<table>
<thead>
<tr>
<th>PART 1 – INTRODUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PART 2 – CONTROLS SETUP</td>
</tr>
<tr>
<td>PART 3 – COCKPIT &amp; EQUIPMENT</td>
</tr>
<tr>
<td>PART 4 – START-UP PROCEDURE</td>
</tr>
<tr>
<td>PART 5 – TAXI &amp; TAKEOFF</td>
</tr>
<tr>
<td>PART 6 – LANDING</td>
</tr>
<tr>
<td>PART 7 – ENGINE &amp; FUEL MANAGEMENT</td>
</tr>
<tr>
<td>PART 8 – FLIGHT &amp; AERODYNAMICS</td>
</tr>
<tr>
<td>PART 9 – HOTAS</td>
</tr>
<tr>
<td>PART 10 – RADAR &amp; SENSORS</td>
</tr>
<tr>
<td>PART 11 – OFFENCE: WEAPONS &amp; ARMAMENT</td>
</tr>
<tr>
<td>PART 12 – DEFENCE: RWR AND COUNTERMEASURES</td>
</tr>
<tr>
<td>PART 13 – DATALINK &amp; IFF</td>
</tr>
<tr>
<td>PART 14 – RADIO TUTORIAL</td>
</tr>
<tr>
<td>PART 15 – FLIGHT CONTROLS &amp; AUTOPILOT</td>
</tr>
<tr>
<td>PART 16 – NAVIGATION &amp; ILS LANDING</td>
</tr>
<tr>
<td>PART 17 – AIR-TO-AIR REFUELING</td>
</tr>
<tr>
<td>PART 18 – OTHER RESOURCES</td>
</tr>
</tbody>
</table>

Special thanks to Paul "Goldwolf" Whittingham for creating the guide icons.
The **F-16C Fighting Falcon** (also nicknamed “Viper” by its pilots) is a supersonic, single-engine, multi-role combat aircraft developed by General Dynamics for the United States Air Force (USAF). Designed as an air superiority day fighter, it evolved into a successful all-weather multirole aircraft. Over 4,600 aircraft have been built since production was approved in 1976.

Experiences in the Vietnam War revealed the need for air superiority fighters and better air-to-air training for fighter pilots. From this need originated the Lightweight Fighter (LWF) program. This program was a United States Air Force technology evaluation program initiated in the late 1960s by a group of officers and defense analysts known as the “Fighter Mafia”. It was spurred by then-Major John Boyd’s ‘energy-maneuverability’ (E-M) theory, which indicated that excessive weight would have severely debilitating consequences on the maneuverability of an aircraft. Boyd’s design called for a light-weight fighter with a high thrust-to-weight ratio, high maneuverability, and a gross weight of less than 20,000 lbs; half that of its counterpart, the McDonnell Douglas F-15 Eagle.

In 1972, the Air Staff selected General Dynamics’ Model 401 and Northrop’s P-600 for the prototype development and testing phase. General Dynamics and Northrop were awarded contracts worth $37.9 million and $39.8 million to produce the YF-16 and YF-17, respectively, with first flights of both prototypes planned for early 1974. Late in the program, in 1974, with the promise of European sales, the Air Force changed the program name to Air Combat Fighter (ACF), and committed to purchasing 650 models of the YF-16, adopted as the F-16 Fighting Falcon. The YF-17, on the other hand, would eventually become the F/A-18 Hornet.
Increased interest turned the LWF into a serious acquisition program. North Atlantic Treaty Organization (NATO) allies Belgium, Denmark, the Netherlands, and Norway were seeking to replace their F-104G Starfighter fighter-bombers. In early 1974, they reached an agreement with the U.S. that if the USAF ordered the LWF winner, they would consider ordering it as well. The USAF also needed to replace its F-105 Thunderchief and F-4 Phantom II fighter-bombers. The U.S. Congress sought greater commonality in fighter procurements by the Air Force and Navy, and in August 1974 redirected Navy funds to a new Navy Air Combat Fighter (NACF) program that would be a navalized fighter-bomber variant of the LWF.

The four NATO allies had formed the "Multinational Fighter Program Group" (MFPG) and pressed for a U.S. decision by December 1974; thus, the USAF accelerated testing. To reflect this serious intent to procure a new fighter-bomber, the LWF program was rolled into a new Air Combat Fighter (ACF) competition.

The ACF would not be a pure fighter, but multi-role, and Schlesinger made it clear that any ACF order would be in addition to the F-15, which extinguished opposition to the LWF. ACF also raised the stakes for GD and Northrop because it brought in competitors intent on securing what was touted at the time as "the arms deal of the century". These were Dassault-Breguet's proposed Mirage F1M-53, the Anglo-French SEPECAT Jaguar, and the proposed Saab 37E "Eurofighter". Northrop offered the P-530 Cobra, which was similar to the YF-17.

The Jaguar and Cobra were dropped by the MFPG early on, leaving two European and the two U.S. candidates. On 11 September 1974, the U.S. Air Force confirmed plans to order the winning ACF design to equip five tactical fighter wings. Though computer modeling predicted a close contest, the YF-16 proved significantly quicker going from one maneuver to the next, and was the unanimous choice of those pilots that flew both aircraft.

On 13 January 1975, the YF-16 was announced as the winner of the ACF competition. The chief reasons given were the YF-16's lower operating costs, greater range, and maneuver performance that was "significantly better" than that of the YF-17, especially at supersonic speeds. Another advantage of the YF-16 – unlike the YF-17 – was its use of the Pratt & Whitney F100 turbofan engine, the same powerplant used by the F-15; such commonality would lower the cost of engines for both programs. Secretary McLucas announced that the USAF planned to order at least 650, possibly up to 1,400 production F-16s.
The Fighting Falcon’s key features include a frameless bubble canopy for better visibility, side-mounted control stick to ease control while maneuvering, an ejection seat reclined 30 degrees from vertical to reduce the effect of g-forces on the pilot, and use of a relaxed static stability/fly-by-wire flight control system which helps to make it an agile aircraft. The F-16 was the first fighter aircraft purpose-built to pull 9-g maneuvers and can reach a maximum speed of over Mach 2. Although the LWF program called for a structural life of 4,000 flight hours, capable of achieving 7.33 g with 80% internal fuel; General Dynamics’ engineers decided to design the F-16’s airframe life for 8,000 hours and for 9-g maneuvers on full internal fuel. This proved advantageous when the aircraft’s mission changed from solely air-to-air combat to multi-role operations.
One change made during production was augmented pitch control to avoid deep stall conditions at high angles of attack. The stall issue had been raised during development, but had originally been discounted. Model tests of the YF-16 conducted by the Langley Research Center revealed a potential problem, but no other laboratory was able to duplicate it. YF-16 flight tests were not sufficient to expose the issue; later flight testing on the FSD (Full-Scale Development) aircraft demonstrated there was a real concern. In response, the area of the horizontal stabilizer were increased by 25% on the Block 15 aircraft in 1981 and later retrofitted to earlier aircraft. In addition, a manual override switch to disable the horizontal stabilizer flight limiter was prominently placed on the control console, allowing the pilot to regain control of the horizontal stabilizers (which the flight limiters otherwise lock in place) and recover. Besides reducing the risk of deep stalls, the larger horizontal tail also improved stability and permitted faster takeoff rotation.

In the 1980s, the Multinational Staged Improvement Program (MSIP) was conducted to evolve the F-16’s capabilities, mitigate risks during technology development, and ensure the aircraft’s worth. The program upgraded the F-16 in three stages. The MSIP process permitted the quick introduction of new capabilities, at lower costs and with reduced risks compared to traditional independent upgrade programs. In 2012, the USAF had allocated $2.8 billion to upgrade 350 F-16s while waiting for the F-35 to enter service. One key upgrade has been an auto-GCAS (Ground collision avoidance system) to reduce instances of controlled flight into terrain. Onboard power and cooling capacities limit the scope of upgrades, which often involve the addition of more power-hungry avionics.

Equipment-wise, early F-16s could be armed with up to six AIM-9 Sidewinder heat-seeking short-range air-to-air missiles (AAM) by employing rail launchers on each wingtip, as well as radar guided AIM-7 Sparrow medium-range AAMs in a weapons mix. More recent versions support the AIM-120 AMRAAM and replaced the AIM-7. The aircraft can carry various other AAMs, a wide variety of air-to-ground missiles, rockets or bombs; electronic countermeasures (ECM), navigation, targeting or weapons pods; and fuel tanks on 9 hardpoints – six under the wings, two on wingtips, and one under the fuselage. Two other locations under the fuselage are available for sensor or radar pods. The F-16 carries a 20 mm M61A1 Vulcan cannon for close range aerial combat and strafing.

At the time, the Thrust-to-Weight ratio of the Viper was nothing short of revolutionary. Check out this 1975 takeoff comparison between a F-16A and the F-4 Phantom in the Netherlands:  https://youtu.be/eyWqKT AG9A?t=46
F-16s have participated in numerous conflicts, most of them in the Middle East. The Viper is one of the most successful export fighters ever built and has been operated by various air forces around the world including the United States, Israel, South Korea, Pakistan, Taiwan, Greece, Netherlands, Belgium, Denmark, Norway, Italy, Poland, Portugal, Oman, Bahrain, Iraq, United Arab Emirates, Turkey, Egypt, Jordan, Romania, Slovakia, Indonesia, Singapore, Thailand, Morocco, Venezuela, and Chile. Its popularity among operators is certainly not a sheer coincidence.
Note: In your controls, make sure you check your “Trim” controls since the default version of the game has your trim hat set to changing your view rather than trim the aircraft. Since most of you are probably equipped with a TRACKIR already, I suggest you make sure the Trim Hat Switch is set up properly.

To modify curves and sensitivities of axes, click on the axis you want to modify and then click on “Axis Tune”.

To assign axis, click on Axis Assign. You can also select “Axis Commands” in the upper scrolling menu.
Bind the following axes:

- PITCH (DEADZONE AT 1, SATURATION X AT 100, SATURATION Y AT 100, CURVATURE AT 5)
- ROLL (DEADZONE AT 1, SATURATION X AT 100, SATURATION Y AT 100, CURVATURE AT 5)
- RUDDER (DEADZONE AT 0, SATURATION X AT 100, SATURATION Y AT 100, CURVATURE AT 0)
- THRUST – CONTROLS ENGINE RPM
- RDR CURSOR SWITCH – X & Y AXIS
- ANT ELEV Knob
- WHEEL BRAKE LEFT / RIGHT
WHAT YOU NEED MAPPED

- Trim Switch – Nose DOWN
- Trim Switch – Right Wing DOWN
- Trim Switch – Nose UP
- Trim Switch – Left Wing DOWN
- TMS UP
- TMS RIGHT
- TMS DOWN
- TMS LEFT
- DMS UP
- DMS RIGHT
- DMS DOWN
- DMS LEFT

NWS A/R DISC MSL STEP Button (hidden grey button on right hand side)

WPN REL Button

Countermeasures Management Sw - FWD
Countermeasures Management Sw – RIGHT
Countermeasures Management Sw – AFT
Chaff/Flare Dispense Button (Slap Switch)

Expand/FOV Button

Paddle Switch - Depress

Camera/Gun Trigger (Two Detents)

Zoom In Slow: L_Shift+TMS UP
Zoom Out Slow: L_Shift+TMS DOWN

+ TOE BRAKES (MAPPED ON PEDALS)
WHAT YOU NEED MAPPED

PART 2 – CONTROLS SETUP

- Transmit Switch - UHF
- Transmit Switch – IFF IN
- Transmit Switch - VHF
- Transmit Switch – IFF OUT
- SPD BRK Switch – AFT/Extend
- SPD BRK Switch – FWD/Retract
- MAN RNG Knob – CCW (Zoom Out)
- MAN RNG Knob – CW (Zoom In)
- RDR Cursor Switch – Y Axis
- RDR Cursor Switch – X Axis
- RDR Cursor Switch – Y Axis
- RDR Cursor Switch – X Axis
- Dogfight Switch – MISSILE OVERRIDE/CENTER
- UNCAGE Switch
- Dogfight Switch – DOGFIGHT/CENTER
- ENABLE Switch (Enter)
- Transmit Switch – UHF
- Transmit Switch – IFF IN
- Transmit Switch – IFF OUT
- SPD BRK Switch – AFT/Extend
- SPD BRK Switch – FWD/Retract
- MAN RNG Knob – CCW (Zoom Out)
- MAN RNG Knob – CW (Zoom In)
- RDR Cursor Switch – Y Axis
- RDR Cursor Switch – X Axis
- RDR Cursor Switch – Y Axis
- RDR Cursor Switch – X Axis
- Dogfight Switch – MISSILE OVERRIDE/CENTER
- UNCAGE Switch
- Dogfight Switch – DOGFIGHT/CENTER
- ENABLE Switch (Enter)
- Transmit Switch – UHF
- Transmit Switch – IFF IN
- Transmit Switch – IFF OUT
- SPD BRK Switch – AFT/Extend
- SPD BRK Switch – FWD/Retract
- MAN RNG Knob – CCW (Zoom Out)
- MAN RNG Knob – CW (Zoom In)
- RDR Cursor Switch – Y Axis
- RDR Cursor Switch – X Axis
- RDR Cursor Switch – Y Axis
- RDR Cursor Switch – X Axis
- Dogfight Switch – MISSILE OVERRIDE/CENTER
- UNCAGE Switch
- Dogfight Switch – DOGFIGHT/CENTER
- ENABLE Switch (Enter)
- Transmit Switch – UHF
- Transmit Switch – IFF IN
- Transmit Switch – IFF OUT
- SPD BRK Switch – AFT/Extend
- SPD BRK Switch – FWD/Retract
- MAN RNG Knob – CCW (Zoom Out)
- MAN RNG Knob – CW (Zoom In)
- RDR Cursor Switch – Y Axis
- RDR Cursor Switch – X Axis
- RDR Cursor Switch – Y Axis
- RDR Cursor Switch – X Axis
- Dogfight Switch – MISSILE OVERRIDE/CENTER
- UNCAGE Switch
- Dogfight Switch – DOGFIGHT/CENTER
- ENABLE Switch (Enter)
Environmental Sensor Pitot
In an emergency situation during the pilot escape initiation, the seat moves up the rails leaving the aircraft. Pitot tubes on the top of the seat near the parachute container are exposed to the airstream. Pitot and Static pressure inputs to the environmental sensing unit act on the speed and altitude transducers to establish the safest mode for the pilot involved, based on the speed and altitude environment.

Magnetic Transmitter Unit
Used to generate a magnetic field used to determine HMD (Helmet-Mounted Display) position/orientation, which is used by the JHMCS (Joint Helmet-Mounted Cueing System).
**FLCS PWR (Flight Control System Power) Test Switch**

Pronounced “Flickiss”, this switch is used to test the flight control system after an engine start.

- **TEST**: With the MAIN PWR switch in BATT it closes the FLCS relay and allows verification of power output to the FLCC (Flight Control Computer) with the aircraft battery as the power source.
- **NORM**: Normal Operation Mode
- **MAINT**: Maintenance

**OBOGS (On-Board Oxygen Generating System) BIT (Built-In Test) Switch**

Tests the illumination of all warning, caution, indicator lights, the warning horn and all voice messages in sequence.

**MAL & IND LTS (Malfunction & Indication Lights) Test Button**

Tests the illumination of all warning, caution, indicator lights, the warning horn and all voice messages in sequence.

**Probe Heat & Test Switch**

**EPU (Emergency Power Unit) Generator Test Switch**

Tests the EPU generator and EPU PMG (Permanent Magnet Generator) output to FLCS on the ground without using hydrazine.

**FLCS PWR Quadruple Indicator**

Indicator of the 4 redundant digital systems (A, B, C & D) of the FLCS (Flight Control System).
Leading Edge Flaps Switch
- **LOCK**: Leading Edge locked in current position. FLCS warning light illuminates and the PFLD reports a >FLCS LEF LOCK< warning message.
- **AUTO**: Leading Edge position is a function of Mach, altitude and angle of attack.

Digital Backup (DBU) Switch
Allowing the pilot to manually select a backup software state of the FLCS.

Alternate Flaps Extend Switch

Flight Control System BIT (Built-In Test) Switch
**BIT/OFF**
Performs the FLCS built in test if the weight on wheel switch is on. BIT takes about 45 seconds, during which the RUN green indicator light is illuminated. During the BIT all flight control surfaces move in sequence (these movements are visible in multiplayer). If the BIT is successful the switch snaps back to the OFF position and the RUN light goes off.

Manual Roll Trim Wheel
**Left Wing Down**: Left
**Right Wing Down**: Right

Manual Pitch Trim Wheel
**Nose Up**: Aft
**Nose Down**: Fwd

Manual Yaw Trim Knob

Roll Trim Indicator (deg)

Trim/AP Disc Switch
**NORM**: Stick trims are energized and autopilot is possible
**DISC**: Stick trims and autopilot are inhibited

Manual TF FLYUP Switch
**Disable/Enable**
Allows you to disable or enable FLYUP protection in MANUAL TF (Terrain Following) mode. Only aircraft fitted with the AN/AAQ-13 navigation pod (NVP), part of the LANTIRN (Low Altitude Navigation and Targeting Infrared for Night) system, will have Terrain Following Radar (TFR) capability.

Alternate Flaps Extend Switch

Flight Control System (FLCS) RESET Switch
**RESET/OFF**
Allows the FLCS fault to be reset.

Run and FAIL lights

Pitch Trim Indicator (deg)
**Fuel Master Switch**
Guarded in MASTER position. When placed in OFF the fuel shutoff valve is closed, preventing fuel from reaching the engine.

**Tank Inerting Switch**
Reduces internal tank pressurisation when ON.

**Air Refueling Door Control Switch**
Open / Close
Also sets flight control gains to takeoff & landing mode

**Engine Feed Selector Switch**
Controls the way the fuel is pumped to the engine. Note that the fuel goes to the engine by gravity feed, so the engine will not starve when the fuel pumps are OFF. Use of the pumps prevents fuel starvation during negative G maneuvers and allows manual fuel balance whenever necessary.

- **OFF** - all fuel pumps are off.
- **NORM** - all pumps are on, the CG (Centre of Gravity) is maintained automatically.
- **AFT** - aft pumps are on. Fuel is transferred from the AFT tank to the engine. CG moves forward.
- **FWD** – forward pumps are on. Fuel is transferred from the FWD tank to the engine. CG moves back.

**Tank Inerting Switch**
Reduces internal tank pressurisation when ON.

**IFF (Identify-Friend-or-Foe) Master Switch**
Controls power to the IFF transponder/interrogator unit.

**IFF Enable Switch**
- M3/M5
- OFF
- M1/M3

**IFF Mode 1 Selector Switches**

**IFF Mode 3 Selector Switches**

**IFF Mode 4 Code Switch**
Zero / A/B / Hold

**IFF Mode 4 Monitor Switch**
Audio/Out

**IFF Mode 4 Reply Switch**
B / A / Out

**C&I (CNI, Communication, Navigation aids, and Identification) Switch**
Allows the pilot to toggle between the BACKUP system and the UFC (Up Front Controller). BACKUP is only used if engine generator failure has occurred.

**IFF Mode 4 Code Switch**
Zero / A/B / Hold

**IFF Mode 4 Monitor Switch**
Audio/Out

**IFF Mode 4 Reply Switch**
B / A / Out
PART 3 – COCKPIT & EQUIPMENT

**Anti-Collision Lights Switch**
- OFF
- 1 / 2 / 3 / 4: Flash pattern settings per cycle (“4” flashes 4 times per cycle, “1” cycles 1 time per cycle... this can be used to recognize wingmen if members of a flight use specific settings)
- A / B / C: Advanced flash pattern settings, which depends on Power Supply Setting set by the ground crew

**Formation Lights Brightness Control Knob**

**Master Lights Switch**
- OFF
- COVERT ALL: All lights flash with covert strobes
- COVERT A-C: Anti-Collision lights flash set pattern (A through C) with covert strobes
- COVERT FORM: Formation lights flash set pattern with covert strobes
- NORM: All lights flash set pattern with visible strobes

**Position Lights Switch**
- Flash / Steady

**Wing/Tail Position Lights Switch**
- Bright/OFF/Dim

**Fuselage Lights Switch**
- Bright/OFF/Dim

**Aerial Refueling Light Brightness Control Knob**
Canopy Defogging Lever
AFT: Min
FWD: Max

Canopy Jettison T-Handle

Manual Canopy Crank
EPU (Emergency Power Unit) Switch
The EPU is a hydrazine-powered, self-contained unit that can provide emergency hydraulic and electrical power, when just bleed air is not enough, for about 10 to 15 minutes. You would most often use this if you lose your engine, and the EPU would provide power to the hydraulic and electrical systems. In a way, it’s like a very limited Auxiliary Power Unit, or APU.

The main requirements for the EPU are that it should be simple, maintenance free, supply power immediately and consistently for the required time. Use of Hydrazine assures this while requiring careful handling, but it is very toxic and inflammable.

EPU Hydrazine/Air Light
• AIR light illuminates when the EPU is engaged and running on engine bleed air and not Hydrazine.
• HYDRAZINE light illuminates when hydrazine is used to power the turbine.

Main Power Switch
• FWD: MAIN (MAIN generator and standby generator provide power to the aircraft systems )
• MID: BATT (aircraft battery is connected and the battery bus is powered)
• AFT: OFF

FLCS (Flight Control System) PMG Indicator
When illuminated, none of the FLCS branches are receiving power from the FLCS PMG (Permanent Magnet Generator)

MAIN GEN Indicator
When illuminated, the main generator is not connected to the non-essential AC buses

STBY GEN Indicator
When illuminated, the standby generator power is not available

EPU GEN Indicator
When illuminated, EPU has been commanded ON but the EPU generator is not providing power to the emergency buses. Be aware that the light does not function with the EPU in OFF (Weight On Wheel ON) and the engine running.

EPU PMG Indicator
When illuminated, EPU has been commanded ON but the EPU is unable to provide power to the FLCS branches (normally through the EPU Permanent Magnet Generator).

EPU RUN Light
• Illuminates when the EPU turbine runs within the proper range and the EPU hydraulic pressure is above 2000 psi

EPU Hydrazine/Air Light
• AIR light illuminates when the EPU is engaged and running on engine bleed air and not Hydrazine.
• HYDRAZINE light illuminates when hydrazine is used to power the turbine.

ACFT BATT FAIL Indicator
When illuminated, indicates there is less than 20 volts in the battery when airborne or a battery failure occurred on the ground.

FLCS RLY (Relay) Indicator
When illuminated, one or more FLCS branches aren’t getting adequate voltage (at least 20 Volts) from the battery.

CAUTION Reset Button
Resets an ELEC fault, displayed as the amber ELEC SYS caution light.

TO FLCS (Flight Control System) Indicator
When illuminated, battery power is going to one or more FLCS branches. Basically the battery is powering the FLCS and will deplete fast.

TO FLCS (Flight Control System) Indicator
When illuminated, one or more FLCS branches aren’t getting adequate voltage (at least 20 Volts) from the battery.

FLCS (Flight Control System) PMG Indicator
When illuminated, none of the FLCS branches are receiving power from the FLCS PMG (Permanent Magnet Generator)

MAIN GEN Indicator
When illuminated, the main generator is not connected to the non-essential AC buses

STBY GEN Indicator
When illuminated, the standby generator power is not available

EPU GEN Indicator
When illuminated, EPU has been commanded ON but the EPU generator is not providing power to the emergency buses. Be aware that the light does not function with the EPU in OFF (Weight On Wheel ON) and the engine running.

EPU PMG Indicator
When illuminated, EPU has been commanded ON but the EPU is unable to provide power to the FLCS branches (normally through the EPU Permanent Magnet Generator).
PART 3 – COCKPIT & EQUIPMENT

AVTR (Airborne Video Tape Recorder) Video Selector Switch
- HUD (Heads-Up Display): Records HUD and MFDs (Multifunction Display)
- HMD (Helmet-Mounted Display): Records HMD and MFDs (Multifunction Display)

ECM (Electronic Countermeasures) Jammer Switch
OPR: Operate
STBY: Standby
OFF

ECM XMIT (Transmit) Switch

ECM Control Buttons

Seat Harness Lock Lever
FWD: Locked

Video Recorder Switch
Event Marker / Record / Unthread (OFF)

Emergency Oxygen Bottle Handle

ECM Panel Dim Button

ECM Reset Button

ECM BIT (Built-In Test) Button
Throttle Cutoff Release
Pressed by using “RSHIFT+HOME” (throttle goes to IDLE) or “RSHIFT+END” (throttle goes to OFF)

Communications UHF/VHF Transmit Switch (4-Way)

MAN RNG/UNCAGE Knob/Switch
Can be rotated or depressed

Dogfight Switch
3-Position switch, Slide

Radar Antenna Elevation Knob
Rotates, Center Detent

Speed Brake Switch
3-Position, Aft Momentary

Radar Cursor/Enable Switch
Depress, Multidirectional

Throttle
The backup control (BUC) for the DEEC (Digital Electronic Engine Control) system was a simple hydromechanical system provided in the event a major malfunction occurs in the DEEC.
The geometry of the throttle quadrant means that depending on the position on the throttle on the quadrant, the orientation of the throttle must be varied to access certain power detents. As an example, the throttle must be angled up to go from the OFF to the IDLE detent due to the mechanical gate. The throttle must also be angled to go in the AB detent range.
Audio 1 Control Panel
Controls the primary communication systems.

Audio 2 Control Panel
Provides control to the less frequently used communications system.

- **COMM 1 (UHF) Radio Power Knob**
- **COMM 2 (VHF) Radio Power Knob**
- **COMM 1 (UHF) Radio Mode Knob**
  - OFF / Squelch / Guard Frequency
- **COMM 2 (VHF) Radio Mode Knob**
  - OFF / Squelch / Guard Frequency
- **Intercom Volume Control Knob**
- **TACAN Power Knob**
- **ILS (Instrument Landing System) Power Knob**
- **HOT MIC CIPHER Switch**
  - HOT MIC / OFF / CIPHER
- **TF Tone Control Knob**
  - (Inoperative)
- **THREAT (TWS, Threat Warning System) Tone Control Knob**
  - (Inoperative)
- **MSL (AIM-9 Missile) Tone Volume Control Knob**
- **Secure Voice Knob**
  - (Inoperative)
UHF (COMM 1) Radio Backup Control Panel
While most of your radio use will be through the integrated control panel, or ICP, and data entry display, or DED, on the instrument panel, a backup UHF radio control head is also available and must be used before engine start as it’s the sole radio that functions on battery power. This includes a door with the preset channel entry button behind it with the selected preset channel to the right of the door. To the right of that is the knob to select a preset channel.

For the UHF backup radio to operate, the C&I switch on the IFF (or AUX COMM) panel needs to be in the BACKUP position.
**Chaff/Flare Slap Button**
Dispenses Chaff & Flare. This is a pushbutton programmed to drop countermeasures Program No. 5. This gives you a third countermeasures program immediately available without switching the PGRM knob on the CMDs.

**JFS (Jet Fuel Starter) RUN Light**
Illuminates within 30 seconds after initiating JFS start to indicate that the JFS has attained governed speed.

**Max Power Switch**
Inoperative for F110-GE-129 engine

**JFS (Jet Fuel Starter) Switch**
- **OFF**: Normal switch position. The JFS can be shut down at anytime by selecting OFF. The switch returns to OFF automatically during a normal ground start at approx. 55 % RPM.
- **START 1**: Vents one of the brake/JFS accumulators to the hydraulic start motor.
- **START 2**: Vents both brake/JFS accumulators to the hydraulic start motor.

**Manual Pitch Override Switch**
In case of a deep stall departure, the pitch override switch allows you to command greater authority from the stabs to help get the nose pointed downhill so you can pick up speed for controlled flight.

**Throttle Friction Wheel**

**ENG CONT (Engine Control) Switch**
- **PRI**: Primary Mode provides unrestricted engine operation throughout the entire flight envelope.
- **SEC**: Secondary Mode provides 70 to 80 % of normal MIL thrust. This level provides a measure of protection against exceeding engine operating limits and provides sufficient thrust for safe flight operations. Afterburner is inhibited.

**AB (Afterburner) Reset Switch**
- **AB RESET**: Attempts to clear DEEC (Digital Electronic Engine Control) faults
- **NORM**: Normal (de-energized) position
- **ENG DATA**: Records engine data in the EDU (Engine Diagnostic Unit)
Canopy Control Switch

Canopy Switch Spider Guard
Shown: Unguarded/Open

Canopy Switch Spider Guard
Shown: Guarded/Closed
**RWR LOW ALTITUDE Control Button & Indicator**
- **LOW:** Priority to dangerous threats in low altitude. When no LOW light is displayed, priority is given to dangerous threats at high altitude.
- **ALT:** EWS (Electronic Warfare System) suite is powered

**RWR SEARCH Control Button & Indicator**
Allows "S" search radar symbols to be displayed on the RWR display if the EWS is powered and detects a search radar; by default they are not. With SEARCH enabled a SAM radar in search mode will display as an ‘S’, well before you would expect to see its acquisition symbol if SEARCH was not enabled, giving you an early warning in most cases.

**RWR ACT/PWR Indicator**
- **ACTIVITY:** EWS (Electronic Warfare System) is powered and detects a radar painting the aircraft.
- **POWER:** EWS (Electronic Warfare System) suite is powered

**Speed Brake Indicator**
- Nine Dots (As Shown): Deployed
- Stripped Lines: Power OFF
- CLOSED: Retracted

**Alternate Landing Gear Lever**

**RWR Dimming Control Knob**

**RWR (Radar Warning Receiver) Indicator Control Power Button**
PART 3 – COCKPIT & EQUIPMENT

RWR (Radar Warning Receiver) Source Switch
Enables RWR data to be used by CMDS (Countermeasures Dispensing System) for dispensing in the SEMI or AUTO modes.

JMR (Jammer) Source Switch
Enables Jammer data to be used by CMDS (Countermeasures Dispensing System) for dispensing in the SEMI or AUTO modes.

MWS (Missile Warning System) Switch
Not functional on Block 50 variant.

Countermeasures Jettison Switch
Jettisons countermeasures when position is set to JETT (UP). Functions even when CMDS is turned OFF.

Countermeasures PRGM (Program) Selector Knob
There are a total of 6 programs but only 1 – 4 can be selected through the PRGM knob. PRG 5 is always activated by the slap switch on the left sidewall, while PRG 6 is the Bypass Program. The first 5 programs can be programmed through DTC, or the UFC whenever the CMDS mode in is STBY.

CMDS (Countermeasures Dispensing System) Mode Knob
- OFF
- STANDBY: release parameters and programming can be manually changed using the UFC. It is the only mode allowing reprogramming. The CMDS cannot release countermeasures in this mode.
- MAN: selected manual program may be dispensed by positioning the CMS forward on the stick
- SEMI (Semi-Automatic): aircraft systems determine the program to be dispensed based on the threat. Consent to dispense must be given by positioning the CMS aft on the stick.
- AUTO: aircraft systems determine the program to be dispensed based on the threat. Countermeasures are dispensed automatically. This mode must also be enabled by positioning the CMS aft on the stick. It may be disabled by selecting CMS right.
- BYP (Bypass): allows manual dispensing of countermeasures when failures prevent the other modes from working.

Expendable Category Power Switches & Quantity Indicators
- O1: Not available on this F-16 variant.
- O2: Not available on this F-16 variant.
- CH: Chaff
- FL: Flares
Note: LO is displayed when quantity is low.

DISPENSE READY CMDS Status Light
Displayed when manual consent is required to dispense countermeasures in the SEMI or AUTO mode.

GO / NO GO CMDS Status Light
Enables RWR data to be used by CMDS (Countermeasures Dispensing System) for dispensing in the SEMI or AUTO modes.

HMCS (Helmet-Mounted Cueing System) Symbology Brightness Knob

JMR (Jammer) Source Switch
Enables Jammer data to be used by CMDS (Countermeasures Dispensing System) for dispensing in the SEMI or AUTO modes.

MWS (Missile Warning System) Switch
Not functional on Block 50 variant.

Countermeasures Jettison Switch
Jettisons countermeasures when position is set to JETT (UP). Functions even when CMDS is turned OFF.

Countermeasures PRGM (Program) Selector Knob
There are a total of 6 programs but only 1 – 4 can be selected through the PRGM knob. PRG 5 is always activated by the slap switch on the left sidewall, while PRG 6 is the Bypass Program. The first 5 programs can be programmed through DTC, or the UFC whenever the CMDS mode in is STBY.

CMDS (Countermeasures Dispensing System) Mode Knob
- OFF
- STANDBY: release parameters and programming can be manually changed using the UFC. It is the only mode allowing reprogramming. The CMDS cannot release countermeasures in this mode.
- MAN: selected manual program may be dispensed by positioning the CMS forward on the stick
- SEMI (Semi-Automatic): aircraft systems determine the program to be dispensed based on the threat. Consent to dispense must be given by positioning the CMS aft on the stick.
- AUTO: aircraft systems determine the program to be dispensed based on the threat. Countermeasures are dispensed automatically. This mode must also be enabled by positioning the CMS aft on the stick. It may be disabled by selecting CMS right.
- BYP (Bypass): allows manual dispensing of countermeasures when failures prevent the other modes from working.

Expendable Category Power Switches & Quantity Indicators
- O1: Not available on this F-16 variant.
- O2: Not available on this F-16 variant.
- CH: Chaff
- FL: Flares
Note: LO is displayed when quantity is low.

DISPENSE READY CMDS Status Light
Displayed when manual consent is required to dispense countermeasures in the SEMI or AUTO mode.

GO / NO GO CMDS Status Light
Enables RWR data to be used by CMDS (Countermeasures Dispensing System) for dispensing in the SEMI or AUTO modes.
Emergency Stores Jettison Button

GND JETT (Ground Jettison) Switch
- UP: Enables ordnance jettison while aircraft is on the ground.
- DOWN: OFF

STORES CONFIG (Stores Configuration) Switch
Used to limit FLCS (Flight Control System) gains/limits based on the stores configuration.
- CAT I: Used for air-to-air loadouts.
- CAT III: Used for heavier air-to-ground loadouts or gas-heavy configurations. FLCS limits the angle of attack and onset rates in order to increase departure resistance.

Brakes Channel Selector
Toe brakes can be initiated by either electrical channel 1 or 2, which also operate the brake hydraulic valves. You will normally keep this set to channel 1.

Landing Gear Horn Silencer Button
Turns OFF the audio horn when you get below 190 knots, below 10,000 feet, trailing flaps extended, and the landing gear is not down and locked.

Landing Gear Lever Note:
- Handle is locked in the up position to prevent inadvertent lowering of the gear. To lower the gear the pilot has to depress the white pushbutton located on the landing gear handle.

Landing Gear Lever
- A red warning light in the top of the handle illuminates when the landing gear and doors are in transit or have failed to lock in position.
- The red light also comes on below 10000 feet when all landing gears are not down and locked, airspeed is less than 190 knots and rate of descent is greater than 250 feet per minute.

Landing Gear Down Lock Release Button

Landing Gear Indicator Lights
Green Lights: Gears are down and locked

Arresting Hook Switch
UP / DOWN

Parking Brake / Anti-Skid Switch
- UP: Parking Brake Mode ON holds the aircraft stationary without the use of toe brakes. The parking brakes are automatically de-energized when the throttle handle moves one inch past the IDLE detent. The parking brakes disengage automatically above 80% RPM. There is no parking brake status indicator aside from the position of the switch.
- MIDDLE: Anti-Skid Mode ON.
- DOWN: OFF

Note:
Considering that a lightly loaded jet can move at idle power, the parking brake can also be used for emergency braking if the toe brakes are inoperative. The parking brake is powered by battery bus No. 2 and system B hydraulics or one brake/JFS accumulator (the brake/JFS accumulator which is not used for START 1).
**RF (Radio Frequency) Switch**
- Allows you to control emissions from your aircraft.
  - **NORM:** all electronic signals for the aircraft are enabled
  - **QUIET:** radar, TACAN, and data link transmit but all other emissions are inhibited.
  - **SILENT:** all electronic signals for the aircraft are disabled, and include the radar, radar altimeter, data link, TACAN transmit, and ECM.

**Master Arm Switch**
- **UP:** Master Arm ON
- **OFF**
- **DOWN:** Simulate (Training) Mode.

**Autopilot Roll Mode Switch**
- **HDG SEL (Heading Select)**
- **ATT HOLD (Attitude Hold)**
- **STRG SEL (Steering to selected steer point in the DED, Data Entry Display)**

**Autopilot Pitch Mode Switch**
- **ALT HOLD (Altitude Hold)**
- **A/P OFF (Autopilot OFF)**
- **ATT HOLD (Attitude Hold)**

**ALT (Alternate) Release Button**
- Functions as a back-up to the weapons release button on the control stick in case of malfunction.

**ECM Enable Light**
- Illuminates when ECM (Electronic Countermeasures) is transmitting.

**ADV (Terrain Avoidance) Mode Switch & Indicator Lights (Not functional on F-16 Block 50)**

**Laser Arm Switch**
TF FAIL Light
Indicates Terrain Following Radar Failure.

F-ACK (Fault Acknowledge) Light
When a fault appears on the Pilot Fault List Display, or PFLD, the fault acknowledge button is pressed to clear the fault.

AOA (Angle of Attack) Indexer
- Top (Red) light: AOA is above 14° (on speed AOA too slow).
- Center (Green doughnut) light: AOA is between 11 and 14° (13° = on speed AOA for landing).
- Bottom (Yellow) light: AOA is below 11° (on speed AOA too fast for approach).

IFF IDENT (Identify-Friend-or-Foe Identification) Light
Pressing the IFF identification button initiates an IFF response to an interrogation or request from air traffic control.
**RWR Mode Selector Button**
- **PRIORITY**: only shows the five highest threats
- **OPEN**: display the 16 highest priority threats

**RWR Control HANDOFF Button**

**RWR MISSILE LAUNCH Light**
Illuminates when a radar missile launch is detected

**RWR UNKNOWN SHIP Toggle Switch**
Toggles display of emitter symbols of unknown weapon systems on and off.

**RWR System Test Button**

**ALR-56M TWA (Threat Warning Azimuth) Indicator**
Also known as RWR (Radar Warning Receiver)

**RWR T (Target Separation) Button**
Separates symbols that cover each other on the azimuth indicator; the symbol with the highest threat priority remains in the right place.
PART 3 – COCKPIT & EQUIPMENT

F-16C VPER

HUD (Heads-Up Display)

Boresight Cross

Pitch Ladder (deg)

Flight Path Marker

Horizon Line

Barometric Altitude (ft AMSL, Above Mean Sea Level)

Radar Altitude (ft AGL, Above Ground Level)

Altitude Low Setting (ft)

Range Provider / Slant Range (nm)
- F: FCS (Fire Control System) is providing range
- R: Radar Altimeter is providing range
- B: Range computed using steerpoint elevation/barometric elevation
- T: Targeting Pod is providing passive range
- L: Targeting Pod laser is firing and being used

TTG (Time to Go)

Distance to Steerpoint (nm) > Steerpoint Number Selected

Distances:
- Distance to Bullseye to Aircraft
- Distance from Bullseye to Aircraft (nm)

Indicators:
- Steerpoint Steering Cue
- Steerpoint Symbol
- EGI (Embedded INS/GPS)
- Magnetic Heading
- Roll Bank Angle Indicator
- Acceration (G)
- Airspeed (kts)
- Master Arm Status
- Mach
- Peak (Maximum) Aircraft G
- Master Mode Selected

Bearing from Bullseye to Aircraft

Master Mode Selected

Distance from Bullseye to Aircraft (nm)
AVTR (Airborne Video Tape Recorder) Camera
Records HUD (Heads-Up Display). Used for mission debrief.
PART 3 – COCKPIT & EQUIPMENT

HMCS (Helmet-Mounted Cueing System) Symbology Brightness Knob

HMCS (Helmet-Mounted Cueing System)

HUD (Heads-Up Display)

Helmet Heading
ICP (Integrated Control Panel)
Also referred as UFC (Upfront Control)

DED (Data Entry Display)

MFD (Multifunction Display)
ICP (Integrated Control Panel)

HUD Symbology Intensity Wheel

HUD Raster Brightness Wheel

ICP Keypad & Priority Function Buttons

DED (Data Entry Display) Increment/Decrement Switch

Increases or decreases values for the field selected on the current DED page. Values that can be increased or decreased are identified by an up and down arrow next to them on the display. The DCS is used to cycle between available fields.

