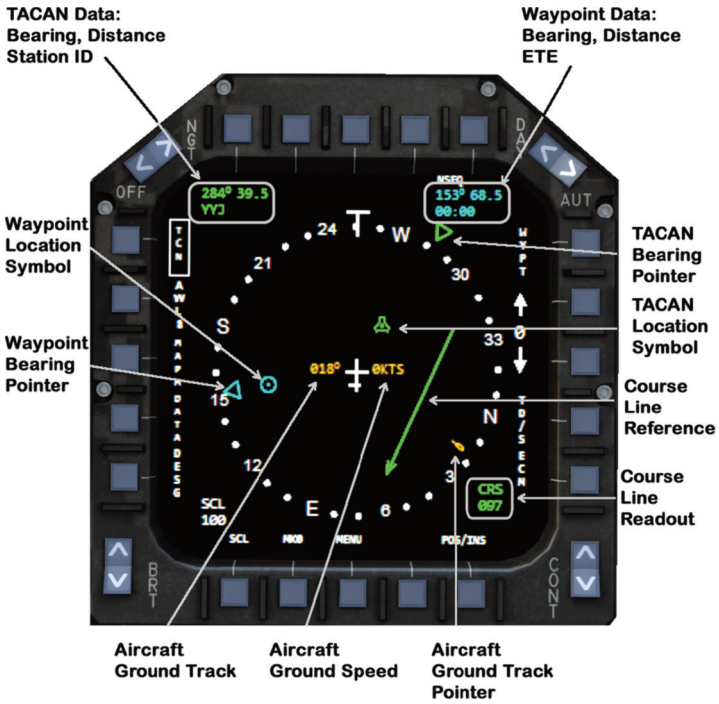


Fig. 60
INS HSI Symbology (True Heading)

TACAN (TACTICAL AIR NAVIGATION) SYSTEM

The TACAN system gives precise bearing and/or slant range distance to a TACAN ground station or suitable equipped aircraft. The TACAN system is limited to line of sight range which depends upon aircraft altitude. The aircraft receives a three letter audio station signal to identify the beacon being received.

NOTE: FSX does not have a TACAN system. To emulate one we have used the existing VOR/DME network. When selecting a TACAN station, you are actually selecting a VOR station.

TACAN Controls and Indicators

The controls and indicators for TACAN operation are on the ODU, UFC, LMPCD, RMPCD.

Fig. 61
TACAN Controls and Indicators

Fig. 62
ODU TACAN Display

Fig. 63
TACAN UFC Display

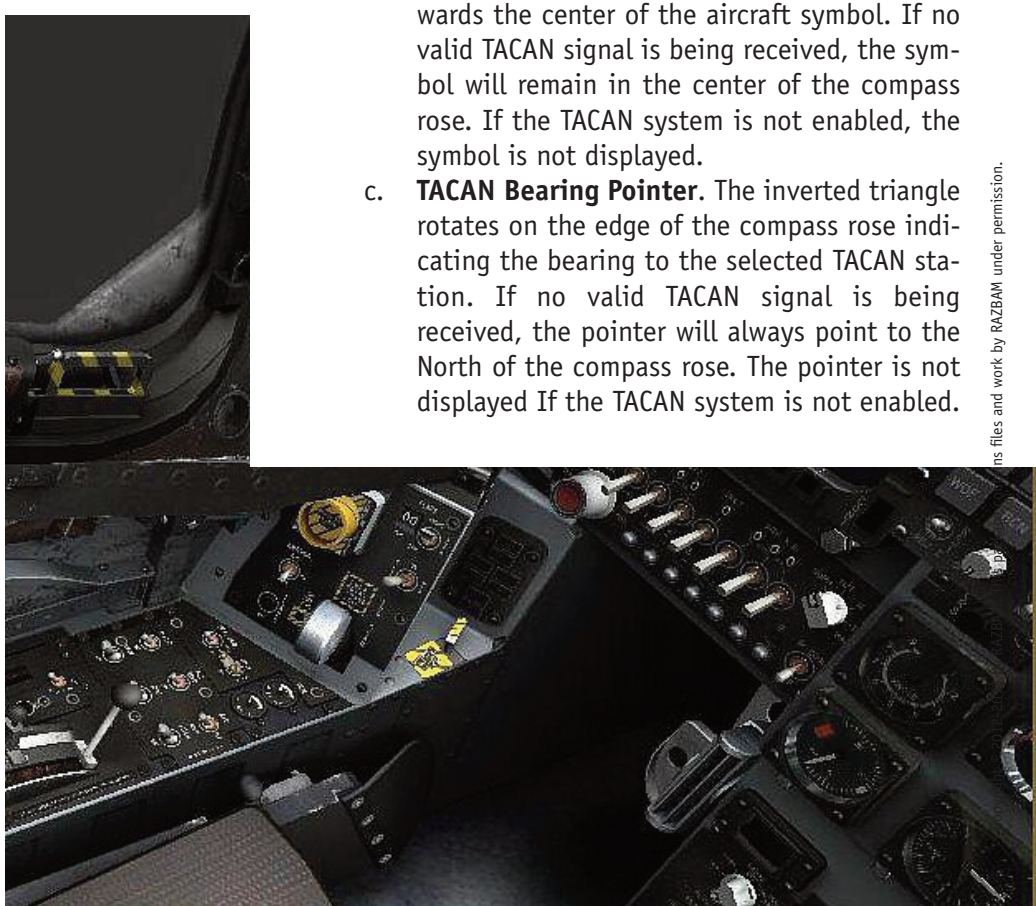
Fig. 64
TACAN Course Set Knob

1. **Upfront Control (UFC).** The pushbuttons and indicators on this control that are used for TACAN operations and display are the TACAN function selector pushbutton (labeled TCN), the ON/OFF selector pushbutton, the EMCON pushbutton, the pushbutton keyboard, the ENTER pushbutton (labeled ENT) and the scratchpad.
   a. **TACAN Function Selector Pushbutton**. Clicking on the TCN pushbutton enables TACAN options to be displayed on the ODU, enables the TACAN status window on the scratchpad to ON, if the TACAN is enabled, and allows the TACAN channel to be displayed on the scratchpad.
   b. **ON/OFF Pushbutton**. Clicking on this pushbutton turns the TACAN system on or off after clicking on the TCN pushbutton.
   c. **EMCON Pushbutton**. Clicking on EMCON puts the TACAN in reception mode if it is on transmit/receive mode. The option display windows 1 thru 5 on the ODU are blanked and the message EMCON is displayed in option window 1. Clicking on EMCON again restores the previous messages.
   d. **ENTER Pushbutton**. Clicking on the ENT pushbutton saves a selected TACAN Channel in the system.
2. **Option Display Unit (ODU)**. The pushbuttons and indicators on the ODU used for TACAN operation and display are the option select pushbuttons and the option display windows.

a. **Option 1**. Displays T/R, indicating the Transmit/Receive mode. Clicking on the pushbutton enables this mode. If the option is active a colon will appear to the left of the display.
b. **Option 2**. Displays RCV, indicating the air to ground Receive mode. Clicking on the pushbutton enables this mode. If the option is active a colon will appear to the left of the display.
c. **Option 3**. Displays A/A, indicating the air to air Receive mode. Clicking on the pushbutton enables this mode. If the option is active a colon will appear to the left of the display.
d. **Option 4**. Displays active TACAN channel mode. Clicking on the pushbutton changes the mode from X to Y and viceversa. In X mode, all TACAN assigned frequencies end in XXX.X00 Mhz. In Y Mode the TACAN assigned frequencies end in XXX.X50 Mhz. (i.e. 109.10/109.15 Mhz respectively).
e. **Option 5**. Clicking on the TONE pushbutton enables the TACAN id tone to be heard. A colon appears to the left of the display to indicate that TONE is enabled.

Options 1 thru 3 are mutually exclusive. If you click on one of them, the others are deselected.

3. **Course Set Knob**. The course set knob is used to set a course to or from the selected TACAN station. You can left click, right click or use the wheel mouse to select a course.
4. **MPCD**. The TACAN information shown in the EHSD option of either the Left or Right MPCS is colored green for easy identification.
   a. **TACAN Data**. Located on the top left corner of the HSI display. It displays the bearing, slant range and Station ID Code to the selected TACAN Station. If no TACAN station is selected or no valid signal can be received, zeros and Xs will be displayed.
   b. **TACAN Location Symbol**. It is located inside the HIS Compass Rose and is centered with the aircraft symbol. It represents the estimated location of the selected TACAN station in relation to the aircraft. The symbol will rotate as the aircraft bearing and it will move from the center towards the compass rose edge as the range increases. If the range decreases, it will move from the edge of the compass rose towards the center of the aircraft symbol. If no valid TACAN signal is being received, the symbol will remain in the center of the compass rose. If the TACAN system is not enabled, the symbol is not displayed.
   c. **TACAN Bearing Pointer**. The inverted triangle rotates on the edge of the compass rose indicating the bearing to the selected TACAN station. If no valid TACAN signal is being received, the pointer will always point to the North of the compass rose. The pointer is not displayed If the TACAN system is not enabled.



TACAN Data entry

To change the current TACAN station you have to follow the following procedure:

1. Click the TCN pushbutton.
2. Enter the new TACAN channel by clicking on the numeric pushbuttons. Valid TACAN channel numbers are between 1 to 126
3. Click the ENT pushbutton to save the new channel into the system.
4. Check on the MPCD if the aircraft is receiving a valid signal (The TACAN data window should display valid information).

   NOTE: Appendix A has a conversion table for TACAN channels to VOR/DME frequencies. Not all TACAN channels have a valid FSX frequency.

TACAN Steering

In TACAN steering, the pilot's display shows the aircraft situation relative to the TACAN station. TACAN steering is selected by clicking on the MPCD button labeled TCN when the HSI is displayed. A box will surround the TCN label to indicate that TACAN steering is enabled. The HUD displays Station ID Code, slant range and relative bearing to the selected station.

ALL WEATHER LANDING SYSTEM (AWLS)

The all weather landing system (AWLS) provides the aircraft with steering information to fly a selected glideslope and localizer. The AWLS operates in conjunction with an airport's ILS system which provides with azimuth and elevation information along with range. AWLS steering bars are displayed on the HUD to help maintain the localizer and glideslope. DME range is also displayed on the HUD.

AWLS Controls and Indicators

he controls and indicators for AWLS operation are on the ODU, UFC, LMPCD, RMPCD and the HUD.

1. **Upfront Control (UFC)**. The pushbuttons and indicators on this control that are used for AWLS operations and display are the AWLS function selector pushbutton (labeled AWL), the ON/OFF selector pushbutton, the pushbutton keyboard, the ENTER pushbutton (labeled ENT) and the scratchpad.
   a. **AWLS Function Selector Pushbutton**. Clicking on the AWL pushbutton enables AWLS options to be displayed on the ODU. The AWLS will initialize on an AWLS frequency which will be displayed on the scratchpad.
   b. **ON/OFF Pushbutton**. Clicking on this pushbutton turns the AWLS system on or off after clicking on the AWL pushbutton.
   c. **ENTER Pushbutton**. Clicking on the ENT pushbutton saves a selected AWLS frequency in the system.
2. **Option Display Unit (ODU)**. The pushbuttons and indicators on the ODU are the option select pushbuttons and the option display windows. A colon displayed on the left side of an ODU window indicates that option has been selected on the pushbutton.
   a. **Option 1**. Displays the current AWLS frequency. When the option is selected, the frequency also appears in the UFC scratchpad and the keyboard can be used to change it.
   b. **Option 2**. Displays the letters GS (glideslope). When the option is selected, the current glideslope will be displayed on the scratchpad.
   c. **Option 3**. Displays AZ (azimuth). When the AZ option is selected the scratchpad displays current azimuth offset.
   d. **Option 4**. Displays the letters :TCNX or :TCNY. Clicking on the option 4 pushbutton alternates between them.
   e. **Option 5**. Displays the letters EL (elevation). When the EL option is selected, the scratchpad displays the current elevation offset.

Options 1, 2, 3 and 5 are mutually exclusive. If you click on one of them, the others are deselected.

3. **MPCD**. To select AWLS steering, click on the pushbutton labeled AWLS. The HUD will display the AWLS steering bars along with slant range and station ID Code. The selection of AWLS steering mode, deselects any other steering mode.
4. **HUD**. When AWLS steering is selected and the localizer beam is acquired, a vertical azimuth steering bar and a horizontal steering bar are displayed. The azimuth bar represents aircraft azimuth angle from the localizer and the horizontal bar represents elevation angle from the glideslope.

AWLS Data entry

To change the current AWLS frequency you have to follow the following procedure:

1. Click the AWLS pushbutton.
2. Enter the new AWLS frequency by clicking on the numeric pushbuttons. To enter the decimals click on the decimal point pushbutton before entering the numeric information. Valid AWLS frequencies are between 108.000 to 117.975 MHz
3. Click the ENT pushbutton to save the new frequency into the system.

EHSD/HSI NAVIGATION CONTROLS AND INDICATORS

The symbols and digital readouts that normally appear on the MPCD are as follows:

1. **Aircraft Symbol**. The aircraft symbol represents the position of the aircraft.
2. **Waypoint Bearing Pointer**. The waypoint bearing pointer indicates bearing to the selected waypoint.
3. **Waypoint Location Symbol**. This symbol represents the location of the selected waypoint in relation to the aircraft's location. The symbol moves from the edge towards the center and vice versa, indicating range to the waypoint.
4. **Bearing (digital readout)**. This readout indicates bearing to the selected waypoint.
5. **Range (digital readout)**. This readout indicates the ground range to the selected waypoint.
6. **Estimated Time En Route (ETE) (digital readout)**. This readout indicates the estimated time to reach the selected waypoint at the current airspeed.
7. **Ground Track Pointer**. This pointer indicates the aircraft's true ground track.
8. **Ground Track (digital readout)**. This readout indicates the aircraft's true ground track.
9. **Ground Speed (digital readout)**. This readout indicates ground speed.