DCS (Data Control Switch, also nicknamed “Dobber”)

- Used to move the asterisk on DED pages, sequence through different data fields, toggle wind data on the CNI page, and return to the CNI page from other pages
- Positions: UP/DOWN/RETURN (LEFT)/SEQUENCE (RIGHT)

A-A (Air-to-Air) and A-G (Air-to-Ground) Master Mode Buttons

Reticle Depression Control Wheel

Used for Backup Bombing Mode

FLIR Polarity Button (WX)

FLIR Increment/Decrement Switch

FLIR Gain/Level Switch

GAIN/LEVEL/AUTO

Drift Cutout / Warning Reset Switch

- DRIFT C/O: Maintains Flight Path Marker in the center of the HUD regardless of wind drift
- NORM: Normal mode, used before landing
- WARN RESET: resets the HUD WARN message

COM1 (UHF Radio), COM2 (VHF Radio), IFF (Identify-Friend-or-Foe) and LIST Override Buttons

Drift Cutout / Warning Reset Switch

- DRIFT C/O: Maintains Flight Path Marker in the center of the HUD regardless of wind drift
- NORM: Normal mode, used before landing
- WARN RESET: resets the HUD WARN message
### Priority Function Pages

<table>
<thead>
<tr>
<th>T-ILS</th>
<th>TACAN and ILS (Instrument Landing System) Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALOW</td>
<td>Altitude Low Page, settings for altitude advisory system</td>
</tr>
<tr>
<td>STPT</td>
<td>Navigation Steerpoint information</td>
</tr>
<tr>
<td>CRUS</td>
<td>Cruise page provides 4 sub-modes: TOS (Time Over Steerpoint), RNG (Range), HOME and EDR (Endurance). Page gives information for navigation, time and fuel while cruising.</td>
</tr>
<tr>
<td>TIME</td>
<td>Allows the pilot to set a HACK timer and a DELTA TOS for ROLEX calls.</td>
</tr>
<tr>
<td>MARK</td>
<td>Creates markpoints</td>
</tr>
<tr>
<td>FIX</td>
<td>Navigation Fix page.</td>
</tr>
<tr>
<td>ACAL</td>
<td>Altitude Calibration page.</td>
</tr>
</tbody>
</table>

### Override Button Pages

<table>
<thead>
<tr>
<th>CNI</th>
<th>(Communication, Navigation &amp; Identification)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COM1</td>
<td>UHF Radio 1</td>
</tr>
<tr>
<td>COM2</td>
<td>VHF Radio 2</td>
</tr>
<tr>
<td>IFF</td>
<td>Identify-Friend-or-Foe</td>
</tr>
<tr>
<td>LIST</td>
<td>Access to additional sub-pages</td>
</tr>
</tbody>
</table>

### LIST Sub-Pages

<table>
<thead>
<tr>
<th>DEST</th>
<th>(Destination): Allows changing coordinates of Steerpoints</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIP</td>
<td>Visual Initial Point page</td>
</tr>
<tr>
<td>INTG</td>
<td>Interrogator Settings Page</td>
</tr>
<tr>
<td>NAV</td>
<td>Accuracy of navigation system (drift)</td>
</tr>
<tr>
<td>MAN</td>
<td>Adjusts gun EEGS (Enhanced Envelope Gun Sight) funnel width manual setting for cannon firing.</td>
</tr>
<tr>
<td>INS</td>
<td>Inertial Navigation System page</td>
</tr>
<tr>
<td>DLNK</td>
<td>Datalink page</td>
</tr>
<tr>
<td>CMDS</td>
<td>Countermeasures Dispenser System page</td>
</tr>
<tr>
<td>MODE</td>
<td>Allows an alternate way of changing Master Mode without using the ICP A-A or A-G buttons.</td>
</tr>
<tr>
<td>VRP</td>
<td>Visual Reference Point page</td>
</tr>
</tbody>
</table>

### MISC Sub-Pages

<table>
<thead>
<tr>
<th>CORR</th>
<th>Correction page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAGV</td>
<td>Magnetic Variation at this aircraft location.</td>
</tr>
<tr>
<td>OFP</td>
<td>Operational Flight Program page</td>
</tr>
<tr>
<td>INSM</td>
<td>Inertial Navigation System Memory page</td>
</tr>
<tr>
<td>LASR</td>
<td>Laser System page (used to set Targeting Pod and Laser Spot Tracker laser codes and modes)</td>
</tr>
<tr>
<td>GPS</td>
<td>Displays information on the Global Positioning System</td>
</tr>
<tr>
<td>DRNG</td>
<td>Not Simulated</td>
</tr>
<tr>
<td>BULL</td>
<td>Bullseye reference point information.</td>
</tr>
<tr>
<td>HARM</td>
<td>AGM-88 High-Speed Anti-Radiation Missile settings</td>
</tr>
</tbody>
</table>
**DED Pages – Priority Functions**

**RCL (Recall) Button**
Depress this button once to erase the last digit that was entered, i.e. backspace key. Depress it a second time to restore the originally entered value.

**ENTR (Enter) Button**
Enter the numbers typed into a field with the keyboard.

---

**Note 1:**
Priority functions are accessed by pressing the ICP Keypad Priority Function Buttons. As an example, button “1” is for the T-ILS page, button “2” is for the ALOW page, etc.

Use the DCS (Data Control Switch, or “Dobber”) LEFT to return (RTN) to the main CNI (Communications, Navigation & Identification) DED page.

**Note 2 (very important):**
To set the Dobber switch in a certain direction, left click on either the arrows above and below the switch, or on the “RTN” and “SEQ” text to the left and right of the switch.

---

**T-ILS (TACAN-ILS) DED page**

**ALOW (Altitude Low) DED page**

**STPT (Steerpoint) DED page**

**CRUS (Cruise) DED page**

**TIME DED page**

**MARK (Markpoint) DED page**

**FIX (Navigation Fix) DED page**

**ACAL (Altitude Calibration) DED page**
PART 3 – COCKPIT & EQUIPMENT

**DED Pages – OVERRIDE Buttons**

COM1, COM2, IFF and LIST Override Buttons

A-A (Air-to-Air) & A-G (Air-to-Ground) Master Mode Buttons

Note:
OVERRIDE pages are accessed by pressing the COM1, COM2, IFF or LIST Override Buttons on the ICP.

DCS (Data Control Switch, or “Dobber”) RTN

**DCS (Data Control Switch)**

COM1 (UHF Radio) DED page

COM2 (VHF Radio) DED page

IFF (Identify-Friend-or-Foe) DED page

LIST DED page
Allows access to multiple sub-menus (see next page)

CNI (Communications, Navigation & Identification) DED page
Accessed by toggling DCS (Data Control Switch) to RTN (Return)
LIST DED page
Allows access to multiple sub-menus. Press the LIST override button, then select desired LIST sub-page with the buttons on the ICP (Integrated Control Panel) keypad.
MISC DED page (LIST Sub-page)
Allows access to multiple sub-menus. Press the LIST override button, then select MISC LIST sub-page with "0 M-SEL" button on the ICP (Integrated Control Panel) keypad. From there, you can select the desired MISC sub-menu with the ICP keypad.

1. CORR (Correction) Sub-Page
2. MAGV (Magnetic Variation) Sub-Page
3. OFP (Operational Flight Program) Sub-Page
4. INSM (Inertial Navigation System Memory) Sub-Page
5. LASR (Laser System) Sub-Page
6. GPS Sub-Page
7. DRNG Sub-Page
8. BULL (Bullseye) Sub-Page
9. HARM (High-Speed Anti-Radiation Missile) Sub-Page
Note 1:
The three lower OSBs are Direct Access (DA) buttons (in pink) and provide direct access to the saved MFD displays according to master mode. Up to three pages for each MFD may be assigned to the DA buttons for each master mode. These pages are toggled by pressing the corresponding direct access OSB button or they can be cycled even faster with the HOTAS buttons: DMS right for the right MFD and DMS left for the left MFD.

Note 2:
To access a specific MFD page, press on one of these three OSBs once, then select desired page with its respective OSB (shown in blue) from the Main Menu page.

Note 3:
You cannot have the same page displayed on both MFDs at the same time, so if you try to display the FCR on the right MFD while it is already being displayed on the left MFD the FCR will simply be taken from the left MFD leaving an empty DA slot where it was originally assigned.
FCR Page Selected

HSD Page Selected

FCR
TEST
DTE

SMS
HSD
FLCS

LEFT MFD
Displayed on MFD
Saved but not displayed on MFD

RIGHT MFD
Displayed on MFD
Saved but not displayed on MFD

DMS (Display Management Switch)
DMS left cycles pages for the left MFD
DMS right cycles pages for the right MFD
### MFD (Multifunction Display) Pages

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FCR</strong>: The Fire Control Radar is basically the radar display.</td>
<td><strong>SMS</strong>: The Stores Management System page will be different depending on the Master Mode you are in when it is selected (NAV, A-A, A-G or S-J).</td>
</tr>
<tr>
<td><strong>TGP</strong>: Targeting Pod page.</td>
<td><strong>HSD</strong>: Horizontal Situation Display page is used for navigation.</td>
</tr>
<tr>
<td><strong>WPN</strong>: Weapon Sensor page, used for AGM-65 Maverick and AGM-88 HARM sensor feed.</td>
<td><strong>DTE</strong>: Data Transfer Equipment page is used to load the Data Cartridge prepared during mission planning in into the aircraft computer. Loading is done (usually at ramp start right after or just before switching the CNI to UFC) by depressing OSB (Option Select Button) next to LOAD.</td>
</tr>
<tr>
<td><strong>TFR</strong>: Terrain Following Radar page. TFR is only available on F-16s carrying an AN/AAQ-13 LANTIRN navigation pod (on the left chin station). The TFR is a short range (36000ft) forward and down radar that allows you to follow the terrain at very low altitude with automatic fly up protection.</td>
<td><strong>TEST</strong>: Test page shows multiple BITs (Built-In Tests)</td>
</tr>
<tr>
<td><strong>FLIR</strong>: The FLIR (Forward-Looking Infrared) page is only available on F-16s carrying an AN/AAQ-13 LANTIRN navigation pod (on the left chin station). The FLIR is a forward looking infrared camera used for low level night navigation. The FLIR is housed in the navigation pod of the LANTIRN system mounted alongside the TFR system.</td>
<td><strong>FLCS</strong>: Flight Control System page.</td>
</tr>
<tr>
<td><strong>BLANK</strong>: Turns off the MFD. Can be helpful when you need only one MFD page active from the Direct Access row for a specific Master Mode.</td>
<td><strong>RCCE</strong>: Reconnaissance page that interfaces with Reconnaissance pods.</td>
</tr>
<tr>
<td><strong>HAD</strong>: HARM Attack Display page is used for operating the AGM-88 HARM (High-Speed Anti-Radiation Missile) missile.</td>
<td><strong>RESET</strong>: Not simulated.</td>
</tr>
</tbody>
</table>
Primary vs Standby Indications

The HUD in all C-model Vipers is certified as a primary flight reference. However, it is not allowed to be used to recover from unusual attitudes while flying at night or in IMC (Instrument Meteorological Conditions). Most indications on the central console can be used as primary indications as well.

HUD (Heads-Up Display)

Standby Indications
PNEU (secondary, right position) operating mode, the altimeter is pneumatically operated by static pressure supplied by the pitot-static system. Should the CADC or altimeter servo malfunction, the altimeter automatically reverts to the pneumatic mode and the PNEU flag appears on the face of the altimeter. The PNEU flag may also appear when accelerating or decelerating through the transonic region or while performing high g maneuvers.

Airspeed Bug (green triangle, set by the Bug Setting Knob)

MAE (Angle of Attack) Indicator (deg)

VVI (Vertical Velocity Indicator) (x1000 ft/min)

Pitch Trim Knob
Used to center the instrument along the fixed horizontal reference (according to the seating position of the pilot.)
**EHSI Mode Selector Button**
Toggle between the following modes:
- NAV: Navigation
- PLS/NAV: Precision Landing System (ILS) / Navigation
- TCN: TACAN
- PLS/TCN: Precision Landing System (ILS) / TACAN

**Fuel Quantity Selector Knob**
- **TEST**: places both pointers at 2000 lbs, and totalizer should display 6000 lbs
- **NORM**: AL pointer indicates remaining fuel in the aft left reservoir and the A-1 fuselage tank, and the FR pointer indicates the sum fuel in the forward right reservoir tank and the F-1 and F-2 fuselage tanks.
- **RSVR**: moves the AF and FR pointers to display fuel in the aft and forward reservoir tanks
- **INT WING**: Indicates quantity for interior left and right wing-mounted external fuel tanks
- **EXT WING**: Indicates quantity for exterior left and right wing-mounted external fuel tanks
- **EXT CTR**: Indicates quantity for exterior fuselage-mounted center tank

**EHSI Brightness Control Knob (when pressed IN)**
Scroll mousewheel to turn knob, left click to press in.
PART 3 – COCKPIT & EQUIPMENT

AR / NWS Light
- AR illuminates when aircraft is in the air and the air refueling boom is inserted and has good contact with the AR receptacle
- NWS illuminates on ground when Nosewheel Steering is engaged, allowing the pilot to steer the aircraft using rudder pedals to control direction

RDY Light
Illuminates when AR (Air Refueling) system is ready for air-to-air refueling (i.e. when AR door is open)

RDY / AR / NWS / DISC Indicator Brightness Control Lever

DISC Light
Illuminates during AR (Air Refueling) when pilot commands a disconnect from the boom

ENG FIRE Light
Engine fire detected

HYD/OIL PRESS Light
- Low Oil Pressure: Illuminates when oil pressure has been below approximately 10 psi for 30 sec. Extinguishes when oil pressure exceeds 20 psi approx.
- Low Hydraulic Pressure: Illuminates when hydraulic pressure for either system A or B decreases below 1000 psi.

FLCS Light
Indicates a dual malfunction in the FLCC (Flight Control Computer) electronics or that a leading edge flaps are locked, or that the FLCS BIT (Built-In Test) has failed.

CANOPY Light
Illuminates when canopy is not locked in place

ENGINE Light
RPM and FTIT indicator signals indicate that an engine overtemperature or flameout has occurred. Illuminates when the RPM decreases below IDLE, or approximately 2 seconds after FTIT indication exceeds 1100 °C.

DBU ON Light
Illuminates when Digital Backup (DBU) software state of the FLCS (Flight Control System) is active.

TO/LDG CONFIG (Takeoff/Landing Configuration) Light
Illuminates in flight whenever pressure altitude is less than 10000 feet, airspeed is less than 190 knots, rate of descent is greater than 250 fpm and either of the following conditions exists:
- Trailing Edge Flaps are not fully down
- Nose Landing Gear or either Main Landing Gear is not down and locked (accompanied by landing gear warning horn)

OXY LOW Light
Illuminates when oxygen regulator pressure has dropped below 5 psi or when the BIT (Built-In Test) has detected a fault
Fuel Flow Indicator (lbs/hour)

SAI (Standby Attitude Indicator)

SAI Caging Knob
- Left Click to Cage
- Scroll Mousewheel to adjust aircraft reference symbol

Engine Oil Pressure Indicator (psi)

Engine Nozzle Position Indicator (% Open)

Engine RPM Indicator (% RPM)

FTIT (Fan Turbine Inlet Temperature) Indicator (x100 deg C)
Ejection Grip

Emergency Manual Chute Deployment Handle
PART 3 – COCKPIT & EQUIPMENT

- **Trim Hat Switch**
  - UP/DOWN/LEFT/RIGHT

- **NWS A/R DISC & MSL STEP Button**
  - NWS: Nosewheel Steering Activation
  - A/R: When in flight and the AIR REFUEL switch in the OPEN position, depressing the button disconnects boom latching
  - MSL (MISSILE) STEP: When in flight, depressing the button in EO or A-A mode selects the next weapon station. Depressing the button in A-G Mode cycles between CCRP, CCIP and DTOS.

- **DMS (Display Management Switch)**
  - UP/DOWN/LEFT/RIGHT

- **CMS (Countermeasures Switch)**
  - FWD/AFT/LEFT/RIGHT

- **Paddle Switch**
  - Overrides Autopilot when depressed

- **Camera/Gun Trigger (Two Stages)**

- **Expand/FOV (Field-of-View) Button**

- **TMS (Target Management Switch)**
  - UP/DOWN/LEFT/RIGHT

- **Weapon Release Button**
F-16C VIPER

PART 3 – COCKPIT & EQUIPMENT

Fuel Quantity Indicator (x100 lbs)

A/L (Aft Left) Pointer

F/R (Front Right) Pointer

Note: indicates center fuel tank load when Selector Knob set to EXT CTR

Total Fuel Quantity Indicator (lbs)

Pilot Fault List Display

The Pilot Fault List Display, or PFLD, lists all FLCS (Flight Control System) detected faults. Two types of PFLDs are displayed: warning level and caution level. Warnings are associated with the FLCS and have a bracket around them. Cautions are associated with other FLCS elements, engine, and avionics systems. To clear a PFLD fault, the fault acknowledge (F-ACK) button is pressed.

Magnetic Compass

Hydraulic Pressure Indicator (x1000 psi) – System A

Hydraulic Pressure Indicator (x1000 psi) – System B
### Caution Advisory Lights

<table>
<thead>
<tr>
<th>Caution Advisory Lights</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FLCS FAULT</strong></td>
<td>Flight Control System Fault detected</td>
</tr>
<tr>
<td><strong>ENGINE FAULT</strong></td>
<td>Engine fault detected</td>
</tr>
<tr>
<td><strong>AVIONICS FAULT</strong></td>
<td>Fault detected in avionics systems</td>
</tr>
<tr>
<td><strong>SEAT NOT ARMED</strong></td>
<td>Ejection seat lever is UP (not armed).</td>
</tr>
<tr>
<td><strong>ELEC SYS</strong></td>
<td>Electrical system failure. Check ELEC panel</td>
</tr>
<tr>
<td><strong>SEC</strong></td>
<td>Engine is operating in secondary mode (see if ENG CONT switch is set to SEC)</td>
</tr>
<tr>
<td><strong>EQUIP HOT</strong></td>
<td>Avionics equipment cooling is insufficient: check AIR SOURCE knob position is set to NORM.</td>
</tr>
<tr>
<td><strong>AVIONICS FAULT</strong></td>
<td>Fault detected in avionics systems</td>
</tr>
<tr>
<td><strong>ELEC SYS</strong></td>
<td>Electrical system failure. Check ELEC panel</td>
</tr>
<tr>
<td><strong>PROBE HEAT</strong></td>
<td>Probe heater failure or monitoring system failure.</td>
</tr>
<tr>
<td><strong>FUEL/OIL HOT</strong></td>
<td>Temperature of fuel going to the engine or engine oil is excessive.</td>
</tr>
<tr>
<td><strong>RADAR ALT</strong></td>
<td>Malfunction of the radar altimeter.</td>
</tr>
<tr>
<td><strong>ANTI SKID</strong></td>
<td>A failure affecting anti-skid braking performance is detected while the aircraft is moving above 5 kts ground speed.</td>
</tr>
<tr>
<td><strong>CADC</strong></td>
<td>Central Air Data Computer failure.</td>
</tr>
<tr>
<td><strong>INLET ICING</strong></td>
<td>Engine Inlet Icing detected</td>
</tr>
<tr>
<td><strong>IFF</strong></td>
<td>There is a condition that prevents IFF (Identify Friend or Foe) Mode 4 operation.</td>
</tr>
<tr>
<td><strong>HOOK</strong></td>
<td>Arresting hook is not up and locked.</td>
</tr>
<tr>
<td><strong>STORES CONFIG</strong></td>
<td>STORES CONFIG switch on the gear panel is not in the correct position for the current loadout.</td>
</tr>
<tr>
<td><strong>OVERHEAT</strong></td>
<td>FTIT (Fan Turbine Inlet Temperature) Overheat detected</td>
</tr>
<tr>
<td><strong>NUCLEAR</strong></td>
<td>Malfunction in the NUCLEAR control circuitry.</td>
</tr>
<tr>
<td><strong>OBOGS</strong></td>
<td>On-Board Oxygen Generating System caution indicates ECS (Environmental Control System) air supply has dropped below 10 psi.</td>
</tr>
<tr>
<td><strong>ATF NOT ENGAGED</strong></td>
<td>Automatic Terrain Following system failure.</td>
</tr>
<tr>
<td><strong>EEC</strong></td>
<td>Electronic Engine Controller caution, not applicable in F-16C Block 50.</td>
</tr>
<tr>
<td><strong>CABIN PRESS</strong></td>
<td>Cockpit pressurization is above 27000 ft. Check AIR SOURCE knob for NORM position. If caution light remains illuminated, descend below 25000 ft and reduce speed to 500 kts max.</td>
</tr>
<tr>
<td><strong>FWD FUEL LOW</strong></td>
<td>Forward reservoir contains less than 400 lbs of fuel.</td>
</tr>
<tr>
<td><strong>BUC</strong></td>
<td>Backup Control caution, not applicable in F-16C Block 50</td>
</tr>
<tr>
<td><strong>AFT FUEL LOW</strong></td>
<td>Aft reservoir contains less than 400 lbs of fuel.</td>
</tr>
</tbody>
</table>

---

**PART 3 – COCKPIT & EQUIPMENT**
Elbow Support (Lift to Rotate)
PART 3 – COCKPIT & EQUIPMENT

- EPU (Emergency Power Unit) Fuel Quantity (%)
- Clock
- Cabin Pressure Altitude Indicator (x1000 ft)
**Left HDPT (Hardpoint) Power Switch**
Power for left chin intake pylon, targeting pod can be installed
- FWD: ON
- AFT: OFF

**Right HDPT (Hardpoint) Power Switch**
Power for right chin intake pylon, targeting pod can be installed
- FWD: ON
- AFT: OFF

**FCR (Fire Control Radar) Power Switch**
- FWD: ON
- AFT: OFF

**RADALT (Radar Altimeter) Power Switch**
- FWD: Radar Altimeter ON
- MIDDLE: Standby
- AFT: Radar Altimeter OFF

**HUD Depressible Reticle Switch**
- FWD: STBY (Standby) displays the standby reticle and removes all other HUD symbology
- MIDDLE: PRI (Primary) displays the primary reticle but does not remove any HUD symbology
- AFT: OFF

**DED (Data Entry Display) Data Switch**
- FWD: DED (Standby) allows data from DED to be visible on the HUD
- MIDDLE: PFL (Pilot Fault List) allows data from PFLD (PFL Display) to be visible on the HUD
- AFT: OFF, displays neither DED nor PFLD data on HUD.

**HUD Scales Switch**
- FWD: VV/VAH displays the Vertical Velocity, Velocity, Altitude and Heading on the HUD.
- MIDDLE: VAH displays Velocity, Altitude and Heading information only.
- AFT: OFF

**HUD Flight Path Marker (FPM) Switch**
- FWD: ATT/FPM displays both the flight path marker and attitude reference bars.
- MIDDLE: FPM displays the flight path marker only.
- AFT: OFF

**HUD Velocity Switch**
- FWD: CAS displays calibrated airspeed on HUD
- MIDDLE: TAS displays true airspeed on HUD
- AFT: GND SPD displays ground speed on HUD

**HUD Altitude Switch**
- FWD: ALT RADAR displays radar altitude on HUD
- MIDDLE: BARO displays the barometric altitude on HUD
- AFT: OFF/Automatic Mode displays radar altitude when above ground altitude is below 1500 ft (displays barometric altitude when above 1500 ft)

**HUD Brightness Control Switch**
- FWD: Day Mode
- MIDDLE: Automatic Brightness Adjustment
- AFT: Night Mode
**Seat Adjustment Switch**

- **FWD:** ARM/REL
- **MIDDLE:** OFF
- **AFT:** REL ONLY

**Nuclear Consent Arming Switch**

- **FWD:** CRAD 1
- **MIDDLE:** PLAIN
- **AFT:** CRAD 2

**Nuclear Consent PLAIN Cipher Switch**

- **FWD:** CRAD 1
- **MIDDLE:** PLAIN
- **AFT:** CRAD 2

**Note:**
The NUCLEAR CONSENT panel controls consent for nuclear weapons release. Placing this switch in ARM/REL gives the airplane consent to arm and release nuclear weapons (if loaded). In REL ONLY, the airplane will release but not arm nuclear weapons. Take note that nuclear weapons are not modelled in DCS.
Air Source Selector Knob
- OFF: engine bleed air valves close.
- NORM: air conditioning system sets for automatic temperature and pressure regulation, cockpit and fuel tanks are pressurized and avionics are cooled.
- DUMP: cabin pressurisation is terminated and the cockpit is vented to outside air pressure. This means cockpit pressure altitude will increase above 8000 feet MSL.
- RAM: engine bleed air valves close. Cabin pressurization is terminated and the cabin is vented to outside air pressure as above. Ram air valves are opened to ventilate the cockpit and avionics. All other ECS functions such as external fuel tank pressurisation & cooling are disabled.

Air Conditioning Temperature Control Knob

FLOOD LIGHTS - CONsoles Brightness Control Knob

FLOOD LIGHTS - INSTRUMENT Panel Brightness Control Knob

Primary Data Entry Display (DED) Brightness Control Knob

MAL & IND LTS (Malfunction & Indicator Lights) Brightness Switch

Primary Instrument Panel Brightness Control Knob

Primary Consoles Brightness Control Knob

ZEROIZE Switch
Used in case of crash landing into enemy territory; erases all sensitive data from all systems like secure voice, GPS keys, and others.
- FWD: OFF (DTC, GPS, AIFF, PDG and RWR data are purged)
- MIDDLE: OFF
- AFT: DATA (DTC, GPS, and AIFF data is purged)
KY-58 Radio Encryption Mode Selector
- P: Plain Mode
- C: Cipher Mode
- LD: Enables loading data into KY-58
- RV: Receiver Variable

FILL Connector

FILL Select Knob
- 1-6: Selects position to be loaded with data
- Z 1 – 5: Selects position in which data will be zeroed (erased)
- Z ALL: Zeroes (erases) data in ALL positions

KY-58 Radio Encryption Volume Control Knob

KY-58 Radio Encryption Power Knob
- ON
- OFF
- TD: Power is turned ON for the system if Cipher Mode has been selected and a time delay is selected for data processing
Oxygen Flow Indicator
Flow is active when indicator alternates between white and black

Oxygen Emergency Lever
- Emergency
- Normal
- Test Mask

Oxygen Diluter Lever
- 100 %
- NORM (Normal)

Oxygen Pressure Indicator (psi)

Oxygen Supply Lever
- PBG: Pressure Breathing for G provides pressure breathing above 4g's to enhance g tolerance and reduce pilot fatigue.
- ON: Provides oxygen supply to mask, helmet bladder, and vest. Pressure breathing as a function of g is not available
- OFF: Turns OFF Oxygen

Emergency
Normal
Test Mask
IFF (Identify-Friend-or-Foe) Antenna Selection Switch
Upper/Norm/Lower Antenna

Engine Anti-Ice Switch
ON/AUTO/OFF

UHF Radio Antenna Selection Switch
Upper/Norm/Lower Antenna

MFD (Multifunction Display) Power Switch

UFC (Upfront Control) Power Switch
Provides power to ICP (Integrated Control Panel)

Map Power Switch
(not used on Block 50 F-16C)

ST STA (Store Stations) Power Switch

MMC (Modular Mission Computer) Power Switch

MIDS (Multifunctional Information Distribution System) LVT (Low Volume Terminal) Datalink Selector Switch
- ZERO: Zeroize (erase) all MIDS information
- OFF: MIDS is OFF
- ON: MIDS is ON

DL (Datalink) Power Switch
Not used for Block 50 variant of the F-16C

EGI (Embedded GPS/INS (Inertial Navigation System)) Selector Switch
- OFF
- ALIGN STOR HDG: Stored Heading Alignment
- ALIGN NORM: Normal Alignment
- NAV: Navigation Mode, normal operation
- IN FLT ALIGN: In-Flight INS Alignment can be performed in flight if GPS data is available.
- ATT: Attitude mode allows you to correct INS alignment by flying a stable attitude to allow the GPS to update the INS.

GPS Receiver Power Switch
DTU (Data Transfer Unit) DTC (Data Transfer Cartridge) Receptacle
PART 3 – COCKPIT & EQUIPMENT

Position/Formation Light (Green)

Position/Formation Light (Red)
PART 3 – COCKPIT & EQUIPMENT

F-16C VPER

Aft: Air Refueling Flood Light
Front: Formation Light (White)

Air Refueling Trap Door

Anti-Collision Strobe Light (White)

Fuselage Formation Light

Fuselage Formation Light

Position Light (White)

Vertical Tail-Mounted Floodlight
Position Light (Red)

Position Light (Green)

Position/Formation Light (Red)

Position/Formation Light (Green)

Formation Light (White)
Landing Light
Engine Intake Splitter Plate
Controls airflow into the engine by diverting the boundary layer away from the engine intake.

Structural Strut
F-16C VIPER

- Radar Warning Antenna
- Threat Warning (Radar Warning Receiver) Antenna
- IFF (Identify-Friend-or-Foe) Antenna Array
- Radome
- Static Port
- Angle of Attack Sensor
- Pitot Head / Air Data Probe
- Pitot Head / Air Data Probe

PART 3 – COCKPIT & EQUIPMENT
PART 3 – COCKPIT & EQUIPMENT

- Angle of Attack Sensor
- Radar Warning Antenna
- M61A1 20 mm Gun
Speed Brake Switch
3-Position, Aft Momentary
Static Dischargers

Static Dischargers

Static Dischargers
Night Vision Goggles (NVG) Controls:

- RSHIFT+H: On/Off
- RSHIFT+RALT+H: Gain Night Vision Goggles Down
- RSHIFT+RCTRL+H: Gain Night Vision Goggles Up
AIRCRAFT START-UP SUMMARY

A. Provide Aircraft Power
B. Perform Aircraft Pre-Start Setup
C. Engine Start
D. Set Up Avionics
E. Perform INS (Inertial Navigation System) Alignment
F. Set Up Datalink
G. Set Up IFF
H. Complete Aircraft Setup
I. (Optional) Perform Aircraft Post-Start Checks
A – PROVIDE AIRCRAFT POWER

1. Set Ejection Seat Lever – DOWN & ARMED (Note: this step is typically done just before takeoff)
2. Test that the FLCS (Flight Control System) functions properly on battery power only
   a) (Mandatory) MAIN PWR Switch – BATT/MIDDLE (Right Click)
      Note: This will connect the aircraft’s battery to essential systems and provide power to engine igniters.
   b) (Mandatory) Verify that the FLCS RLY (Flight Control System Relay) light is illuminated. This confirms that the FLCS’s fault monitoring system operates properly.
   c) (Optional) Set and hold FLCS PWR TEST switch to TEST position (Right Click and hold).
   d) (Optional) While FLCS PWR TEST switch is set to TEST, confirm that:
      i. The four FLCS PWR (Power) lights illuminate
      ii. The FLCS RLY (Relay) light extinguishes
      iii. The TO FLCS light illuminates (battery power is powering FLCS)
      iv. The FLCS PMG (Permanent Magnet Generator) light illuminates
   e) (Optional) Release FLCS PWR TEST switch to NORM position (release Right Click).
3. Set MAIN PWR Switch – MAIN PWR/FWD (Right Click)
       Note: This will connect the aircraft’s battery to essential systems and provide power to engine igniters.

Note: The amount of power available from the battery is limited; do not leave the MAIN PWR switch in BATT or MAIN PWR for more than 5 minutes. Start the engine or apply external power if more time is needed.
**A – PROVIDE AIRCRAFT POWER**

4. MAIN PWR prepares the aircraft to run off the engine-mounted generator, but electrical power is not available until the engine is running (IDLE RPM). For that reason the following warning lights should be illuminated:
   a) ENGINE warning Light
   b) HYD/OIL PRESS warning light
   c) ELEC SYS caution light
   d) SEC caution light
   e) FLCS RLY light

5. On EPU (Emergency Power Unit) Panel, verify that EPU GEN (Generator) and EPU PMG (Permanent Magnet Generator) lights are OFF.

*Note: Illumination of either light indicates criteria for EPU activation are met, which means that the EPU could activate and create a hazardous condition if the EPU safety pin is removed by the ground crew.*
PART 4 – START-UP PROCEDURE

B – PERFORM AIRCRAFT PRE-START SETUP

6. Set Parking Brake / Anti-Skid Switch – PARKING BRAKE (UP)
   *Note: the parking brake holds the aircraft stationary without the use of toe brakes. It can also be used for emergency braking if the toe brakes are inoperative. The parking brake is powered by battery bus No. 2 and system B hydraulics or one brake/JFS accumulator (the brake/Jet Fuel Starter accumulator which is not used for START 1).*

7. Hold the Canopy Control Switch DOWN to close the Canopy (LCTRL+C).
8. Close the Canopy Switch Spider Guard (Left Click)
9. Confirm canopy is closed and locked with the CANOPY light being extinguished.
B – PERFORM AIRCRAFT PRE-START SETUP

PART 4 – START-UP PROCEDURE
10. Set ENGINE FEED Selector – NORM
   This will turn on all fuel pumps, which will also automatically control the aircraft CG (Centre of Gravity).
11. Set AIR SOURCE Selector Knob – NORM
   This will open the engine bleed air valves when engine is spooled up, which sets automatic air temperature control, cockpit pressure regulation, and avionic systems cooling.
12. Verify that throttle is at the OFF detent
   Note: you can use RSHIFT+END to set throttle to OFF.
13. Set JFS (Jet Fuel Starter) switch AFT to START2 (Left Click).
   Note: START1 and START2 refer to the number of compressed air bottles use to start the JFS. Normally, one should be sufficient in cold conditions. However, you may need to use two bottles on hot days or high altitudes to generate enough air pressure to spool up the JFS.
14. When the Jet Fuel Starter reaches IDLE RPM (within 30 seconds):
   a) The JFS RUN green light should illuminate
   b) FLCS RLY (Flight Control System Relay) light should extinguish
   c) FLCS PMG (Permanent Magnet Generator) should illuminate
   d) TO FLCS light should illuminate
15. When JFS (Jet Fuel Starter) is operational, a clutch inside the Accessory Drive Gearbox (ADG) will engage, driving the General Electric F-110 engine through the accessory drive gearbox and PTO (Power Takeoff) shaft. Engine RPM will increase, gradually spooling up to 20-25% RPM.

16. When engine RPM reaches between 20% and 25%, move throttle from OFF position to IDLE position (RSHIFT+HOME). Moving throttle too early may result in an engine hot start.

17. The engine should light-off within 10 seconds. Engine RPM and FTIT (Fan Turbine Inlet Temperature) should increase. Only the RPM and FTIT indicators will function until the standby generator comes online.
PART 4 – START-UP PROCEDURE

C – ENGINE START

18. The SEC caution light goes off at 20% Engine RPM
19. The standby generator becomes operational at approximately 60% RPM. This should extinguish the ENGINE warning light and the STBY GEN light.
20. Five to ten seconds after the standby generator comes online, the main generator comes online (MAIN GEN light extinguishes) and the standby generator goes offline.
21. The JFS should have automatically shut down at approximately 55% RPM. Turn the JFS off if that did not occur.
22. Verify engine parameters stabilize as follows:
   a) HYD/OIL PRESS warning light – Off
   b) Fuel Flow – 700-1700 pph
   c) Oil pressure – 15 psi (minimum)
   d) Nozzle Position – Greater than 94%
   e) Engine RPM – 62-80%
   f) FTIT (Fan Turbine Inlet Temperature) – 650 deg C or less
   g) Hydraulic Pressure (Systems A & B) – 2850-3250 psi
**Very important Note:** Verify that engine is running and **Air Source Selector** knob is set to **NORM** since engine bleed air cooling is required before turning on avionic systems.

23. Set MMC (Modular Mission Computer) Power Switch – ON
24. Set ST STA (Store Stations) Power Switch – ON
25. Set MFD (Multifunction Display) Power Switch – ON
26. Set UFC (Upfront Control) Power Switch – ON
27. Set GPS (Global Positioning System) Receiver Power Switch – ON
28. DL (Datalink) Receiver and MAP switches can be left to OFF since they have no function on the F-16C Block 50.
29. A series of BITs (Built-In Tests) will be performed as avionic systems are powered.
30. Set LEFT HDPT (Left Hardpoint) Power Switch – ON (FWD) if a HTS pod (HARM (High-Speed Anti-Radiation Missile) Targeting System) is equipped on the left chin hardpoint. However, for now it should be left to OFF since the HTS pod is not available yet.

31. Set RIGHT HDPT (Right Hardpoint) Power Switch – ON (FWD) if a targeting pod is equipped on the right chin hardpoint.

32. Set FCR (Fire Control Radar) Power Switch – FCR/ON (FWD). The Fire Control Radar system will then enter a Built-In Test (BIT) that should take a few minutes to complete.
   *Note: While on the ground, radar operation is inhibited.*

33. Set RDR ALT (Radar Altimeter) Power Switch – STBY (MIDDLE).
   *Note: While on the ground, Radar Altimeter functionality is inhibited.*
D – SET UP AVIONICS

34. Set COMM1 UHF and COMM2 VHF Radio Power/Volume knobs – ON (Volume as required)
35. Set COMM1 UHF and COMM2 VHF Radio Mode Switches – SQL (Squelch)
36. Set UHF Backup Radio Function Knob – BOTH (or MAIN, as desired)
37. Scroll HUD (Heads-Up Display) Symbology Intensity Wheel (SYM) to turn on the HUD.
38. Set C&I (CNI, Communication, Navigation aids, and Identification) Switch to UFC (Upfront Control).
   This enables control of primary communications, navigation and identification functions from the
   upfront controls.
E – PERFORM INS (INERTIAL NAVIGATION SYSTEM) ALIGNMENT

• **Note:** You can either use a Normal alignment (takes roughly 8 minutes) or a Stored Heading alignment (takes roughly 2 minutes), which is quicker but accumulates drift error more rapidly.

• NORMAL alignment is done with the EGI Selector set to ALIGN NORM. Aircraft coordinates need to be confirmed. Alignment is done when INS Alignment Status reaches "6".

• STORED HEADING alignment is done with the EGI Selector set to ALIGN STOR HDG. Aircraft coordinates do not need to be confirmed since they are already entered in the system. Alignment is done when INS Alignment Status reaches "10".

39. Set EGI (Embedded GPS/Inertial Navigation System) Selector Switch to ALIGN NORM for Normal Alignment or STOR HDG for Stored Heading Alignment. This will perform the Inertial Navigation System Alignment.
   • A normal alignment will take approximately 8 minutes for a full alignment, while a stored heading alignment will take approximately 2 minutes.

40. The INS (Inertial Navigation System) Alignment Status is available on the DED (Data Entry Display) INS page, which is selected automatically when INS alignment is in progress.

**INS (Inertial Navigation System) Alignment Status**
- **99:** Initialization
- **90:** Valid Altitude data, coarse alignment begins
- **79:** Valid heading data
- **70:** Degraded navigation state, steady RDY displayed on DED, steady ALIGN displayed on HUD (Heads-Up Display)
- **60-20:** Estimated position error compared to fully aligned state
  - **60 = 6.0** times normal
  - **20 = 2.0** times normal
- **10:** INS fully aligned, RDY flashes on DED, ALIGN flashes on HUD
- **6:** INS fully aligned and enhanced to 0.6 times normal precision with GPS data or other techniques
41. Enter and confirm aircraft coordinates used for INS alignment.
   a) **IMPORTANT:** You must either enter or confirm the latitude and longitude coordinates of your aircraft on the INS DED page within two minutes after starting an alignment. Failing to do that within 2 minutes will result in a degraded INS alignment.
   b) Check the aircraft coordinates via the F10 map.
   c) The “*” symbols next to LAT indicate that the LATITUDE field is selected. Confirm that coordinates entered there match the aircraft coordinates. Normally, these coordinates should match and should not need to be corrected.
   d) Press “ENTR” button on the ICP (Integrated Control Panel) to enter/confirm LATITUDE coordinates.
   e) Press the DCS (Data Control Switch, also called “Dobber”) DOWN to select the LNG (LONGITUDE) field.
   f) The “*” symbols next to LNG indicate that the LONGITUDE field is selected. Confirm that coordinates entered there match the aircraft coordinates. Normally, these coordinates should match and should not need to be corrected.
   g) Press “ENTR” button on the ICP (Integrated Control Panel) to enter/confirm LONGITUDE coordinates.
42. **FOR NORMAL ALIGNMENT**: When Alignment Status indication reaches “6 RDY”, INS alignment is complete.

**FOR STORED HEADING ALIGNMENT**: When Alignment Status indication reaches “10 RDY”, INS alignment is complete.

### INS (Inertial Navigation System) Alignment Status

- **99**: Initialization
- **90**: Valid Altitude data, coarse alignment begins
- **79**: Valid heading data
- **70**: Degraded navigation state, steady RDY displayed on DED, steady ALIGN displayed on HUD (Heads-Up Display)
- **60-20**: Estimated position error compared to fully aligned state
  - **60**: 6.0 times normal
  - **20**: 2.0 times normal
- **10**: INS fully aligned, RDY flashes on DED, ALIGN flashes on HUD
- **6**: INS fully aligned and enhanced to 0.6 times normal precision with GPS data or other techniques
43. When INS alignment is complete, set EGI (Embedded GPS/Inertial Navigation System) Selector Switch to NAV (Navigation).
F – SET UP DATALINK

44. Set up LINK-16 Datalink

a) Power up Datalink by setting MIDS LVT (Multifunctional Information Distribution System Low Volume Terminal) switch to ON

b) You can leave the DL (Datalink) Switch to OFF since it is not used on the Block 50 variant of the F-16.

c) On HSD (Horizontal Situation Display) page, select Datalink Transmission Option (XMT) to L16 by toggling the OSB (Option Select Button) next to XMT.

45. (Optional) If desired, consult Datalink page to customize settings

a) Press the LIST button on the ICP (Integrated Control Panel)

b) Select Datalink (DLNK) page by pressing the ENTR (E) button.

c) On the DED (Data Entry Display) Datalink page 1 (P1), you can consult Datalink Network Status and time references.
45. (Optional) If desired, consult Datalink page to customize settings
   d) Press the DCS (Data Control Switch, also called “Dobber”) RIGHT (SEQ) select the DED Datalink page 2 (P2).
   e) On the DED Datalink page 2, you can consult Datalink MIDS Radio Options. Most MIDS settings can be left as is.
   f) If desired, you can modify your MIDS settings by selecting a field with the “Dobber” switch UP or DOWN. “*” symbols will indicate which data field is selected. Then, enter the field value on the ICP keypad, then press “ENTR” button on the ICP to modify the field.
   g) Press the DCS (Data Control Switch, “Dobber”) RIGHT (SEQ) select the DED Datalink page 3 (P3).
   h) On the DED Datalink page 3, you can consult Datalink Flight Management data.
   i) If desired, you can modify your Own ID Number on your flight’s Datalink Network. As an example, you can select the “OWN” field with the “Dobber” switch UP or DOWN. “*” symbols will indicate which data field is selected. Then, enter the field value on the ICP keypad, then press “ENTR” button on the ICP to modify the field. In this example, we are Ship #1, which has a Track Number of 00201.
G – SET UP IFF (IDENTIFY-FRIEND-OR-FOE)

46. To turn on the IFF (Identify-Friend-or-Foe) system, set IFF Master Switch to NORM.
47. To consult your IFF Mode codes, press “IFF” button on the ICP (Integrated Control Panel). This will display the IFF DED (Data Entry Display) page.
48. By default, all IFF transponder/interrogator codes should already be set and do not need to be updated. In the case that IFF codes differ from your default values, as could be listed in a mission briefing, consult the “DATALINK & IFF” section.
H – COMPLETE AIRCRAFT SETUP

49. Uncage SAI (Standby Attitude Director Indicator) by turning the caging knob to the MIDDLE position. Red “OFF” flag should disappear when SAI is uncaged.

50. Set appropriate Fly-By-Wire control mode by setting STORES CONFIG switch as per ordnance loadout:
   - CAT I: Air-to-Air loadouts without external wing tanks
   - CAT III: Air-to-Ground loadouts, or any loadout with external wing tanks

51. Set Oxygen Supply Lever – ON

52. Set Oxygen Emergency Lever – NORMAL

53. Set Oxygen Diluter Lever – NORMAL

54. Confirm that Oxygen Pressure Indicator is in the green range

55. Confirm that Oxygen Flow Indicator blinks, which confirms that oxygen supply to mask is adequate

56. In real life, you would need to request the ground crew to remove the EPU (Emergency Power Unit) Safety Pin, however this is not simulated.
H – COMPLETE AIRCRAFT SETUP

57. Press the Threat Warning Azimuth / Radar Warning Receiver (TWA/RWR) Power Button. The RWR will enter a Built-In Test sequence.
58. Set CMDS RWR (Countermeasure Dispensing System Radar Warning Receiver) Switch – ON (UP)
59. Set CMDS JMR (Countermeasure Dispensing System Jammer) Switch – ON (UP)
60. Note: MWS (Missile Warning System) Switch can be left to OFF (switch is not applicable on Block 50 variant of the F-16)
61. Set CMDS (Countermeasure Dispenser System) CH (Chaff) Switch – ON (UP)
62. Set CMDS (Countermeasure Dispenser System) FL (Flares) Switch – ON (UP)
63. Set Countermeasure Mode Selector to desired release mode. In that case, we will choose SEMI-AUTOMATIC mode. However, MANUAL or AUTOMATIC could also be selected if desired.
64. Set Countermeasure PRGM (Program) Selector to desired Program (i.e. Program 1)

ALR-56M TWA (Threat Warning Azimuth) Indicator
Also known as RWR (Radar Warning Receiver)
H – COMPLETE AIRCRAFT SETUP

65. If you want to use the HMCS (Helmet-Mounted Cueing System), set the HMCS SYMBOLOGY INTENSITY knob to INC.
H – COMPLETE AIRCRAFT SETUP

66. Load the Data Transfer Cartridge (DTC) data via the DTE (Data Transfer Equipment) page.
   a) (Not Simulated Yet) Verify that DTC is inserted
   b) (Not Simulated Yet) Press OSB (Option Select Button) next to “DTE” to select the DTE (Data Transfer Equipment) page
   c) (Not Simulated Yet) Press OSB next to “LOAD” to load data saved in the DTC (includes IFF codes, Datalink settings, Weapon Profiles, Countermeasure Programs, Inventory Data, Communication Preset Frequencies, Navigation Flight Plan, etc.)
67. Clear avionic faults on the TEST page.
   a) (Not Simulated Yet) Press OSB (Option Select Button) next to “TEST” to select the Test page
   b) (Not Simulated Yet) Press OSB next to “CLR” to clear any faults listed in the MFL (Malfunction Fault List)
I – PERFORM AIRCRAFT POST-START CHECKS

Note: The entirety of the post-start checks are optional and can be skipped. Normally, these checks are performed after the engine start, but for simplicity we will leave the post-start checks at the end of the Start-Up Procedure section.

68. (Optional) Verify Pitot Probe Heater system operation
   a) Set PROBE HEAT switch to PROBE HEAT position.
   b) Verify PROBE HEAT caution light is OFF. Illumination means one or more probe heaters are inoperative.
   c) Set PROBE HEAT switch to TEST position.
   d) Verify PROBE HEAT caution flashes 3 to 5 times per second.
   e) Return PROBE HEAT switch to OFF position. Leaving it to ON while on the ground could risk overheating the probe; we will set it on 2 minutes prior to takeoff.

69. (Optional) Verify Fire & Overheat Detection system operation
   a) Press and hold the FIRE & OHEAT DETECT button
   b) While button is pressed, verify that the ENG FIRE warning light and the OVERHEAT caution light are illuminated
   c) Release the FIRE & OHEAT DETECT button
70. (Optional) Verify Malfunction & Indicator Lights system operation
   a) Press and hold the MAL & IND LTS button
   b) Verify all cockpit warning, caution & indicator lights illuminate when button is pressed
   c) Confirm VMS (Voice Message System) audio alerts are audible ("PULLUP", "ALTITUDE", "WARNING", "JAMMER", "COUNTER", "CHAFF FLARE", "LOW", "ALT", "LOCK", "CAUTION", "BINGO", "DATA", "IFF"). A brief Landing Gear warning horn should be heard prior to the "WARNING" and "CAUTION" words.
   d) Release the MAL & IND LTS button
71. (Optional) Verify SEC (Secondary Engine Control) system operation. This mode is selected in the case of failure of the engine-mounted digital computer that controls fuel flow scheduling.
   a) Take note of the initial engine RPM and Nozzle position in PRI (Primary) engine control mode
   b) Raise ENG CONT (Engine Control) switch Guard, then set switch to SEC (Secondary)
   c) Verify the SEC caution light illuminates and engine RPM is stabilized. RPM may drop up to 10% from PRI (Primary engine operation) value before stabilizing. Stabilized SEC IDLE RPM may be up to 5% lower than in PRI (Primary) IDLE.
   d) Hold wheel brake pedals. The parking brake switch automatically disengages if engine RPM is greater than 85%.
   e) Slowly advance throttle towards MIL (Military) Power detent and wait for engine RPM to increase to 85%.
   f) When at 85% RPM, snap throttle back to IDLE and check for normal indications and smooth operation. Nozzle should be 5% or less within 30 seconds after selecting SEC.
   g) Set ENG CONT (Engine Control) switch back to PRI (Primary) and lower switch guard.
   h) Check that the SEC caution light extinguishes and nozzle position returns to greater than 94%.
I – PERFORM AIRCRAFT POST-START CHECKS

72. (Optional) Verify FLCS (Flight Control System) operation

   a) Cycle all your flight controls with the stick and rudder pedal input. Maximum stick inputs warm hydraulic fluid and removes air bubbles, making a test failure less likely.
   b) Set FLCS BIT (Flight Control System Built-In Test) Switch – BIT
   c) RUN light on the Flight Control Panel illuminates for the duration of the test.
   d) Approximately 45 seconds later, the RUN light extinguishes if the completion of the FLCS BIT is successful.
   e) The FLCS BIT switch will automatically spring back to OFF. The FAIL light and FLCS warning light should remain off.
I – PERFORM AIRCRAFT POST-START CHECKS

73. (Optional) Verify Fuel Quantity Indicating system operation
   a) Set FUEL QUANTITY knob to TEST
   b) On fuel quantity indicator, verify that FR and AL pointers indicate 2000 (+/- 100) lbs.
   c) On fuel quantity indicator, verify that Fuel Totalizer indicates 6000 (+/- 100) lbs.
   d) Verify that FWD FUEL LOW and AFT FUEL LOW caution lights illuminate.
   e) Cycle FUEL QUANTITY knob to other positions and verify that quantity readouts in all other positions match the aircraft’s actual fuel load.
   f) Set FUEL QUANTITY knob to NORM.

74. (Optional) Verify DBU (Digital Backup Software) system operation.
   The DBU is used if problems arise with the primary Flight Control System (FLCS) software.
   a) Set DIGITAL BACKUP switch to BACKUP
   b) Verify that DBU ON warning light illuminates.
   c) Operate flight controls with the stick and rudder and confirm that all control surfaces respond normally.
   d) Set DIGITAL BACKUP switch to OFF.
   e) Verify that DBU ON warning light extinguishes.
I – PERFORM AIRCRAFT POST-START CHECKS

75. (Optional) Verify Trim system operation
   a) Set TRIM/AP DISC (Trim/Autopilot Disconnect) switch to DISC
   b) Use your trim hat on the stick to trim in both pitch and roll axis.
   c) Verify that there is no control surface motion and no movement on the TRIM wheel or indicators.
   d) Set TRIM/AP DISC (Trim/Autopilot Disconnect) switch to NORM
   e) Use your trim hat on the stick to trim in both pitch and roll axis.
   f) Verify that there is control surface motion and movement on the TRIM wheel or indicators.
   g) Center trim for pitch and roll, then use YAW TRIM knob to check and center trim for yaw.

76. (Optional) Verify MPO (Manual Pitch Override) system operation
   a) Push the stick full forward and hold it in that position. Horizontal tail should deflect down.
   b) Set and hold MPO (Manual Pitch Override) switch to OVRD position.
   c) Verify that horizontal tail trailing edges move farther down.
   d) Release stick and MPO switch (it will spring back to NORM).
   e) Confirm that horizontal tail returns to its original position.
I – PERFORM AIRCRAFT POST-START CHECKS

77. (Optional) Verify EPU (Emergency Power Unit) system operation. This test will verify that the EPU can provide electrical power in case of an engine failure, and it also tests the EPU generator and EPU PMG (Permanent Magnet Generator) output to FLCS on the ground without using hydrazine.
   a) Check EPU Fuel (Hydrazine) Quantity reads between 95 and 102 %
   b) Set OXYGEN switch to 100 %
   c) Hold down wheel brakes and increase engine RPM 10 % above normal IDLE power
   d) Set EPU/GEN TEST (Emergency Power Unit/Generator) switch to EPU/GEN and hold it in position.
   e) Verify that EPU AIR light illuminates
   f) Verify EPU RUN light illuminates for a minimum of 5 seconds
   g) Verify EPU GEN (Generator) light remains extinguished (may come on momentarily at the start of the test)
   h) Verify EPU PMG (Permanent Magnet Generator) light remains extinguished (may come on momentarily at the start of the test)
   i) Verify FLCS PWR (Flight Control System Power) lights illuminate
   j) Release EPU/GEN TEST switch – OFF
   k) Return throttle to IDLE
   l) Set OXYGEN back to NORMAL
1. Verify that Parking Brake / Anti-Skid Switch is DISENGAGED (ANTI-SKID).
   Note: The parking brake automatically disengages if engine RPM is greater than 85% (which you reached when performing the engine run-up checks) or if the switch is manually set to the ANTI-SKID (Middle) position.
2. Turn on Taxi Light (DOWN)
3. Press the NWS A/R DISC & MSL STEP Button (Nosewheel Steering, Air Refueling Disconnect & Missile Step) on the stick to engage nosewheel steering for taxiing; this will allow you to turn using rudder pedals. The “NWS” Status light indicates nosewheel steering is active.
4. **Set Formation, Anti-Collision & Position Lights – As Required.**
   a) Set Anti-Collision Switch – 1 (or any other flash pattern setting)
   b) Set Position Lights Switch – FLASH (when parked or during taxi)
   c) Set Wing/Tail Position Lights Switch – BRT (Bright)
   d) Set Fuselage Position Lights Switch – BRT (Bright)
   e) Set Formation Lights Brightness Control Knob – BRT (Bright)
   f) Set Master Lights Switch – NORM (sets pattern with visible strobes) for day operations

5. Throttle up slightly above IDLE to start taxiing.
6. Perform taxi turns at 10 kts or less.
7. Taxi speed is generally kept below 25 kts.
PART 5 – TAXI & TAKEOFF

TAKEOFF

1. Line up on the runway
2. Turn OFF taxi light (MIDDLE).
3. Set Position Lights Switch - STEADY
4. Set Probe Heat switch – PROBE HEAT
5. Verify Nosewheel Steering is engaged
6. Check that Speed Brakes are CLOSED (Retracted)
7. Check the Status panel and confirm that correct Flight Control System mode is selected
   - CAT I for air-to-air loadouts
   - CAT III for air-to-ground/heavy loadouts
8. Set RADAR ALTIMETER switch to ON (FWD)
PART 5 – TAXI & TAKEOFF

9. Hold wheel brakes
10. Throttle up to 90 % RPM
11. Confirm that engine spools up correctly
   a) HYD/OIL PRESS warning light is OFF
   b) Oil pressure is between 25 and 65 psi
   c) FTIT (Fan Turbine Inlet Temperature) is 935 deg C or less
   d) Hydraulic Pressure for systems A & B is between 2850 and 3250 psi
12. Throttle up to either MIL (Military) Power if using a light load or Full Afterburner if using heavy loads or using a short runway.
13. Release wheel brakes
14. When reaching 70 kts, press the NWS A/R DISC & MSL STEP Button on the stick to disengage nosewheel steering. Confirm that NWS indication extinguishes.

15. Your takeoff speed is a function of your aircraft weight, which can be obtained from the ground crew when choosing your loadout.
   - In our case, we have a takeoff weight of approx. 34,000 lbs
   - Using the Takeoff Speed table, we can determine that our takeoff speed for 34,000 lbs is approx. 173 kts

16. Gently pull back on the stick and establish a takeoff attitude (8-12 degrees of pitch).
   - When using MIL power, pull back on the stick at approx. 10 kts below the takeoff speed (163 kts in our case)
   - When using afterburner, pull back on the stick at approx. 15 kts below the takeoff speed (158 kts)

<table>
<thead>
<tr>
<th>Aircraft Weight (lbs)</th>
<th>Takeoff Speed (kias)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20000</td>
<td>128</td>
</tr>
<tr>
<td>24000</td>
<td>142</td>
</tr>
<tr>
<td>28000</td>
<td>156</td>
</tr>
<tr>
<td>32000</td>
<td>168</td>
</tr>
<tr>
<td>36000</td>
<td>178</td>
</tr>
<tr>
<td>40000</td>
<td>188</td>
</tr>
<tr>
<td>44000</td>
<td>198</td>
</tr>
</tbody>
</table>
17. Ensure a positive rate of climb, and then raise the landing gear.

- Trailing edge flaps retract at the same time as the landing gear and may cause the aircraft to settle and scrape the runway when lift is lost.
- Make sure the landing gear is retracted before reaching 300 kts, since higher airs speeds may cause structural damage to the landing gear doors.
1. Initial Approach  
2. Overhead Break  
3. Downwind Leg  
4. Base Turn  
5. Final Turn  
6. Short Final  
7. Roll-Out
1. **Initial Approach**
   a) Set RADAR ALTIMETER switch to ON (FWD)
   b) Align your aircraft with the landing runway at 1500 ft above ground level and maintain 300 kts
2. **Overhead Break**
   a) Break left or right over the desired touchdown point
   b) Set throttle to 80 % RPM
   c) Deploy Speedbrakes
   d) Fly the break at about 70 deg of bank, pulling approx. 3 to 4 Gs.
   e) Align the HUD (Heads-Up Display) Flight Path Marker with the Horizon Line to maintain a level turn
3. Downwind Leg
   a) Roll out on the downwind leg opposite the landing heading at about 200-220 kts and 1500 ft AGL
   b) Extend landing gear
   c) Turn on LANDING light (UP).
   d) Reduce speed as required to prevent excessive airspeed buildup in the base turn
   e) Trim to an angle of attack (AOA) of 11 deg. Angle of Attack can be monitored with the three following indications:
      - The AOA Indicator
      - The AOA Indexer
      - The HUD (Heads-Up Display) AOA Bracket (with Flight Path Marker)
LANDING

4. **Base Turn**
   a) Initiate base turn when abeam the rollout point. You may estimate this position by starting the turn when your wingtip is at the end of the runway.
   b) Lower the nose to 8-10 deg of pitch and fly the turn at 11 deg AOA

5. **Final Turn**
   a) Use throttle to control airspeed while using the stick to maintain a pitch of 8-10 deg nose low and 11 deg AOA through the turn
   b) Roll out on final and raise the nose to maintain proper glide path (300 ft AGL, 1 nm from the touchdown point)
   c) Align the HUD Flight Path Marker and the 2.5 deg pitch ladder lines with the runway threshold to ensure proper glidepath while maintaining 11 deg AOA
LANDING

6. Short Final
   a) When flying over the “overrun” (portion of the runway before the primary surface starts), shift the Flight Path Marker forward to a point 300-500 ft down the runway.
   b) Gently pull back on the stick to flare and reduce the descent rate. DO NOT level off!
   c) Pull the throttle back to IDLE and touchdown with a maximum AOA of 13 deg (green circle). More than 15 deg AOA during the landing roll-out may cause the speedbrakes or engine nozzle to smash the runway.
7. **Roll-Out**

a) Maintain 13 deg nose-up attitude for a two-point aerodynamic braking until your airspeed has reduced to approx. 100 kts. This step is **very important** since the F-16's brakes are not very effective.
b) Reduce back stick pressure and lower the nosewheel to the runway.
c) Open speedbrakes fully and maintain full aft stick for maximum braking effectiveness.
d) Apply moderate to heavy braking to slow the aircraft.
e) Engage nosewheel steering when below 30 kts and taxi off the runway.
The F-16C modelled in DCS is powered by the General Electric F110-GE-129 afterburning turbofan engine. The F110 powers more than 70% of today’s most advanced USAF F-16C/D aircraft. Derivatives of the F110 also powered the F-14B and the South Korean F-15K.

Initially, the F-16 entered service powered by the Pratt & Whitney F100. Seeking a way to drive unit costs down, the USAF implemented the Alternative Fighter Engine (AFE) program in 1984, under which the engine contract would be awarded through competition.

Initial orders were for the F110-GE-100 rated at 28,000 lbf (125 kN). Later versions of the F110 include the F110-GE-129 delivering 29,000 lbf (129 kN) thrust.
The twin-spool F110 turbofan assembly has a 3-stage fan, 9 high-pressure compressor stages, a single high-pressure turbine stage and 2 low-pressure turbine stages. The engine is equipped with an annular combustion chamber and an augmentor (afterburner). The pressure ratio at maximum power is 30.7, while the Thrust-to-Weight Ratio is 7.29.

Take note that the F-16 is not equipped with any auto-throttle system.
**ENGINE INSTRUMENTS & PARAMETERS**

**HYD/OIL PRESS Light**
- Low Oil Pressure: Illuminates when oil pressure has been below approximately 10 psi for 30 sec. Extinguishes when oil pressure exceeds 20 psi approx.
- Low Hydraulic Pressure: Illuminates when hydraulic pressure for either system A or B decreases below 1000 psi.

**ENGINE Light**
RPM and FTIT indicator signals indicate that an engine overtemperature or flameout has occurred. Illuminates when the RPM decreases below IDLE, or approximately 2 seconds after FTIT indication exceeds 1100 °C.

**ENGINE FAULT Caution**

**SEC Caution**

**Fuel/Oil Hot Caution**

**EEC Caution**

**ENG FIRE Light**
Engine fire detected

**FTIT (Fan Turbine Inlet Temperature) Indicator (x100 deg C)**

**Fuel Flow Indicator** (lbs/hour)

**Engine Oil Pressure Indicator (psi)**

**Engine Nozzle Position Indicator (% Open)**

**Engine RPM Indicator (% RPM)**
# ENGINE LIMITS

## ENGINE LIMITS (ON GROUND)

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>FTIT (Fan Turbine Inlet Temperature) (deg C)</th>
<th>RPM (%)</th>
<th>Oil Pressure (psi)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine Start</td>
<td>935</td>
<td>-</td>
<td>-</td>
<td>During cold start, oil pressure may be 100 psi for up to 2 minutes</td>
</tr>
<tr>
<td>Idle</td>
<td>650</td>
<td>-</td>
<td>15 (minimum)</td>
<td>-</td>
</tr>
<tr>
<td>MIL/AB (Military/Afterburner)</td>
<td>980</td>
<td>108</td>
<td>25-65</td>
<td>At MIL power and above, oil pressure must increase 10 PSI minimum above IDLE oil pressure</td>
</tr>
<tr>
<td>Transient</td>
<td>980</td>
<td>109</td>
<td>25-65</td>
<td>-</td>
</tr>
<tr>
<td>Fluctuation</td>
<td>+/- 10</td>
<td>+/- 1</td>
<td>+/- 5</td>
<td>Must remain within steady-state limits. Nozzle fluctuations limited to +/- 2 %</td>
</tr>
</tbody>
</table>

## ENGINE LIMITS (IN FLIGHT)

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>FTIT (Fan Turbine Inlet Temperature) (deg C)</th>
<th>RPM (%)</th>
<th>Oil Pressure (psi)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine Start</td>
<td>935</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Idle</td>
<td>-</td>
<td>-</td>
<td>15 (minimum)</td>
<td>-</td>
</tr>
<tr>
<td>MIL/AB (Military/Afterburner)</td>
<td>980</td>
<td>108</td>
<td>25-65</td>
<td>Oil pressure must increase as RPM increases</td>
</tr>
<tr>
<td>Transient</td>
<td>980</td>
<td>109</td>
<td>25-65</td>
<td>-</td>
</tr>
<tr>
<td>Fluctuation</td>
<td>+/- 10</td>
<td>+/- 1</td>
<td>+/- 5</td>
<td>Must remain within steady-state limits. Zero oil pressure is allowable for periods up to 1 minute during flight at less than +1 G.</td>
</tr>
</tbody>
</table>
There are two main engine modes, which are controlled by the Engine Control (ENG CONT) switch:

- **PRI (Primary):** Primary Mode provides unrestricted engine operation throughout the entire flight envelope.

- **SEC (Secondary Engine Control):** Secondary Mode provides 70 to 80% of normal MIL thrust. This mode may be set manually with the ENG CONT switch or automatically in case of certain failures being detected by the DEEC (Digital Electronic Engine Control). This level provides a measure of protection against exceeding engine operating limits and provides sufficient thrust for safe flight operations. This mode also closes exhaust nozzle and inhibits afterburner operation.

Note: the MAX POWER Switch (also known as "V_{max} Switch") is not functional on the F110-GE-129 engine installed on our airplane. In certain Pratt & Whitney engines, this function is available and was mainly used as a "Hail Mary switch" to get away as fast as possible. This mode could destroy the engine in a matter of minutes, which is why it was mainly safetied off or completely disconnected/inhibited from the engine altogether.
The afterburner is engaged by throttling past the MIL (Military) Power gate on the throttle quadrant.

The geometry of the throttle quadrant means that depending on the position on the throttle on the quadrant, the orientation/angle of the throttle must be varied to access certain power detents. To push the throttle past the MIL Power Detent, the throttle needs to be angled to allow the throttle stripe past the detent. Within DCS, this is done automatically for you as you throttle up.
There is no “afterburner” indication in the cockpit, but you can monitor the fuel flow indication and the Nozzle Position indications. Keep in mind that the fuel flow consumption will increase dramatically; keep an eye on those fuel gauges.
The EPU is a hydrazine-powered, self-contained unit that can provide emergency hydraulic and electrical power for flight control systems, when bleed air alone is not enough. The EPU has enough fuel to run for about 10 to 15 minutes.

You would most often use this if you lose your engine, and the EPU would provide power to the hydraulic and electrical systems, allowing you to keep flying the aircraft since the flight control systems are not mechanically linked to the stick.

The main requirements for the EPU are that it should be simple, maintenance free, supply power immediately and consistently for the required time. Use of Hydrazine assures this while requiring careful handling, but it is very toxic and inflammable.

**Important note:** the EPU has a safety pin set on the ground, which needs to be removed by the ground crew prior to the flight. This safety pin is not modelled yet in DCS.

Here is an interesting video on the EPU: [https://youtu.be/o8SdArJGWt8](https://youtu.be/o8SdArJGWt8)
There are three main operating modes for the EPU, which are controlled by the EPU Switch. During normal operation, you should leave the EPU switch to NORM.

- **NORM:**
  - When in NORM mode, EPU system is armed for automatic operation (except during engine shutdown on the ground).
  - If an engine flameout is detected, the EPU will automatically run.
  - With the Weight-On-Wheels and throttle in OFF, the EPU will not activate when the main and standby generators go offline.

- **ON:**
  - When ON, the EPU is commanded to run regardless of failure conditions.

- **OFF:**
  - When on ground, prevents or terminates EPU operation.
  - When in flight and switch has remained OFF since takeoff, EPU operation is terminated or inhibited (except when main and standby generator failure is detected).
  - OFF will not prevent or terminate EPU operation in flight for main and standby generator failures if switch was cycled or placed to NORM any time since takeoff.

**EPU RUN Light**
- Illuminates when the EPU turbine runs within the proper range and the EPU hydraulic pressure is above 2000 psi

**EPU HYDRAZN (Hydrazine) Light**
- Illuminates when the EPU is commanding hydrazine for operation (whether hydrazine is available or not) or if a primary speed control failure has occurred.

**EPU Air Light**
- Illuminates whenever the EPU has been commanded to run with the EPU safety pin removed. It remains on even when the EPU is augmented by hydrazine.
A windmilling start is used when enough altitude and airspeed is available. Otherwise, a JFS (Jet Fuel Starter)-assisted start is required.

**ENGINE RELIGHT PROCEDURE**

**WINDMILLING RELIGHT**

1. When engine flameout occurs, the EPU (Emergency Power Unit) will automatically activate (provided the EPU switch is set to NORM) to provide you electrical and hydraulic power for the flight control system. The EPU will be running until it runs out of fuel/hydrazine (about 10 minutes).
2. Verify ENGINE FEED Selector is set to NORM
3. Throttle back to IDLE, then set throttle to CUTOFF (RSHIFT+END).
4. Immediately nose down to gain enough airspeed for the engine’s compressor blades to generate enough RPM due to windmilling (air flow drives compressor blades). Ensure you have enough airspeed to maintain a windmilling engine RPM above 20-25 %.
5. When engine RPM is windmilling above 20-25 %, move throttle from OFF position to IDLE position (RSHIFT+HOME).
6. Confirm engine RPM and FTIT increase
7. When engine RPM increases above 60 %, throttle up and resume normal operation.
**ENGINE RELIGHT PROCEDURE**

**JFS-ASSISTED RELIGHT**

1. When engine flameout occurs, the EPU (Emergency Power Unit) will automatically activate (provided the EPU switch is set to NORM) to provide you electrical and hydraulic power for the flight control system. The EPU will be running until it runs out of fuel/hydrazine (about 10 minutes).
2. Verify ENGINE FEED Selector is set to NORM.
3. Throttle back to IDLE, then set throttle to CUTOFF (RSHIFT+END).
4. Set aircraft flight parameters within JFS (Jet Fuel Starter) operation envelope:
   - Altitude should be below 20000 ft, airspeed should be below 400 kts
5. Set JFS (Jet Fuel Starter) switch AFT to START2 (Left Click).
6. When the Jet Fuel Starter reaches IDLE RPM (within 30 seconds), the JFS RUN green light should illuminate.
7. When JFS is operational, the Jet Fuel Starter accumulators will drive the hydraulic starter motor to start the engine. Engine RPM will increase.
8. When engine RPM reaches 20 %, move throttle from OFF position to IDLE position (RSHIFT+HOME).
9. The engine should light-off within 10 seconds. Engine RPM and FTIT (Fan Turbine Inlet Temperature) should increase.
10. When engine RPM increases above 60 %, throttle up and resume normal operation.

*Note: A windmilling start is used when enough altitude and airspeed is available. Otherwise, a JFS (Jet Fuel Starter)-assisted start is required.*
FUEL SYSTEM

The F-16 is equipped with 6 internal tanks (left wing, right wing, aft fuselage, aft fuselage reservoir, forward fuselage, forward fuselage reservoir). External fuel tanks can be equipped under the fuselage (300 Gal) and under the wings (370 Gal). Total fuel quantity is displayed on the fuel indicator. The Fuel Quantity Selector knob is used to choose what fuel quantity you wish you display.
**Fuel Quantity Selector Knob**
- **TEST**: places both pointers at 2000 lbs, and totalizer should display 6000 lbs
- **NORM**: AL pointer indicates remaining fuel in the aft left reservoir and the A-1 fuselage tank, and the FR pointer indicates the sum fuel in the forward right reservoir tank and the F-1 and F-2 fuselage tanks.
- **RSVR**: moves the AF and FR pointers to display fuel in the aft and forward reservoir tanks
- **INT WING**: Indicates quantity for interior left and right wing-mounted external fuel tanks
- **EXT WING**: Indicates quantity for exterior left and right wing-mounted external fuel tanks
- **EXT CTR**: Indicates quantity for exterior fuselage-mounted center tank

*Note: indicates center fuel tank load when Selector Knob set to EXT CTR*

**External Fuel Transfer Switch**
- **NORM**: allows external centerline tank to empty first
- **Wing First**: allows the external wing tanks to empty first.

**Fuel Quantity Indicator (x100 lbs)**

**A/L (Aft & Left) Pointer**

**F/R (Front & Right) Pointer**

**Total Fuel Quantity Indicator (lbs)**
FUEL SYSTEM

Fuel Quantity Indicator (x100 lbs)
A/L (Aft & Left) Pointer
F/R (Front & Right) Pointer
Note: indicates center fuel tank load when Selector Knob set to EXT CTR
Total Fuel Quantity Indicator (lbs)

PART 7 – ENGINE & FUEL MANAGEMENT

External Wing Tank

Left Wing Tank
Right Wing Tank

F1 Fwd Fuselage Tank
F2 Fwd Fuselage Tank
Air Receptacle

Fuel Reservoir

Fwd Reservoir
Aft Reservoir Tank
A1 Aft Fuselage Tank

Main Fuel Shutoff Valve
Fuel Flow Transmitter

Forward & Right Fuel System
Aft & Left Fuel System
Fuel Transfer on Aft & Left system
Fuel Transfer on Fwd & Right system
Inbound transfer from Air Receptacle and Ground Receptacle
To Engine
**Fuel Master Switch**
Guarded in MASTER position. When placed in OFF the fuel shutoff valve is closed, preventing fuel from reaching the engine.

**Tank Inerting Switch**
Reduces internal tank pressurisation when ON. This will pump non-volatile Halon 1301 gas into the fuel tanks to reduce internal pressure and reduce risk for fire during an emergency... like battle damage.

**Air Refueling Door Control Switch**
Open / Close
Also sets flight control gains to takeoff & landing mode

**Engine Feed Selector Switch**
Controls the way the fuel is pumped to the engine. Note that the fuel goes to the engine by gravity feed, so the engine will not starve when the fuel pumps are OFF. Use of the pumps prevents fuel starvation during negative G maneuvers and allows manual fuel balance whenever necessary.
- OFF - all fuel pumps are off.
- NORM - all pumps are on, the CG (Centre of Gravity) is maintained automatically.
- AFT - aft pumps are on. Fuel is transferred from the AFT tank to the engine. The CG moves forward.
- FWD – forward pumps are on. Fuel is transferred from the FWD tank to the engine. CG moves back.
BINGO FUEL

BINGO fuel is the amount of fuel that once reached triggers an immediate return to home plate (home base). It takes into account the fuel needed to fly the return leg of the flight, the fuel required to fly the briefed approach, the fuel to go to the alternate (if necessary) and the emergency fuel which is not supposed to be used except in an emergency.

JOKER fuel is usually set above BINGO as a warning that the bingo is approaching. We usually set it 1000 lbs above Bingo to allow 1 minute of combat time in afterburner.

Your “BINGO FUEL” can be set by:
1. Pressing the LIST button
2. Pressing “2” on the ICP (Integrated Control Panel) to select BNGO (Bingo Fuel) DED Page.
3. Entering the desired BINGO FUEL value via the ICP keypad, then pressing ENTR.
4. Setting the FUEL QTY SEL knob to NORM to ensure BINGO fuel warning computation is based on fuselage fuel.
5. When fuel state falls below BINGO fuel limit, a FUEL caution will appear in the HUD and the VMS (Voice Message System) will give a “BINGO, BINGO” aural cue.
### FLIGHT PLAN BINGO FUEL CALCULATION

<table>
<thead>
<tr>
<th>FLIGHT PLAN BINGO FUEL CALCULATION</th>
<th>EXAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. FUEL FOR LANDING</strong></td>
<td>lbs</td>
</tr>
<tr>
<td>800</td>
<td>800</td>
</tr>
<tr>
<td><strong>2. FUEL FOR GO-AROUND</strong></td>
<td>+</td>
</tr>
<tr>
<td><strong>Conditions at Homeplate:</strong></td>
<td></td>
</tr>
<tr>
<td>A. VFR (Good Weather)</td>
<td>400</td>
</tr>
<tr>
<td>B. IFR (Bad Weather)</td>
<td>800</td>
</tr>
<tr>
<td><strong>3. FUEL FOR GO-TO ALTERNATE</strong></td>
<td>+</td>
</tr>
<tr>
<td><strong>Distance from Homeplate to Alternate</strong></td>
<td>(Distance in nm) x 10</td>
</tr>
<tr>
<td><strong>4. FUEL FOR EGRESS</strong></td>
<td>+</td>
</tr>
<tr>
<td><strong>Route from Target to Homeplate</strong></td>
<td></td>
</tr>
<tr>
<td>A. Medium Altitude (x15)</td>
<td>(Distance in nm) x 15</td>
</tr>
<tr>
<td>B. Low Altitude (x20)</td>
<td>(Distance in nm) x 20</td>
</tr>
<tr>
<td><strong>BINGO =</strong></td>
<td>..........</td>
</tr>
<tr>
<td><strong>5. FUEL BUFFER</strong></td>
<td>1000</td>
</tr>
<tr>
<td><strong>JOKER =</strong></td>
<td>..........</td>
</tr>
</tbody>
</table>
AERODYNAMICS & AIRCRAFT LIMITS

AIRSPEED LIMITS

- Maximum Airspeed ($V_{NE}$): 800 kts at sea level or Mach 2.05 above 30000 ft
- Canopy Open or in Transit: 70 kts (includes ground wind velocity)
- Landing Gear Extended or In Transit: 300 kts / Mach 0.65 (whichever is less)
- Air Refueling Door Opening/Closing: 400 kts / Mach 0.85 (whichever is less)
- Air Refueling Door Open: 400 kts / Mach 0.95 (whichever is less)
- Flight in Severe Turbulence (+3 G): 500 kts
- Crosswind limit: 25 kts

G LIMITS

- Structural Limits for the aircraft are +9 G / - 3 G.
- Takeoff & Landing:
  - +4 G / 0 G for symmetric loadout
  - +2.0 G / 0 G for asymmetric loadout
- Landing Gear Retraction & Extension:
  - +4 G / 0 G for symmetric loadout
  - +2.0 G / 0 G for asymmetric loadout
  - If landing gear handle is raised near 2 Gs approaching 300 kts, actuator power may be insufficient to completely retract the landing gear until G load factor is reduced
- Negative G limits (with both reservoir tanks full)
  - Afterburner thrust: 10 seconds
  - MIL (Military) Power thrust or below: 30 seconds

WEIGHT LIMITS

Maximum Takeoff Weight: 48,000 lbs

FLIGHT ENVELOPE

Service Ceiling: 59000+ ft
The Altitude-LOW (ALOW) page allows you (no pun intended) to set low altitude advisory settings. Here is a quick summary of how the system works.