EHSD/HSI MPCD MENU

The menu that normally appears on the MPCD is as follows:

1. **TCN**. Selects TACAN steering.
2. **AWLS**. Selects AWLS steering.
3. **MAPM**. Displays the digital map.
4. **DATA**. Displays NAV data.
5. **DSEG**.
6. **SCL**. Changes the HSI range scale. The scale cycles between 5, 13, 25 and 100.
7. **MK**. Selects a MARK waypoint.
8. **MENU**. Returns to the MPCD main menu.
9. **Blank.**
10. **POS/INS**.
11. **ECM**. Displays the ECM page.
12. **TO/S**. Non Functional. Used for TACAN Offset navigation.
13. **Down Arrow**. Selects previous waypoint.
14. **Up Arrow**. Selects next waypoint
15. **WYPT**. Selects NAV steering.
16. **NSEQ**. Non Functional. Used for Non Sequential navigation.
17. **Blank.**
18. **Blank.**
19. **Blank.**
20. **Blank.**

MAPM (MAP MENU) OPTIONS

Clicking on the pushbutton labeled MAPM displays the digital map menu options. The map is not displayed until selected. A box displayed around the label indicates a function that has been enabled.

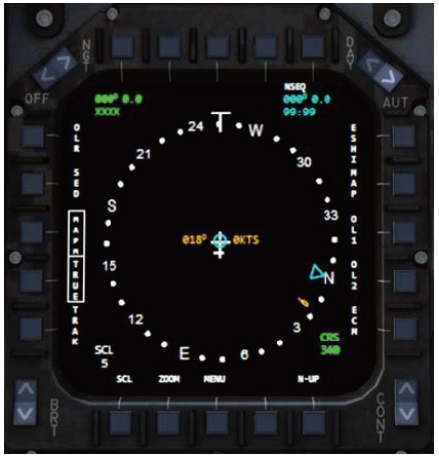


Fig. 65
MAPM Initial display

Fig. 66
MAPM Digital Map display

Fig. 67
MAPM Digital Map display with Compass Rose

1. **OLR. Non Functional.**
2. **SED. Non Functional.**
3. **MAPM**. Boxed. Indicates that the Map Menu is active.
4. **TRUE**. When boxed, indicates that True Heading is being used. Click to switch between True and Magnetic heading.
5. **TRAK. Non Functional**
6. **SCL**. Changes the HSI range scale. The scale cycles between 5, 13, 25 and 100.
7. **ZOOM**. Zooms the digital map when displayed.
8. **MENU**. Returns to the MPCD main menu.
9. **Blank.**
10. **N UP**. When boxed, indicates that the top of the map is always North, otherwise, the top of the map is the aircraft's heading.
11. **ECM**. Displays the ECM page.
12. **OL2. Non Functional.**
13. **OL1. Non Functional.**
14. **MAP**. Displays the digital map.
15. **EHSI**. Displays the compass rose.
16. **NSEQ**. Non Functional. Used for Non Sequential navigation.
17. **Blank.**
18. **Blank.**
19. **Blank.**
20. **Blank.**

WAYPOINT DATA DISPLAY

The waypoint data display allows for viewing the data required for each waypoint in a flight plan. The display is enabled by clicking on the pushbutton labeled DATA in the MPCD. The displays initializes with the aircraft data indicated by the boxed DATA and A/C legends.

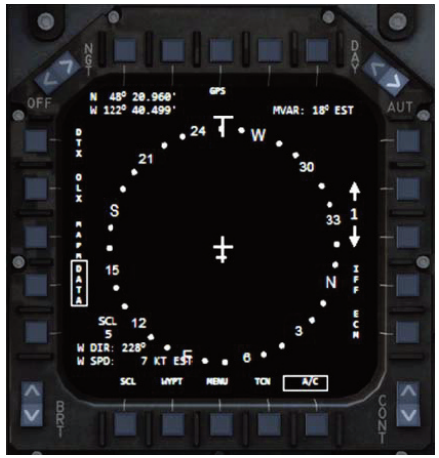


Fig. 68
DATA Display
(A/C Data)

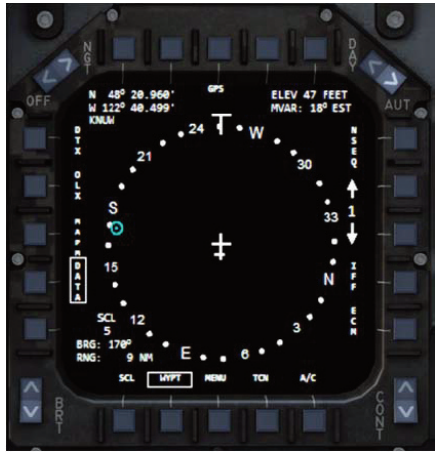


Fig. 69
DATA Display
(Waypoint Data)

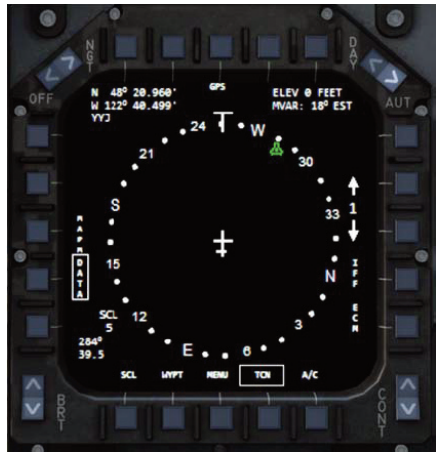


Fig. 70
DATA Display
(TACAN Data)

Aircraft Data (A/C)

To view the aircraft data, click on the A/C labeled pushbutton. The A/C label will be boxed when the data is displayed. The following information is available: Aircraft LAT/LON position (upper left corner), Magnetic Variation (upper right corner), Wind Direction and Wind speed (lower left corner).

Waypoint Data (WYPT)

To view the flight plan waypoint data, click on the WYPT labeled pushbutton. The WYPT label will be boxed when the data is displayed. The following information is available: Waypoint LAT/LON position and ID (upper left corner), Waypoint elevation in feet and magnetic variation (upper right corner), Waypoint bearing and range in nautical miles (lower left corner). To select another waypoint click on the pushbuttons labeled with an arrow. The number between the arrows indicates the waypoint index. Selecting another waypoint to check does not change the current active waypoint. The waypoint symbol will appear and show both bearing and range towards the waypoint.

NOTE: Waypoint elevation is only available when the selected waypoint is either an airport or a navaid station; otherwise the flight plan selected altitude will be shown.

TACAN Data (TCN)

To view the selected TACAN station data, click on the TCN labeled pushbutton. The TCN label will be boxed when the data is displayed. The following information is available: TACAN Station LAT/LON position and ID (upper left corner), Station elevation in feet and magnetic variation (upper right corner), Station bearing and range in nautical miles (lower left corner). The TACAN symbol will appear and show both bearing and range towards the station.