1. Make sure CNI (Communication, Navigation & Identification) DED page is displayed, which can be selected by pressing Dobber Switch LEFT (RTN).
2. RDR ALT (Radar Altimeter) switch should be set to ON (FWD) for the ALOW system to be active.
3. Select ALOW page by pressing ALOW (2) button on the ICP (Integrated Control Panel).
4. Altitude restrictions can be on the steerpoint of your choice, which can be selected with the DED Increment/Decrement Switch.
5. CARA ALOW (Combined Altitude Radar Altimeter – Altitude Low) is used as a warning setting for low altitude flying. When below this altitude setting, the “AL” notation flashes and VMS (Voice Message System) gives an aural “ALTITUDE” call.
6. MSL FLOOR is your Minimum Safe Level Floor, and is used as a warning setting for approaches. A MSL FLOOR of 18,000 ft is generally used as a reminder when flying below Transition Altitude, which is the altitude below which the pilot needs the switch to local barometric pressure setting (QNH) for the altimeter calibration setup. The MSL FLOOR can be set at any altitude of your choice, and descending below this altitude will trigger a VMS (Voice Message System) aural “ALTITUDE” call.
7. CARA ALOW or MSL FLOOR settings can be modified by selecting their data field with the Dobber Switch UP/DOWN (asterisks indicate which field is selected), then entering the desired value on the ICP keypad, then pressing ENTR button.
ALOW (ALTITUDE-LOW) ADVISORY SYSTEM

Pull Up Cues (X)

CARA ALOW (Altitude Low) Height (ft)
The VMS (Voice Message System), also nicknamed “Bitching Betty”, provides aural warning messages. The system is controlled with the VOICE MESSAGE switch.

Note: Setting the VOICE MESSAGE switch to INHIBIT (AFT) will mute all voice messages.

### Voice Message System (VMS) Warnings

<table>
<thead>
<tr>
<th>WARNING MESSAGE</th>
<th>PRIORITY SEQUENCE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PULLUP</td>
<td>1</td>
<td>Ground proximity warning is activated.</td>
</tr>
<tr>
<td>ALTITUDE</td>
<td>2</td>
<td>Descent is occurring after takeoff, or radar altitude is below entered radar ALOW value, or Barometric altitude is below the entered MSL ALOW value.</td>
</tr>
<tr>
<td>WARNING</td>
<td>3</td>
<td>Any glareshield-mounted warning light is illuminated.</td>
</tr>
<tr>
<td>JAMMER</td>
<td>4</td>
<td>Advises that a threat should be jammed and pilot consent is required.</td>
</tr>
<tr>
<td>COUNTER</td>
<td>5</td>
<td>Advises that a dispense command should be initiated (CMDS semi-automatic mode only).</td>
</tr>
<tr>
<td>CHAFF-FLARE</td>
<td>6</td>
<td>CMDS has initiated a dispense program.</td>
</tr>
<tr>
<td>LOW</td>
<td>7</td>
<td>Advises that expendable (countermeasure) low quantity exists.</td>
</tr>
<tr>
<td>OUT</td>
<td>8</td>
<td>Advises that expendable (countermeasure) type is completely spent.</td>
</tr>
<tr>
<td>LOCK</td>
<td>9</td>
<td>Radar has locked on to target.</td>
</tr>
<tr>
<td>CAUTION</td>
<td>10</td>
<td>Any light on the caution light panel is illuminated (except IFF caution light).</td>
</tr>
<tr>
<td>BINGO</td>
<td>11</td>
<td>Bingo fuel warning has been activated.</td>
</tr>
<tr>
<td>DATA</td>
<td>12</td>
<td>Not simulated.</td>
</tr>
<tr>
<td>IFF</td>
<td>13</td>
<td>Identify-Friend-or-Foe system is not operable in flight (message heard during ground test).</td>
</tr>
</tbody>
</table>
HOTAS

SSC (SIDE STICK CONTROLLER) CONTROLS

**Weapon Release Button**

**Trim Hat Switch**
- UP/DOWN/LEFT/RIGHT

**DMS (Display Management Switch)**
- UP/DOWN/LEFT/RIGHT

**TMS (Target Management Switch)**
- UP/DOWN/LEFT/RIGHT

**Camera/Gun Trigger (Two Stages)**

**Paddle Switch**
- Overrides Autopilot when depressed

**CMS (Countermeasures Switch)**
- FWD/AFT/LEFT/RIGHT

**Expand/FOV (Field-of-View) Button**
- Cycles through available field-of-view for the sensor of system that is currently selected

**NWS A/R DISC & MSL STEP Button**
- NWS: Nosewheel Steering Activation
- A/R: When in flight and the AIR REFUEL switch in the OPEN position, depressing the button disconnects boom latching
- MSL (MISSILE) STEP: When in flight, depressing the button in EO or A-A mode selects the next weapon station. Depressing the button in A-G Mode cycles between CCRP, CCIP and DTOS.
HOTAS
SSC (SIDE STICK CONTROLLER) CONTROLS

Display Management Switch (DMS). The DMS is used to control Sensor of Interest (SOI) selection.

<table>
<thead>
<tr>
<th>Direction</th>
<th>Duration</th>
<th>HUD</th>
<th>FCR</th>
<th>TGP</th>
<th>WPN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fwd</td>
<td>Short</td>
<td>SOI to HUD</td>
<td>SOI to HUD</td>
<td>SOI to HUD</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Long</td>
<td>SOI to MFD</td>
<td>SOI MFD Swap</td>
<td>SOI MFD Swap</td>
<td></td>
</tr>
<tr>
<td>Aft</td>
<td>Short</td>
<td>Next LFT MFD Format</td>
<td>Next LFT MFD Format</td>
<td>Next LFT MFD Format</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Long</td>
<td>SOI to MFD</td>
<td>SOI MFD Swap</td>
<td>SOI MFD Swap</td>
<td></td>
</tr>
<tr>
<td>Left</td>
<td>Short</td>
<td>Next RT MFD Format</td>
<td>Next RT MFD Format</td>
<td>Next RT MFD Format</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Long</td>
<td>Next RT MFD Format</td>
<td>Next RT MFD Format</td>
<td>Next RT MFD Format</td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>Short</td>
<td>Next RT MFD Format</td>
<td>Next RT MFD Format</td>
<td>Next RT MFD Format</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Long</td>
<td>Next RT MFD Format</td>
<td>Next RT MFD Format</td>
<td>Next RT MFD Format</td>
<td></td>
</tr>
</tbody>
</table>

Target Management Switch (TMS). The TMS controls target designation and data management for the radar, AGM-88 Maverick missile, and the targeting pod.

<table>
<thead>
<tr>
<th>Direction</th>
<th>Duration</th>
<th>HUD</th>
<th>FCR</th>
<th>TGP</th>
<th>WPN</th>
<th>HSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fwd</td>
<td>Short</td>
<td>DTOS/EO Vis Designate</td>
<td>RWS Spotlight / ACM BORE</td>
<td>Track</td>
<td>Track</td>
<td>Designate</td>
</tr>
<tr>
<td></td>
<td>Long</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aft</td>
<td>Short</td>
<td>Target Reject</td>
<td>Target Reject</td>
<td>Target Reject</td>
<td>Drop</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Long</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left</td>
<td>Short</td>
<td>Interrogate All</td>
<td>Polarity Swap</td>
<td>Polarity Swap</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Long</td>
<td>Interrogate Tgt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>Short</td>
<td>TWS bug step / ACM rotary</td>
<td>TWS/ACS Swap</td>
<td>Area Track</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Long</td>
<td>TWS/ACS Swap</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Countermeasures Management Switch (CMS). The CMS controls deployment of countermeasures and operation of the ECM pod if installed.

<table>
<thead>
<tr>
<th>Direction</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fwd</td>
<td>Dispenses selected manual program</td>
</tr>
<tr>
<td>Aft</td>
<td>Gives consent in SEMI and enables AUTO dispense modes</td>
</tr>
<tr>
<td>Left</td>
<td>No function</td>
</tr>
<tr>
<td>Right</td>
<td>Disables AUTO dispense mode</td>
</tr>
</tbody>
</table>

DMS (Display Management Switch) UP/DOWN/LEFT/RIGHT
TMS (Target Management Switch) UP/DOWN/LEFT/RIGHT
CMS (Countermeasures Switch) FWD/AFT/LEFT/RIGHT
HOTAS
TQS (THROTTLE QUADRANT SYSTEM) CONTROLS

Communications UHF/VHF Transmit Switch (4-Way)
- AFT: transmits on UHF radio
- FWD: transmits on VHF radio
- RIGHT (INBOARD) SHORT: filters datalink information on Fire Control Radar (FCR) display
- LEFT (OUTBOARD) SHORT: toggles datalink tracks on and off

MAN RNG/UNCAGE Knob/Switch
Can be rotated or depressed
- Functions depend on the master mode and selected system

Dogfight Switch
3-Position switch, Slide
- DOGFIGHT (Outboard): provides symbology on HUD for both 20 mm gun firing and air-to-air missile delivery
- Missile Override (Inboard): provides symbology on HUD for air-to-air missile firing only
- Center: Returns to last selected Master Mode

Radar Antenna Elevation Knob
Rotates, Center Detent

Speed Brake Switch
3-Position, Aft Momentary
- Open (AFT): speed brakes open/deployed
- Close (FWD): speed brakes close/retract
- Center: speed brakes remain in current position

Radar Cursor/Enable Switch
Depress, Multidirectional
- Used for slewing of the fire control radar cursor or targeting pod/weapon video.

Throttle
SECTION STRUCTURE

1 - Sensors
- 1.1 – Introduction to Sensors
- 1.2 – Sensors Display Selection
- 1.3 – Sensor Master Modes
- 1.4 – HMD (Helmet-Mounted Display)
- 1.5 – My Sensors Control Setup

2 - AN/APG-68 Fire Control Radar (FCR)
- 2.1 – Air-to-Air Modes
  - 2.1.1 – Radar Display & Performance
  - 2.1.2 – Main Modes Overview
  - 2.1.3 – CRM (Combined Radar Mode)
    - 2.1.3.1 – RWS Mode
    - 2.1.3.2 – TWS Mode
  - 2.1.4 – SAM Mode
  - 2.1.5 – STT Mode (Radar Lock)
- 2.1.6 – ACM (Air Combat Mode) Modes
  - 2.1.6.1 – Mode Selection
  - 2.1.6.2 – Boresight (BORE) Sub-Mode
  - 2.1.6.3 – Vertical Scan Sub-Mode
  - 2.1.6.4 – HUD Scan Sub-Mode
  - 2.1.6.5 – Slewable Sub-Mode
  - 2.1.7 – EXP (Expand) Feature
  - 2.1.8 – HMCS (Helmet-Mounted Cueing System) Radar Lock
  - 2.1.9 – Radar Lingo and Terminology
- 2.2 – Air-to-Ground Modes
  - 2.2.1 – GM (Ground Mapping) Mode
  - 2.2.2 – GMT (Ground Moving Target) Mode
  - 2.2.3 – BCN (Beacon) Mode
- 2.3 – Air-to-Sea Modes
  - 2.3.1 – SEA Mode

3 - AN/AAQ-28 LITENING AT Targeting Pod
- 3.1 – Introduction
- 3.2 – Displays
- 3.3 – Controls
- 3.4 – Target Designation Clarifications
- 3.5 – Start-Up & Lasing Procedure
- 3.6 – Steerpoint Slaving Mode & Cursor Zero (CZ)
- 3.7 – Boresight Function
- 3.8 – Laser Spot Search (LSS) Mode

4 - AGM-65D Maverick Air-to-Ground Missile
- 4.1 – Displays
- 4.2 – Controls
1.1 – INTRODUCTION TO SENSORS

The F-16 is by definition one of the most versatile aircraft when it comes to armament and sensors. Here is an overview of how the Viper can “see” the outside world.

- **AN/APG-68 FCR (Fire Control Radar):** pulse-Doppler, look-down/shoot-down radar with both BVR (Beyond Visual Range) and close in ACM (Air Combat Maneuvering) modes of operation for air-to-air combat. Air-to-Ground and Air-to-Sea modes are also implemented, which makes it a very powerful tool at your disposal.
  - Air-to-Air Modes currently implemented are RWS (Range While Search), TWS (Track While Scan), SAM (Situational Awareness Mode), STT (Single Target Track) and ACM (Air Combat Maneuvering).

- **AN/AAQ-28 LITENING AT Targeting Pod:** Targeting system developed to provide precision strike capability. Target designation is achieved by using a laser designator/range finder or an infrared laser marker, which can be created by the pod itself. It is also capable of displaying a FLIR (Forward-Looking Infrared) thermal imagery.

- **AGM-65D Maverick Seeker Head feed:** Maverick air-to-ground missiles have seeker heads that have video capability and that can be used as supplemental sensors.

- **HTS (HARM Targeting System) Pod:** This pod is used by High-Speed Anti-Radiation Missiles (HARM) to home on radar emitters for SEAD (Suppression of Enemy Air Defenses) operations.
1.1 – INTRODUCTION TO SENSORS

This section will introduce you to various sensors. You will get the « what », but the « how » will be demonstrated later in the Weapons section since the use and application of sensors will make more sense to you once you start using them for a specific purpose. Just keep in mind that your sensors can be monitored from the HUD (Heads-Up Display) and various displays, while they can be operated from the HOTAS stick and throttle.
1.1 – INTRODUCTION TO SENSORS

Part 10 – Radar & Sensors

Left MFD (Multifunction Display)
- Displayed: FCR (Fire Control Radar) Page
- Set as SOI (Sensor of Interest)

Right MFD (Multifunction Display)
- Displayed: HSD Page
- Not set as SOI (no SOI Box)

HUD (Heads-Up Display)

TMS (Target Management Switch)

DMS (Display Management Switch)

FCR (Fire Control Radar) Page
The SOI (Sensor of Interest) is the sensor or display for which the hands-on controls are currently active. Similar functions are activated by the same switches, whenever possible, to provide consistent operation regardless of the SOI or mode selected. The current SOI can be identified by the SOI Box around the MFD (Multifunction Display) screen or the asterisk in the top left of the HUD.

The SOI is changed from display to display with the Display Management Switch (DMS). Basic functionality as it applies to SOI is:

- **DMS UP**: SOI transitions to the HUD if in A-G Master Mode (asterisk will be visible on HUD when SOI)
- **DMS DOWN**: SOI transitions from the HUD to the highest priority MFD. DMS DOWN again swaps SOI to the other MFD. A white “SOI” box will be visible on the display when MFD is SOI.
There are three Master Modes in the F-16:

- **A-A (Air-to-Air) Mode**, which is used for air-to-air missile and radar employment.
- **A-G (Air-to-Ground) Mode**, which is used for air-to-ground weapons. Upon selection of the A-G master mode, the SMS (Stores Management Set) Air-to-Ground (SMS A-G) page is displayed on the right MFD.
- **NAV (Navigation) Mode**, which is used for navigation (shocking, I know!).

**Notes**

- Depressing the A-A button selects the Air-to-Air Master Mode, and the A-G button selects the Air-to-Ground Master Mode. This configures the aircraft systems and displays for the selected attack mode in one easy step.
- Depressing the same button a second time returns to the NAV (Navigation) Master Mode.
- When Dogfight or missile override mode is selected with the DOGFIGHT Switch, request for master mode changes via the Integrated Control Panel (ICP) buttons will be ignored.

**A-A (Air-to-Air) Master Mode Button**

**A-G (Air-to-Ground) Master Mode Button**

**NAV (Navigation) Master Mode**

**A-G (Air-to-Ground) Master Mode**

**A-A (Air-to-Air) Master Mode**
1.3 – SENSOR MASTER MODES

There are two Override Modes: DGFT (Dogfight) and MSL OVRD (Missile Override). Both can be selected with the Dogfight Switch.

- **DGFT (Dogfight) Override Mode** is selected by pressing the Dogfight switch Outboard to the DOGFIGHT position. Upon DGFT mode selection:
  - A-A, A-G and NAV Master Modes are overridden
  - ACM (Air Combat Mode) Radar mode is automatically selected
  - Symbology on the HUD is provided for both 20 mm gun firing and air-to-air missile

- **MSL OVRD (Missile Override) Override Mode** is selected by pressing the Dogfight switch Inboard to the MSL OVRD position. Upon mode selection:
  - A-A, A-G and NAV Master Modes are overridden
  - ACM (Air Combat Mode) Radar mode is automatically selected
  - Symbology on the HUD is provided for air-to-air missile firing only

---

**Dogfight Switch**
3-Position switch, Slide
- **DOGFIGHT (Outboard)**: provides symbology on HUD for both 20 mm gun firing and air-to-air missile delivery
- **Missile Override (Inboard)**: provides symbology on HUD for air-to-air missile firing only
- **Center**: Returns to last selected Master Mode

---

**NO RAD indication**
Shows that the HUD Scan ACM Radar Mode (30° x 20°) has been selected automatically upon DGFT Mode selection

**20 mm Gun Funnel Symbology**

**Aircraft Acceleration (G)**

**DGFT Override Mode Indication**

**ACM (Air Combat Mode) Indication**
Automatically selected upon DGFT Mode selection

**AAA (Attitude Awareness Arc)**
Displays aircraft attitude. Extremities of the arc line up on the horizon. Arc grows as aircraft nose is down and shrinks as nose is up.
1.4 – HMD (HELMET-MOUNTED DISPLAY)

The HMD (Helmet-Mounted Display) can be used by turning the HMCS Symbology Brightness Control Knob to BRT. The HMCS (Helmet-Mounted Cueing System) allows the pilot to project the Heads-Up Display in his field of vision at all times. It also allows the slaving of sensors and weapons to the helmet’s line of sight.

In the F-16, the HMCS is very useful for using missiles like the AIM-9X, an upgraded version of the AIM-9 with TVC (Thrust Vectoring Control) allowing 80 deg off-boresight shots.

Note: The HMCS projection can be toggled on and off pressing the DMS (Display Management Switch) DOWN LONG (for more than 0.5 sec).
1.5 – MY SENSORS CONTROL SETUP

Real Aircraft Controls

**Dogfight Switch**
- Provides symbology on HUD for both 20 mm gun firing and air-to-air missile delivery
- Missile Override (Inboard): Provides symbology on HUD for air-to-air missile firing only
- Center: Returns to last selected Master Mode

**Communications UHF/VHF Transmit Switch (4-Way)**
- Transmit Switch – IFF IN (INBOARD): Cycles filter options
- Transmit Switch – IFF OUT (OUTBOARD): Removes datalink tracks

**MAN RNG/UNCAGE Knob/Switch**
- MAN RNG Clockwise: Zooms In
- MAN RNG Counter-Clockwise: Zooms Out
- UNCAGE (Depressed): Laser Spot Search Mode ("C" binding)

**DMS (Display Management Switch)**
- UP/DOWN/LEFT/RIGHT

**TMS (Target Management Switch)**
- UP/DOWN/LEFT/RIGHT

**Camera/Gun Trigger (Two Stages)**

**Expand/FOV (Field-of-View) Button**

**Radar Cursor/Enable Switch**
- Depress, Multidirectional

**Radar Antenna Elevation Knob**
- Rotates, Center Detent

**Communications UHF/VHF Transmit Switch (4-Way)**
- Transmit Switch – IFF IN (INBOARD): Cycles filter options
- Transmit Switch – IFF OUT (OUTBOARD): Removes datalink tracks

**MAN RNG/UNCAGE Knob/Switch**
- MAN RNG Clockwise: Zooms In
- MAN RNG Counter-Clockwise: Zooms Out
- UNCAGE (Depressed): Laser Spot Search Mode ("C" binding)

**DMS (Display Management Switch)**
- UP/DOWN/LEFT/RIGHT

**TMS (Target Management Switch)**
- UP/DOWN/LEFT/RIGHT

**Camera/Gun Trigger (Two Stages)**

**Expand/FOV (Field-of-View) Button**

**Radar Cursor/Enable Switch**
- Depress, Multidirectional

**Radar Antenna Elevation Knob**
- Rotates, Center Detent

**Communications UHF/VHF Transmit Switch (4-Way)**
- Transmit Switch – IFF IN (INBOARD): Cycles filter options
- Transmit Switch – IFF OUT (OUTBOARD): Removes datalink tracks

**MAN RNG/UNCAGE Knob/Switch**
- MAN RNG Clockwise: Zooms In
- MAN RNG Counter-Clockwise: Zooms Out
- UNCAGE (Depressed): Laser Spot Search Mode ("C" binding)
1.5 – MY SENSORS CONTROL SETUP

My Controls

- **WPN REL Button**
- **Camera/Gun Trigger** (Two Detents)
- **Expand/FOV Button**
- **MAN RNG Knob** – CCW (Zoom Out)
- **MAN RNG Knob** – CW (Zoom In)
- **UP** Transmit Switch – IFF IN
- **DOWN** Transmit Switch – IFF OUT
- **RDR Cursor Switch** – Y Axis
- **RDR Cursor Switch** – X Axis
- **RDR Cursor Switch** – Y Axis
- **RDR Cursor Switch** – X Axis
- **ENABLE Switch (Enter)**
- **UNCAGE Switch**
- **Dogfight Switch** – MISSILE OVERRIDE/CENTER
- **Dogfight Switch** – DOGFIGHT/CENTER
- **ANT ELEV Knob (Radar Antenna Elevation)**
- **Transmit Switch** – IFF IN
- **Transmit Switch** – IFF OUT
- **RDR Cursor Switch** – Y Axis
- **RDR Cursor Switch** – X Axis
- **RDR Cursor Switch** – Y Axis
- **RDR Cursor Switch** – X Axis
- **ENABLE Switch (Enter)**
- **UNCAGE Switch**
- **Dogfight Switch** – MISSILE OVERRIDE/CENTER
- **Dogfight Switch** – DOGFIGHT/CENTER
- **ANT ELEV Knob (Radar Antenna Elevation)**
The air-to-air radar uses a B-Scope representation, which is a top-down view of what’s in front of you.

- Radar Data can be shown on the **FCR (Fire Control Radar)** page and on the HUD (Heads-Up Display).

- The **FCR Power Switch** must be set FWD and the Master Mode needs to be set to **A-A (Air-to-Air)** for the radar to be functional. Take note that FCR is inhibited while aircraft is on the ground.
You can slew your radar using the **Radar Cursor/Enable** Switch. This will move the ACQ (Acquisition) cursor on the FCR page.

The **Radar Antenna Elevation Knob** on the throttle is used to control where your radar is scanning vertically.

The **DMS (Display Management Switch)** is used to select which display (Multifunction Display or Heads-Up Display) is the current Sensor of Interest (SOI).

The **TMS (Target Management Switch)** is used for RWS (Range While Search) spotlight, Target Rejection, Target Interrogation, TWS (Track While Scan) Bug Step and RWS/TWS swap functionalities.

- **TMS UP** is used to radar lock a target
- **TMS DOWN** is used to unlock a locked target

The **Expand/FOV Button** is used to “expand” (zoom in) on a specific section of your radar screen.

The **DOGFIGHT Switch** is used to select HUD Symbology for either DOGFIGHT mode (used for gun & air-to-air missile delivery) or MISSILE OVERRIDE mode (use for air-to-air missile delivery only).
The F-16’s radar has a range of 160 nautical miles, a horizontal arc of 120 degrees and a variable vertical arc that is customizable. You can control the radar scan pattern (bars), which will give you a narrower or wider scanning area.

The numbers next to the Acquisition Cursor (ACQ) correspond to the altitudes (in thousands of feet) of the top and bottom of the radar beam at the distance of the target designator. As you move the cursor closer and further you will see the numbers change. The practical application is that the radar will not detect targets above or below these altitudes which is why you need to slew the radar antenna up and down to do a complete search.

Acquisition (ACQ) Cursor
Upper number: Upper altitude covered by radar (46000 ft)
Lower number: Lower altitude covered by radar (-27000 ft)
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)

2.1.1 – Air-to-Air Radar Display & Performance

** Acquisition (ACQ) Cursor **
Upper number: Upper altitude covered by radar (46000 ft)
Lower number: Lower altitude covered by radar (-27000 ft)

** Radar Azimuth (Total Coverage from left to right) **
(can be set to +/- 10/20/25/30/60 deg)
A3 stands for “Azimuth 30 degrees”

** Elevation Bar Scan **
Cycles between 1, 2, 3 and 4 bars of faster scanning
4B stands for “4 bars”

** IFF Interrogation Mode Selected **
M4: Mode 4

** Bearing & Range from Ownship to Bullseye **
- 28: you are 28 nm from Bullseye
- 018: you have a bearing of 18 degrees from Bullseye

** Increase Range Scale **
Range Scale Reference: 80 nm
(can be set to 5/10/20/40/80/160 nm)

** Decrease Range Scale **
Range: Full Scale (80 nm)
Range: 3/4 Scale (60 nm)
Decrease Range Scale
Range: 1/2 Scale (40 nm)
Decrease Range Scale
Range: 1/4 Scale (20 nm)
Decrease Range Scale
Range: 0 nm

** Spotlight Scan Lines **
Radar Contact
Based on Azimuth and Range Scale, we can deduce that the contact is 44 nm in front of us, 15 degrees to our right

** Antenna Elevation Caret **

** Radar Operational Status **
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.1 – Air-to-Air Radar Display & Performance

Radar Sub-Mode Selector
- RWS: Range While Search
- TWS: Track While Scan

FCR Mode:
- Normal or Expanded Mode

OVRD Function: Radar Override Button prevent the radar from transmitting in any mode

CNTL: Accesses FCR Control Menu

SOI (Sensor of Interest) Control Indication Box
- The current SOI can be identified by the box around the MFD screen. The SOI is changed from display to display with the Display Management Switch (DMS).
  - DMS DOWN swaps Multifunction Displays (MFDs) as the SOI
  - DMS UP sets the Heads-Up Display (HUD) as the SOI

Radar Mode Selected
- CRM: Combined Radar Mode
- ACM: Air Combat Mode
- GM: Ground Mapping
- GMT: Ground Moving Target
- SEA: Sea Mode
- BCN: Beacon Mode
- STBY: Standby Mode

OVRD Function: Radar Override Button prevent the radar from transmitting in any mode

DMS (Display Management Switch)
The F-16 Spotlight Scan lines can be visible on both the FCR page and on the HSD (Horizontal Situation Display) page as well.
Track symbols displayed on the FCR page may be filtered using the UHF/VHF Transmit switch. This affects tracks displayed on the radar display only and does not affect those displayed on the HSD.

Positioning the **Transmit switch inboard short** (less than .5 sec) rotates between three filter options.

Positioning the **Transmit Switch outboard short** (less than .5 sec) selects **NONE** and removes all datalink tracks. Selecting **outboard short** again returns to the previously selected filter option.

**Communications UHF/VHF Transmit Switch (4-Way)**
- Transmit Switch – IFF IN (INBOARD): Cycles filter options
- Transmit Switch – IFF OUT (OUTBOARD): Removes datalink tracks

**Filter Options**
- **ALL**: All Datalink symbols are displayed
- **FTR+**: Datalink Surveillance tracks are removed
- **TGTS**: Datalink Surveillance and PPLI tracks are removed
- **NONE**: No Datalink symbols are displayed
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.2 – Air-to-Air Main Modes Overview

CRM (Combined Radar Mode)
- RWS (Range While Search)
- TWS (Track While Scan)

ACM (Air Combat Mode)
- Vertical Scan
- Boresight
- HUD Scan
- Slewable

SAM (Situational Awareness Mode)
- Acquisition Mode

STT (Single Target Track)
- Acquisition Mode
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)

2.1.2 – Air-to-Air Main Modes Overview

The radar has the following main modes: **BVR** (Beyond Visual Range, used for long-distance engagements), and **ACM** (Air Combat Maneuvering, used for close air engagements), and STT (Single Target Track).

---

**BVR Search sub-modes include:**

- **CRM** (Combined Radar Mode): CRM mode is selected by default at power-up. It is designed to reduce pilot workload by combining air-to-air submodes used for search under one interface. CRM sub-modes include RWS (Range While Search) and TWS (Track While Scan). These may also be cycled using the HOTAS by holding TMS (Target Management Switch) right for more than one second.

- **RWS** (Range While Search): RWS radar mode allows for detection of contacts in a large volume. It is the default search mode for air-to-air or when an air-to-air missile is placed in priority. RWS mode provides all-aspect (nose-on, tail-on) and all altitude (look-up, look-down) target detection. The display shows range as the vertical axis and azimuth angle on the horizontal.

- **TWS** (Track While Scan): TWS maintains an actual track on several aircraft while still searching for others. While in TWS mode, the radar can maintain up to 10 trackfiles (targets). The radar allocates part of its power to tracking the target or targets while part of its power is allocated to scanning, unlike the straight tracking mode, when the radar directs all its power to tracking the acquired targets. In the TWS mode the radar has a possibility to acquire additional targets as well as providing an overall view of the airspace and helping maintain better situational awareness. Since the radar is sharing its computing time between targets, the accuracy is less precise than for a single target track (STT) mode of operation. TWS mode allows for trackfiles to be kept at a high update rate. To accomplish this, TWS artificially limits the scan volume (bars/azimuth) and provides for automatic scan centering. It is also optimal for providing post-launch datalink for the AIM-120 AMRAAM missile while remaining in search.

- **SAM** (Situational Awareness Mode): SAM mode is a hybrid mode between RWS and STT. When locking a target in RWS mode, the radar enters SAM mode. In SAM mode, radar will periodically scan the locked target while scanning the whole area, and the controls are basically the same as RWS. In other words, target acquisition and lock is initiated by placing the acquisition cursor over a target, positioning the TMS on the stick forward once, then releasing the TMS. This starts the Situational Awareness Mode (SAM) acquisition sequence. During acquisition, the antenna is directed to the last known target position, and a 4-bar, ±10-degree Spotlight search is performed.

---
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)

2.1.2 – Air-to-Air Main Modes Overview

The radar has the following main modes: **BVR** (Beyond Visual Range, used for long-distance engagements), and **ACM** (Air Combat Maneuvering, used for close air engagements), and **STT** (Single Target Track).

---

**STT**

**STT** (Single Target Track): STT mode is a traditional radar "lock" where the radar continuously scans a single target, resulting in a very high update rate; this makes it the primary method of providing guidance to air-to-air weapons. STT maintains a trackfile for its target and automatically designates it. The radar is slaved to this trackfile; as such, manual antenna elevation control is inhibited and the B-sweep follows the trackfile. Only the trackfile that is placed in STT is visible and all onboard trackfiles are dropped. In STT, the FCR page format is presented in azimuth along the horizontal axis and range along the vertical axis.

Single Target Track is obtained by:

- Placing the acquisition cursor over a target (with the Radar Cursor switch), positioning the TMS (Target Management Switch) on the stick FWD twice in quick succession, then releasing the TMS.
- using an Air Combat Maneuvering mode

STT is exited by pressing the TMS (Target Management Switch) on the stick AFT.

- TMS DOWN once returns to SAM mode with the target bugged.
- TMS DOWN twice returns to RWS mode.
- The radar is returned to the last-entered search mode.

---

**EXP**

**EXP** (Expanded) Feature: The radar provides the ability to enter an expanded field of view display that allows sorting and resolution of closely grouped contacts. This can be thought of as a zoom feature that provides a 4:1 scale view centered around the radar cursor. This feature is available in all radar modes.
The radar has the following main modes: **BVR** (Beyond Visual Range, used for long-distance engagements), and **ACM** (Air Combat Maneuvering, used for close air engagements), and **STT** (Single Target Track).

---

ACM sub-modes include:

- **Vertical Scan**: Radar will scan in a 10°× 60° vertical area. The scan center is 23° above the HUD’s gun cross. This mode is indicated by a vertical line extending from the gun cross to the bottom of the HUD. The lock range is 10 nautical miles. The radar automatically locks on to the first target in this zone. When locked, the target is automatically tracked in STT mode.

- **BORE** (Boresight): BORE scan pattern searches a small one-beamwidth area located 3° below the HUD’s gun cross. An additional Boresight Cross is displayed on the HUD at the center of the radar scan zone to aid in positioning the target in the radar beam. BORE is useful for quickly locking a target within visual range (WVR) and allows a degree fine control as to the target being locked. The first target detected within 20 nautical miles is locked and automatically tracked in STT mode.

- **HUD** (Heads-Up Display Area Scan): Radar will scan the HUD area (30°× 20°). The lock range is 10 nautical miles. The radar automatically locks on to the first target in this zone. When locked, the target is automatically tracked in STT mode. There is no special HUD symbology for this submode. This submode is less precise than the BORE submode and may take longer to achieve a lock because of the larger target area for the radar scan to cover.

- **Slewable**: The scan pattern is approximately 20° high x 60° wide. When selected, the scan is centered directly in front of the aircraft on the horizon. The scan is slewable via the CURSOR/ENABLE control on the throttle until a target is acquired. The amount of slew is limited by the radar gimbal limits. As with the other submodes, the radar automatically locks on to the first target in this zone. When locked, the target is automatically tracked in STT mode. This mode is useful when you have a direction to look, for example ‘bandits 2 o’clock high’, but have not picked them up visually yet.

---
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.3 – Air-to-Air CRM (Combined Radar Mode)

The Combined Radar Mode (CRM) is selected by default at power-up. It is designed to reduce pilot workload by combining air-to-air submodes used for search under one interface.

If you are using another radar mode, CRM Mode can be selected by:
1. Verifying that the FCR Power Switch is ON (FWD)
2. Selecting FCR page
3. Pressing OSB (Option Select Button) next to Radar Mode Selector Field
4. Pressing OSB next to CRM
5. CRM Sub-Modes can be toggled using the OSB next to the Radar Sub-Mode Selector Field.

Radar Mode Selected
- CRM: Combined Radar Mode
- ACM: Air Combat Mode
- GM: Ground Mapping
- GMT: Ground Moving Target
- SEA: Sea Mode
- BCN: Beacon Mode
- STBY: Standby Mode

Radar Sub-Mode Selector
RWS: Range While Search
TWS: Track While Scan
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.3 – Air-to-Air CRM (Combined Radar Mode)

CRM Sub-modes are:
- RWS (Range While Search)
- TWS (Track While Scan)
- DMS DOWN: sets the FCR page as the Sensor of Interest (SOI)
- TMS RIGHT LONG: Cycles between RWS and TWS sub-modes.

Note: Cycling between RWS and TWS sub-modes can also be done by pressing the OSB (Option Select Button) next to RWS/TWS.

Radar Sub-Mode Selector
RWS: Range While Search
TWS: Track While Scan

DMS (Display Management Switch)
DOWN: Sets FCR page as SOI

TMS (Target Management Switch)
RIGHT LONG: Cycles between TWS and RWS Sub-Modes

Radar Mode Selected
- CRM: Combined Radar Mode
- ACM: Air Combat Mode
- GM: Ground Mapping
- GMT: Ground Moving Target
- SEA: Sea Mode
- BCN: Beacon Mode
- STBY: Standby Mode
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.3.1 – Air-to-Air RWS (Range While Search) Mode

The Range While Search (RWS) submode is used for long-range acquisition and engagement. The pilot can set the acquisition range (10, 20, 40, 80, or 160 nautical miles) and change the azimuth and elevation. You can then select a specific track and lock it into STT mode.

RWS is selected in the following manner:
1. FCR Power Switch must be set to ON (FWD)
2. Select FCR page, then press the DMS (Display Management Switch) DOWN to set the FCR (Fire Control Radar) page as the SOI (Sensor of Interest).
3. Select RWS mode by either:
   a) Using the Radar Mode and Radar Sub-Mode selector OSBs (Option Select Button), or;
   b) Pressing the TMS (Target Management Switch) RIGHT LONG to cycle between RWS and TWS mode.

Note: from RWS Mode, you can either transition to SAM (Situational Awareness Mode) Mode or lock a target using STT (Single Target Track) Mode. Consult relevant SAM and STT sections to know how to transition to these modes.
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.3.2 – Air-to-Air TWS (Track While Scan) Mode

INTRODUCTION

TWS (Track While Scan) mode combines the information unique to RWS and STT (Single Target Track) modes. Generally, the TWS display is very similar to the RWS display. TWS mode allows for trackfiles to be kept at a high update rate. To accomplish this, TWS artificially limits the scan volume (bars/azimuth) and provides for automatic scan centering. It is also optimal for providing post-launch datalink for the AIM-120 AMRAAM missile while remaining in search.

When combined with the AIM-120, TWS provides a powerful ability to engage multiple targets quickly. Nevertheless, the target tracking reliability is less than STT. Unlike STT though, a TWS launch with an AMRAAM will not provide the enemy aircraft with a radar lock and launch indication. As such, the first warning the enemy pilot will likely get is when the active radar seeker of the AIM-120 missile goes active near the target.

TWS has several restrictions. The radar will attempt to build track files for each contact, but given a large scan volume, there will be a sizable refresh time between scans. During each scan the radar will try to predict the position of the contact for the next scan. If, however the target takes evasive, high-G maneuvers and quickly changing its trajectory and speed, the radar can lose the track by making an incorrect track file prediction. Using such a defensive tactic, the hunter can quickly become the hunted.

Since TWS mode is one of the more complex (yet powerful!) radar modes, this section will be divided in the following sub-sections:

• A: Information Display
• B: Symbology & Target Types
• C: TWS Scanning
• D: TWS Designation
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.3.2 – Air-to-Air TWS (Track While Scan) Mode

A – INFORMATION DISPLAY

TWS (Track While Scan) “Track Files” (fancy term for radar contacts) are established on up to 10 targets based on information received on each radar sweep. The radar scan volume options are identical to those used for RWS but are reduced to 3-bar, ±25 degrees when a target is designated.
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.3.2 – Air-to-Air TWS (Track While Scan) Mode

B – SYMBOLOGY & TARGET TYPES

Four types of target symbols are available to help sort contacts in order of priority: Search Target, Track Target, System Target and Bugged Target.

- **Search Target**: These are radar contacts that have not been resolved well enough to build a track. These are displayed as a small box in much the same way as in RWS. These targets disappear after a few sweeps if a track cannot be obtained. If a valid track is obtained, usually after being detected on two consecutive sweeps, the contact becomes a Track Target.

- **Track Target**: These targets are displayed as large filled boxes with a velocity vector line showing their direction of travel. Their altitude is displayed just below each contact. Up to 10 of these tracks may be present at one time. Track targets can be considered the baseline contact type. Other options become available after a contact has reached this stage. Contacts that are determined to be friendly through IFF interrogation or other means may be left as a Track Target. Contacts that require closer attention can be transitioned to System Targets.

- **System Target**: The purpose of system targets is to ease designation and tracking of the contacts considered most important. These are displayed as empty boxes and include the velocity vector line and altitude.

- **Bugged Target**: This is the highest priority of all the tracked targets and the target an AIM-120 missile fired at that moment will engage. It is displayed as a contact with a circle around it.
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.3.2 – Air-to-Air TWS (Track While Scan) Mode

B – SYMBOLOGY & TARGET TYPES

Now that we know what different target types there are, how do we transition from one to the other?

**Search Target** ➔ **Track Target** ➔ **System Target** ➔ **Bugged Target** ➔ **Radar STT Lock**

- **Search Target**: If a valid track is obtained from a **Search Target**, usually after being detected on two consecutive antenna sweeps, the contact becomes a **Track Target** automatically.

- **Track Target**: **Track targets** can be transitioned to system targets in two ways:
  - Place the **Acquisition Cursor** over a track target with the **Radar Cursor Switch** and select **TMS UP** on the stick to transition only that target.
  - Or...
  - **TMS RIGHT** on the stick to transition all track targets to system targets if no other system targets are displayed.

- **System Target**: **System Targets** can be designated as the bugged target by placing the **Acquisition Cursor** over it with the **Radar Cursor Switch** and **TMS UP** on the stick. This transitions the scan to 3-bar, ±25 degrees centered on the bugged target to provide faster updates and reduce the chance of losing the track.
  - **TMS RIGHT** will also select the closest system target as the bugged target.
  - **Subsequent presses of TMS RIGHT** will cycle through all displayed system targets, making each the bugged target in turn.

- **Bugged Target**: A **Bugged Target** may be transitioned to an STT (Single Target Track Radar Lock) track by selecting **TMS UP** with the **Acquisition Cursor** over the bugged target.
  - Selecting **TMS DOWN** from STT returns to the TWS mode. Each subsequent **TMS DOWN** downgrades the status of the track files.

- **Radar STT Lock**: **A Bugged Target** can be transitioned to an STT (Single Target Track Radar Lock) track by selecting **TMS UP** with the **Acquisition Cursor** over the bugged target.
  - Selecting **TMS DOWN** from STT returns to the TWS mode. Each subsequent **TMS DOWN** downgrades the status of the track files.

**Radar Cursor/Enable Switch**
- **Depress, Multidirectional**
  - *Used for slewing of the fire control radar cursor or targeting pod/weapon video.*
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.3.2 – Air-to-Air TWS (Track While Scan) Mode

C – TWS SCANNING

• The azimuth scans, depending on the mode, can be ±60° (the whole width of the radar scope) centred about the nose, or ±30°, ±25°, ±20° or ±10° centered about the acquisition (ACQ) cursor anywhere within the ±60° gimbal limits.

• The ±25° azimuth (3 bar) scan is exclusive to Track-While-Scan (TWS) mode.
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.3.2 – Air-to-Air TWS (Track While Scan) Mode

**D – TWS DESIGNATION**

1. FCR Power Switch must be set to ON (FWD)
2. Select FCR page, then press the DMS (Display Management Switch) DOWN to set the FCR (Fire Control Radar) page as the SOI (Sensor of Interest).
3. Select TWS mode by either:
   a) Using the Radar Mode and Radar Sub-Mode selector OSBs (Option Select Button), or;
   b) Pressing the TMS (Target Management Switch) RIGHT LONG to cycle between RWS and TWS mode.
4. Adjust radar range, azimuth and bar setting as desired.
5. Search targets will first appear when valid tracks (radar contacts) are obtained.
6. After being detected on two consecutive antenna sweeps, Search Targets become Track Targets automatically.

**SOI (Sensor of Interest) Control Indication Box**
*The current SOI can be identified by the box around the MFD screen. The SOI is changed from display to display with the Display Management Switch (DMS).*

**Radar Cursor/Enable Switch**
*Depress, Multidirectional*
- Used for slewing of the fire control radar cursor or targeting pod/weapon video.

**Search Target**
**Track Target**

**FCR (Fire Control Radar) Power Switch**

**DMS (Display Management Switch)**

**TMS (Target Management Switch)**
D – TWS DESIGNATION

7. Transition Track Targets into System Targets, which can then be “bugged” subsequently. You can use two different procedures to do this:

i. **PROCEDURE I:** Establish a Cursor Target on the desired Track Target(s)
   a) Use the Radar Cursor/Enable switch to move the Acquisition Cursor over the desired Track Target.
   b) Press TMS (Target Management Switch) UP to set selected Track Target into a System Target.
   c) Previous steps can be repeated to set other existing Track Targets into System Targets.

ii. **PROCEDURE II:** Transition all Track Targets into System Targets using TMS RIGHT SHORT
   a) Press TMS (Target Management Switch) RIGHT SHORT
   b) All existing Track Targets will transition into System Targets
D – TWS DESIGNATION

8. Designate the desired System Target as a “Bugged Target”. You can perform this in two ways:
   i. **PROCEDURE I: Bug System Target with Acquisition Cursor**
      a) Use the Radar Cursor/Enable switch to move the Acquisition Cursor over the desired System Target.
      b) Press TMS (Target Management Switch) UP to set selected System Target into a Bugged Target.
   ii. **PROCEDURE II: Bug the closest System Target to you using TMS RIGHT SHORT**
      a) Press TMS (Target Management Switch) RIGHT SHORT
      b) System Target closest to you will automatically be selected as the Bugged Target.
      c) Subsequent presses of TMS RIGHT SHORT will cycle through all displayed System Targets, making each the Bugged Target in turn.

9. When a “Bugged Target” is designated, the radar automatically transitions the scan to 3-bar, ±25 degrees centered on the bugged target to provide faster updates and reduce the chance of losing the track. Bugged Target information (Aspect Angle, Ground Track, Airspeed (kts), Closure Speed (kts)) will be displayed on the upper region of the FCR page.
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.3.2 – Air-to-Air TWS (Track While Scan) Mode

D – TWS DESIGNATION

10. Depending on the direction of the target, either a Steering Cue (Tadpole) or a TD (Target Designator) Box towards the Bugged Target is displayed on the Heads-Up Display. Bugged Target Range (nm) and Closure Speed (kts) are also displayed.

- Note: The use of the A-A (Air-to-Air) Master Mode is not mandatory but strongly recommended if you want to use air-to-air missile symbology.
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.3.2 – Air-to-Air TWS (Track While Scan) Mode

D – TWS DESIGNATION

11. A Bugged Target may be transitioned to an STT (Single Target Track Radar Lock) Track by setting the Acquisition Cursor over the Bugged Target with the Radar Cursor Switch, then pressing TMS UP.
12. Selecting TMS DOWN from STT returns to the Track While Scan mode. Each subsequent TMS DOWN downgrades the status of the track files.
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.4 – Air-to-Air SAM (Situational Awareness Mode)

SAM (Situational Awareness Mode) is an “acquisition mode” (some sort of hybrid mode between RWS (Range While Search) and STT (Single Target Track/Radar Lock)). When locking a target in RWS mode, the radar enters SAM mode.

In SAM mode:
- Radar will periodically scan the locked target while scanning the whole area.
- The controls are basically same as RWS.
- During acquisition, the antenna is directed to the last known target position, and a 4-bar, ±10-degree Spotlight search is performed.

1. FCR Power Switch must be set to ON (FWD)
2. Select FCR page, then press the DMS (Display Management Switch) DOWN to set the FCR (Fire Control Radar) page as the SOI (Sensor of Interest).
3. Select RWS mode by either:
   a) Using the Radar Mode and Radar Sub-Mode OSBs (Option Select Button),
   or;
   b) Pressing the TMS (Target Management Switch) RIGHT LONG to cycle between RWS and TWS mode.
4. Adjust radar range, azimuth and bar setting as desired.
5. Search targets will first appear when valid tracks (radar contacts) are obtained.
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.4 – Air-to-Air SAM (Situational Awareness Mode)

6. Acquire target and designate it as a “Bugged Target”
   a) Use the Radar Cursor/Enable switch to move the Acquisition Cursor over the desired Search Target.
   b) Press TMS (Target Management Switch) UP, then release it to set selected Search Target into a Bugged Target.

7. Once target is designated as a “Bugged Target”, the Situational Awareness Mode (SAM) acquisition sequence is initiated.

8. During acquisition, the radar antenna is directed to the last known target position, and a 4-bar, ±10-degree Spotlight search is performed.

9. Bugged Target information (Aspect Angle, Ground Track, Airspeed (kts), Closure Speed (kts)) will be displayed on the upper region of the FCR page.

- Note: While in SAM, target is tracked but the radar continues to scan the area and display additional targets. This is commonly referred to as ‘designating’ or ‘bugging’ a target. An AIM-120 AMRAAM will guide on the bugged target even without an STT lock.
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.4 – Air-to-Air SAM (Situational Awareness Mode)

10. Depending on the direction of the target, either a TLL (Target Locator Line) or a TD (Target Designator) Box towards the Bugged Target is displayed on the Heads-Up Display. Bugged Target Range (nm) and Closure Speed (kts) are also displayed.

• Note: The use of the A-A (Air-to-Air) Master Mode is not mandatory but strongly recommended if you want to use air-to-air missile symbology.

- Bugged Target Target Locator Line (10 deg to your left)
- Bugged Target Closure Speed (kts)
- Bugged Target Target Designator (TD) Box

Range Provider / Slant Range (nm)
• F: FCS (Fire Control System) is providing range
• 041.5: Bugged Target is 41.5 nm away

- A-A (Air-to-Air) Master Mode Button
11. A Bugged Target may be transitioned to a STT (Single Target Track Radar Lock) Track by pressing TMS UP a second time.
12. Selecting TMS DOWN from STT returns to the Range While Search mode.
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.5 – Air-to-Air STT (Single Target Track) Radar Lock

STT (Single Target Track) mode is a traditional radar "lock" where the radar continuously scans a single target, resulting in a very high update rate; this makes it the primary method of providing guidance to air-to-air weapons. STT maintains a trackfile for its target and automatically designates it. The radar is slaved to this trackfile; as such, manual antenna elevation control is inhibited and the B-sweep follows the trackfile. Only the trackfile that is placed in STT is visible and all onboard trackfiles are dropped. In STT, the FCR page format is presented in azimuth along the horizontal axis and range along the vertical axis.

Single Target Track is obtained by:
• Placing the acquisition cursor over a target (with the Radar Cursor switch), positioning the TMS (Target Management Switch) on the stick FWD twice in quick succession, then releasing the TMS.
• using an Air Combat Maneuvering mode

STT is exited by pressing the TMS (Target Management Switch) on the stick AFT.
• TMS DOWN once returns to SAM mode with the target bugged.
• TMS DOWN twice returns to RWS mode.
• The radar is returned to the last-entered search mode.

Search Target
Acquisition (ACQ) Cursor
Bugged Target

TMS (Target Management Switch)
Radar Cursor/Enable Switch
Bugged Target locked in STT Mode
Altitude (17 = 17000 ft)
When the locked target is outside the HUD field on view as shown below, a Target Locator Line (TLL) extends from the Gun Cross and points directly at the target. The Relative Angle is displayed next to the Gun Cross showing the number of degrees in tens between the cross and the target.
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.6 – Air-to-Air ACM (Air Combat Mode) Modes
2.1.6.1 – Mode Selection

There are four main ACM (Air Combat Mode) Modes, which are used for close range air-to-air engagements. FCR Power Switch needs to be set to ON (FWD). Selection of ACM Sub-modes can be done as follows:

1. FCR Power Switch must be set to ON (FWD)
2. Select FCR page, then press the DMS (Display Management Switch) DOWN to set the FCR (Fire Control Radar) page as the SOI (Sensor of Interest).
3. ACM Mode can be selected in two ways:
   i. Using the Main Radar Mode selector OSB (Option Select Button) on the FCR page, or;
   ii. Pressing the Dogfight Switch Outboard (DGFT)

3i a Main Radar Mode Selection

3i b ACM Mode Selection

3i c ACM Sub-Mode Selection

- 20: 30 x 20 deg HUD Scan
- 60: 10 x 60 deg Vertical Scan
- BORE: Boresight
- SLEW: Slewable

Dogfight Switch
3-Position switch, Slide
- DOGFIGHT (Outboard)
- Missile Override (Inboard)
- Center: Returns to last selected Master Mode

FCR (Fire Control Radar) Power Switch

DMS (Display Management Switch)
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.6 – Air-to-Air ACM (Air Combat Mode) Modes
2.1.6.1 – Mode Selection

4. ACM Sub-Mode can be selected in two ways:
   a) Using the TMS (Target Management Switch), or;
   b) Using the ACM Sub-Mode Selection OSB

TMS (Target Management Switch)
• UP: Boresight (BORE) Sub-mode
• DOWN:
  • Without target lock: Vertical Scan Sub-mode
  • With target lock: Target Reject and HUD Scan NO RAD Sub-mode.
• RIGHT: HUD Scan Sub-Mode
• LEFT: No Function
2.1.6 – Air-to-Air ACM (Air Combat Mode) Modes

2.1.6.2 – Boresight (BORE) Sub-Mode

BORE scan pattern searches a small one-beamwidth area located 3° below the HUD’s gun cross. An additional Boresight Cross is displayed on the HUD at the center of the radar scan zone to aid in positioning the target in the radar beam. BORE is useful for quickly locking a target within visual range (WVR) and allows a degree fine control as to the target being locked.

- BORE can be selected in two ways:
  - From FCR Page – ACM Sub-Mode OSB, or;
  - TMS (Target Management Switch) UP
- The first target detected within 20 nautical miles is locked and automatically tracked in STT mode.
- If STT lock is acquired, TMS DOWN can reject the target lock (unlock)

**ACM Sub-Mode Selection**
- **20**: 30 x 20 deg HUD Scan
- **60**: 10 x 60 deg Vertical Scan
- **BORE**: Boresight
- **SLEW**: Slewable

**Range Provider / Slant Range (nm)**
- **F**: FCS (Fire Control System) is providing range
- **005.3**: Bugged Target is 5.3 nm away

**Closure Rate (kts)**
- **STT Lock Acquired**
Vertical Scan Radar mode will scan in a 10°× 60° vertical area. The scan center is 23° above the HUD’s gun cross. This mode is indicated by a vertical line extending from the gun cross to the bottom of the HUD. When locked, the target is automatically tracked in STT mode.

- Vertical Scan can be selected in two ways:
  - From FCR Page – ACM Sub-Mode OSB, or;
  - Without STT radar lock being active, set TMS (Target Management Switch) DOWN
- The first target detected within 10 nautical miles is locked and automatically tracked in STT mode.
- If STT lock is acquired, TMS DOWN can reject the target lock (unlock)
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.6 – Air-to-Air ACM (Air Combat Mode) Modes
2.1.6.4 – HUD Scan Sub-Mode

The HUD (Heads-Up Display Area Scan) mode will scan the HUD area (30° x 20°). This ACM submode is the default selection commanded upon entry into ACM from any other mode. There is no special HUD symbology for this submode. This submode is less precise than the BORE submode and may take longer to achieve a lock because of the larger target area for the radar scan to cover.

- The HUD Scan submode is entered in a non-radiating (NO RAD) state by default when ACM mode is selected. Radiating mode can be selected in two ways:
  - From FCR Page – ACM Sub-Mode OSB, or;
  - Set TMS (Target Management Switch) RIGHT
- The first target detected within 10 nautical miles is locked and automatically tracked in STT mode.
- If a target is locked in STT mode, TMS DOWN can reject the target lock (unlock). However, it will also revert the ACM mode to the HUD Scan non-radiating NO RAD sub-mode.

**Range Provider / Slant Range (nm)**
- F: FCS (Fire Control System) is providing range
- 002.8: Bugged Target is 2.8 nm away

**ACM Sub-Mode Selection**
- 20: 30 x 20 deg HUD Scan
- 60: 10 x 60 deg Vertical Scan
- BORE: Boresight
- SLEW: Sleworth

**TMS (Target Management Switch)**
- DOWN (with target lock): Target Reject and HUD Scan NO RAD Sub-mode
- RIGHT: HUD Scan Sub-Mode

**STT Lock**
- Altitude: 9 = 9000 ft

**HUD Scan NO RAD**
- Scan Region
  - 30 x 20 deg
The scan pattern is approximately 20° high x 60° wide. When selected, the scan is centered directly in front of the aircraft on the horizon. The scan is slewable via the CURSOR/ENABLE control on the throttle until a target is acquired. The amount of slew is limited by the radar gimbal limits. As with the other submodes, the radar automatically locks on to the first target in this zone. When locked, the target is automatically tracked in STT mode. This mode is useful when you have a direction to look, for example 'bandits 2 o’clock high', but have not picked them up visually yet.

Not yet implemented.
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.7 – Air-to-Air EXP (Expand) Feature

The radar provides the ability to enter an expanded field of view display that allows sorting and resolution of closely grouped contacts. This can be thought of as a zoom feature that provides a 4:1 scale view centered around the radar cursor. This feature is available in all radar modes.

The expanded display may be toggled on or off by selecting the OSB (Option Select Button) next to NORM/EXP or by depressing the Expand/FOV Button (pinky switch) on the stick while the FCR is sensor of interest.

The expanded display features a 2 nm x 2 nm reference box centered on the Acquisition Cursor, which is controlled by the Radar Cursor Switch. Basic functions and symbology are unchanged from the normal display.
To perform a radar lock with the HMCS:

1. The system Helmet-Mounted Cueing System (HMCS) is powered with the HMCS Symbology Brightness Knob.
2. Make sure the FCR (Fire Control Radar) switch is ON (FWD).
3. Select DGFT Mode with the Dogfight Switch (Outboard).
4. Select BORE (Boresight) ACM (Air Combat Mode) Search Sub-Mode by pressing the TMS (Target Management Switch) UP.
5. The HMCS Bore Ellipse will appear when BORE is selected.
6. Move your helmet to put the HMCS Ellipse on the target. Then, press TMS (Target Management Switch) UP to radar lock the target. Radar will enter STT (Single Target Track) Lock Mode.
7. A Target Designation Box will appear on the locked target.
8. You can unlock the target and exit BORE Search mode by pressing TMS (Target Management Switch) DOWN.

Range Provider / Slant Range (nm)
- F: FCS (Fire Control System) is providing range
- R: Radar Altimeter is providing range
- B: Range computed using steerpoint elevation/barometric elevation
- T: Targeting Pod is providing passive range
- L: Targeting Pod laser is firing and being used

HUD Scan Search Mode (Selected by default in DGFT Mode)

BORE Search Mode (Selected with TMS UP)

HMCS Bore Ellipse

Target Designation Box (STT Radar Lock)
26: Target Altitude in thousands of feet
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.9 – Air-to-Air Radar Lingo & Terminology

- BANDIT: Identified Enemy Aircraft
- BOGEY: Unidentified Aircraft
- SPIKE: Air-to-Air radar is locked on you
- BUDDY SPIKE: Friendly radar is locked on you
- NAILS: RWR contact, which emits radar waves but does not have a radar lock on you
- FOX 1: semi-active radar missile (27R/ER + AIM-7)
- FOX 2: heat-seeking infrared missile (27T/ET + AIM-9 + R-73/60)
- FOX 3: active radar missile, meaning the missile tracks to an aircraft’s radar up to a certain distance, then it’s internal radar activates (pitbull) (AIM-120/R-77)
- RIFLE: AGM-65 Air-to-Ground missile
- RAYGUN: When locking a target with your radar, it is good practice to say “RAYGUN” so your teammates are aware that you are locking someone. It is often used to identify a contact as friend or foe. If a person yells “BUDDY SPIKE!”, it’s very likely that you are locking a friendly contact.
- IFF: meaning “Is he friendly or bandit (enemy)?”
- PITBULL: Any FOX 3 (active radar) missile that starts using its onboard radar for tracking
2. AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.1 – GM (Ground Mapping) Mode

Not yet implemented.
2. AN/APG-68 FIRE CONTROL RADAR (FCR)

2.2.2 – GMT (Ground Moving Target) Mode

Not yet implemented.
2. AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.3 – BCN (Beacon) Mode

Not yet implemented.
2.3.1 – SEA Mode

Not yet implemented.
3 - AN/AAQ-28 LITENING AT TARGETING POD

3.1 – Introduction

The AN/AAQ-28 LITENING AT targeting pod system is a self-contained, multi-sensor targeting and surveillance system. The LITENING enables aircrews to detect, acquire, auto-track and identify targets at long ranges for weapon delivery or non-traditional intelligence, surveillance and reconnaissance missions. LITENING’s FLIR, charged-coupled device (CCD), laser imaging sensors, advanced image processing and digital video output provide useful imagery of targets on the ground, allowing aircrews to identify and engage targets under a wide range of battlefield conditions.
3.2 – Displays

**Targeting Pod Mode Selected**
- A-G: Air-to-Ground
- A-A: Air-to-Air
- STBY: Standby

**Zoom Factor**
- 0Z: Zoomed Fully Out
- 9Z: Zoomed Fully In

**Override (OVRD) Select**
- Overrides any current mode and returns to STBY.
- The last selected mode is returned to when OVRD is selected a second time.

**Sensor Type**
- TV / CCD (Charge Coupled Device)
- WHOT: White Hot FLIR (Forward Looking Infrared)
- BHOT: Black Hot FLIR (Forward Looking Infrared)

**Field-of-View Setting**
- Narrow/Wide

**Targeting Pod Control (CNTL) Page Selector**
Used to set targeting pod settings

**Laser Spot Search (LSS) Code**

**CZ (Cursor Zero) Function**
CZ will zero out or erase any previously created system deltas and will return all STPTs (Steerpoints) to their original position. CZ is highlighted if a system delta exists.

**SP (Snowplow) Mode**
Snowplow mode is stabilized on the horizon, following our aircraft heading. It is a basic “look and designate” mode that is done through the targeting pod feed.

**Track Mode**
- POINT: Point Track
- AREA: Area Track
- INR: Inertial Rate, TGP will remain fixed on a geographic reference point

**Sighting Point**
STP: Steerpoint (when NAV Master Mode selected)
TGT: Target (when A-G Master Mode selected)

**DCLT (Declutter) Function**

**Laser Status**
Flashing: Laser Designator is firing

**TGP (Targeting Pod) Page Selector**

**Note:** Items in RED are not yet implemented.
3 - AN/AAQ-28 LITENING AT TARGETING POD
3.2 – Displays

Targeting Pod A-G Control (CNTL) Page
Not Yet Implemented
3 - AN/AAQ-28 LITENING AT TARGETING POD

3.2 – Displays

TGP (Targeting Pod) CCRP Designation Box

TGP (Targeting Pod) Reticle Steering Information
Shown: Designation Box is 30 degrees to our right

CCRP (Continuously Computed Release Point) Bomb Release Mode

TGP (Targeting Pod) CCRP Designation Box
Crossed Out = Beyond Heads-Up Display Limits
3 - AN/AAQ-28 LITENING AT TARGETING POD

3.2 – Displays

The Targeting Pod View Relative Direction symbol on the TGP display can give you a good idea of where the pod is pointing in relationship to your aircraft. This view direction is represented in a top-down view.
3 - AN/AQ-28 LITENING AT TARGETING POD
3.2 – Displays

| TV / CCD Mode | WHOT (White Hot) FLIR Mode | BHOT (Black Hot) FLIR Mode |
Some useful HOTAS functionalities when using the targeting pod:

- **DMS (Display Management Switch):**
  - DOWN: Swaps SOI (Sensor of Interest) to the left or right display.

- **TMS (Target Management Switch):**
  - UP: Toggles between Point Track (POINT, tracks an object like a high-contrast vehicle) and Area Track (AREA).
  - LEFT: Toggles TV camera and infrared polarity (TV/Charged-Coupled Device, WHOT/White Hot, BHOT/Black Hot)
  - DOWN: Boresight Mode

- **MAN RNG (Manual Range) Knob:**
  - CCW (Counter-Clockwise): Zooms OUT
  - CW (Clockwise): Zooms IN

- **Expand/FOV Button:** Toggles between narrow and wide field-of-view

- **Camera/Gun Trigger First Detent:** Fires Laser

- **Radar Cursor Switch:** Slews targeting pod reticle

- **Uncage Switch (Depressed):** Laser Spot Search Mode

**MAN RNG/UNCAGE Knob/Switch**
- MAN RNG Clockwise: Zooms In
- MAN RNG Counter-Clockwise: Zooms Out
- UNCAGE (Depressed): Laser Spot Search Mode ("C" binding)
In the current Early Access implementation of the Targeting Pod, there are different ways to visualize and/or designate a ground target. Here are a few things to keep in mind.

a) The targeting pod functions available depend on what Master Mode is selected (A-A, A-G, or NAV).

b) The targeting pod works differently based on your weapon release mode like CCIP (Continuously Computed Impact Point) or CCRP (Continuously Computed Release Point), which can be set in the SMS (Stores Management Set) page. A valid weapon (e.g., bombs) needs to be equipped for these release modes to be available.

c) The use of the targeting pod in the F-16 relies heavily on waypoints/steerpoints of your flight plan. Generally, you will want to have a steerpoint already set near to a target, slave the targeting pod to this waypoint, then find the target and designate it.

d) To slave the targeting pod to a waypoint, the following conditions must be met:
   • A-G (Air-to-Ground) Master Mode must be selected
   • Targeting pod A-G mode must be selected
   • A valid steerpoint must be selected
   • CCRP (Continuously Computed Release Point) release mode must be selected via the SMS (Stores Management Set), or toggled with the NWS A/R DISC & MSL STEP Button
   • The targeting pod will automatically slave to the active steerpoint
3 - AN/AQQ-28 LITENING AT TARGETING POD
3.4 – Target Designation Clarifications

e) When CCIP (Continuously Computed Impact Point) release mode is selected, the **targeting pod's line of sight is slaved to the CCIP pipper location**. The targeting pod cannot designate anything in this mode, but it can be used to have a good visual cue of the target you are diving on.

f) When **CCRP (Continuously Computed Release Point)** release mode is selected, pressing **TMS (Target Management Switch) DOWN** will **boresight** at 150 mils below the zero sight line of the aircraft, directly forward. You can then slew the targeting pod (similar to “snowplow” mode) by using the **DMS (Display Management Switch) DOWN** to set the Targeting Pod page as the **SOI (Sensor of Interest)**, then using the Radar Cursor Switch to slew the targeting pod.
3 - AN/AAQ-28 LITENING AT TARGETING POD

3.5 – Start-Up & Lasing Procedure

1. For the targeting pod features to be available, the following avionics systems must be powered ON
   - MMC (Modular Mission Computer) Switch – ON
   - ST STA (Store Station) switch – ON
   - MFD (Multifunction Display) switch – ON
   - UFC (Up Front Controller) switch – ON
   - EGI/INS switch - NAV

2. Select A-G (Air-to-Ground) Master Mode. The SMS (Stores Management Set) page will be set on the right MFD and the FCR (Fire Control Radar) will be set on the left MFD.

3. Set desired MFD to the TGP (Targeting Pod) page. We will set the left MFD as the TGP page.

4. Set Radar Altimeter Power Switch – ON (FWD)

5. Since the TGP is always installed on the right cheek of the fuselage, set RIGHT HDPT (Right Hardpoint) ON (FWD) to power up the pod.
3 - AN/AAQ-28 LITENING AT TARGETING POD

3.5 – Start-Up & Lasing Procedure

6. A series of power-up self tests and FLIR sensor cooldown will be initiated once the pod is powered.
   
   - *(Not simulated yet)* When the TGP is initially activated, the Standby page will be displayed with a “NOT TIMED OUT” message displayed in the upper center portion. Time is needed to run automatic power-up self tests and for the FLIR sensor to cool down.
   
   - *(Not simulated yet)* A “FLIR HOT” message is displayed in white text on a black background with half the text height as the “NOT TIMED OUT” message. After about three minutes, the message will be removed, video will appear, and the Standby mode page will be selected.

7. After about three minutes, video will appear, and the Standby mode page will be selected.
3 - AN/AAQ-28 LITENING AT TARGETING POD
3.5 – Start-Up & Lasing Procedure

8. Set targeting pod mode from STBY (Standby) to A-G (Air-to-Ground). This will un-stow the camera.

9. Set Master Arm Switch – ON (UP)

10. Set Laser Switch – ARMED (UP)
3 - AN/AAQ-28 LITENING AT TARGETING POD

3.5 – Start-Up & Lasing Procedure

11. Set the Targeting Pod’s Laser Code as desired. The default laser code is 1688, but in this case we will choose 1655.
   a) Press the LIST button
   b) The LIST sub-menus will appear on the DED (Data Entry Display). Press the “0” button on the ICP (Integrated Control Panel) to select the MISC (Miscellaneous) sub-menu.
   c) Press the “5” button on the ICP to select the LASR (Laser) sub-menu.
   d) The TGP code is selected by default (asterisks indicate field is selected).
   e) To change laser code to “1655”, type “1655” on the ICP keypad
   f) Press “ENTR” button (Enter) to update laser code.
3 - AN/AAQ-28 LITENING AT TARGETING POD
3.5 – Start-Up & Lasing Procedure

12. Make sure a steerpoint is set in the vicinity of the target (see Navigation section on how to create steerpoints).

13. Select CNI (Communications, Navigation & Identification) DED page by pressing the DCS/Dobber (Data Control Switch) left to RTN.

14. Select desired steerpoint using the DED (Data Entry Display) Increment/Decrement Switch. We will select Steerpoint 2.

15. On the SMS (Stores Management Set) page, select desired weapon (a valid weapon must be selected, like the GBU-12 laser-guided bomb).

16. On the SMS page, CCIP (Continuously Computed Impact Point) mode is selected by default. TGP is currently slaved to the CCIP pipper.
3 - AN/AAQ-28 LITENING AT TARGETING POD
3.5 – Start-Up & Lasing Procedure

17. On SMS page, select CCRP (Continuously Computed Release Point) weapon release mode. You can do this through the SMS page or toggle release modes with the NWS A/R DISC & MSL STEP button on your stick.

18. Pod will automatically be slaved to the selected steerpoint.

19. Press DMS (Display Management Switch) DOWN to set TGP page as the SOI (Sensor of Interest).
PART 10 – RADAR & SENSORS

3.5 – Start-Up & Lasing Procedure

20. Slew the targeting pod using the Radar Cursor switch
21. Select desired Sensor Mode using the TV/BHOT/WHOT OSB (Option Select Button) or using the TMS (Target Management Switch) LEFT.
22. Set Field of View as desired using the NARO/WIDE OSB or using the Expand/FOV button.
23. Use the MAN RNG (Manual Range) Knob controls to set zoom level.
   • CCW (Counter-Clockwise): Zooms OUT
   • CW (Clockwise): Zooms IN
24. Select Tracking Mode using the TMS (Target Management Switch) UP to toggle between Point Track (POINT, tracks moving objects) or Area Track (AREA, tracks static objects).
25. Fire Laser by pressing and holding the Camera/Gun First Stage Trigger.
26. A flashing “L” indicates laser is being fired. You may now launch laser-guided weapons as per their release procedure.
27. Release trigger to stop firing laser.
3 - AN/AQ-28 LITENING AT TARGETING POD

3.6 – Steerpoint Slaving Mode & Cursor Zero (CZ)

The F-16’s targeting pod is used primarily by slaving the pod on waypoints/steerpoints of your flight plan. I highly recommend that you have a steerpoint already set near a target. Then, you can slave the targeting pod to this waypoint and find the target by slewing the pod reticle.
3 - AN/AAQ-28 LITENING AT TARGETING POD
3.6 – Steerpoint Slaving Mode & Cursor Zero (CZ)

To slave the targeting pod to a waypoint, the in-depth procedure is explained in the Lasing Procedure section. Here is a quick summary:

1. Targeting pod and radar altimeter must be powered on
2. A-G (Air-to-Ground) Master Mode must be selected
3. Targeting pod A-G mode must be selected
4. A valid steerpoint must be selected
5. A valid weapon must be selected
6. CCRP (Continuously Computed Release Point) release mode must be selected via the SMS (Stores Management Set), or toggled with the NWS A/R DISC & MSL STEP Button
7. The targeting pod will automatically slave to the active steerpoint
8. Set the TGP as the SOI using the DMS (Display Management Switch) DOWN.
9. You can slew the targeting pod as desired using the Radar Cursor switch. Other TGP controls are as per the Lasing Procedure section.
3 - AN/AAQ-28 LITENING AT TARGETING POD
3.6 – Steerpoint Slaving Mode & Cursor Zero (CZ)

When the targeting pod is slaved to a steerpoint, the targeting pod’s reticle will create a SPI (Sensor Point of Interest). Slewing the reticle of the pod will move the position of the SPI, which will dynamically create steerpoint offsets, also referred as “deltas”.

System deltas are longitude and latitude offset values which reflect the horizontal difference between the SPI position and the currently selected steerpoint’s original position. The SPI position is initially locked on the steerpoint position. Once SPI is moved (by slewing the TGP) system delta values change. These delta values are applied to all steerpoints, even though the original steerpoint positions (including Bullseye) will still be displayed on the FCR (Fire Control Radar) and HSD (Horizontal Situation Display) pages.

The Cursor Zero function (which is available on the TGP page) allows you to erase any previously created system delta. All steerpoints will return to their original position, and will return the SPI position to the current steerpoint position. “CZ” indication on the TGP page will be highlighted if a system delta exists.

Take note that the System Deltas and Cursor Zero function are not yet implemented.
The “boresight” mode is stabilized on the horizon, following our aircraft heading. It is a basic “look and designate” mode that is done through the targeting pod feed. This is more or less the secondary employment mode of the targeting pod.

In the eventuality that you have no waypoints to slave the Targeting pod to, you can:

1. Select A-G Master Mode
2. On the SMS page, select desired weapon (a valid weapon must be selected).
3. On the SMS page, select CCRP Mode
4. Set the TGP page as the SOI (Sensor of Interest) by using DMS (Display Management Switch) DOWN
5. Uncage the targeting pod in boresight mode using TMS (Target Management Switch) DOWN
6. Slew the targeting pod as desired using the Radar Cursor switch. Other TGP controls are as per the Lasing Procedure section.
3 - AN/AAQ-28 LITENING AT TARGETING POD
3.8 – Laser Spot Search (LSS) Mode

The targeting pod can also spot and track a laser from someone else (a friendly Hornet lasing his own target, or a JTAC, Joint Tactical Air Controller, calling an air strike). To track another laser:
1. Find out what the laser code used by the friendly is (in our case, the friendly JTAC uses code 1688). Make sure the friendly asset is lasing the target before attempting to track it.
2. Power up the Targeting Pod and set A/G Master Mode as per the previous Power-Up Procedure.
3. Select a valid air-to-ground weapon and CCRP release mode
4. Set the TGP page as the SOI (Sensor of Interest) by using DMS (Display Management Switch) DOWN
5. Uncage the targeting pod in boresight mode using TMS (Target Management Switch) DOWN
6. Set Master Arm Switch – ON (UP)
7. Set Laser Switch – ARMED (UP)

DMS (Display Management Switch)
UP/DOWN/LEFT/RIGHT

TMS (Target Management Switch)
UP/DOWN/LEFT/RIGHT
3 - AN/AAQ-28 LITENING AT TARGETING POD

3.8 – Laser Spot Search (LSS) Mode

8. Set the Targeting Pod’s LSS (Laser Spot Search) Code used by the JTAC. The default laser code is 1688.
   a) Press the LIST button
   b) The LIST sub-menus will appear on the DED (Data Entry Display). Press the “0” button on the ICP (Integrated Control Panel) to select the MISC (Miscellaneous) sub-menu.
   c) Press the “5” button on the ICP to select the LASR (Laser) sub-menu.
   d) The TGP code is selected by default (asterisks indicate field is selected).
   e) Press the DCS/Dobber (Data Control Switch) DOWN to select the LST (Laser Spot Track) Code.
   f) The default code of “1688” is already entered, but if we were to change the laser LST code to something else, we would need to type the code (“1688”) on the ICP keypad,
   g) Press “ENTR” button (Enter) to update LST code if required.
9. Fly in the vicinity of the JTAC or laser designator. If a steerpoint is available next to the JTAC, it is good practice to slave your TGP to this steerpoint to narrow the laser search region and facilitate laser spotting.
10. Press the Uncage Switch (Depressed) on the MAN RNG/UNCAGE Knob to activate Laser Spot Search Mode.
11. Once selected, the LSS (Laser Spot Search) indication will be boxed.
12. When targeting pod has found a friendly laser, targeting pod mode will switch from LSS (Laser Spot Search) to LST (Laser Spot Track). It will actively track the JTAC laser.
13. Select Tracking Mode using the TMS (Target Management Switch) UP to toggle between Point Track (POINT, tracks moving objects) or Area Track (AREA, tracks static objects). This will allow you to designate this target.
14. You may now launch laser-guided weapons as per their release procedure.
15. When desired, press the Uncage Switch (Depressed) on the MAN RNG/UNCAGE Knob to stop tracking the laser.
4 – AGM-65D MAVERICK AIR-TO-GROUND MISSILE
4.1 – Displays

Not yet implemented.
4 – AGM-65D MAVERICK AIR-TO-GROUND MISSILE
4.2 – Controls

Not yet implemented.
1 - Introduction
  • 1.1 – Introduction to Weapons
  • 1.2 – Armament Overview
  • 1.3 – My Weapons Control Setup
  • 1.4 – SMS (Stores Management Set) Page
  • 1.5 – Bomb Delivery Modes

2 – Air-to-Ground Weapons
  • 2.1 – Unguided Bombs
    • 2.1.1 – MK-82 Low Drag (CCIP)
    • 2.1.2 – MK-82AIR High Drag (Post-Designate CCIP)
    • 2.1.3 – MK-82 Snaye Eyes (CCRP with Steerpoint)
    • 2.1.4 – MK-84 (CCRP with Targeting Pod)
  • 2.2 – CBU-87 Cluster Bombs (CCIP)
  • 2.3 – GBU-12 Paveway II (Laser-Guided)
  • 2.4 – Rockets
  • 2.5 – M61A1 Gun (Air-to-Ground)
  • 2.6 – GBU-38 JDAM (Not Available Yet)
  • 2.7 – AGM-154A JSOW (Not Available Yet)
  • 2.8 – AGM-65D Maverick (Not Available Yet)
  • 2.9 – AGM-88C HARM (Not Available Yet)

3 – Air-to-Air Weapons
  • 3.1 – M61A1 Gun
    • 3.1.1 – EEGS (Enhanced Envelope Gun Sight) Introduction
    • 3.1.2 – EEGS Level II (No Radar)
    • 3.1.3 – EEGS Level V (With Radar)
  • 3.2 – AIM-9M Sidewinder
    • 3.2.1 – Sidewinder Introduction
    • 3.2.2 – No Radar
    • 3.2.3 – Radar
  • 3.3 – AIM-9X HOBS Sidewinder (HMCS)
  • 3.4 – AIM-120C AMRAAM
    • 3.4.1 – AMRAAM Introduction
    • 3.4.2 – Radar – Single Target
    • 3.4.3 – Radar – Multiple Targets

4 – Ordnance Jettison
  • 4.1 – Selective Ordnance Jettison
  • 4.2 – Emergency Stores Jettison
1.1 – INTRODUCTION TO WEAPONS

The F-16 carries a good variety of weapons. The strength of the Viper lies in its array of sensors: the FCR (Fire Control Radar) and Targeting Pod provide you a lot of information in order to use both guided and unguided weapons with great precision. The Viper is a multirole aircraft by design, therefore the types of missions you can perform is quite extensive. Most of the weapon functions are directly accessible from HOTAS (Hands On Throttle And Stick) controls. The workload should be relatively light while allowing you as many options to use your weapons as the mission requires.
### 1.2 – ARMAMENT OVERVIEW

#### BOMBS

<table>
<thead>
<tr>
<th>WEAPON</th>
<th>TYPE</th>
<th>WEAPON</th>
<th>TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MK-82</td>
<td>500 lbs low-drag unguided bomb</td>
<td>CBU-87</td>
<td>Combined Effects Munitions (CEM) weighs 950 lbs and is an all-purpose cluster bomb.</td>
</tr>
<tr>
<td></td>
<td>Fuze Setting:</td>
<td></td>
<td>Fuze Setting:</td>
</tr>
<tr>
<td></td>
<td>• Either Nose, Tail, or NSTL (Nose/Tail) for redundancy.</td>
<td>• NSTL (Nose &amp; Tail): Bomblets dispense using settings displayed on SMS page</td>
<td></td>
</tr>
<tr>
<td>MK-82SE</td>
<td>500 lbs unguided low-drag retarded bomb</td>
<td>CBU-97</td>
<td>• NOSE: Bomblets dispense immediately after release</td>
</tr>
<tr>
<td>(Snake Eye)</td>
<td>Fuze Setting:</td>
<td></td>
<td>• TAIL: Dud (Disarmed)</td>
</tr>
<tr>
<td></td>
<td>• NSTL (Nose &amp; Tail): High Drag</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• NOSE: Low Drag</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• TAIL: High Drag</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MK-82AIR</td>
<td>500 lbs high-drag unguided bomb</td>
<td>BDU-33</td>
<td>25 lbs unguided training bomb</td>
</tr>
<tr>
<td></td>
<td>Fuze Setting:</td>
<td></td>
<td>Fuze Setting:</td>
</tr>
<tr>
<td></td>
<td>• NSTL (Nose &amp; Tail): High Drag</td>
<td>• Either Nose, Tail, or NSTL (Nose/Tail) for redundancy.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• NOSE: Low Drag</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• TAIL: High Drag</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fuze Setting:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Either Nose, Tail, or NSTL (Nose/Tail) for redundancy.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GBU-10/12/16</td>
<td>2000/500/1000 lbs laser-guided bomb</td>
<td>GBU-38</td>
<td>Global Positioning System (GPS)-guided Joint Direct Attack Munition (JDAM) bombs</td>
</tr>
<tr>
<td>PAVEWAY II</td>
<td>Fuze Setting:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Either Nose, Tail, or NSTL (Nose/Tail) for redundancy.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## 1.2 – ARMAMENT OVERVIEW

### GUN POD

<table>
<thead>
<tr>
<th>WEAPON</th>
<th>TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>M61A1 Vulcan</td>
<td>Six-barrel 20 mm Gatling-type rotary cannon (512 rounds)</td>
</tr>
</tbody>
</table>

### AIR-TO-AIR MISSILES

<table>
<thead>
<tr>
<th>WEAPON</th>
<th>TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIM-9L/M Sidewinder</td>
<td>Infrared guided air-to-air missile. Referred as “SRM” (Short Range Missile) on the HUD.</td>
</tr>
<tr>
<td>AIM-9X Sidewinder</td>
<td>Infrared guided air-to-air missile with thrust vectoring. Referred as “HOB” (High Off-Boresight Missile) on the HUD.</td>
</tr>
<tr>
<td>AIM-120 AMRAAM</td>
<td>Advanced Medium Range Air-to-Air Missile (AMRAAM), active radar homing air-to-air missile. Referred as “MRM” (Medium Range Missile) on the HUD.</td>
</tr>
</tbody>
</table>

### ROCKETS

<table>
<thead>
<tr>
<th>WEAPON</th>
<th>TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.75 in</td>
<td>2.75 inches rocket, used for general purpose</td>
</tr>
</tbody>
</table>
## 1.2 – ARMAMENT OVERVIEW

### AIR-TO-GROUND MISSILES

<table>
<thead>
<tr>
<th>WEAPON</th>
<th>TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGM-65D Maverick – IR Seeker</td>
<td>Air-to-Ground missile guided by imaging infrared system and used at night and during bad weather.</td>
</tr>
<tr>
<td>AGM-88C HARM</td>
<td>Air-to-Surface High-Speed Anti-Radiation Missile (HARM) missile. Anti-radiation guidance homes in on radiowave emissions from a radar, allowing it to attack surface-to-air missile (SAM) sites. Uses the HTS (HARM Targeting System) pod</td>
</tr>
</tbody>
</table>
1.3 – MY WEAPONS CONTROLS SETUP

**Real Aircraft Controls**

**DMS (Display Management Switch)**
- UP/DOWN/LEFT/RIGHT

**Weapon Release Button**

**Camera/Gun Trigger (Two Stages)**

**Expand/FOV (Field-of-View) Button**

**TMS (Target Management Switch)**
- UP/DOWN/LEFT/RIGHT

**Radar Cursor/Enable Switch**
- Depress, Multidirectional

**Radar Antenna Elevation Knob**
- Rotates, Center Detent

**NWS A/R DISC & MSL STEP Button**
- NWS: Nosewheel Steering Activation
- A/R: When in flight and the AIR REFUEL switch in the OPEN position, depressing the button disconnects boom latching
- MSL (MISSILE) STEP: When in flight, depressing the button in EO or A-A mode selects the next weapon station. Depressing the button in A-G Mode cycles between CCRP, CCIP and DTOS.