GPS Data

The GPS Data option displays the entire flight plan for review. To select this option, click on the GPS labeled pushbutton. The display will change depending on whether a flight plan exists or not. See the images. Click on the boxed GPS button to return to the previous page.

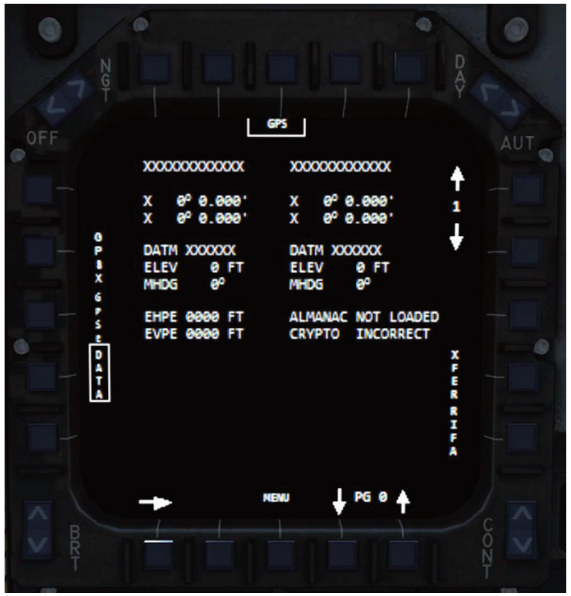


Fig. 71
GPS Data Display
(No flight plan)

1. Active waypoint data.
2. Next waypoint data.
3. Waypoint Selector. Clicking on these pushbuttons change the active waypoint.

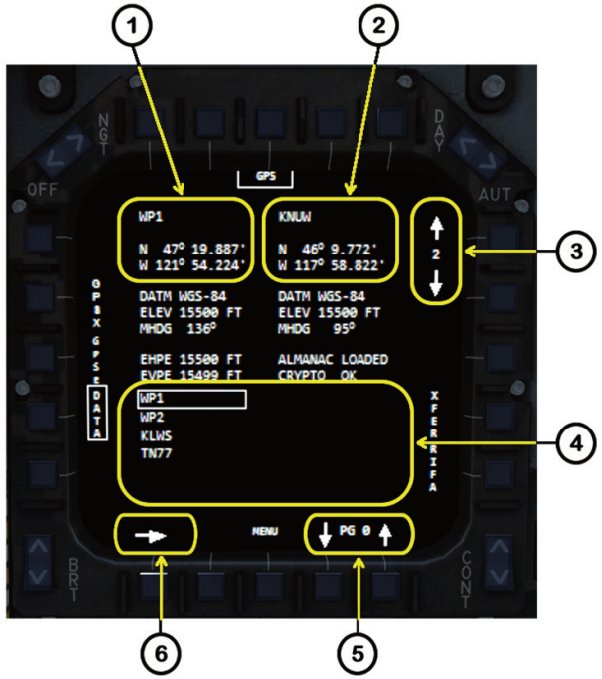


Fig. 72
GPS Data Display
(flight plan active)

4. Flight plan waypoint list. The active waypoint is boxed.
5. Waypoint list page navigator. Clicking on these pushbuttons changes the list pages.
6. Waypoints list navigator. Clicking on this pushbutton changes the column.

NOTE: Changing the waypoint in this display will change the active waypoint that the aircraft is flying to.

ABOUT FLIGHT PLANS

The aircraft systems read any active flight plan generated by FSX and loaded by using the LOAD FLIGHT PLAN option. Currently there is no way to edit/generate a flight plan in cockpit.

The AFCS does not follow the route specified in the flight plan. It is the pilot's task to ensure that the aircraft is heading down the selected waypoint bearing. Waypoints will automatically change to the next one once you have arrived to them.

Electronic warfare Equipment and procedures

ELECTRONIC COUNTERMEASURES (ECM)

The HARRIER has three different types of Electronic Countermeasures: Two internals and one external. The internal ECM options consist of an integrated Radar Warning Receiver (RWR) that allows the aircraft to detect other radar emitters and two internal dispensers on the bottom of the aft fuselage, that provide the capability to carry expendable countermeasures. The external option consist of the TERMA AIRCM pod which provide more dispensers.

RADAR WARNING RECEIVER (RWR)

The RWR system detects the radio emissions of radar systems in a 10 nautical miles circle centered on the own aircraft.

Its primary purpose is to issue a warning when a radar signal that might be a threat is detected.

ECM EXPENDABLES SYSTEM (EXP)

The ECM expendables system is part of the aircraft defense system, allowing the aircraft to interfere with enemy target tracking capabilities. The expendables consist of three types of countermeasures:

1. CHAFF: Used to confuse radar search and tracking signals.
2. FLARES: Used to confuse infrared (heat seeking) homing missiles.

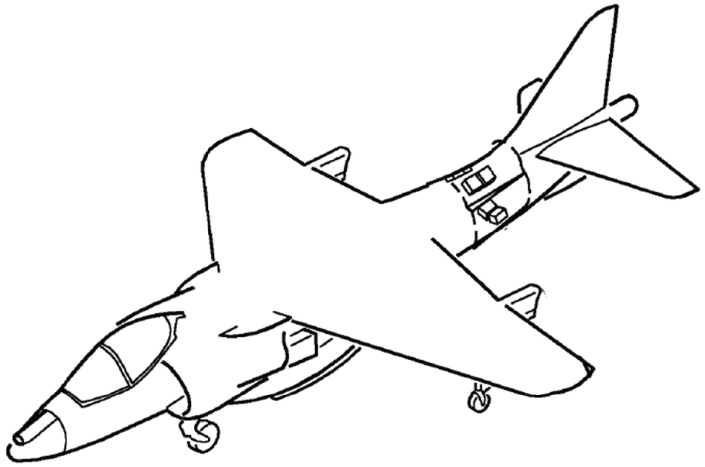


Fig. 87
Expendable dispensers location.

The following expendables dispensing modes are available:

1. **S (single)**: One chaff, flare or jammer is dispensed with each activation of the assigned keyboard key.
2. **P (program)**: One complete programmed sequence is dispensed. Not implemented on this version.
3. **M (multiple)**: Flares only. Similar to single except that one to four flares are dispensed sequentially. The number of flares dispensed depends on the number of dispensers loaded with flares.
4. **G (group)**: Flares only. One to four flares are dispensed at the same time. The number of flares dispensed depends on the number of dispensers loaded with flares.
5. **R (RWR)**: The RWR commands the release of a single chaff, flare or jammer as threats are detected. This option is not available on this aircraft due to hardware incompatibility.

ECM CONTROLS AND INDICATORS

The controls and indicators for RWR operation are on the ECM SWITCH PANEL, and MPCDs.