**MAN RNG/UNCAGE Knob/Switch**
- MAN RNG Clockwise: Zooms In
- MAN RNG Counter-Clockwise: Zooms Out
- UNCAGE (Depressed): Laser Spot Search Mode or uncages sidewinder (“C” binding)

**Weapon Release Button**

**Dogfight Switch**
- 3-Position switch, Slide
  - DOGFIGHT (Outboard): provides symbology on HUD for both 20 mm gun firing and air-to-air missile delivery
  - Missile Override (Inboard): provides symbology on HUD for air-to-air missile firing only
  - Center: Returns to last selected Master Mode
1.3 – MY WEAPONS CONTROLS SETUP

My Controls

- NWS A/R DISC MSL STEP Button (hidden grey button on right hand side)
- WPN REL Button
- Camera/Gun Trigger (Two Detents)
- Expand/FOV Button
- TMS UP
- TMS RIGHT
- TMS DOWN
- TMS LEFT
- DMS UP
- DMS RIGHT
- DMS DOWN
- DMS LEFT
- MAN RNG Knob – CCW (Zoom Out)
- MAN RNG Knob – CW (Zoom In)
- ANE ELEV Knob (Radar Antenna Elevation)
- ENABLE Switch (Enter)
- RDR Cursor Switch – Y Axis
- RDR Cursor Switch – X Axis
- Dogfight Switch – MISSILE OVERRIDE/CENTER
- UNCAGE Switch
- Dogfight Switch – DOGFIGHT/CENTER
The SMS (Stores Management Set) page can be accessed by clicking on the SMS OSB (Option Select Button). This page allows for viewing, configuration and status monitoring of loaded stores. This page acts like the A-10C’s DSMS (Digital Stores Management Systems) page and allows you to select your armament and program useful options like bomb delivery mode or advanced air-to-air missile modes.

The display provides the number, type, and status of all stores loaded on the aircraft’s weapon stations.

- Different options are available depending on the type of weapons that are selected.
- If the NAV Master Mode is selected (neither A-A or A-G are selected), the Inventory Page is selected by default.
- A Selective Jettison page (S-J) is also available that allows selected stores to be jettisoned in an unarmed state.

Note:
- MAU stands for “MAU-12 Bomb Ejector Rack”.
- TER stands for “Triple Ejector Rack”.
- LO3 stands for “LAU-3 Rocket Pod”.
- MRL stands for “Missile Rail Launcher”

PART 11 – OFFENCE: WEAPONS & ARMAMENT
1.4 – SMS PAGE
(STORES MANAGEMENT SET)

- If the NAV Master Mode is selected (neither A-A or A-G are selected), the Inventory Page is selected by default.
- If either A-A (Air-to-Air) or A-G (Air-to-Ground) Master Mode is selected, you can access the inventory page by selecting the INV OSB.
- When SMS is selected and the Master Mode is A-G the SMS page displays only information relevant to A-G weapons.
- When SMS is selected and the Master Mode is A-A the SMS page displays only information relevant to AAM (Air-to-Air Missile) weapons.
1.5 – BOMB DELIVERY MODES
CCIP & CCRP

There are 5 main methods to deliver a bomb:
- CCIP (Continuously Computed Impact Point)
- CCRP (Continuously Computed Release Point)
- DTOS (Dive Toss) – Not Simulated Yet
- LADD (Low Altitude Drogue Delivery) – Not Simulated Yet
- MAN (Manual) – Not Simulated Yet

CCIP mode is the traditional dive bombing approach: you dive on target and the reticle will tell you where the bomb will impact.

However, dive bombing is a risky business, especially if anti-air defences are surrounding your target. The lower you go, the more vulnerable you are. This is why CCRP release mode was invented.

CCRP mode allows you to fly straight and level without having to dive down. The HUD will tell you when to release your bomb for the target you have designated with your radar. It is a much safer way to release a bomb, but as you may have guessed already, it is less precise.
2.1.1 – UNGUIDED BOMB – MK-82 (CCIP)

1. Verify that FCR (Fire Control Radar) switch is ON (FWD); the FCR is used for target ranging.
2. **(Optional)** If you wish to use the targeting pod laser to range the target:
   a) Set the RIGHT HDPT switch to ON (FWD).
   b) Set Laser Switch – ARMED (UP)
3. Select Air-to-Ground Master Mode by pressing the A-G Button on the ICP (Integrated Control Panel). This will configure the Fire Control Radar, Targeting Pod and displays for air-to-ground attacks.
4. Set Master Arm switch – ARM (UP)
5. On the SMS (Stores Management Set) page, select MK-82 bombs (M82) by toggling weapons with the OSB (Option Select Button) adjacent to the Selected Weapon option.
6. On the SMS page, select desired weapon profile. Let’s take PROF1 since it is CCIP-compliant by default.
7. On the SMS page, verify that CCIP (Continuously Computed Impact Point) release mode is selected. If it is not, press the OSB next to the Release Mode option and select OSB next to “CCIP”. Alternatively, you can toggle Release Mode with the NWS A/R DISC & MSL STEP button on the stick.
8. Set desired fuze option (press OSB to toggle setting). We will set NSTL:
   • NOSE: Nose Fuze only
   • TAIL: Tail Fuze only
   • NSTL: Nose & Tail, typically used for redundancy.
9. Set desired Single/Pair option (press OSB to toggle setting). We will select SINGLE:
   • SGL: Single Launcher
   • PAIR: With PAIR selected, bombs will be released from both opposite stations, assuming identical bombs are loaded on stations 4 and 6 or 3 and 7.
10. If more than one bomb is to be released, set desired Release Interval option. In our case, this setting is not relevant.
    • Type in the new impact spacing distance using the OSBs on the left and right of the display and select ENTR.
    • You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.
11. If more than one bomb is to be released, set the number of release pulses. We will leave it at 1.
    • Type in the desired number of release pulses using the OSBs on the left and right of the display and select ENTR.
    • You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.
12. Verify that System Status displays RDY (Ready) on the SMS page.
2.1.1 – UNGUIDED BOMB – MK-82 (CCIP)

13. Place the target 30 degrees off your nose, left or right.
   - For a 45-degree dive, place the target just below the canopy rail.
   - For a 30-degree dive, place the target one fist length above the canopy rail.
   - For a 20-degree dive, place the target a fist with thumbs up above the canopy rail.
   - For a 10-degree dive, place the target the length of a hang-ten hand signal above the canopy rail (pinky tip to top of thumb).

14. Once you have the correct sight picture, roll in on the target. In our case, we will perform a 30-deg dive.
15. When performing your dive, place your FPM (Flight Path Marker) to an Aim Off Distance Point of your choosing (typically 2000 ft further than the target).
16. Align the BFL (Bomb Fall Line) with the target.
17. The CCIP pipper tracks up the bomb fall line towards the target. Don’t fly the pipper to the target or hold it on the target using forward stick (you risk colliding with your own bomb on release). Wait for the pipper to intersect the target naturally.
18. If the CCIP impact point does not lay within the HUD field of view, the Time Delay Cue (TDC) is shown as a short, horizontal line on the Bomb Fall Line.
19. When the TDC is no longer displayed on the Bomb Fall Line, the pipper is in the HUD field of view. That will be the impact point if the bombs are released immediately.

20. (Optional) If the targeting pod is equipped, press the first stage of the gun trigger to fire your laser and acquire ranging information from the laser. When laser is being fired, the “L” symbol on the HUD will flash. Releasing the trigger stops lasing.
   - When “laser ranging”, the laser is fired and the time it takes to receive the reflected laser energy is measured, providing a precise range. This information is then fed to the Fire Control Computer to update the stored target elevation and greatly improve the accuracy of the computed firing solution.
   - If Laser Ranging is not used, the Fire Control Computer will still display a range, but not as precise.

21. Monitor the Pull-Up Anticipation Cue (PUAC) to ensure it does not go above the Flight Path Marker (see note on PUAC at the end of this tutorial).

22. When CCIP pipper intersects the target, depress the Weapon Release (RALT+SPACE) button to release the bomb.
23. After release, fly a safe escape maneuver to avoid the bomb fragmentation. A 5G pull-up to a 30-deg climb is recommended.
2.1.1 – UNGUIDED BOMB – MK-82 (CCIP)
2.1.1 – UNGUIDED BOMB – MK-82 (CCIP)

Note on Time Delay Cue (TDC):

Between the CCIP pipper and the velocity vector marker is the Time Delay Cue (also called Reflected Cue).

When the Time Delay Cue (TDC) is visible on the BFL (Bomb Fall Line), it indicates that the CCIP pipper on the HUD is not showing the true impact point if you were to drop the bomb at that moment.

Instead, the true impact location is a mirror of the distance from the Time Delay Cue to the CCIP pipper. When Reflected Cue disappears, the CCIP pipper will then indicate the true impact point.
2.1.1 – UNGUIDED BOMB – MK-82 (CCIP)

Note on the PUAC (Pull-Up Anticipation Cue):

Monitor the Pull-Up Anticipation Cue to ensure it does not go above the Flight Path Marker.

The Pull-Up Anticipation Cue (PUAC) provides a visual representation of the altitude required for the bomb fuze to arm or altitude to initiate a pull-up to avoid impacting the ground, whichever is more immediate. It moves up toward the Flight Path Marker (FPM) as the aircraft loses altitude. Releasing a bomb with the FPM below the PUAC will not give the bomb time to arm and result in a dud.
2.1.2 – UNGUIDED BOMB – MK-82AIR HIGH DRAG (Post-Designate CCIP)

An option for CCIP bombs delivery is available for situations where the target cannot be within the HUD field of view at release. This can sometimes happen on attacks from a shallow dive angle or high altitude. The steps to enter CCIP mode are the same as described in the CCIP section. The difference is in when you depress and hold the Weapons Release button.
2.1.2 – UNGUIDED BOMB – MK-82AIR HIGH DRAG (Post-Designate CCIP)

1. Verify that FCR (Fire Control Radar) switch is ON (FWD); the FCR is used for target ranging.
2. Select Air-to-Ground Master Mode by pressing the A-G Button on the ICP (Integrated Control Panel). This will configure the Fire Control Radar and displays for air-to-ground attacks.
3. Set Master Arm switch – ARM (UP)
4. On the SMS (Stores Management Set) page, select MK-82AIR bombs (B49, standing for the “BSU-49/B high drag tail assembly”, also called a “ballute”) by toggling weapons with the OSB (Option Select Button) adjacent to the Selected Weapon option.
5. On the SMS page, select desired weapon profile. Let’s take PROF1 since it is CCIP-compliant by default.
6. On the SMS page, verify that CCIP (Continuously Computed Impact Point) release mode is selected. If it is not, press the OSB next to the Release Mode option and select OSB next to “CCIP”. Alternatively, you can toggle Release Mode with the NWS A/R DISC & MSL STEP button on the stick.
7. Set desired fuzing option (press OSB to toggle setting). We will set NSTL.
   • NSTL (Nose & Tail): High Drag
   • NOSE: Low Drag
   • TAIL: High Drag
8. Set desired Single/Pair option (press OSB to toggle setting). We will select PAIR.
   • SGL: Single Launcher
   • PAIR: With PAIR selected, bombs will be released from both opposite stations, assuming identical bombs are loaded on stations 4 and 6 or 3 and 7.
9. If more than one bomb is to be released, set desired Release Interval option. We will set it to 25 ft.
   • Type in the new impact spacing distance using the OSBs on the left and right of the display and select ENTR.
   • You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.
10. If more than one bomb is to be released, set the number of release pulses. We will set it to 2.
    • Type in the desired number of release pulses using the OSBs on the left and right of the display and select ENTR.
    • You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.
11. Verify that System Status displays RDY (Ready) on the SMS page.
2.1.2 – UNGUIDED BOMB – MK-82AIR HIGH DRAG (Post-Designate CCIP)

12. Once you have the correct sight picture, roll in on the target. In our case, we will perform a shallow dive (between 10 and 15 deg).
13. If the CCIP impact point does not lay within the HUD field of view, the Time Delay Cue (TDC) is shown as a short, horizontal line on the Bomb Fall Line.
14. Maneuver your aircraft to position the CCIP Pipper on target and align the BFL (Bomb Fall Line) with the target.
15. Designate the CCIP pipper’s location as the target by depressing and holding the Weapons Release button (RALT+SPACE).
16. As you hold the Weapon Release button, the HUD symbology displayed will change to a symbology identical to that used for a CCRP delivery.
17. Level off the aircraft and keep the Flight Path Marker aligned with the Azimuth Steering Line (ASL). This will align your aircraft with the target even though the target will be out of sight.
18. A Solution Cue is displayed at the top of the Steering Line. The Solution Cue will fall down the Azimuth Steering Line as the range decreases and the weapon is about to be released.
19. As you keep the Weapon Release button held, keep flying the Flight Path Marker over the Azimuth Steering Line as the Solution Cue continues to track downward.
20. The bombs are released when the Solution Cue passes the Flight Path Marker.
2.1.2 – UNGUIDED BOMB – MK-82AIR HIGH DRAG (Post-Designate CCIP)
2.1.3 – UNGUIDED BOMB – MK-82SE (SNAKE EYES) (CCRP with Steerpoint)

1. We will be bombing a target that is directly on a steerpoint that is already in our flight plan (i.e. Steerpoint No. 2). To enter Steerpoint coordinates manually, see the Navigation section.
2. Select CNI (Communications, Navigation & Identification) DED page by pressing the DCS/Dobber (Data Control Switch) left to RTN.
3. Select desired waypoint using the DED (Data Entry Display) Increment/Decrement Switch. We will select Steerpoint 2.
4. Steer towards selected Steerpoint using cues on the HUD and HSD (Horizontal Situation Display) page.
2.1.3 – UNGUIDED BOMB – MK-82SE (SNAKE EYES)
(CCRP with Steerpoint)

5. Verify that FCR (Fire Control Radar) switch is ON (FWD); the FCR is used for target ranging.

6. Select Air-to-Ground Master Mode by pressing the A-G Button on the ICP (Integrated Control Panel). This will configure the Fire Control Radar and displays for air-to-ground attacks.

7. Set Master Arm switch – ARM (UP)

8. On the SMS (Stores Management Set) page, select MK-82 Snake Eye bombs (M82S) by toggling weapons with the OSB (Option Select Button) adjacent to the Selected Weapon option.

9. On the SMS page, select desired weapon profile. Let’s take PROF2 since it is CCRP-compliant by default.

10. On the SMS page, verify that CCRP (Continuously Computed Release Point) release mode is selected. If it is not, press the OSB next to the Release Mode option and select OSB next to “CCRP”. Alternatively, you can toggle Release Mode with the NWS A/R DISC & MSL STEP button on the stick.
2.1.3 – UNGUIDED BOMB – MK-82SE (SNAKE EYES) (CCRP with Steerpoint)

11. Set desired fuzing option (press OSB to toggle setting). We will set NSTL.
   - NSTL (Nose & Tail): High Drag
   - NOSE: Low Drag
   - TAIL: High Drag
12. Set desired Single/Pair option (press OSB to toggle setting). We will select PAIR.
   - SGL: Single Launcher
   - PAIR: With PAIR selected, bombs will be released from both opposite stations, assuming identical bombs are loaded on stations 4 and 6 or 3 and 7.
13. If more than one bomb is to be released, set desired Release Interval option. We will set it to 100 ft.
   - Type in the new impact spacing distance using the OSBs on the left and right of the display and select ENTR.
   - You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.
14. If more than one bomb is to be released, set the number of release pulses. We will set it to 3.
   - Type in the desired number of release pulses using the OSBs on the left and right of the display and select ENTR.
   - You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.
15. Verify that System Status displays RDY (Ready) on the SMS page.
16. Depending on the direction of the target, either a TLL (Target Locator Line) or a TD (Target Designator) Box towards the Steerpoint/Target is displayed on the Heads-Up Display.

17. Level off the aircraft and keep the Flight Path Marker aligned with the Azimuth Steering Line (ASL). This will align your aircraft with the target.

18. A Solution Cue is displayed at the top of the Azimuth Steering Line (ASL). The Solution Cue will fall down the Azimuth Steering Line as the range decreases and the weapon is about to be released.

19. When Solution Cue falls down towards the Flight Path Marker, depress and hold the Weapons Release button (RALT+SPACE).

20. As you keep the Weapon Release button held, keep flying the Flight Path Marker over the Azimuth Steering Line as the Solution Cue continues to track downward.

21. The bombs are released when the Solution Cue passes the Flight Path Marker.
2.1.3 – UNGUIDED BOMB – MK-82SE (SNAKE EYES) (CCRP with Steerpoint)
2.1.4 – UNGUIDED BOMB – MK-84 (CCRP with Targeting Pod)

1. Verify that FCR (Fire Control Radar) switch is ON (FWD); the FCR is used for target ranging.
2. Verify that Radar Altimeter (RDR ALT) switch is ON (FWD).
3. To use the targeting pod laser to range the target:
   a) Set the RIGHT HDPT switch to ON (FWD).
   b) Set Laser Switch – ARMED (UP).
4. Select Air-to-Ground Master Mode by pressing the A-G Button on the ICP (Integrated Control Panel). This will configure the Fire Control Radar, Targeting Pod and displays for air-to-ground attacks.
5. Set Master Arm switch – ARM (UP).
6. On the SMS (Stores Management Set) page, select MK-84 bombs (M84) by toggling weapons with the OSB (Option Select Button) adjacent to the Selected Weapon option.
7. On the SMS page, select desired weapon profile. Let’s take PROF2 since it is CCRP-compliant by default.
8. On the SMS page, verify that CCRP (Continuously Computed Release Point) release mode is selected. If it is not, press the OSB next to the Release Mode option and select OSB next to “CCRP”. Alternatively, you can toggle Release Mode with the NWS A/R DISC & MSL STEP button on the stick.
2.1.4 – UNGUIDED BOMB – MK-84
(CCRP with Targeting Pod)

9. Set desired fuzing option (press OSB to toggle setting). We will set NSTL.
   • NOSE: Nose Fuze only
   • TAIL: Tail Fuze only
   • NSTL: Nose & Tail, typically used for redundancy.

10. Set desired Single/Pair option (press OSB to toggle setting). We will select SINGLE.
    • SGL: Single Launcher
    • PAIR: With PAIR selected, bombs will be released from both opposite stations,
      assuming identical bombs are loaded on stations 4 and 6 or 3 and 7.

11. If more than one bomb is to be released, set desired Release Interval option. In our
    case, this setting is not relevant.
    • Type in the new impact spacing distance using the OSBs on the left and right
      of the display and select ENTR.
    • You may correct numbers entered in error by selecting RCL or return to the
      SMS page without making changes by selecting RTN.

12. If more than one bomb is to be released, set the number of release pulses. We will
    leave it at 1.
    • Type in the desired number of release pulses using the OSBs on the left and
      right of the display and select ENTR.
    • You may correct numbers entered in error by selecting RCL or return to the
      SMS page without making changes by selecting RTN.

13. Verify that System Status displays RDY (Ready) on the SMS page.
2.1.4 – UNGUIDED BOMB – MK-84 (CCRP with Targeting Pod)

- Typically, a Steerpoint should be programmed in your flight plan near the target. In this case, we will assume Steerpoint 2 is set near the target.

14. Select CNI (Communications, Navigation & Identification) DED page by pressing the DCS/Dobber (Data Control Switch) left to RTN
15. Select desired waypoint using the DED (Data Entry Display) Increment/Decrement Switch. We will select Steerpoint 2.
16. When CCRP release mode is selected, the Targeting Pod will automatically be slaved to the selected steerpoint (Steerpoint 2 in our case).
2.1.4 – UNGUIDED BOMB – MK-84 (CCRP with Targeting Pod)

17. Press DMS (Display Management Switch) DOWN to set TGP page as the SOI (Sensor of Interest). The SOI Box around the TGP page will indicate when the targeting pod can be controlled with HOTAS controls.

18. Slew the targeting pod using the Radar Cursor switch.

19. Select desired Sensor Mode using the TV/BHOT/WHOT OSB (Option Select Button) or using the TMS (Target Management Switch) LEFT.

20. Set Field of View as desired using the NARO/WIDE OSB or using the Expand/FOV button.

21. Use the MAN RNG (Manual Range) Knob controls to set zoom level.
   - CCW (Counter-Clockwise): Zooms OUT
   - CW (Clockwise): Zooms IN

22. Select Tracking Mode using the TMS (Target Management Switch) UP to toggle between Point Track (POINT, tracks moving objects) or Area Track (AREA, tracks static objects).

MAN RNG/UNCAGE Knob/switch
- MAN RNG Clockwise: Zooms In
- MAN RNG Counter-Clockwise: Zooms Out
- UNCAGE (Depressed): Laser Spot Search Mode (“C” binding)

Radar Cursor/Enable Switch
Depress, Multidirectional

TMS (Target Management Switch)
UP/DOWN/LEFT/RIGHT

DMS (Display Management Switch)
UP/DOWN/LEFT/RIGHT

Expand/FOV (Field-of-View) Button

SOI (Sensor of Interest) Box

Point Track

Targeting Pod Cursor

Laser Status
Steady L: Laser Armed
Flashing L: Laser Firing

CCRP Release Mode Selected

TGP (Targeting Pod) CCRP Designation Box

Steady L: Laser Armed
Flashing L: Laser Firing

CCRP Release Mode Selected
2.1.4 – UNGUIDED BOMB – MK-84 (CCRP with Targeting Pod)

- Important Note: In the case where a Steerpoint is not available near the target, you can uncage the targeting pod in boresight mode. To do so:
  a) Press DMS (Display Management Switch) DOWN to set TGP page as the SOI (Sensor of Interest)
  b) Press TMS (Target Management Switch) DOWN to uncage the targeting pod
  c) Slew the Targeting Pod Cursor using the Radar Cursor.
2.1.4 – UNGUIDED BOMB – MK-84 (CCRP with Targeting Pod)

16. Depending on the direction of the target, either a TLL (Target Locator Line) or a TD (Target Designator) Box towards the Steerpoint/Target is displayed on the Heads-Up Display.

17. Level off the aircraft and keep the Flight Path Marker aligned with the Azimuth Steering Line (ASL). This will align your aircraft with the target.

18. A Solution Cue is displayed at the top of the Azimuth Steering Line (ASL). The Solution Cue will fall down the Azimuth Steering Line as the range decreases and the weapon is about to be released.

19. (Optional) If desired, press the first stage of the gun trigger to fire your laser and acquire ranging information from the laser. When laser is being fired, the “L” symbol on the HUD will flash. Releasing the trigger stops lasing.
   - When “laser ranging”, the laser is fired and the time it takes to receive the reflected laser energy is measured, providing a precise range. This information is then fed to the Fire Control Computer to update the stored target elevation and greatly improve the accuracy of the computed firing solution.
   - If Laser Ranging is not used, the Fire Control Computer will still display a range, but not as precise.

20. When Solution Cue falls down towards the Flight Path Marker, depress and hold the Weapons Release button (RALT+SPACE).

21. As you keep the Weapon Release button held, keep flying the Flight Path Marker over the Azimuth Steering Line as the Solution Cue continues to track downward.

22. The bomb is released when the Solution Cue passes the Flight Path Marker.

**Diagram Notes:**
- **Solution Cue** Moves from Top to Bottom
- **Flight Path Marker (FPM)**
- **Azimuth Steering Line (ASL)**
- **Master Arm ON**
- **Weapon Release Button**
- **Camera/Gun Trigger (Two Stages)**
- **Laser Armed (When flashing, laser is firing)**
- **Slant Range Indicator (nm)**
- **Distance to Target (nm)**
- **Bearing to Target (deg)**
- **Time to Target (sec)**
2.1.4 – UNGUIDED BOMB – MK-84 (CCRP with Targeting Pod)
2.2 – CBU-87 CLUSTER BOMB (CCIP)

CBUs (Cluster Bomb Units) are generally used against “soft” targets.

Keep in mind that there are two parameters that affect the effectiveness of CBUs. At the moment, we cannot modify them yet.
* Height of Function (HoF), which determines at which height the bomblets will release. It impacts area spread and accuracy.
* RPM, which is the area spread of the bomblets that affects the concentration of fire available on the target. This parameter is applicable to the CBU-87 only.

Take note that the general bomblet footprint coverage is 200 by 400 meters.

### CBU (Cluster Bomb Unit) Types

**CBU-87 (CB87B):** This Combined Effects Munitions (CEM) weighs 950 lbs and is an all-purpose cluster bomb. The SW-65 Tactical Munitions Dispenser contains 202 BLU-97/B Combined Effects Bomblets (CEB) and they are effective against armored and unarmored targets.
* Preset HoF parameter: 1500 ft

**CBU-97 (CB97B):** 1,000-pound class weapon containing sensor-fused sub-munitions for specifically attacking armor.
* Preset HoF parameter: 1500 ft

---

### Parameters (Applicable for CBU-87)

- Height of function
- RPM

### Parameters (Applicable for CBU-97)

- Height of function
- Wind
2.2 – CBU-87 CLUSTER BOMB (CCIP)

1. Verify that FCR (Fire Control Radar) switch is ON (FWD); the FCR is used for target ranging.
2. Select Air-to-Ground Master Mode by pressing the A-G Button on the ICP (Integrated Control Panel). This will configure the Fire Control Radar, Targeting Pod and displays for air-to-ground attacks.
3. Set Master Arm switch – ARM (UP)
4. On the SMS (Stores Management Set) page, select CBU-87 bombs (CB87B) by toggling weapons with the OSB (Option Select Button) adjacent to the Selected Weapon option.
5. On the SMS page, select desired weapon profile. Let’s take PROF1 since it is CCIP-compliant by default.
6. On the SMS page, verify that CCIP (Continuously Computed Impact Point) release mode is selected. If it is not, press the OSB next to the Release Mode option and select OSB next to “CCIP”. Alternatively, you can toggle Release Mode with the NWS A/R DISC & MSL STEP button on the stick.
2.2 – CBU-87 CLUSTER BOMB (CCIP)

7. Set desired fuzing option (press OSB to toggle setting). We will set NSTL.
   • NSTL (Nose & Tail): Bomblets dispense using settings displayed on SMS page
   • NOSE: Bomblets dispense immediately after release
   • TAIL: Dud (Disarmed)

8. Set desired Single/Pair option (press OSB to toggle setting). We will select SINGLE.
   • SGL: Single Launcher
   • PAIR: With PAIR selected, bombs will be released from both opposite stations, assuming identical bombs are loaded on stations 4 and 6 or 3 and 7.

9. If more than one bomb is to be released, set desired Release Interval option. In our case, we will set 200 ft.
   • Type in the new impact spacing distance using the OSBs on the left and right of the display and select ENTR.
   • You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.

10. If more than one bomb is to be released, set the number of release pulses. We will set it to 8.
    • Type in the desired number of release pulses using the OSBs on the left and right of the display and select ENTR.
    • You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.

11. The Height of Function (BA stands for Burst Altitude) setting should be set to 1500 ft (cannot be modified yet).
12. Verify that System Status displays RDY (Ready) on the SMS page.
2.2 – CBU-87 CLUSTER BOMB (CCIP)

13. When performing your dive, place your FPM (Flight Path Marker) to an Aim Off Distance Point of your choosing (typically 2000 ft further than the target).
14. Align the BFL (Bomb Fall Line) with the target.
15. The CCIP pipper tracks up the bomb fall line towards the target... Don’t fly the pipper to the target or hold it on the target using forward stick (you risk colliding with your own bomb on release). Wait for the pipper to intersect the target naturally.
16. If the CCIP impact point does not lay within the HUD field of view, the Time Delay Cue (TDC) is shown as a short, horizontal line on the Bomb Fall Line.

**Time Delay Cue (TDC)**
Displays a mirrored view of how far below the HUD the real CCIP aiming pipper is
17. When the TDC is no longer displayed on the Bomb Fall Line, the pipper is in the HUD field of view. That will be the impact point if the bombs are released immediately.

18. Monitor the Pull-Up Anticipation Cue (PUAC) to ensure it does not go above the Flight Path Marker.

19. When CCIP pipper intersects the target, depress the Weapon Release (RALT+SPACE) button to release the bomb.

**PART 11 – OFFENCE: WEAPONS & ARMAMENT**

**2.2 – CBU-87 CLUSTER BOMB (CCIP)**

![Image of HUD with CCIP Pipper, Target, and Slant Range Indicator]
2.2 – CBU-87 CLUSTER BOMB (CCIP)

20. After release, fly a safe escape maneuver to avoid the bomb fragmentation. A 5G pull-up to a 30-deg climb is recommended.
2.2 – CBU-87 CLUSTER BOMB (CCIP)
2.3 – GBU-12 PAVEWAY II (Laser-Guided)

The GBU-12 Paveway II is the laser-guided version of the Mk-82 unguided, general purpose bomb. The GBU-12 guides using the same principles as the GBU-10, the only difference being the bomb the LGB is based on. The seeker head on each laser guided bomb is set to track only a specific laser pulse rate frequency (PRF) code. These are manually set by the weapons load crew during ground operations (via Mission Editor) and may not be set from the cockpit during flight.
2.3 – GBU-12 PAVEWAY II (Laser-Guided)

If you are flying in multiplayer and do not know your GBU-12 code, you can open the WEAPON Kneeboard page by pressing "RSHIFT+K". This will show you the laser code set on your GBU-12 laser-guided bomb.

Laser-guided bomb laser codes will eventually be programmable on ground by using the following commands:
- `RS#IFT + RALT + 9`: Changes Laser Code (Hundreds)
- `RS#IFT + RALT + 0`: Changes Laser Code (Ones)
- `RS#IFT + RALT+-`: Changes Laser Code (Tens)

At the moment, this functionality is not enabled.
2.3 – GBU-12 PAVEWAY II (Laser-Guided)

1. Set the Targeting Pod’s Laser Code as per the GBU-12 code programmed on the guided bomb, which is set via the mission editor. The default laser code is 1688, but in this case we will pick a bomb with a laser code of 1655.
   a) “RSHIFT+K” displays the WEAPON Kneeboard page and your GBU-12 laser code (1655).
   b) Press the LIST button
   c) The LIST sub-menus will appear on the DED (Data Entry Display). Press the “0” button on the ICP (Integrated Control Panel) to select the MISC (Miscellaneous) sub-menu.
   d) Press the “5” button on the ICP to select the LASR (Laser) sub-menu.
   e) The TGP code is selected by default (asterisks indicate field is selected).
   f) To change laser code to “1655”, type “1655” on the ICP keypad
   g) Press “ENTR” button (Enter) to update laser code.
2. Verify that FCR (Fire Control Radar) switch is ON (FWD); the FCR is used for target ranging.
3. Verify that Radar Altimeter (RDR ALT) switch is ON (FWD)
4. To use the targeting pod laser to range the target:
   a) Set the RIGHT HDPT switch to ON (FWD).
   b) Set Laser Switch – ARMED (UP)
5. Select Air-to-Ground Master Mode by pressing the A-G Button on the ICP (Integrated Control Panel). This will configure the Fire Control Radar, Targeting Pod and displays for air-to-ground attacks.
6. Set Master Arm switch – ARM (UP)
7. On the SMS (Stores Management Set) page, select GBU-12 laser-guided bombs (GB12) by toggling weapons with the OSB (Option Select Button) adjacent to the Selected Weapon option.
8. On the SMS page, select desired weapon profile. Let’s take PROF2 since it is CCRP-compliant by default.
9. On the SMS page, verify that CCRP (Continuously Computed Release Point) release mode is selected. If it is not, press the OSB next to the Release Mode option and select OSB next to “CCRP”. Alternatively, you can toggle Release Mode with the NWS A/R DISC & MSL STEP button on the stick.
2.3 – GBU-12 PAVEWAY II (Laser-Guided)

10. Set desired fuzing option (press OSB to toggle setting). We will set NSTL.
   • NOSE: Nose Fuze only
   • TAIL: Tail Fuze only
   • NSTL: Nose & Tail, typically used for redundancy.

11. Set desired Single/Pair option (press OSB to toggle setting). We will select SINGLE.
   • SGL: Single Launcher
   • PAIR: With PAIR selected, bombs will be released from both opposite stations, assuming identical bombs are loaded on stations 4 and 6 or 3 and 7.

12. If more than one bomb is to be released, set desired Release Interval option. In our case, this setting is not relevant.
   - Type in the new impact spacing distance using the OSBs on the left and right of the display and select ENTR.
   - You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.

13. If more than one bomb is to be released, set the number of release pulses. We will leave it at 1.
   - Type in the desired number of release pulses using the OSBs on the left and right of the display and select ENTR.
   - You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.

14. Verify that System Status displays RDY (Ready) on the SMS page.
2.3 – GBU-12 PAVEWAY II (Laser-Guided)

- Typically, a Steerpoint should be programmed in your flight plan near the target. In this case, we will assume Steerpoint 2 is set near the target.

15. Select CNI (Communications, Navigation & Identification) DED page by pressing the DCS/Dobber (Data Control Switch) left to RTN
16. Select desired waypoint using the DED (Data Entry Display) Increment/Decrement Switch. We will select Steerpoint 2.
17. When CCRP release mode is selected, the Targeting Pod will automatically be slaved to the selected steerpoint (Steerpoint 2 in our case).
2.3 – GBU-12 PAVEWAY II (Laser-Guided)

18. Press DMS (Display Management Switch) DOWN to set TGP page as the SOI (Sensor of Interest). The SOI Box around the TGP page will indicate when the targeting pod can be controlled with HOTAS controls.
20. Select desired Sensor Mode using the TV/BHOT/WHOT OSB (Option Select Button) or using the TMS (Target Management Switch) LEFT.
21. Set Field of View as desired using the NARO/WIDE OSB or using the Expand/FOV button.
22. Use the MAN RNG (Manual Range) Knob controls to set zoom level.
   • CCW (Counter-Clockwise): Zooms OUT
   • CW (Clockwise): Zooms IN
23. Select Tracking Mode using the TMS (Target Management Switch) UP to toggle between Point Track (POINT, tracks moving objects) or Area Track (AREA, tracks static objects).
2.3 – GBU-12 PAVEWAY II (Laser-Guided)

- Important Note: In the case where a Steerpoint is not available near the target, you can uncage the targeting pod in boresight mode. To do so:
  a) Press DMS (Display Management Switch) DOWN to set TGP page as the SOI (Sensor of Interest)
  b) Press TMS (Target Management Switch) DOWN to uncage the targeting pod
  c) Slew the Targeting Pod Cursor using the Radar Cursor.
Depending on the direction of the target, either a TLL (Target Locator Line) or a TD (Target Designator) Box towards the Steerpoint/Target is displayed on the Heads-Up Display.

Level off the aircraft and keep the Flight Path Marker aligned with the Azimuth Steering Line (ASL). This will align your aircraft with the target.

A Solution Cue is displayed at the top of the Azimuth Steering Line (ASL). The Solution Cue will fall down the Azimuth Steering Line as the range decreases and the weapon is about to be released.

When Solution Cue falls down towards the Flight Path Marker, depress and hold the Weapons Release button (RALT+SPACE).

As you keep the Weapon Release button held, keep flying the Flight Path Marker over the Azimuth Steering Line as the Solution Cue continues to track downward.

The bomb is released when the Solution Cue passes the Flight Path Marker.

Press and hold the first stage of the gun trigger to fire your targeting pod’s laser. When laser is being fired, the “L” symbol on the HUD will flash. Releasing the trigger stops lasing.

Note: Lasing the target should be done no later than 8-12 seconds prior to impact.

The bomb will track the laser for as long as it is fired until it reaches the target.
2.3 – GBU-12 PAVEWAY II (Laser-Guided)
2.4 – ROCKETS

1. Verify that FCR (Fire Control Radar) switch is ON (FWD); the FCR is used for target ranging.
2. (Optional) If you wish to use the targeting pod laser to range the target:
   a) Set the RIGHT HDPT switch to ON (FWD).
   b) Set Laser Switch – ARMED (UP)
3. Select Air-to-Ground Master Mode by pressing the A-G Button on the ICP (Integrated Control Panel). This will configure the Fire Control Radar, Targeting Pod and displays for air-to-ground attacks.
4. Set Master Arm switch – ARM (UP)
5. On the SMS (Stores Management Set) page, select Rockets by toggling weapons with the OSB (Option Select Button) adjacent to the Selected Weapon option.
6. On the SMS page, CCIP (Continuously Computed Impact Point) release mode should be automatically selected.
7. The Rocket Rate of Fire (Single/Ripple) is set via the Mission Editor.
8. Set desired Single/Pair option (press OSB to toggle setting). We will select SINGLE.
   - SGL: Single Launcher
   - PAIR: With PAIR selected, rockets will be fired from each rocket launcher, assuming launchers are loaded on station 3 and 7.
9. Verify that System Status displays RDY (Ready) on the SMS page.

M151 for MK151 HE (High Explosive)
M156 for MK156 WP (White Phosphorus)
M5 for MK5 HEAT (High Explosive Anti-Tank)
M61 for MK61 WP (White Phosphorus)
10. Perform a 20-30 deg dive on the target and place the CCIP Pipper on the target.

11. (Optional) If the targeting pod is equipped, press the first stage of the gun trigger to fire your laser and acquire ranging information from the laser. When laser is being fired, the “L” symbol on the HUD will flash. Releasing the trigger stops lasing.
   • When “laser ranging”, the laser is fired and the time it takes to receive the reflected laser energy is measured, providing a precise range. This information is then fed to the Fire Control Computer to update the stored target elevation and greatly improve the accuracy of the computed firing solution.
   • If Laser Ranging is not used, the Fire Control Computer will still display a range, but not as precise.

12. An In-Range Cue will be displayed over the CCIP pipper when slant range is less than 8,000 feet and rockets are most effective.

13. When CCIP In-Range Cue is visible, depress the Weapon Release (RALT+SPACE) button to fire rockets.
2.4 – ROCKETS
2.5 – M61A1 GUN (Air-to-Ground)

1. Verify that FCR (Fire Control Radar) switch is ON (FWD); the FCR is used for target ranging.
2. (Optional) If you wish to use the targeting pod laser to range the target:
   a) Set the RIGHT HDPT switch to ON (FWD).
   b) Set Laser Switch – ARMED (UP)
3. Select Air-to-Ground Master Mode by pressing the A-G Button on the ICP (Integrated Control Panel). This will configure the Fire Control Radar, Targeting Pod and displays for air-to-ground attacks.
4. Set Master Arm switch – ARM (UP)
5. On the SMS (Stores Management Set) page, select GUN by toggling Operating Mode with the OSB (Option Select Button) adjacent to the Operating Mode option.
6. On the SMS page, verify that STRF (Strafe) gun sub-mode is selected. If it is not, press the OSB next to the gun sub-mode option or toggle it with the NWS A/R DISC & MSL STEP button on the stick.
7. Set Gun’s In-Range Cue Distance option as desired
   a) Select the OSB (Option Select Button) next to the In-Range Cue distance on the SMS page.
   b) Effective engagement range is generally from 2,500 to 7,000 feet. For armored vehicles, closer is better, and you should attack from behind the target where its armor is weakest.
   c) Type in the new in-range cue distance using the OSBs on the left and right of the display. We will take 6,000 ft.
   d) Select ENTR
   e) You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.

8. Verify that System Status displays RDY (Ready) on the SMS page.
2.5 – M61A1 GUN
(Air-to-Ground)

9. Dive on the target and place the Gun Pipper on the target.
10. (Optional) If the targeting pod is equipped, press the first stage of the gun trigger to fire your laser and acquire ranging information from the laser. When laser is being fired, the “L” symbol on the HUD will flash. Releasing the trigger stops lasing.
   • When “laser ranging”, the laser is fired and the time it takes to receive the reflected laser energy is measured, providing a precise range. This information is then fed to the Fire Control Computer to update the stored target elevation and greatly improve the accuracy of the computed firing solution.
   • If Laser Ranging is not used, the Fire Control Computer will still display a range, but not as precise.
11. Wait for the gun’s Ranging Reticle to unwind until the In-Range Cue (previously set to 6000 ft) is reached. When In-Range Cue is reached, you are within effective gun range and may fire when ready.
12. Squeeze the trigger all the way to the second detent to fire the gun (SPACE).
2.5 – M61A1 GUN (Air-to-Ground)
2.6 – GBU-38 JDAM
(Not Available Yet)
2.7 – AGM-154A JSOW
(Not Available Yet)
2.8 – AGM-65D MAVERICK
(Not Available Yet)
2.9 – AGM-88C HARM
(Not Available Yet)
3.1 – M61A1 GUN
3.1.1 – EEGS (Enhanced Envelope Gun Sight) Introduction

The F-16 is equipped with a 20 mm Gatling-type rotary cannon. The Enhanced Envelope Gun Sight (EEGS) provides the capability to accurately employ the gun at all aspects, with or without a radar lock. The EEGS consists of five levels of displays, each providing an increasing level of capability. Take note that only Levels II and V are relevant to DCS.

- **LEVEL I**: failure mode that only displays the Boresight Cross in the event of a Rate Sensor Unit (RSU) and INS failure. It should almost never be encountered.
- **LEVEL II**: provides a prediction of the bullet path when there is no radar lock. The Boresight Cross, EEGS Funnel and Multiple Reference Gunsight (MRGS) Lines are provided.
- **LEVEL III**: intermediate level that leads to the Level V display.
- **LEVEL IV**: intermediate level that leads to the Level V display
- **LEVEL V**: displayed after radar lock-on and a firing solution has been computed using that data. Additional references in the HUD include the Target Designator, T-Symbol, Slant Range, Closure Rate and Level V Pipper.

Level II Symbology (no radar lock)

Level V Symbology (with radar lock)
3.1 – M61A1 GUN
3.1.1 – EEGS (Enhanced Envelope Gun Sight) Introduction

Ammunition types for the gun can only be set through the mission editor. Here are the available ammo types:

- HEI-T: High-Explosive Incendiary-Tracer
- HEI: High-Explosive Incendiary
- AP: Armor Piercing
- TP: Target Practice Tracer
- SAPHEI PGU: High Explosive Armor Piercing PGU
- TP PGU: Target Practice Tracer PGU
3.1 – M61A1 GUN
3.1.1 – EEGS (Enhanced Envelope Gun Sight) Introduction

If you already know the type of aircraft you are engaging and its wingspan, you can set the EEGS Gun Funnel properties to match the wingspan (ft). As an example, we will set the wingspan property to a MiG-29’s, which is 36 ft (11 m).

1) Press the LIST button on the ICP (Integrated Control Panel)
2) Press “5” button to select the MAN (Manual Setting) sub-menu.
3) On the DED (Data Entry Display), the WSPAN data field is set to 33 ft by default.
4) Press “36” on the ICP, then press “ENTR” to set the wingspan to 36 ft.

Note: Manual Setting Profiles can be toggled and set manually using the DED Increment/Decrement Switch.

<table>
<thead>
<tr>
<th>Aircraft</th>
<th>Wingspan (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-10</td>
<td>58</td>
</tr>
<tr>
<td>F-111</td>
<td>48</td>
</tr>
<tr>
<td>F-14</td>
<td>51</td>
</tr>
<tr>
<td>F-15</td>
<td>43</td>
</tr>
<tr>
<td>F-16</td>
<td>31</td>
</tr>
<tr>
<td>F/A-18</td>
<td>38</td>
</tr>
<tr>
<td>F-4</td>
<td>39</td>
</tr>
<tr>
<td>F-5</td>
<td>27</td>
</tr>
<tr>
<td>MiG-21</td>
<td>24</td>
</tr>
<tr>
<td>MiG-23</td>
<td>37</td>
</tr>
<tr>
<td>MiG-25</td>
<td>46</td>
</tr>
<tr>
<td>MiG-29</td>
<td>36</td>
</tr>
<tr>
<td>MiG-31</td>
<td>46</td>
</tr>
<tr>
<td>Su-24</td>
<td>44</td>
</tr>
<tr>
<td>Su-25</td>
<td>51</td>
</tr>
<tr>
<td>Su-27</td>
<td>42</td>
</tr>
</tbody>
</table>
3.1 – M61A1 GUN
3.1.2 – EEGS LEVEL II (No Radar)

Note: The gun can be selected either through the AAM (Air-to-Air Missile Mode) or DGFT (Dogfight Override Mode). In this case, we will use AAM Mode.

1. Select AAM (Air-to-Air Missile Mode) by pressing the A-A (Air-to-Air) Master Mode button.
2. Set Master Arm switch – ARM (UP)
3. In the case where you do NOT want to use the FCR (Fire Control Radar) to lock the target, set the RF (Radio Frequency) Switch to SILENT (DOWN).
4. On the SMS (Stores Management Set) page, press on the OSB (Option Select Button) next to AAM to select the Air-to-Air EEGS Gun Mode.
5. The EEGS (Enhanced Envelope Gun Sight) Level II symbology will appear on the Heads-Up Display. The Boresight Cross, EEGS Funnel and Multiple Reference Gunsight (MRGS) Lines are provided.
3.1 – M61A1 GUN
3.1.2 – EEGS LEVEL II (No Radar)

6. Maneuver your aircraft to frame the target aircraft within the EEGS funnel. The top of the funnel is 600 ft range, and the bottom is between 2500 ft and 3000 ft depending upon altitude.

7. When the target’s wing tips are on the EEGS funnel lines, you can fire your gun.

8. Squeeze the trigger all the way to the second detent to fire the gun (SPACE).
3.1 – M61A1 GUN  
3.1.2 – EEGS LEVEL II (No Radar)

Note:

While during normal chase you should always use the gun funnel, there are instances where the target could require you to pull a substantial amount of lead for high aspect shots. For high aspect chases, you can use the MRGS (Multiple Reference Gunsight) Lines.

The MRGS sight is composed of a series of five line segments pointing toward the Gun Bore Line, and spaced in an arc near the bottom of the HUD. They aid in lining up long range, high aspect shots by providing the correct lateral aiming solution so the target flies up the funnel.

The length of the lines correspond to the approximate length of the fuselage of an aircraft at that position with the proper amount of lead.

To use, pull lead until the aircraft is over one of the lines.
- If the aircraft is smaller than the line, you are pulling too little lead and need to be closer or add back pressure.
- If the aircraft is larger than the line, you are pulling too much lead and need to get further or relax the g.

In the example to the right, the aircraft is larger than the MGRS line... therefore we need to either slow down and let the target gain some distance... or pull less Gs.
3.1 – M61A1 GUN
3.1.3 – EEVS LEVEL V (With Radar)

Note: The gun can be selected either through the AAM (Air-to-Air Missile Mode) or DGFT (Dogfight Override Mode). In this case, we will use DGFT Mode.

1. Verify that FCR (Fire Control Radar) Switch is ON (FWD)
2. Select DGFT (Dogfight) Override Mode by pressing the Dogfight switch Outboard to the DOGFIGHT position.
3. With DGFT Override selected:
   a) The Gun is automatically selected with Air-to-Air EEVS Gun Mode
   b) ACM (Air Combat Mode) Radar mode is automatically selected with HUD Scan ACM Radar Sub-Mode (30°x20°).
   c) Symbology on the HUD is provided for both 20 mm gun firing and air-to-air missile
4. The EEVS (Enhanced Envelope Gun Sight) Level II symbology will appear on the Heads-Up Display. The Boresight Cross, EEVS Funnel and Multiple Reference Gunsight (MRGS) Lines are provided.
5. Set Master Arm switch – ARM (UP)

**Dogfight Switch**
3-Position switch, Slide

- **DOGFIGHT (Outboard):** provides symbology on HUD for both 20 mm gun firing and air-to-air missile delivery
- **Center:** Returns to last selected Master Mode
3.1 – M61A1 GUN
3.1.3 – EEGS LEVEL V (With Radar)

6. In ACM Radar Mode, target lock will be automatically performed. Press TMS (Target Management Switch) UP to enter ACM Boresight Mode.

7. When radar STT (Single Target Track) lock is acquired, EEGS (Enhanced Envelope Gun Sight) Level V symbology will appear on the Heads-Up Display.

Note: When using DGFT mode, symbology for both missiles and gun is displayed. The Closure Rate indication will be displayed differently depending on whether you have air-to-air missiles equipped or not. Since you are most likely not going on a mission with “just” a single gun to defend yourself, I decided to show both types of symbology.
3.1 – M61A1 GUN
3.1.3 – EEGS LEVEL V (With Radar)

8. Maneuver your aircraft to frame the target aircraft within the EEGS funnel and stabilize the Level V EEGS Pipper on the target.
9. When the Level V EEGS Pipper is on the target, you can fire the gun.
10. Squeeze the trigger all the way to the second detent to fire the gun.
11. The Bullets at Target Range (BATR) Symbol is displayed after rounds are fired. The BATR is displayed as the first real or simulated round passes the target range and is removed after the last round has passed.
3.1 – M61A1 GUN
3.1.3 – EEGS LEVEL V (With Radar)
3.2 – AIM-9M SIDEWINDER
3.2.1 – Sidewinder Introduction

The AIM-9 Sidewinder missile has two main operating modes: BORE and SLAVE.

Boresight (BORE) mode:
- When HMCS (Helmet-Mounted Cueing System) is not powered, the missile seeker “looks” ahead on the aircraft bore line.
- When HMCS is powered, the seeker is boresighted to the Helmet Mounted Display’s reticle. This is useful when using the AIM-9X for a HOBS (High Off Boresight) shot.

Slaved (SLAVE) mode:
- When a radar lock is acquired, the missile seeker is slaved to the FCR (Fire Control Radar)
- When no radar lock is acquired, the seeker is slaved to the aircraft bore line
3.2 – AIM-9M SIDEWINDER
3.2.1 – Sidewinder Introduction

There are three main methods of selecting an AIM-9 missile:

- Press Dogfight Switch OUTBOARD (DGFT). AIM-9 missiles will be automatically selected.
- Press Dogfight Switch INBOARD (MSL OVRD/Missile Override). Then, from the SMS page, select the desired missile.
- Select Air-to-Air Master Mode by pressing the A-A Button. Then, from the SMS page, select the desired missile.

Dogfight Switch
3-Position switch, Slide
- DOGFIGHT (Outboard): provides symbology on HUD for both 20 mm gun firing and air-to-air missile delivery
- Missile Override (Inboard): provides symbology on HUD for air-to-air missile firing only
- Center: Returns to last selected Master Mode
### 3.2 – AIM-9M SIDEWINDER

#### 3.2.2 – No Radar

*Note: The missile can be selected either through the AAM (Air-to-Air Missile Mode), DGFT (Dogfight Override Mode) or MSL OVRD (Missile Override Mode). In this case, we will use AAM Mode.*

1. Select AAM (Air-to-Air Missile Mode) by pressing the A-A (Air-to-Air) Master Mode button.
2. Set Master Arm switch – ARM (UP)
3. In the case where you do NOT want to use the FCR (Fire Control Radar) to lock the target, set the RF (Radio Frequency) Switch to SILENT (DOWN).
4. On the SMS (Stores Management Set) page, press on the OSB (Option Select Button) next to the current Missile Type to toggle to the 9LM (AIM-9M) missile. Alternatively, you can press the NWS / MSL STEP button on the stick for more than 0.5 sec (LONG) to toggle the missile type.
5. Select desired missile station by pressing the NWS / MSL STEP button on the stick for less than 0.5 sec (SHORT).
6. Select desired missile field-of-view by pressing the OSB next to SPOT/SCAN
   - **SPOT:** Narrow field-of-view, detection range is increased
   - **SCAN:** Wide field-of-view, detection range is decreased
7. Select desired missile line-of-sight parameters by pressing the OSB next to SLAVE/BORE. In this case, choose BORE.
   - **BORE:** Missile follows aircraft boresight line
   - **SLAVE:** Missile follows radar line-of-sight
8. Activate missile seeker head argon cooling by setting the cooling status to COOL (press OSB next to WARM/COOL). It will increase missile detection sensitivity.
   - *Note: COOL is selected automatically when entering DGFT or MSL Override mode. Argon supply duration varies depending on outside air temperature, pressure and bottle charge level at installation, but the average duration is 90 minutes.*
3.2 – AIM-9M SIDEWINDER
3.2.2 – No Radar

9. Maneuver until target is within the missile launch zone
10. Fly the missile reticle in the HUD over a target. If the missile detects enough infrared energy from the target, target detection is indicated by an audio missile detection tone (growling sound).
11. When the AIM-9 seeker detects a target, uncage it by pressing the Cage/Uncage button on the throttle. This will allow the seeker to lock on and follow the target within the confines of the missile seeker’s field of view.
12. When the missile is tracking a heat signature, the Missile Diamond latches to the target and the missile growl sound will become high pitched.
13. Depress the Weapon Release (RALT+SPACE) button to fire the missile.
3.2 – AIM-9M SIDEWINDER
3.2.2 – No Radar
3.2 – AIM-9M SIDEWINDER
3.2.3 – With Radar

Note: The missile can be selected either through the AAM (Air-to-Air Missile Mode), DGFT (Dogfight Override Mode) or MSL OVRD (Missile Override Mode). In this case, we will use DGFT Mode.

1. Verify that FCR (Fire Control Radar) Switch is ON (FWD)
2. Select DGFT (Dogfight) Override Mode by pressing the Dogfight switch Outboard to the DOGFIGHT position.
3. With DGFT Override selected:
   a) The Gun is automatically selected with Air-to-Air EECS Gun Mode
   b) ACM (Air Combat Mode) Radar mode is automatically selected with HUD Scan ACM Radar Sub-Mode (30° x 20°).
   c) Symbology on the HUD is provided for both 20 mm gun firing and air-to-air missile
4. Set Master Arm switch – ARM (UP)
5. On the SMS (Stores Management Set) page, press on the OSB (Option Select Button) next to the current Missile Type to toggle to the 9LM (AIM-9M) missile. Alternatively, you can press the NWS / MSL STEP button on the stick for more than 0.5 sec (LONG) to toggle the missile type.
6. Select desired missile station by pressing the NWS / MSL STEP button on the stick for less than 0.5 sec (SHORT).
7. Select desired missile field-of-view by pressing the OSB next to SPOT/SCAN
   • SPOT: Narrow field-of-view, detection range is increased
   • SCAN: Wide field-of-view, detection range is decreased
8. Select desired missile line-of-sight parameters by pressing the OSB next to SLAVE/BORE. In this case, choose SLAVE.
   • BORE: Missile follows aircraft boresight line
   • SLAVE: Missile follows radar line-of-sight
9. Activate missile seeker head argon cooling by setting the cooling status to COOL (press OSB next to WARM/COOL). It will increase missile detection sensitivity.
   • Note: COOL is selected automatically when entering DGFT or MSL Override mode. Argon supply duration varies depending on outside air temperature, pressure and bottle charge level at installation, but the average duration is 90 minutes.
3.2 – AIM-9M SIDEWINDER
3.2.3 – With Radar

10. Maneuver until target is within the missile launch zone
11. Press TMS (Target Management Switch) UP to enter ACM Boresight Mode. In ACM Radar Mode, target lock will be automatically performed.
12. When radar STT (Single Target Track) lock is acquired, missile symbology should appear on your HUD (DLZ and Slant Range).
13. Fly the missile reticle in the HUD over the target. If the missile detects enough infrared energy from the target, target detection is indicated by an audio missile detection tone (growling sound).
14. When the AIM-9 seeker detects a target, uncage it by pressing the Cage/Uncage button on the throttle. This will allow the seeker to lock on and follow the target within the confines of the missile seeker’s field of view.
15. When the missile is tracking a heat signature, the Missile Diamond latches to the target and the missile growl sound will become high pitched.
16. Consult DLZ (Dynamic Launch Zone) indicator and make sure the range to target is between the Minimum Range and the Max Missile Range vs Maneuvering Target.
17. Depress the Weapon Release (RALT+SPACE) button to fire the missile.
Take note that HUD symbology will be slightly different if you use DGFT mode or A-A Mode to acquire a radar lock. For instance, A-A mode will display a TD (Target Designator) Box over the locked contact.

- **FCS (Fire Control System) is providing range**
  - Displays hundreds of ft when under 1 nm

- **Target Range Caret**
  - 12 o’clock: Target is flying towards you
  - 6 o’clock: Target is flying away from you

- **Minimum Missile Range**

- **Target Aspect Caret**
  - 12 o’clock: Target is flying towards you
  - 6 o’clock: Target is flying away from you

- **Range Scale (nm)**

- **Maximum Missile Range**

- **Range to Target Caret**

- **DLZ (Dynamic Launch Zone)**

- **Range Provider / Slant Range (nm)**

- **Missile Reticle**

- **Missile Diamond**

- **TD (Target Designator) Box**

- **4 SRM (Short Range Missiles) Available**

- **Master Arm is ON**
3.2 – AIM-9M SIDEWINDER
3.2.3 – With Radar
3.3 – AIM-9X HOBS SIDEWINDER (HMCS)

The HMD (Helmet-Mounted Display) and HMCS (Helmet-Mounted Cueing System) allow the pilot to project the Heads-Up Display in his field of vision at all times. It also allows the slaving of sensors and weapons to the helmet’s line of sight. In the F-16, the HMCS is very useful for using missiles like the AIM-9X, an upgraded version of the AIM-9 with TVC (Thrust Vectoring Control) allowing 80 deg off-boresight shots.
3.3 – AIM-9X HOBS SIDEWINDER (HMCS)

1. Verify that FCR (Fire Control Radar) Switch is ON (FWD)
2. Select DGFT (Dogfight) Override Mode by pressing the Dogfight switch Outboard to the DOGFIGHT position.
3. With DGFT Override selected:
   a) The Gun is automatically selected with Air-to-Air EEGS Gun Mode
   b) ACM (Air Combat Mode) Radar mode is automatically selected with HUD Scan ACM Radar Sub-Mode (30°x20°).
   c) Symbology on the HUD is provided for both 20 mm gun firing and air-to-air missile
4. Set Master Arm switch – ARM (UP)
5. On the SMS (Stores Management Set) page, press on the OSB (Option Select Button) next to the current Missile Type to toggle to the 9X (AIM-9X) missile. Alternatively, you can press the NWS / MSL STEP button on the stick for more than 0.5 sec (LONG) to toggle the missile type.
6. Select desired missile station by pressing the NWS / MSL STEP button on the stick for less than 0.5 sec (SHORT).
7. Select desired missile field-of-view by pressing the OSB next to SPOT/SCAN
   • SPOT: Narrow field-of-view, detection range is increased
   • SCAN: Wide field-of-view, detection range is decreased
8. Select desired missile line-of-sight parameters by pressing the OSB next to SLAVE/BORE. In this case, choose BORE.
   • BORE: Missile follows HMCS boresight line
   • SLAVE: Missile follows radar line-of-sight
9. Activate missile seeker head argon cooling by setting the cooling status to COOL (press OSB next to WARM/COOL). It will increase missile detection sensitivity.
   • Note: COOL is selected automatically when entering DGFT or MSL Override mode. Argon supply duration varies depending on outside air temperature, pressure and bottle charge level at installation, but the average duration is 90 minutes.
10. Power up the Helmet-Mounted Cueing System (HMCS) by turning HMCS Symbology Brightness Knob RIGHT (Clockwise).
11. Select BORE (Boresight) ACM (Air Combat Mode) Search Sub-Mode by pressing the TMS (Target Management Switch) UP.
12. The HMCS Bore Ellipse will appear when BORE is selected.
13. Move your helmet to put the HMCS Ellipse on the target. Then, press TMS (Target Management Switch) UP to radar lock the target. Radar will enter STT (Single Target Track) Lock Mode.
14. A Target Designator Box will appear on the locked target.
3.3 – AIM-9X HOBS SIDEWINDER (HMCS)

15. When radar STT (Single Target Track) lock is acquired, missile symbology should appear on your HUD (DLZ and Slant Range).

16. If the missile detects enough infrared energy from the target, target detection is indicated by an audio missile detection tone (growling sound).

17. When the AIM-9 seeker detects a target, uncage it by pressing the Cage/Uncage button on the throttle. This will allow the seeker to lock on and follow the target within the confines of the missile seeker’s field of view.

18. When the missile is tracking a heat signature, the Missile Diamond latches to the target and the missile growl sound will become high pitched.

19. Consult DLZ (Dynamic Launch Zone) indicator and make sure the range to target is between the Minimum Range and the Max Missile Range vs Maneuvering Target.

20. Depress the Weapon Release (RALT+SPACE) button to fire the missile.
3.3 – AIM-9X HOBS SIDEWINDER (HMCS)

Missile Diamond
3.3 – AIM-9X HOBS SIDEWINDER (HMCS)

Take note that HUD symbology will be slightly different if you use DGFT mode or A-A Mode to acquire a radar lock.
3.4 – AIM-120C AMRAAM
3.4.1 – AMRAAM Introduction

The AIM-120 AMRAAM (Advanced Medium-Range Air-to-Air Missile) has two main operating modes: BORE and SLAVE. BORE mode is rarely used since in practice, you will always need to identify your target before firing.

Boresight (BORE) mode:
- When HMCS (Helmet-Mounted Cueing System) is not powered, the missile seeker “looks” ahead on the aircraft bore line. This is called a “mad dog” shot since the missile flies ballistically out to a point without guidance, then turns on its onboard radar and locks up and flies to the first radar contact it finds. It has no IFF (Identify-Friend-or-Foe) system, so it doesn’t distinguish between a friendly or a hostile.
- When HMCS is powered, the seeker is boresighted to the Helmet Mounted Display’s reticle. However, the missile is confined to the restrictions of the FCR’s field of view.

Slaved (SLAVE) mode:
- When a radar lock is acquired, the missile seeker is slaved to the FCR (Fire Control Radar). This is the standard mode of operation you should be using.
- When no radar lock is acquired, the seeker is slaved to the aircraft bore line.
There are three main methods of selecting an AMRAAM missile:

- Press **Dogfight Switch OUTBOARD (DGFT)**. AIM-9 missiles will be automatically selected. Then, from the SMS page, select the AIM-120 missile.
- Press **Dogfight Switch INBOARD (MSL OVRD/Missile Override)**. Then, from the SMS page, select the desired missile.
- Select **Air-to-Air Master Mode** by pressing the A-A Button. Then, from the SMS page, select the desired missile.
3.4 – AIM-120C AMRAAM
3.4.2 – Radar (Single Target)

Note: The missile can be selected either through the AAM (Air-to-Air Missile Mode), DGFT (Dogfight Override Mode) or MSL OVRD (Missile Override Mode). In this case, we will use Air-to-Air Mode.

1. Verify that FCR (Fire Control Radar) Switch is ON (FWD)
2. Select AAM (Air-to-Air Missile Mode) by pressing the A-A (Air-to-Air) Master Mode button.
3. Set Master Arm switch – ARM (UP)
4. On the SMS (Stores Management Set) page, press on the OSB (Option Select Button) next to the current Missile Type to toggle to the A120C (AIM-120C) missile. Alternatively, you can press the NWS / MSL STEP button on the stick for more than 0.5 sec (LONG) to toggle the missile type.
   • Note: As the AIM-120 missile is selected, symbology for the ASEC (Allowable Steering Error Circle) and the Missile Diamond will appear.
5. Select desired missile station by pressing the NWS / MSL STEP button on the stick for less than 0.5 sec (SHORT).
6. Select desired missile line-of-sight parameters by pressing the OSB next to SLAVE/BORE. In this case, choose SLAVE.
   • BORE: Missile follows aircraft boresight line
   • SLAVE: Missile follows radar line-of-sight

The Allowable Steering Error Circle (ASEC) shows the zone in which the Attack Steering Cue (ASC) should be located prior to launch to hit the target with a given probability of kill. The ASC is displayed after radar lock.

The ASEC shows the maximum, angular steering error probability. In other words, the circle increases in size when the distance to the target intercept point decreases, which means that as the distance decreases, the missile can be launched with greater steering error.
3.4 – AIM-120C AMRAAM
3.4.2 – Radar (Single Target)

7. Select FCR page, then press the DMS (Display Management Switch) DOWN to set the FCR (Fire Control Radar) page as the SOI (Sensor of Interest).

8. Select RWS mode by either:
   a) Using the Radar Mode and Radar Sub-Mode selector OSBs (Option Select Button), or;
   b) Pressing the TMS (Target Management Switch) RIGHT LONG to cycle between RWS and TWS mode.

9. Set desired radar range scale (40 nm in our case)
10. Set desired radar azimuth range (+/- 30 deg in our case)
11. Set desired radar bar mode (4 or 2 bars are generally used)
12. Search targets will first appear when valid tracks (radar contacts) are obtained.
13. Acquire target and designate it as a “Bugged Target”
   a) Use the Radar Cursor/Enable switch to move the Acquisition Cursor over the desired Search Target.
   b) Press TMS (Target Management Switch) UP, then release it to set selected Search Target into a Bugged Target.
14. Once target is designated as a “Bugged Target”, the Situational Awareness Mode (SAM) acquisition sequence is initiated.
15. During acquisition, the radar antenna is directed to the last known target position, and a 4-bar, ±10-degree Spotlight search is performed.
16. Bugged Target information (Aspect Angle, Ground Track, Airspeed (kts), Closure Speed (kts)) will be displayed on the upper region of the FCR page.
17. Depending on the direction of the target, either a TLL (Target Locator Line) or a TD (Target Designator) Box towards the Bugged Target is displayed on the Heads-Up Display. Bugged Target Range (nm) and Closure Speed (kts) are also displayed.
3.4 – AIM-120C AMRAAM
3.4.2 – Radar (Single Target)

18. Transition Bugged Target to a STT (Single Target Track Radar Lock) Track by pressing TMS UP a second time.
19. When the target enters the HUD, the Target Designator Box will be displayed over the target and the Missile Diamond will track that location.

20. Maneuver until Attack Steering Cue (ASC) is inside the Allowable Steering Error Circle (ASEC).

21. Consult DLZ (Dynamic Launch Zone) indicator and make sure the range to target is between the Minimum Range and the Max Missile Range vs Maneuvering Target.

22. Depress the Weapon Release (RALT+SPACE) button to fire the missile.
3.4 – AIM-120C AMRAAM
3.4.2 – Radar (Single Target)

Note: When you first fire an AMRAAM missile, the missile is initially guided by your own radar. However, an «active radar homing missile» also has its own radar inside the seeker head. The moment the missile goes «active» (meaning it will start self-homing/tracking targets on his own instead of using your aircraft’s radar) is called «Pitbull». When the missile goes «Pitbull», the missile truly becomes fire-and-forget. NATO brevity word “Pitbull” would be called out on the radio to inform other pilots, just as “Fox Three” would be called out upon launch.
3.4 – AIM-120C AMRAAM
3.4.2 – Radar (Single Target)
3.4 – AIM-120C AMRAAM
3.4.3 – Radar (Multiple Targets)

Note: The missile can be selected either through the AAM (Air-to-Air Missile Mode), DGFT (Dogfight Override Mode) or MSL OVRD (Missile Override Mode). In this case, we will use Air-to-Air Mode.

1. Verify that FCR (Fire Control Radar) Switch is ON (FWD)
2. Select AAM (Air-to-Air Missile Mode) by pressing the A-A (Air-to-Air) Master Mode button.
3. Set Master Arm switch – ARM (UP)
4. On the SMS (Stores Management Set) page, press on the OSB (Option Select Button) next to the current Missile Type to toggle to the A120C (AIM-120C) missile. Alternatively, you can press the NWS / MSL STEP button on the stick for more than 0.5 sec (LONG) to toggle the missile type.
   • Note: As the AIM-120 missile is selected, symbology for the ASEC (Allowable Steering Error Circle) and the Missile Diamond will appear.
5. Select desired missile station by pressing the NWS / MSL STEP button on the stick for less than 0.5 sec (SHORT).
6. Select desired missile line-of-sight parameters by pressing the OSB next to SLAVE/BORE. In this case, choose SLAVE.
   • BORE: Missile follows aircraft boresight line
   • SLAVE: Missile follows radar line-of-sight

The Allowable Steering Error Circle (ASEC) shows the zone in which the Attack Steering Cue (ASC) should be located prior to launch to hit the target with a given probability of kill. The ASC is displayed after radar lock.

The ASEC shows the maximum, angular steering error probability. In other words, the circle increases in size when the distance to the target intercept point decreases, which means that as the distance decreases, the missile can be launched with greater steering error.
7. Select FCR page, then press the DMS (Display Management Switch) DOWN to set the FCR (Fire Control Radar) page as the SOI (Sensor of Interest).
8. Select TWS mode by either:
   a) Using the Radar Mode and Radar Sub-Mode selector OSBs (Option Select Button), or;
   b) Pressing the TMS (Target Management Switch) RIGHT LONG to cycle between RWS and TWS mode.
9. Set desired radar range scale (40 nm in our case)
10. Set desired radar azimuth range (+/- 30 deg in our case)
11. Set desired radar bar mode (4 or 2 bars are generally used)
12. After being detected on two consecutive antenna sweeps, Search Targets become Track Targets automatically.

3.4 – AIM-120C AMRAAM
3.4.3 – Radar (Multiple Targets)

Track Targets
Search Targets
DMS (Display Management Switch)
TMS (Target Management Switch)
SOI (Sensor of Interest) Control

PART 11 – OFFENCE: WEAPONS & ARMAMENT
F-16C VIPER

3.4.3 – Radar (Multiple Targets)
13. Transition Track Targets into System Targets, which can then be “bugged” subsequently. **Transition all Track Targets into System Targets using TMS RIGHT SHORT**
   a) Track targets are visible as white filled squares
   b) Press TMS (Target Management Switch) RIGHT SHORT
   c) All existing Track Targets will transition into System Targets

14. Designate the desired System Target as a “Bugged Target”. **Bug System Target with the Acquisition Cursor**
   a) Use the Radar Cursor/Enable switch to move the Acquisition Cursor over the desired System Target.
   b) Press TMS (Target Management Switch) UP to set selected System Target into a Bugged Target.

15. When a “Bugged Target” is designated, the radar automatically transitions the scan to 3-bar, ±25 degrees centered on the bugged target to provide faster updates and reduce the chance of losing the track.

16. Bugged Target information (Aspect Angle, Ground Track, Airspeed (kts), Closure Speed (kts)) will be displayed on the upper region of the FCR page.
17. Depending on the direction of the target, either a TLL (Target Locator Line) or a TD (Target Designator) Box towards the Bugged Target is displayed on the Heads-Up Display. Bugged Target Range (nm) and Closure Speed (kts) are also displayed.
When the target enters the HUD, the Target Designator Box will be displayed over the target and the Missile Diamond will track that location.

Maneuver until Attack Steering Cue (ASC) is inside the Allowable Steering Error Circle (ASEC).

Consult DLZ (Dynamic Launch Zone) indicator and make sure the range to target is between the Minimum Range and the Max Missile Range vs Maneuvering Target.

Depress the Weapon Release (RALT+SPACE) button to fire the missile.
3.4 – AIM-120C AMRAAM
3.4.3 – Radar (Multiple Targets)
22. To engage other targets, press TMS (Target Management Switch) RIGHT SHORT to cycle to next displayed system target.
23. Depress the Weapon Release (RALT+SPACE) button to fire the missile.
24. Repeat steps 22 and 23 to engage further targets.
4 – ORDNANCE JETTISON
4.1 – Selective Ordnance Jettison

1. Select SMS (Stores Management Set) page by pressing the OSB (Option Select Button) next to SMS
2. Select Selective Jettison menu by pressing the OSB next to S-J
3. Depress the OSB next to the store to highlight it for jettison.
4. If more than one jettisonable store is loaded on a station, for example stores on a TER-9 (Triple Ejector Rack), one depression of the OSB highlights the store and another depression highlights both the store and the rack.
5. Depress the Weapon Release (RALT+SPACE) button to jettison highlighted (selected) stations.
The emergency jettison button will jettison all fuel tanks, carted suspension racks, and free fall ordnance.
INTRODUCTION

Countermeasures are very simple to use. You have three countermeasure types at your disposal: flares, chaff and an ECM (Electronic Countermeasure) jammer. We will explore together what is used against what, and how.

Missiles can generally track you using 2 things: radar signature (radar waves are sent at you and you reflect them, which is called a “radar signature”) and heat signature (like the exhaust of your engines). Countermeasures will only be effective against the kind of weapon it was meant to counter; a heat-seeking missile will not care if you deploy electronic countermeasures against it since it tracks heat, not radar signatures. This is why it is important to know what is attacking you in order to counter it properly. This is what the RWR (Radar Warning Receiver) is for: to help you know what is firing at you so you can take the adequate action to counter it.

**Flares** are used against missiles that track heat (infrared or IR) signatures. Instead of going for the heat signature generated by your engines, a missile will go for a hotter heat source like flares.

**Chaff** is a form of “passive” jamming. Passive (reflected) jamming is when a deceptive object or device reflects radar waves. Chaff is simply a bundle of small pieces of metal foil with reflective coating, which creates clusters of radar signatures that prevent a radar to get a solid lock on the aircraft itself.

The AN/ALQ-131 ECM pod (not simulated yet) is the onboard Electronic Countermeasure/Jammer system. It is a form of “continuous” jamming, also called “active” or “transmitted” jamming. This device transmits its own synchronized radar waves back at your enemy’s radar receiver to simulate erroneous radar wave returns. Simply put, active jamming will try to drown a radar in white noise.

In order to use these three forms of countermeasures, you can use “countermeasure programs”, routines that will deploy a number of flares/chaff for a number of cycles at a given interval.
Detected radars are displayed on the Azimuth Indicator (aka Radar Warning Receiver). The Azimuth Indicator is a circular-shaped display on the left of the front dash that provides you a visual representation of radar emitters around your aircraft. The display is in plan view with your aircraft in the center.

As threats are displayed around the center of the display, the icons represent the azimuth direction to the threat. In addition to the icons, an audio system will alert you to the status of the radars detected (search, track, and launch).

The locations of radar emitters on the display do not necessarily correlate to emitter range from your aircraft. The distance of the threat icon from the center of the display indicates radar signal strength. The closer the icon is to the center of the display generally indicates the closer the radar is to you.

Any time a new emitter symbol is displayed on the azimuth indicator, a status change tone is generated by the system. Special tones are also generated for specific threats or critical threat modes of operation.

The TWA (Threat Warning Azimuth) / RWR (Radar Warning Receiver) is powered by pressing the RWR POWER Button on the Threat Warning Auxiliary Panel.
AN/ALR-56M AZIMUTH INDICATOR/RWR
RADAR WARNING RECEIVER
**AN/ALR-56M AZIMUTH INDICATOR/RWR RADAR WARNING RECEIVER**

- **A diamond** indicates the highest threat level.
- If a symbol is displayed with **no circle around it**, it indicates that the radar is in acquisition/search mode. When a new emitter is detected, a new threat tone will be heard.
- If a symbol has a **steady circle around it**, it indicates that the radar is tracking/locked on to your aircraft. When being tracked by an engagement radar, you will be provided a radar lock tone.
- If a symbol has a **flashing circle around it**, it indicates that the radar is supporting a missile that has been launched at you.
- When being launched on by a radar-guided missile, you will hear a missile launch tone and the LAUNCH light to the left will illuminate.

**MiG-29 Radar Detected**
- **Position**: In front of you
- **Diamond** = Highest Threat Level
- **Steady Circle** = Radar Tracking
- **Flashing Circle** = Missile Radar Tracking
The TWP (Threat Warning Prime) panel is used for primary RWR functions. As soon as the EWS (Electronic Warfare System) detects a radar missile launched at you, the MISSILE LAUNCH light will illuminate and a warning tone is audible. Keep in mind that this function only detects radar-guided missiles. Infrared-guided missiles are not detected by this system.

**AN/ALR-56M AZIMUTH INDICATOR/RWR THREAT WARNING PRIME (TWP) PANEL**

**RWR Control HANDOFF Button (Not Simulated Yet)**
Used to set the mode of operation of the RWR. The four modes are:
- Normal
- Diamond Float
- Transient
- Latch

**RWR MISSILE LAUNCH Light**
Illuminates when a radar missile launch is detected

**RWR UNKNOWN SHIP Toggle Switch (Not Simulated Yet)**
Toggles display of emitter symbols of unknown weapon systems on and off.

**RWR System Test Button (Not Simulated Yet)**

**RWR T (Target Separation) Button**
Separates symbols that cover each other on the azimuth indicator; the symbol with the highest threat priority remains in the right place.