1. **ECM Switch Panel**: The ECM Switch panel is located to the right of the main instruments panel.

   a. **RWR Switch**:
   OFF Removes all power to the RWR System.
   ON RWR System is operational.
   VOL Controls Audio Warnings Volume **Non Functional**.

   b. **Expendables Switch (EXP)**: This switch controls the release of expendables countermeasures:
   OFF Power is removed from the system. No expendables are released.
   ON The release of expendables is enabled.
   RWR The RWR selects the dispenser/countermeasure. Non Functional.

   c. **Electronic Counter Measures Switch (ECM)**: This switch controls the TERMA pod when installed on the aircraft:
   OFF Removes power to the DCEM pod.
   STBY The pod is in standby mode.
   BIT Activates the pod's built in test.
   RCV Activates a pod mode.
   RPT Activates a pod mode.

Fig. 88
ECM Switch Panel

2. **MPCDs**: The ECM display can be accessed by clicking on the pushbutton labeled ECM. The pilot is provided with expendables remaining, dispensing options, RWR display and airborne counter measures (AIRCM).
To change an expendable dispensing option you only need to click on the assigned pushbutton until the applicable dispensing mode appears.

The AIRCM option is only active when the TERMA pod is onboard. Clicking on the AIRCM pushbutton will change chaff/flare dispensing options between 10/5/1.
Clicking on the PROG pushbutton enables the expendables dispensing program page. Expendables dispensing program is not available in this version. The page will display the expendable distributions among the dispensers.

ATTENTION: BE CAREFUL WHEN DISPENSING BOTH CHAFF AND FLARES. THEY ARE ACTUAL OBJECTS IN THE SIMULATOR THAT ARE SPAWNED VERY CLOSE TO THE AIRCRAFT. UNDER CERTAIN MANEUVERS IT IS POSSIBLE TO COLLIDE WITH THEM TERMINATING THE FLIGHT.

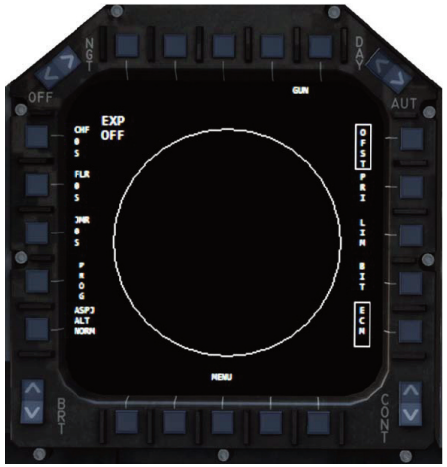


Fig. 89
ECM Display with all systems OFF.

Fig. 90
ECM Display. RWR ON, Expendables OFF.

Fig. 91
ECM Display. RWR and Expendables Active.

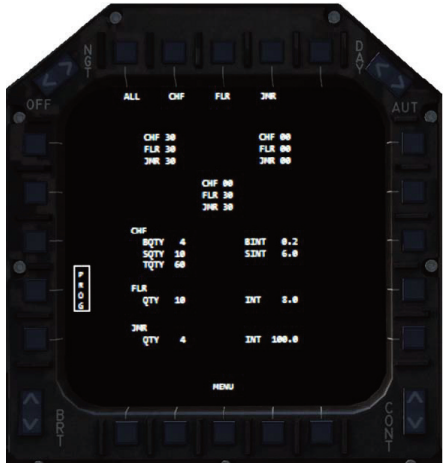
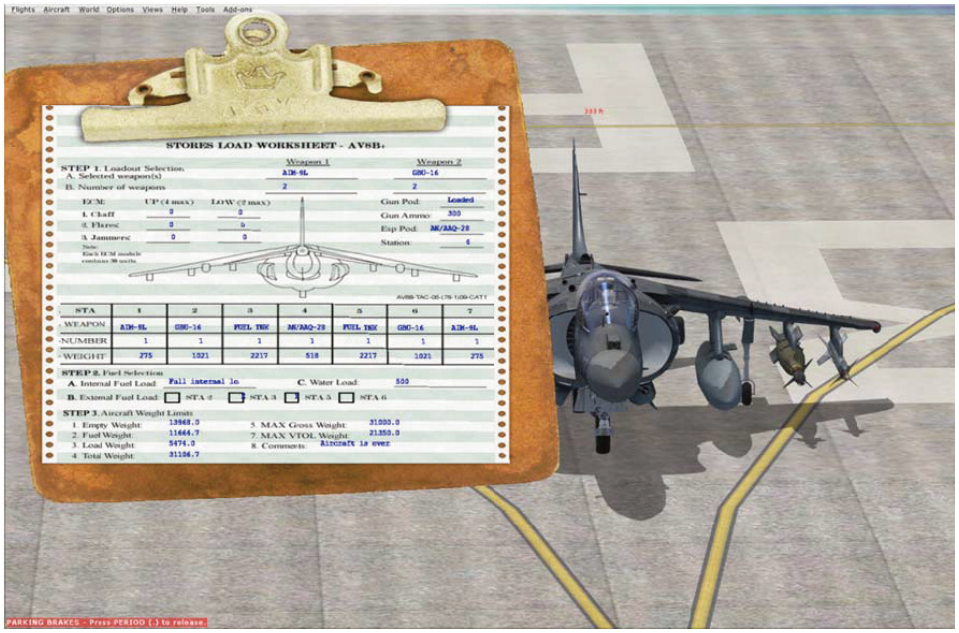


Fig. 92
Expendables Dispensing Program Display

Weapons Management

STORES MANAGEMENT CONTROL SET

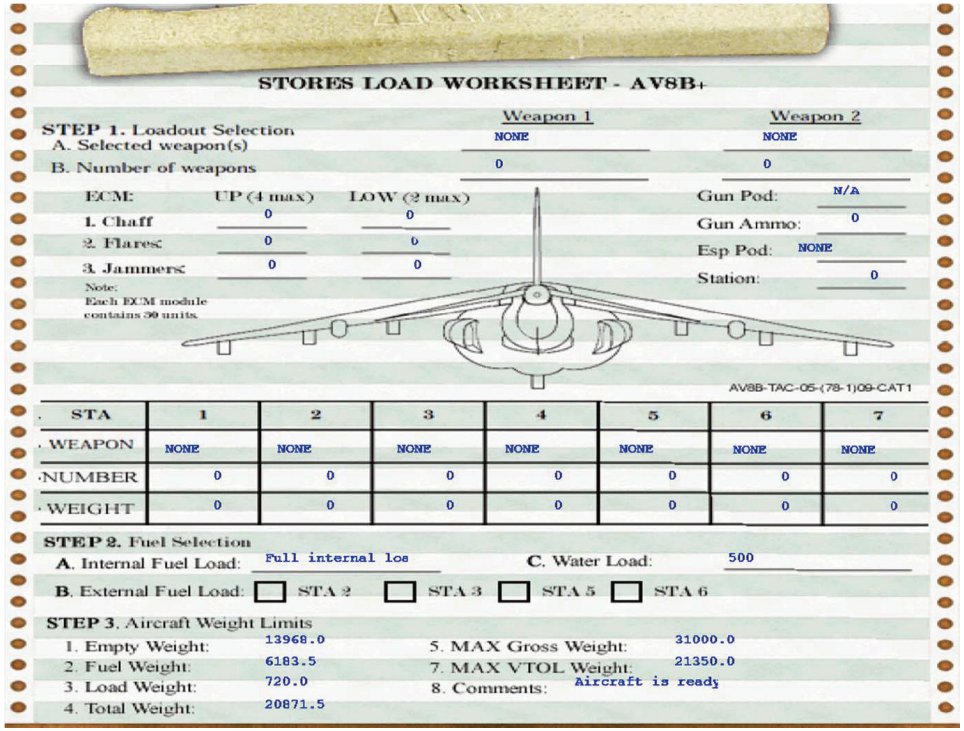
The Store Management Control Set, which in the real aircraft is located in the fuselage's avionics bay, provides the control for loading weapons and external fuel tanks into the aircraft eight pylons. The system is operated by the ground crew according to a Stores Load Worksheet that is filled by the Crew Chief. In this case you only need to fill the worksheet and the ground crew will make the necessary adjustments to the system.



OPERATION

The Stores Load Worksheet can be viewed by using FSXs view instruments menu. The Worksheet is only operational under the following conditions: Aircraft is on the ground, Parking brakes are set and engine is completely shutdown (0 % RPM). The point is that only ground personnel have access to the SMC panel and they won't work if the airplane is hot.

The Stores Load Worksheet is divided in 3 areas:



1. Loadout selection

In this section you specify which weapons load will be installed on the aircraft. Due to operational restrictions only two different types of weapons can be carried at any given time. The mix is endless and can be composed by either Air to Air and/or Air to Ground weapons as the mission requires.

1.1 Weapons Selection:

To select a weapon you must:

a. Click on the line below either Weapon 1 or Weapon 2 column titles. To select a weapon under Weapon 2, the Weapon 1 column must be filled. Repeatedly clicking on the word NONE will cycle through the weapons selection.

b. Click on the line below the name of the selected weapon to indicate the maximum amount that will be loaded.

NOTE: Although you can select the maximum quantity available for a given weapon; that does not necessarily indicate that will be the amount that will be finally loaded on the aircraft. Excess weapons requested will be ignored.

1.2 Pods Selection:

The ADEN Gun Pods and EW (Electronic Warfare) Pods are independently requested and mounted. All pods, including the guns are mounted in the aircraft's belly. There are three stations numbered 4A, 4 and 4B counted from the left to the right. To select one of the pods available, you need to click on the row labeled POD and select the station where you want to mount it. Some pods can only be mounted on a specific station, see the table below. The pod that can be mounted depends on the aircraft model as well. If you select an ADEN gun pod, the armorer will automatically load 150 rounds of 25 mm ammunition.

1.3 ECM Consumables:

The Harrier also carry ECM consumables in the form of Chaff, Flares and Disposable Frequency Jammers. These consumables are placed in six bays located in the aircraft's tail, four on the top and two on the bottom. Each bay can hold a module containing 30 units of a selected consumable. You can select any ECM consumable mix that you want to carry.

To select a ECM Consumable you only have to click on either the UP (indicating the top bays) or the LOW (indicating the bottom bays) columns next to the label of your choice. Each number actually represent a single module containing 30 units. The ECM panel in the aircraft will show unit count instead of module.

1.4 Weapons Installation:

Once you have selected the weapons that will be loaded, you will need to determine in which stations they will be installed. There are seven available stations in the aircraft, counted from left to right, starting from 1 and ending in 7. The worksheet has an outline of the aircraft shown from behind to help you determine the location of each station.

The stations have weight limitation based on their distance from the aircraft´s center. The farther away, the less weight they can carry. Also there are technical limitations regarding weapons installations. The following table shows which weapon can be selected and where it can be installed along with the maximum number.

NOTE: Stations 1A and 7A are dedicated to AIM-9L Sidewinder missiles. They can be independently loaded regardless of weapons selected; enabling the aircraft to carry a varied Air-to-Ground weapons selection and Air-to-Air weapons at the same time. These stations are not subject to main weapons load limitation but are counted for total aircraft weight. Only one missile can be carried on each station.

Missile Load

Weapon	Station	Max Load	
		Station	Aircraft
AIM-9L Sidewinder	1, 2, 6, 7	1	4
AIM-9L Sidewinder (see note)	1A, 7A	1	2
AGM-65L (Laser) Maverick	2, 3, 5, 6	1	4
AGM-65IR (Infra-Red) Maverick	2, 3, 5, 6	1	4
CRV-7 Rocket Pod (7-Rockets per pod)	2, 3, 5, 6	1	4
MATRA Rocket Pod (18 Rockets per pod)	1, 2, 6, 7	1	4

Bomb Load

Weapon	Station	Max Load	
		Station	Aircraft
MK-82L (Low Drag) Bomb	1,7	1	14
	2,3,5,6	3	
Paveway IV (500 lbs) Laser Guided Bomb	1,2,3,5,6,7	1	6
Paveway II Enhanced (1,000 lbs) Laser Guided Bomb	2,3,5,6	1	4

EW Pods

Weapon	Model		Station	Max Load	
	GR.7	GR.9		Station	Aircraft
LITENING II	No	Yes	4A, 4. 4B	1	1
DJRPS	Yes	Yes	4	1	1
TIALD	Yes	No	4A	1	1
SNIPER	No	Yes	4A	1	1
TERMA AIRCM	Yes	Yes	4B	1	1

To mount a weapon you must:

a. Click on the row labeled WEAPON under the column for the station where you want to mount it. Clicking on the box will cycle between the two selected weapons as indicated in the Weapon 1 and Weapon 2 columns.
b. Click on the row labeled NUMBER to select the quantity to mount in the selected station. Clicking on the box will increase the amount to the maximum allowed. The cycle will return to 0 if you keep clicking past the maximum amount.
c. The row labeled WEIGHT will show the weight that the selected station is carrying at any given time.

2. Fuel Selection

In this section you select the fuel quantity that will be loaded in the aircraft. There are two options: Internal Fuel and External Fuel in auxiliary tanks. Also in this section you can reload the aircraft water tank if needed.

2.1 Internal Fuel Selection:

Since the aircraft is capable of vertical take off and landing (VTOL) operations, fuel weight is a critical consideration. You have three options for internal fuel:

1. Full fuel load which will top all internal tanks to 100% fuel, but which will carry a weight penalty that will prevent the aircraft from VTOL operations;
2. VTOL fuel load which will top all hull internal tanks but will fill the wing tanks to only 40% of fuel capacity, enabling VTOL operations;
3. Minimal fuel load, which will empty the wing tanks, top all the hull internal tanks except for the rear tank which will be filled at 50% capacity. This will enable you to carry a greater weapons load for VTOL operations but you will have to top the tanks by air refueling as soon as possible. To select the internal fuel load you only need to click on the line next to the Internal Fuel Load label, the line will change to reflect the amount loaded in the aircraft.

2.2 External Fuel Selection:

The aircraft is capable to carry up to 4 300 gallon external tanks to increase operational range and/or allow long ferry flights. The external tanks are carried in Stations 2, 3, 5 and 6. The selection of an external tank will preclude the use of that station for weapons installation.

To select the external fuel load that you require, click on the square next to the station label where the tank will be installed. If any weapon was already installed in that station, it will be uninstalled and the fuel tank mounted instead. If you have selected either VTOL or Minimal fuel load, the selected external tanks will be empty.

ATTENTION

FSX FUEL MANAGEMENT REQUIRES THAT ALL FUEL TANKS BE AVAILABLE AT ALL TIMES. THE EXTERNAL TANKS HAVE BEEN ASSIGNED THE FOLLOWING FSX FUEL TANKS, FROM LEFT TO RIGHT:

STA-2: EXTERNAL 1
STA-3: LEFT WING TIP
STA-5: RIGHT WING TIP
STA-6: EXTERNAL 3

IF THERE IS ANY AMOUNT OF FUEL IN THESE TANKS, NO MATTER HOW LITTLE, THE SYSTEM WILL LOCK THE STATION AND THE ASSIGNED EXTERNAL TANK WILL BECOME VISIBLE OVERRIDING ANY WEAPON INSTALLATED.

3. Aircraft Weight Limits

Because of the VTOL capabilities, weight management is a must in this aircraft. It is essential to maintain balance within the aircraft to prevent problems during flight or VTOL operations. Everything that is loaded in this aircraft has weight. Not only the pilot, the fuel and the weapons but their containers and racks as well. For example an external fuel tank weighs 207 pounds empty. So when you add an external fuel tank you not only add the fuel weight but the tank as well. Another example is when you load three MK 82L bombs, each individual bomb weights about 500 pounds for a combined total of 1,500 pounds, but the ejector rack also weighs 105 pounds so the total weight of the 3 bombs will be 1,605 pounds.

This section is not interactive but informative, since it tells you the actual weight of the aircraft so you can make an informed decision regarding the loadout choices that you can use depending on the mission.

On the Comments section, the crew chief will inform you whether the aircraft is within VTOL weight limits, if it must do a normal take off or if it is too overloaded to fly.

WARNING

IT IS RECOMMENDED THAT YOU USE THE MSC FOR LOADING/UNLOADING THE AIRCRAFT, INCLUDING THE FUEL. USING THE FSX AIRCRAFT FUEL/PAYLOAD MENU CAN CREATE PROBLEMS WITH THE MODULE.

WEAPON SYSTEM

The Master Modes

The Harrier weapon system is built around four master operational modes: navigation (NAV), vertical and short take off and landing (VSTOL), air to ground (A/G), and air to air (A/A). The master mode design allows a single pilot action to configure the aircraft avionics for take off and landing, navigation or attack. The operation of the avionics subsystem and respective controls /displays are tailored to the operating master mode.

NAV, VSTOL and A/G master modes are selected by pressing the appropriate push button on the Master Armament Panel. The A/G mode can also be selected by selecting waypoint overfly (WOF) or target of opportunity (TOO) in the UFC. The A/A mode is a HOTAS function.

Master Armament Panel

Armament Control Panel (ACP)

NOTE: Harrier master modes are mutually exclusive with the last selected mode being the current mode of operation.

A/G Mode

The A/G master mode is selected by clicking on the A/G master mode button in the MAP. It is also automatically selected when clicking on the WOF or TOO buttons in the UFC. Activation of the A/G master mode provides attack symbology on the HUD and initializes the selected weapon for delivery. In the A/G master mode, the pilot is provided with four A/G delivery modes and aiming references are provided for the delivery of bombs, launching rockets and firing the gun. For releasing/firing A/G weapons, the Master Arm switch must be clicked to the ARM position.

Master Arm Switches:

1. **MASTER Arm**: Enables all Air to Ground weapons.
2. **GUNS Master Arm**: Enables the gun pods when mounted.
   a. S = Starboard gun pod.
   b. P = Port gun pod.
3. **LATE ARM**: **Not implemented**.

A/A Mode

The A/A master mode is automatically entered by selecting an air to air weapon via HOTAS keyboard command. The following modes can be selected: A/A Gun or Sidewinder boresight mode (SW). Selecting anyone of these weapons enables the system for firing, changes HUD symbology and sets the radar, if active, into Air to Air mode.

The Armament Control Panel

The Armament Control Panel (ACP), located on the lower left main instrument panel, contains controls and indicators for the Store Management Control Set (SMCS). The panel has display windows that indicate weapons programs that can be set by the pilot via the adjacent switches or the UFC and ODU. Regardless of which control is used the result is displayed in the ACP windows and in the stores page (STR) in anyone of the MPDs.

ATTENTION

THIS MODEL USES THE **CABIN ALERT – SEATBELTS (ON/OFF)** EVENT TO SEND A WEAPONS RELEASE SIGNAL. THE ACTUAL **RELEASE DROPPABLE OBJECT** EVENT IS NOT USED ALTHOUGH IT STILL IS ACTIVE. PLEASE MAP YOUR JOYSTICK TRIGGER BUTTON AND ASSIGNA KEYBOARD COMBINATION TO THE **CABIN ALERT – SEATBELTS (ON/OFF)** EVENT. FAILURE TO DO SO WILL PREVENT THE ACTIVATION OF THE WEAPONS RELEASE ANIMATIONS.

ATTENTION

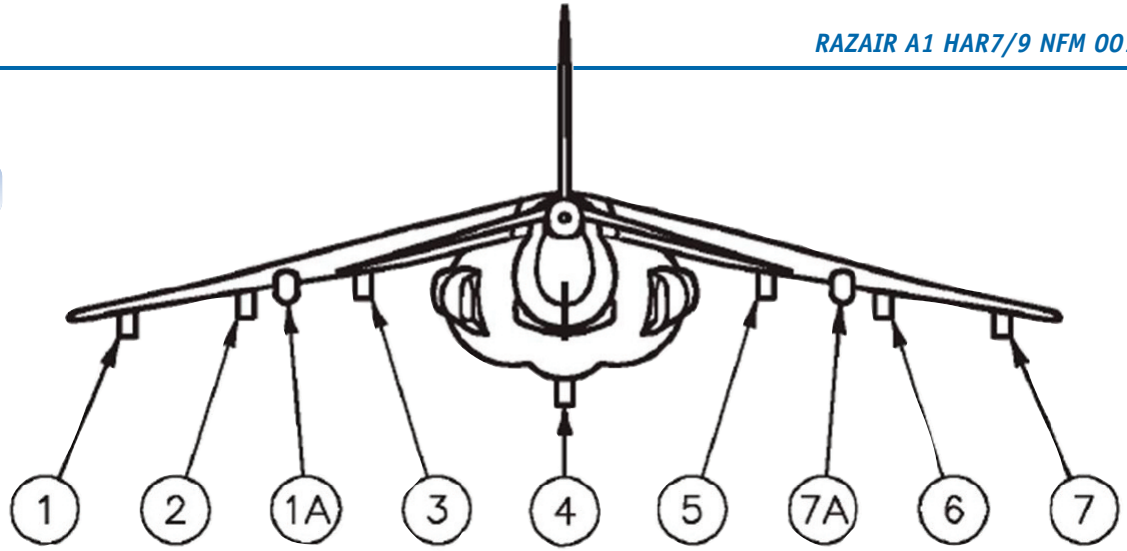
THIS MODEL RELEASES A BOMB EACH TIME THE TRIGGER IS PRESSED. THE BOMB RELEASE IS AVAILABLE IN BOTH FREE FLIGHT AND MISSION MODE. IN FREE FLIGHT, NO DESTRUCTION OF SCENERY WILL OCCUR ALTHOUGH YOU WILL BE ABLE TO SEE A SMOKE COLUMN IF THE BOMB HITS DRY LAND. ALL RELEASED WEAPONS ARE FREE FALLING NON-GUIDED. YOUR ABILITY TO GET THE TARGET INTO THE **CCIP** WILL DETERMINE WHETHER YOU HIT IT OR NOT. THERE ARE NO GUIDED WEAPONS IN THIS MODEL.

Weapons delivery (i.e.: dropping bombs) is controlled by the HARRIER's Armament Control Panel (ACP). The Armament Control Panel is comprised by: Either one of the MPDs set in the stores (STR) page. The ACP Panel located below the LMPCD.

Weapons delivery is accomplished by either pressing the trigger button on your joystick (usually button 01) or by using the assigned keyboard combination.

EXTERNAL STORES JETTISON SYSTEM

There are two ways to jettison the external stores: via the emergency jettison button or the selective jettison button on the ACP. These controls provide an unarmed weapon jettison capability for all weapons aboard except the fuselage gun and Sidewinders on stations 1, 1A and 7, 7A. Five modes of jettison (emergency, combat, fuel tank, station and stores) are provided and summarized in the following table.



EXTERNAL STATION(S) (STORES JETTISONED)	INTERLOCKS	JETTISON CONTROLS	JETTISON PROCEDURE
EMERGENCY MODE (All Stations) All stores and suspension equipment, including A/A weapons on LAU-7 launchers, except AA weapons on stations 1, 1A, 7 and 7A.	Gear handle UP or aircraft weight off wheels.	Emergency Jettison Button. (EJB)	EJB: CLICK
COMBAT MODE (All Stations) All stores and suspension equipment. All A/A weapons and EW pods are retained.	Gear handle UP **AND** aircraft weight off wheels.	Selective Jettison Knob (SJK). Selective Jettison Button (SJB).	SJK: CMBT. SJB: CLICK.
FUEL MODE (Selected Stations) Fuel tanks dropped in pairs from 2 and 6 then 3 and 7.	Same as above.	SJK. Station Select Buttons (SSB). SJB.	SJK: FUEL. SSB: CLICK appropriate buttons. SJB: CLICK.
STATION MODE (Selected Stations) All selected stations 1, 2, 3, 4, 5, 6 and 7. All stores including suspension equipment. A/A weapons on stations 1, 1A, 7 and 7A are retained.	Same as above.	SJK. SSB. SJB.	SJK: STA. SSB: CLICK appropriate buttons. SJB: CLICK.
STORES MODE (Selected Stations) All selected stations 1, 2, 3, 4, 5, 6 and 7. All stores including suspension equipment. Stores mounted on ITERs are jettisoned but the ITERs are retained. A/A weapons on stations 1, 1A, 7 and 7A are retained.	Same as above.	Same as above.	SJK: STOR. SSB: CLICK appropriate buttons. SJB: CLICK.
NOTES: Outrigger pylons (stations 1A and 7A) are not authorized for carriage, however the capability exists.			

APENDIX

A. TACAN vs. VOR Frequency Equivalence Table.

Note: The highlighted channels have invalid VOR frequencies.

TACAN CH	VOR Freq	TACAN CH	VOR Freq	TACAN CH	VOR Freq	TACAN CH	VOR Freq
01	134.4	33	109.6	65	133.8	97	115.0
02	134.5	34	109.7	66	133.9	98	115.1
03	134.6	35	109.8	67	134.0	99	115.2
04	134.7	36	109.9	68	134.1	100	115.3
05	134.8	37	110.0	69	134.2	101	115.4
06	134.9	38	110.1	70	112.3	102	115.5
07	135.0	39	110.2	71	112.4	103	115.6
08	135.1	40	110.3	72	112.5	104	115.7
09	135.2	41	110.4	73	112.6	105	115.8
10	135.3	42	110.5	74	112.7	106	115.9
11	135.4	43	110.6	75	112.8	107	116.0
12	135.5	44	110.7	76	112.9	108	116.1
13	135.6	45	110.8	77	113.0	109	116.2
14	135.7	46	110.9	78	113.1	110	116.3
15	135.8	47	111.0	79	113.2	111	116.4
16	135.9	48	111.1	80	113.3	112	116.5
17	108.0	49	111.2	81	113.4	113	116.6
18	108.1	50	111.3	82	113.5	114	116.7
19	108.2	51	111.4	83	113.6	115	116.8
20	108.3	52	111.5	84	113.7	116	116.9

TACAN CH	VOR Freq	TACAN CH	VOR Freq	TACAN CH	VOR Freq	TACAN CH	VOR Freq
21	108.4	53	111.6	85	113.8	117	117.0
22	108.5	54	111.7	86	113.9	118	117.1
23	108.6	55	111.8	87	114.0	119	117.2
24	108.7	56	111.9	88	114.1	120	117.3
25	108.8	57	112.0	89	114.2	121	117.4
26	108.9	58	112.1	90	114.3	122	117.5
27	109.0	59	112.2	91	114.4	123	117.6
28	109.1	60	133.3	92	114.5	124	117.7
29	109.2	61	133.4	93	114.6	125	117.8
30	109.3	62	133.5	94	114.7	126	117.9
31	109.4	63	133.6	95	114.8		
32	109.5	64	133.7	96	114.9		

B. Tactical Communications Reception.

The aircraft comes with a set of individual sounds, including a tactical communication recording. If you want to change it, the file is named *chatter.wav* and can be found at:

<drive letter>:\Program Files (x86)\Microsoft Games\Microsoft Flight Simulator X\SimObjects\Airplanes\RAZBAM Harrier plus\sound\AV8B AUDIO

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40 days ago · reply · retweet · favorite

CodingBear @defreitasmario Misterios de la vida que nunca se podrtan resolver.
115 days ago · reply · retweet · favorite

CodingBear @CNEL_ec En la ciudad de manta tenemos 5:30 sin luz.

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RAZBAM RT @eagledynamics RAZBAM Protocol forums.eagle.ru/showthread
130 days ago · reply · retweet · favorite

RAZBAM @defreitasmario Su lectura respecto a la medida de que las remesas y transacciones del exterior ahora tienen que pasar por el BCE?
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Razbam has brought to FSX the Convair F/A-201A Multirole aircraft.
This aircraft is the first one in our new "What-IF" line.
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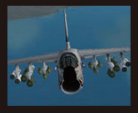

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