**MiG-29 Radar Detected**
- Position: In front of you
- Diamond = Highest Threat Level
- Steady Circle = Radar Tracking
- Flashing Circle = Missile Radar Tracking

**THREAT (TWS, Threat Warning System) Tone Control Knob**
If too many contacts start overlapping each other, you can press the “TARGET SEPARATION” function (TGT SEP), which will separate enemy icons.
The TWA (Threat Warning Auxiliary) panel is used to power up the EWS (Electronic Warfare System) Suite.

**AN/ALR-56M AZIMUTH INDICATOR/RWR THREAT WARNING AUXILIARY PANEL**

- **RWR ACT/PWR Indicator** *(Not Simulated Yet)*
  - **ACTIVITY**: EWS (Electronic Warfare System) is powered and detects a radar pointing the aircraft.
  - **POWER**: EWS (Electronic Warfare System) suite is powered

- **RWR SEARCH Control Button & Indicator** *(Not Simulated Yet)*
  - Allows ‘S’ search radar symbols to be displayed on the RWR display if the EWS is powered and detects a search radar; by default they are not. With SEARCH enabled a SAM radar in search mode will display as an ‘S’, well before you would expect to see its acquisition symbol if SEARCH was not enabled, giving you an early warning in most cases.

- **RWR LOW ALTITUDE Control Button & Indicator** *(Not Simulated Yet)*
  - **LOW**: Priority to dangerous threats in low altitude. When no LOW light is displayed, priority is given to dangerous threats at high altitude.
  - **ALT**: EWS (Electronic Warfare System) suite is powered

- **RWR (Radar Warning Receiver) Source Switch**
  - Enables RWR data to be used by CMDS (Countermeasures Dispensing System) for dispensing in the SEMI or AUTO modes.

- **JMR (Jammer) Source Switch**
  - Enables Jammer data to be used by CMDS (Countermeasures Dispensing System) for dispensing in the SEMI or AUTO modes.

- **MWS (Missile Warning System) Switch**
  - Not functional on Block 50 variant.
Keep in mind that there are two blind spots on the RWR. Therefore, you cannot rely completely on the RWR to detect radar locks.
**AN/ALR-56M AZIMUTH INDICATOR/RWR SYMBOLOGY**

Note: “U” or “UKN” symbol stands for “Unknown”, which is sometimes attributed to ships.

**MiG-29 Radar Detected**
- **Position:** In front of you
- **Diamond** = Highest Threat Level
- **Steady Circle** = Radar Tracking
- **Flashing Circle** = Missile Radar Tracking

---

### Ship Threats

<table>
<thead>
<tr>
<th>Threat</th>
<th>Ship Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>19 – MiG-19P</td>
<td>AV – AV-8B</td>
</tr>
<tr>
<td>21 – MiG-21Bis</td>
<td>11 – F-111</td>
</tr>
<tr>
<td>22 – Tu-22M3</td>
<td>13 – C-130</td>
</tr>
<tr>
<td>23 – MiG-23</td>
<td>14 – F-14</td>
</tr>
<tr>
<td>24 – Su-24</td>
<td>15 – F-15</td>
</tr>
<tr>
<td>25 – MiG-25</td>
<td>16 – F-16</td>
</tr>
<tr>
<td>29 – J-11</td>
<td>17 – C-17</td>
</tr>
<tr>
<td>29 – MiG-29</td>
<td>18 – F/A-18C</td>
</tr>
<tr>
<td>29 – Su-27</td>
<td>37 – AJS-37 Viggen</td>
</tr>
<tr>
<td>29 – Su-33</td>
<td>52 – B-52</td>
</tr>
<tr>
<td>30 – Su-30</td>
<td>B1 – B-1</td>
</tr>
<tr>
<td>39 – Su-39</td>
<td>E2 – E-2D AWACS</td>
</tr>
<tr>
<td>31 – MiG-31</td>
<td>E3 – E-3A AWACS</td>
</tr>
<tr>
<td>34 – Su-34</td>
<td>E6 – EA-6B</td>
</tr>
<tr>
<td>50 – KJ-2000 AWACS</td>
<td>F2 – F/2 / Tornado</td>
</tr>
<tr>
<td>50 – A-50 AWACS</td>
<td>F4 – F-4E</td>
</tr>
<tr>
<td>76 – Il-76</td>
<td>F5 – F-5E3</td>
</tr>
<tr>
<td>78 – Il-78</td>
<td>KC – KC-130</td>
</tr>
<tr>
<td>95 – Tu-95</td>
<td>KC – KC-135</td>
</tr>
<tr>
<td>AN – AN-26</td>
<td>M2 – Mirage 2000C</td>
</tr>
<tr>
<td>AN – AN-30</td>
<td>S3 – S-38B</td>
</tr>
<tr>
<td>BJ – Tu-160</td>
<td>JF – JF-17 Thunder</td>
</tr>
<tr>
<td>Tu – Tu-142</td>
<td></td>
</tr>
</tbody>
</table>

### Ground Threats

<table>
<thead>
<tr>
<th>Threat</th>
<th>Ship Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>A – ZU 23 AA</td>
<td>A – Vulcan M163 – A</td>
</tr>
<tr>
<td>A – ZSU 23 Shilka</td>
<td>A – Gepard</td>
</tr>
<tr>
<td>8 – SA-8</td>
<td>RO – Roland ADS</td>
</tr>
<tr>
<td>11 – SA-11</td>
<td>GR – Roland EWR</td>
</tr>
<tr>
<td>13 – SA-13</td>
<td>RS – Rapier Blindfire Track Radar</td>
</tr>
<tr>
<td>15 – SA-15</td>
<td>RT – Rapier Launcher Radar</td>
</tr>
<tr>
<td>S6 – SA-19</td>
<td>HA – Hawk Search Radar</td>
</tr>
<tr>
<td>FS – SA-2 Fan Song Track Radar</td>
<td>HK – Hawk Track Radar</td>
</tr>
<tr>
<td>FF – SA-3 Flat Face Search Radar</td>
<td>HK – Hawk Acquisition Radar</td>
</tr>
<tr>
<td>LB – SA-3 Low Blow Track Radar</td>
<td>PT – Patriot Search/Track Radar</td>
</tr>
<tr>
<td>06 – SA-6</td>
<td></td>
</tr>
<tr>
<td>DE – SA-9 Dog Ear Search Radar</td>
<td></td>
</tr>
<tr>
<td>SD – SA-11 Snow Drift Search Radar</td>
<td></td>
</tr>
<tr>
<td>CS – SA-11 Clam Shell Search Radar</td>
<td></td>
</tr>
<tr>
<td>10 – SA-10 Track Radar</td>
<td></td>
</tr>
<tr>
<td>BB – SA-10 Big Bird Search Radar</td>
<td></td>
</tr>
<tr>
<td>EW – Box Spring Early Warning Radar</td>
<td></td>
</tr>
<tr>
<td>EW – Tail Rack Early Warning Radar</td>
<td></td>
</tr>
</tbody>
</table>
CMDS CONTROLS (REAL AIRCRAFT CONTROLS)

CMS (Countermeasures Switch)
- **FWD**: Dispenses currently selected CMDS program
- **AFT**: Gives Consent to Semi-Automatic and Automatic CMDS programs to release their countermeasures automatically
- **LEFT**: No Function
- **RIGHT**: Disables Consent to Semi-Automatic and Automatic CMDS programs to release their countermeasures automatically

Chaff/Flare Slap Button
Dispenses Chaff & Flare. This is a pushbutton programmed to drop countermeasures Program No. 5. This gives you a third countermeasures program immediately available without switching the PGRM knob on the CMDS.

Note: the “Slap” button should be used as a “panic” button.
**COUNTERMEASURES - CHAFF & FLARES**  
AN/ALE-47 CMDS (COUNTERMEASURES DISPENSER SYSTEM)

**CMDS CONTROLS (REAL AIRCRAFT CONTROLS)**

- **RWR (Radar Warning Receiver) Source Switch**  
  Enables RWR data to be used by CMDS (Countermeasures Dispensing System) for dispensing in the SEMI or AUTO modes.

- **JMR (Jammer) Source Switch**  
  Enables Jammer data to be used by CMDS (Countermeasures Dispensing System) for dispensing in the SEMI or AUTO modes.

- **MWS (Missile Warning System) Switch**  
  Not functional on Block 50 variant.

- **Countermeasures Jettison Switch**  
  Jettisons countermeasures when position is set to JETT (UP). Functions even when CMDS is turned OFF.

- **Countermeasures PRGM (Program) Selector Knob**  
  There are a total of 6 programs but only 1 – 4 can be selected through the PRGM knob. PRG 5 is always activated by the slap switch on the left sidewall, while PRG 6 is the Bypass Program. The first 5 programs can be programmed through DTC, or the UFC whenever the CMDS mode is STBY.

- **GO / NO GO CMDS Status Light**

- **DISPENSE READY CMDS Status Light**  
  Displayed when manual consent is required to dispense countermeasures in the SEMI or AUTO mode.

- **Expendable Category Power Switches & Quantity Indicators**  
  - **O1: Other 1 (TALD)** - Not available on this F-16 variant.
  - **O2: Other 1** - Not available on this F-16 variant.
  - **CH: Chaff**
  - **FL: Flares**  
    Note: LO is displayed when quantity is low.

- **CMDS (Countermeasures Dispensing System) Mode Knob**
  - **OFF**
  - **STANDBY**: release parameters and programming can be manually changed using the UFC. It is the only mode allowing reprogramming. The CMDS cannot release countermeasures in this mode.
  - **MAN**: selected manual program may be dispensed by positioning the CMS forward on the stick.
  - **SEMI (Semi-Automatic)**: aircraft systems determine the program to be dispensed based on the threat. Consent to dispense must be given by positioning the CMS aft on the stick.
  - **AUTO**: aircraft systems determine the program to be dispensed based on the threat. Countermeasures are dispensed automatically. This mode must also be enabled by positioning the CMS aft on the stick. It may be disabled by selecting CMS right.
  - **BYP (Bypass)**: allows manual dispensing of countermeasures when failures prevent the other modes from working.
CMDS CONTROLS (MY CONTROLS)

I usually go for a simpler control setup. However, nothing stops you from mapping other switches of the CMDS panel (like the CMDS Mode knob or the CMDS Program Selector knob) to other buttons if you want.

- Countermeasures Management Sw - FWD
- Countermeasures Management Sw – RIGHT
- Countermeasures Management Sw – AFT
- Chaff/Flare Dispense Button (Slap Switch)

My Setup
**COUNTERMEASURES - CHAFF & FLARES**

**AN/ALE-47 CMDS (COUNTERMEASURES DISPENSER SYSTEM)**

**FCD (FLARE/CHAFF DISPENSER)**

Flare and Chaff dispensers are located inside the body fairing. You can request the ground crew to set the number of chaff and flares as desired, for a maximum of 120 combined flares and chaff. A typical loadout is set to 60 chaff and 60 flares.
COUNTERMEASURES - CHAFF & FLARES
AN/ALE-47 CMDS (COUNTERMEASURES DISPENSER SYSTEM)

COUNTERMEASURE PROGRAM & USAGE TUTORIAL

1. Press the Threat Warning Azimuth / Radar Warning Receiver (TWA/RWR) Power Button. The RWR will enter a Built-In Test sequence. This step must be performed if you intend to use Semi-Automatic or Automatic Modes.
2. Set CMDS RWR (Countermeasure Dispensing System Radar Warning Receiver) Switch – ON (UP)
3. Set CMDS JMR (Countermeasure Dispensing System Jammer) Switch – ON (UP)
4. Set CMDS (Countermeasure Dispenser System) CH (Chaff) Switch – ON (UP)
5. Set CMDS (Countermeasure Dispenser System) FL (Flares) Switch – ON (UP)
6. Set Countermeasure Mode Selector to STBY (Standby).
7. Set Countermeasure PRGM (Program) Selector to desired Program (i.e. Program 3)
COUNTERMEASURES - CHAFF & FLARES
AN/ALE-47 CMDS (COUNTERMEASURES DISPENSER SYSTEM)

COUNTERMEASURE PROGRAM & USAGE TUTORIAL

8. Press the LIST button on the ICP (Integrated Control Panel)
9. Press "7" button to select the CMDS (Countermeasures Dispenser System) sub-menu.
10. On the DED (Data Entry Display), the CMDS BINGO page will be displayed.
11. Using the Dobber Switch UP/DOWN and the ICP keypad, you can select and modify any of the BINGO options as desired. ENTR button confirms changes.
12. Toggle the Dobber Switch RIGHT (SEQ) to display CMDS Countermeasure Page on the DED (Data Entry Display).

Chaff Bingo Quantity
Threshold when you are low on countermeasures

Flare Bingo Quantity

Other Countermeasure (O1) Bingo Quantity

Other Countermeasure (O2) Bingo Quantity

BQ: Burst Quantity
Number of countermeasures released per burst.

BI: Burst Interval (sec)
Interval in seconds between countermeasures per burst

SQ: Salvo Quantity
Number of bursts commanded when release consent is given

SI: Salvo Interval (sec)
Time in seconds between each burst

CMDS BINGO DED Page

CMDS Countermeasure DED Page

FDBK: Feedback Message
Enables or disables the 'Chaff Flare' audio message that plays when a countermeasures program has been initiated.

REQCTR: Request Countermeasures Message
Enables or disables the 'Counter' audio message that plays when consent to release countermeasures is requested in the SEMI or AUTO mode

BINGO: Bingo Message
Enables or disables the 'Low' or 'Out' audio message that plays when the bingo quantity is reached, or all countermeasures have been expended

Selected Countermeasure Program
Selected program is toggled by using the DED Increment/Decrement Switch
13. Toggle the Dobber Switch RIGHT (SEQ) to display the desired CMDS Countermeasure Page on the DED (Data Entry Display). We will pick the FLARE page. The CMDS pages are listed as follows:
   - BINGO
   - CHAFF
   - FLARE
   - OTHER 1
   - OTHER 2
14. Select the profile you want to edit using the DED Increment/Decrement Switch. We will edit Program 3. 
15. Press Dobber Switch DOWN to highlight the desired field (* means “selected”). We will edit the BI (Burst Interval) field. 
16. Use the ICP keypad to type in the new desired value (020 will set 0.020 seconds). 
17. Press ENTR to accept the changes. 
18. Repeat steps 13 to 17 if you want to change any other setting for the selected countermeasure program.
COUNTERMEASURES - CHAFF & FLARES
AN/ALE-47 CMDS (COUNTERMEASURES DISPENSER SYSTEM)

COUNTERMEASURE PROGRAM & USAGE TUTORIAL

19. Set Countermeasure Mode Selector to MAN (Manual)
20. Double-check to see if the Countermeasure PRGM (Program) Selector is set to the desired Program (Program 3)
21. Press the CMS (Countermeasure Switch) FWD to dispense countermeasures as per the selected program.

<table>
<thead>
<tr>
<th>Program</th>
<th>Chaff</th>
<th>Flare</th>
<th>Burst Quantity</th>
<th>BI (sec)</th>
<th>SQ Quantity</th>
<th>SI (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0.020</td>
<td>10</td>
<td>1.0</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0.020</td>
<td>10</td>
<td>0.5</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0.100</td>
<td>5</td>
<td>1.0</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0.100</td>
<td>10</td>
<td>0.5</td>
</tr>
<tr>
<td>Panic (PRG 5) Slap Switch</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0.050</td>
<td>20</td>
<td>0.75</td>
</tr>
<tr>
<td>Bypass (PRG 6)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0.020</td>
<td>1</td>
<td>0.5</td>
</tr>
</tbody>
</table>
COUNTERMEASURES - CHAFF & FLARES
AN/ALE-47 CMDS (COUNTERMEASURES DISPENSER SYSTEM)

COUNTERMEASURE PROGRAM & USAGE TUTORIAL

Program 3 (Modified)
- 2 Chaff per burst, at 0.1 sec interval
- 2 Flares per burst, at 0.02 sec interval
- 5 bursts, at 1 sec interval
COUNTERMEASURES - CHAFF & FLARES
AN/ALE-47 CMDS (COUNTERMEASURES DISPENSER SYSTEM)

CMDS PAGE STRUCTURE

LIST Button
DED (Data Entry Display)
Increment/Decrement Switch
DCS (Data Control Switch, also nicknamed “Dobber”)

LIST Button
Press “7” to select CMDS DED Page

CMDS BINGO Page

CMDS CHAFF Page Prog 1

Dobber RIGHT (SEQ)

CMDS CHAFF Page Prog 2

DED Increment/Decrement Switch

CMDS CHAFF Page Prog 3

CMDS CHAFF Page Prog 2

CMDS FLARE Page Prog 1

Dobber RIGHT (SEQ)

CMDS FLARE Page Other 1

CMDS FLARE Page Other 2

Dobber RIGHT (SEQ)

Dobber RIGHT (SEQ)

Dobber RIGHT (SEQ)

Dobber RIGHT (SEQ)
AN/ALQ-131 ECM POD (ELECTRONIC COUNTERMEASURE JAMMER)

Note: the ECM pod is not yet implemented in Early Access. This section will be updated once it is available.
One of the biggest challenges of integrated modern warfare is the identification of contacts. As various information donors like friendly fighters, ground radar stations, AWACS (Airborne Warning and Control System, like an E-3 Sentry or an E-2 Hawkeye), and ships interrogate unknown contacts with IFF (Identify-Friend-or-Foe) systems, this information needs to be relayed to everyone within a given Network. This is where Datalink comes in; with Link 16 Datalink, military aircraft as well as ships and ground forces may exchange their tactical picture in near-real time. Link 16 also supports the exchange of text messages, imagery data and provides two channels of digital voice (2.4 kbit/s and/or 16 kbit/s in any combination).

Multifunctional Information Distribution System (MIDS) is the NATO name for the communication component of Link-16. MIDS is an advanced command, control, communications, computing and intelligence (C4I) system incorporating high-capacity, jam-resistant, digital communication links for exchange of near real-time tactical information, including both data and voice, among air, ground, and sea elements. MIDS is intended to support key theater functions such as surveillance, identification, air control, weapons engagement coordination and direction for all Services.

The aircraft relies on the MIDS radios that allow the transmission and reception of data over the Link 16 Tactical Data Information Link (TADIL) network.
The Datalink system on the F-16 can be turned ON using the MIDS (Multifunctional Information Distribution System) LVT (Low Volume Terminal) Datalink Selector Switch.

Datalink parameters can be accessed from the DED (Data Entry Display) DLNK sub-menu and modified through the ICP (Integrated Control Panel).

Datalink data is visible on both the FCR (Fire Control Radar) page and on the HSD (Horizontal Situation Display) page.
Link 16/MIDS can receive and display three types of track files:

- **Surveillance Tracks**, provided by data sources like AWACS and radar ground stations.
- **Fighter Tracks**, provided by donor aircraft, other fighters providing track data, on the network. They are all correlated against each other to avoid duplicate trackfiles. These are visually identical to surveillance tracks.
- **PPLI (Precise Participant Location and Identification) Tracks**, show the location and status of members of the pilot’s own flight and up to four additional donor aircraft.

Take note that on the FCR (Fire Control Radar) page, the **RWS (Range While Search) contacts are uncorrelated** because they lack tracking precision, whereas **TWS (Track While Scan) contacts are correlated** because of much more precise tracking information.

You have acquired this track and another information donor has given you information (offboard trackfile) about it as well. This means this information is correlated/coherent between an onboard (you) and an offboard information source. This is termed Multi Source Integration (MSI).

This information comes from a surveillance donor (like an AWACS or a ship) on the same datalink network. This is an offboard trackfile.

This information comes from a friendly fighter donor (F/F: Fighter-to-Fighter) on the same datalink network, however you have not acquired this track yourself. This is an offboard trackfile.

The Precise Participant Location and Identification (PPLI) system broadcasts to other aircraft on datalink positional information about the PPLI donor itself. These symbols show the location and status of members of the pilot’s own flight and up to four additional donor aircraft.

Symbol

Vector Line

Altitude (Thousands of Feet)
2 – DATALINK
2.3 – HSD (HORIZONTAL SITUATION DISPLAY) SYMBOLOGY

SAM (Surface-to-Air Missile) Site Symbol (SA-10)

Hostile Track, altitude 30000 ft

SAM (Surface-to-Air Missile) Site Threat Ring
• This ring is set by the DTC (Data Transfer Cartridge) via the Mission Editor. This is an indicator of the SAM radar range and this region should be avoided if possible.
• If SAM site is destroyed, the Threat Ring will remain displayed. It does not update dynamically with the SAM site itself, it is merely a visual marker set prior to the mission according to currently available intelligence on deployment of enemy forces.

Friendly Track, altitude 31000 ft.

HSD (Horizontal Situation Display) Page
2 – DATALINK
2.3 – HSD (HORIZONTAL SITUATION DISPLAY) SYMBOLOGY

Current zoom level on the HSD
- NORM (normal view)
- EXP1 (area around your aircraft is expanded
- EXP2 (area around your aircraft is expanded further)

View Position of HSD
- DEP: Depressed (Default) Position
- CEN: Centered Position

View Coupled (CPL) or Decoupled (DCPL) from FCR (Fire Control Radar) Range

Displays Datalink Message (MSG)

HSD CNTL (Control) Page

HSD Datalink XMT (Transmit) Option
- OFF
- L16 (LINK-16)
- IDM (Improved Data Modem)

HSD FZ (Freeze) Function. HSD will freeze in its current position, and will not turn with your aircraft or reposition itself to keep you centered.

HSD Datalink Contact Filter
- FR ON: All Friendly Contacts
- FL ON: Flight Leaders Only
- FR OFF: Friendly Contacts OFF

Display Declutter (DCLT) Function. Removes information from HSD to make it more readable.


2 – DATALINK
2.4 – FCR (FIRE CONTROL RADAR) SYMBOLOGRAPHY

**RWS contacts are uncorrelated** because they lack tracking precision.

**TWS contacts are correlated** because TWS generates more precise tracking information.

![Diagram of FCR (Fire Control Radar) page showing various tracks and symbols.]

- Hostile Track Bugged by Wingman 2, altitude 19000 ft.
- Hostile Track Bugged by Wingman 3, altitude 18000 ft.
- Friendly Tracks, altitude 18000 ft.
- Hostile Track Bugged by Multiple Donors (M), altitude 16000 ft.
- Hostile Track Bugged by Flight Member Ford 1-1 (FD11), altitude 13000 ft.
To consult the MIDS Network Data on the DLNK DED Pages:

1. Press the LIST button on the ICP (Integrated Control Panel).
2. Select Datalink (DLNK) page by pressing the ENTR (E) button.
3. On the DED (Data Entry Display) Datalink page 1 (P1), you can consult Datalink Network Status and time references.
4. Press the DCS (Data Control Switch, also called “Dobber”) RIGHT (SEQ) select the DED Datalink page 2 (P2).
5. On the DED Datalink page 2, you can consult Datalink MIDS Radio Options. Most MIDS settings can be left as is.
6. If desired, you can modify your MIDS settings by selecting a field with the “Dobber” switch UP or DOWN. “*” symbols will indicate which data field is selected. Then, enter the field value on the ICP keypad, then press “ENTR” button on the ICP to modify the field.
7. Press the DCS (Data Control Switch, “Dobber”) RIGHT (SEQ) select the DED Datalink page 3 (P3).
8. On the DED Datalink page 3, you can consult Datalink Flight Management data.
2 – DATALINK
2.5 – DED (DATA ENTRY DISPLAY) DLNK PAGES

DLNK PAGE STRUCTURE

LIST Button

DCS (Data Control Switch, also nicknamed “Dobber”)

LIST Button
Press “ENTR” to select DLNK DED Page

Datalink Network Status

MIDS Radio Options

Flight Management

NET STATUS
GPS TIME:ON
TIME: 15:31:01
NTR OFF
SYNC FINE

Dobber RIGHT (SEQ)

Dobber RIGHT (SEQ)

Dobber RIGHT (SEQ)
Here is an overview of the three different kinds of channels you can set.

- **Fighter Channel (FC)** is for members of your own flight
- **Mission Channel (MC)** is for members of other flights
- **Surveillance Channel (SC)** is for tactical datalink with information donors (i.e., AWACS)

**YOU - Flight Member Track Number:**
00201 (#1, Flight Lead, Enfield 1-1)

**Flight Member Track Number:**
00202 (#2, Enfield 1-2)

**Flight Member Track Number:**
00301 (#1, Flight Lead, Colt 1-1)

**Flight Member Track Number:**
00302 (#2, Colt 1-2)

**MIDS Radio Options**
- Flight Management
At the moment, you should assume that your Callsign and Flight Lead (FL) Identifiers are all set correctly since they are generated by the Mission Editor.

The only thing you can change is your Own Flight Position ID. This number will indicate your position in your current flight (i.e. Enfield Flight in our case).

Blue Symbols indicate member of your current flight. Green symbols are friendly members of your Datalink network, but from different flights.

The number inside the circle symbol is the Own Flight Position Number within your own flight. The number below the circle symbol is the altitude of the Datalink contact in thousands of feet (06 = 6000 ft).

**YOU - Flight Member Track Number:**
00201 (#1, Flight Lead, Enfield 1-1)
00202 (#2, Enfield 1-2)

**YOU - Flight Member Track Number:**
00301 (#1, Flight Lead, Colt 1-1)
00302 (#2, Colt 1-2)
This is an example of how members of two different flights on a same LINK-16 Datalink network would see each other.
PART 13 – DATALINK & IFF

2 – DATALINK
2.6 – MIDS NETWORK – SETTING ID NUMBER

If desired, you can modify your Own ID Number on your flight’s Datalink Network.

As an example, if you want to set your Own ID Number from #3 to #4:
1. Select MIDS FLIGHT MANAGEMENT page
   a) Press LIST Button
   b) Press ENTR Button
   c) Select Dobber RIGHT (SEQ)
   d) Your Current Own ID Number within your flight can be seen as #3 (Track Number is 00207)
2. Select the “OWN” field with the “Dobber” switch UP or DOWN. **” symbols will indicate which data field is selected.
3. Enter the field value on the ICP keypad (4)
4. Press “ENTR” button on the ICP to modify the field.
5. Your Own ID Number within your flight will now be #4. Your track Number will now be 00210.
2 – DATALINK
2.7 – WINGMAN RADAR LOCK LINES

A dashed cyan wingman lock line is drawn from wingmen to their currently bugged (or radar locked) targets.

a. Wingman lock lines are only displayed for flight members (blue) and not for all donors on the network.
b. There is no lock line visible for your own bugged targets on your own HSD page.
c. Your wingmen will see your lock line for your own bugged targets if the XMT option is set to L16 (LINK-16) on the HSD page.
Track symbols displayed on the FCR page may be filtered using the UHF/VHF Transmit switch. This affects tracks displayed on the radar display only and does not affect those displayed on the HSD.

Positioning the Transmit switch inboard short (less than .5 sec) rotates between three filter options.

Positioning the Transmit Switch outboard short (less than .5 sec) selects NONE and removes all datalink tracks. Selecting outboard short again returns to the previously selected filter option.

Communications UHF/VHF Transmit Switch (4-Way)
- Transmit Switch – IFF IN (INBOARD): Cycles filter options
- Transmit Switch – IFF OUT (OUTBOARD): Removes datalink tracks

Filter Options
- ALL: All Datalink symbols are displayed
- FTR+: Datalink Surveillance tracks are removed
- TGTS: Datalink Surveillance and PPLI tracks are removed
- NONE: No Datalink symbols are displayed
If you press on the CNTL (Control) OSB (Option Select Button) of the HSD page, you can configure what kind of data is displayed.

- **AiFF**: Toggles the display of Advanced IFF (Identify-Friend-or-Foe) responses from other aircraft.
- **PRE** (Pre-Programmed): Toggles the display of enemy targets that were programmed into your aircraft's computer before takeoff.
- **FCR**: Toggles display of the radar scan area and the "ghost" cursor showing the position of your FCR (Fire Control Radar) cursor.
- **NAV 1**: Toggles the display of your navigational route 1.
- **NAV 2**: Toggles the display of your navigational route 2.
- **NAV 3**: Toggles the display of your navigational route 3.
- **RINGS**: Toggles the display of range rings around your aircraft.
- **LINE 1**: Toggles the display of map information line 1 on the HSD (i.e. Forward Line of Troops).
- **LINE 2**: Toggles the display of map information line 2 on the HSD.
- **LINE 3**: Toggles the display of map information line 3 on the HSD.
- **LINE 4**: Toggles the display of map information line 4 on the HSD.
- **Access to CNTL Page 2**
If you press on the CNTL (Control) OSB (Option Select Button) of the HSD page, you can configure what kind of data is displayed.

**PDLT RNG** (Primary Datalink Track Range): HSD range scale automatically increases to maintain the PDLT within the HSD Field of View.

**A TGT**: Toggles the display of air threats/targets uploaded to your computer from data link.

**G TGT**: Toggles the display of ground threats/targets uploaded to your computer from data link.

**SAM**: Toggles the display of SAM (Surface-to-Air Missile) symbols and threat rings.

**SHIP**: Toggles the display of Ship symbols uploaded to your computer from data link.

**A IDM**: Not Functional

**REF PT**: Not Functional

**L16 ENG**: Not Functional

**A SURV**: Toggles the display of surveillance air threats/targets uploaded to your computer from data link.

**G FRND**: Toggles the display of friendly ground units uploaded to your computer from data link.

**LAR**: Toggles Launch Acceptable Range (LAR) Symbology from HSD.

**MP**: Not Functional

**Access to CNTL Page 1**
Identifying what you may or may not shoot should be your primary concern at all times. This is where the IFF (Identify-Friend-or-Foe) system comes into play.

An IFF system consists of an **interrogator** component and a **transponder** component.

The **interrogator** component broadcasts an interrogation signal with a specific “code” (pulse frequency).

A **transponder** equipped on another aircraft will receive the interrogation signal and broadcast a reply signal with its own “code” (pulse frequency) as well. The information sent from this reply signal will vary based on the transponder mode selected.

Your own aircraft transponder will then see if the interrogation code and reply codes match, which in some cases can be used to determine whether the other aircraft is a friendly contact. The nature of the information determined will vary based on the transponder mode.

Take note that if you set an incorrect transponder code, friendly contacts may not be able to identify you as a friendly.
In its simplest form, a "Mode" or interrogation type is generally determined by pulse spacing between two or more interrogation pulses. Various modes exist from Mode 1 to 5 for military use, to Mode A, C, and Mode S for civilian use. The takeaway from this table should be:

- **Mode 4 is the preferred mode in a combat scenario** because it is highly secure (encrypted). Encrypted interrogation codes cannot be detected by an enemy transponder, and your transponder will not broadcast a reply signal to the other team.
- **Mode 4 invalid/lack of reply cannot guarantee that an aircraft is hostile**, but a **valid reply is a guarantee of a friendly contact** (within DCS)
- **Modes 1, 2, and 3 are not secure to use** since any other aircraft from the opposing team could find what your Interrogator code is and set his transponder to it, fooling you into thinking he is a friendly contact. These modes also easily give away your position since every time your transponder broadcasts an answer, this signal can be intercepted by an enemy transponder, which can send your position to other enemy fighters via datalink.

*Take note that only Mode 4 is simulated as of 2020/04/21.*

<table>
<thead>
<tr>
<th>Military Interrogation Mode</th>
<th>Civilian Interrogation Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Provides 2-digit 5-bit mission code</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Provides 4-digit octal unit code (set on ground for fighters, can be changed in flight by transport aircraft)</td>
</tr>
<tr>
<td>3</td>
<td>A</td>
<td>Provides a 4-digit octal identification code for the aircraft, set in the cockpit but assigned by the air traffic controller. Mode 3/A is often combined with Mode C to provide altitude information as well.</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>Provides the aircraft's pressure altitude and is usually combined with Mode 3/A to provide a combination of a 4-digit octal code and altitude as Mode 3 A/C, often referred to as Mode A and C</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Provides a 3-pulse reply, delay is based on the encrypted challenge</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Provides a cryptographically secured version of Mode S and ADS-B GPS position</td>
</tr>
<tr>
<td>S</td>
<td></td>
<td>Mode S (Select) is designed to help avoiding overinterrogation of the transponder (having many radars in busy areas) and to allow automatic collision avoidance. Mode S transponders are compatible with Mode A and Mode C Secondary Surveillance Radar (SSR) systems. This is the type of transponder that is used for TCAS or ACAS II (Airborne Collision Avoidance System) functions</td>
</tr>
</tbody>
</table>
The “Interrogator” component of the IFF system is used to interrogate unknown contacts. The “Transponder” component of the IFF system is used to respond to interrogations from other aircraft.

<table>
<thead>
<tr>
<th>Interrogation Code (Who are you?)</th>
<th>Transponder Code (Who am I?)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode 4</td>
<td>Mode 4</td>
</tr>
<tr>
<td>Key A</td>
<td>Key A</td>
</tr>
</tbody>
</table>
The primary components you will use when performing target identification are the TMS (Target Management Switch), the FCR (Fire Control Radar) page and the IFF Master Switch, which powers the IFF system.

Take note that all switches in red on the IFF panel are only meant to be used as a backup only. In order to use them, the C&I Switch must be set to BACKUP. Otherwise, all IFF codes are set via the UFC (Up-Front Control) on the ICP (Integrated Control Panel).
The **CNI DED page** is used to monitor what IFF Transponder modes and codes are active.

The **IFF Menu DED page** is used to monitor and set Transponder codes, which are used to “respond” to IFF interrogations. Currently, only Mode 4 is available.

Take note that as of 2020/04/21, these codes are already set for you and cannot be modified yet.

### IFF Visual/Audio feedback Setting
- **OUT**: No feedback when interrogated by another aircraft with Mode 4
- **LIT**: Number 4 illuminates on CNI page when you are interrogated with Mode 4
- **AUD**: You receive an audio tone when you are interrogated with Mode 4

### IFF Master Mode Status
- **ON / STBY / OFF / EMER**

### IFF Mode 1 Transponder Code & Status
- **Code: 42**, highlighted if active

### IFF Mode 2 Transponder Code & Status
- **Code: 6174**, highlighted if active

### IFF Mode 3 Transponder Code & Status
- **Code: 1337**, highlighted if active

### IFF Mode 4 Transponder Key & Status
- Highlighted if active, **key not yet simulated**

### IFF Mode S Transponder Code & Status

### IFF POS (Position) Event Setting
- **NOF1**: Selected Modes change when aircraft flies North of Steerpoint 1

### IFF Time Event Setting
- **01:23** - Selected Modes change at 01:23
3 – IFF (IDENTIFY FRIEND-OR-FOE)
3.3 – IFF COMPONENTS & CONTROLS

INTG DED Pages are used to monitor and set Interrogator codes, which are used to interrogate unknown contacts. INTG LOS (Line of Sight) and INTG SCAN are two different interrogation methods, which are divided in INTG sub-menus that can be toggled with the Dobber Switch set to RIGHT (SEQ).

Take note that as of 2020/04/21, these codes are already set for you and cannot be modified yet.
3 – IFF (IDENTIFY FRIEND-OR-FOE)
3.4 – SETTING IFF CODES

Take note that as of 2020/04/21, IFF codes are already set for you and cannot be modified yet.
3 – IFF (IDENTIFY FRIEND-OR-FOE)
3.5 – IFF TUTORIAL (MODE 4)

There are two methods of interrogating a target:
• **SCAN** interrogates a locked target or immediate area around the radar cursor.
• **LOS (Line of Sight)** interrogates all contacts in the radar scan volume.

**SCAN INTERROGATION METHOD**

1. Set the IFF Master Switch to NORM to power up the IFF System.
2. Display SCAN Interrogation Codes by pressing LIST Button, then pressing “RCL” to select INTG SCAN Sub-Menu
3. (Not Simulated Yet) Set required key/code for Mode 4 IFF Interrogator by pressing “6” on the ICP (Integrated Control Panel), then pressing “ENTR”. This will set Mode 4 Interrogator key for SCAN mode to “A”.
4. (Not Simulated Yet) Display Transponder Codes by pressing IFF Menu Button, then set required key/code for Mode 4 IFF Transponder by pressing “6” on the ICP (Integrated Control Panel), then pressing “ENTR”. This will set Mode 4 Transponder key for mode 4 to “A”.

---

**IFF (Identify-Friend-or-Foe) Master Switch**
Controls power to the IFF transponder/interrogator unit.

<table>
<thead>
<tr>
<th>Interrogation Code (Who are you?)</th>
<th>Transponder Code (Who am I?)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode 4</td>
<td>Mode 4</td>
</tr>
<tr>
<td>Key A</td>
<td>Key A</td>
</tr>
</tbody>
</table>
3 – IFF (IDENTIFY FRIEND-OR-FOE)
3.5 – IFF TUTORIAL (MODE 4)

SCAN INTERROGATION METHOD

5. Set FCR (Fire Control Radar) page as the Sensor of Interest (SOI) by pressing DMS (Display Management Switch) DOWN.
6. Press TMS (Target Management Switch) LEFT SHORT (1 second or less) to interrogate all contacts in the radar scan volume.
7. If the contact is friendly, a green circle is drawn around the contact for three seconds. Friendly contacts will be displayed on the HSD (Horizontal Situation Display) as well.
8. If no reply is received, no indication is displayed, and the contact is classified as unknown. These contacts may be assumed to be hostile depending on the rules of engagement (ROE) in your current scenario.
There are two methods of interrogating a target:

- **SCAN** interrogates a locked target or immediate area around the radar cursor.
- **LOS (Line of Sight)** interrogates all contacts in the radar scan volume.

### LOS (LINE OF SIGHT) INTERROGATION METHOD

1. Set the IFF Master Switch to NORM to power up the IFF System.
2. Display LOS Interrogation by pressing LIST Button, then pressing “RCL” to select INTG SCAN Sub-Menu. Then, press Dobber switch right (SEQ) to select LOS Sub-Menu.
3. (Not Simulated Yet) Set required key/code for Mode 4 IFF by pressing “6” on the ICP (Integrated Control Panel), then pressing “ENTR”. This will set Mode 4 Interrogator key for SCAN mode to “A”.
4. (Not Simulated Yet) Display Transponder Codes by pressing IFF Menu Button, then set required key/code for Mode 4 IFF Transponder by pressing “6” on the ICP (Integrated Control Panel), then pressing “ENTR”. This will set Mode 4 Transponder key for mode 4 to “A”.

<table>
<thead>
<tr>
<th>Interrogation Code (Who are you?)</th>
<th>Transponder Code (Who am I?)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode 4</td>
<td>Mode 4</td>
</tr>
<tr>
<td>Key A</td>
<td>Key A</td>
</tr>
</tbody>
</table>
3 – IFF (IDENTIFY FRIEND-OR-FOE)
3.5 – IFF TUTORIAL (MODE 4)

LOS (LINE OF SIGHT) INTERROGATION METHOD

5. Set FCR (Fire Control Radar) page as the Sensor of Interest (SOI) by pressing DMS (Display Management Switch) DOWN.
6. With Radar Cursor/Enable Switch, slew the Acquisition Cursor (ACQ) over the contact you want to interrogate.
7. If desired, you can bug the target by using TMS (Target Management Switch) UP, but this step is not necessary.
8. Press TMS (Target Management Switch) LEFT LONG (more than 1 second) to interrogate all contacts in the radar scan volume.
9. If the contact is friendly, a green circle is drawn around the contact for three seconds. Friendly contacts will be displayed on the HSD (Horizontal Situation Display) as well.
10. If no reply is received, no indication is displayed, and the contact is classified as unknown. These contacts may be assumed to be hostile depending on the rules of engagement (ROE) in your current scenario.
One of the biggest challenges of IFF is that a lack of IFF response does NOT guarantee that the contact you are interrogating is an enemy.

A lack of response could be explained by:
- A friendly aircraft that is damaged and has a damaged transponder
- A friendly aircraft that has not set correct transponder (response) codes
- A friendly aircraft that forgot to turn on his IFF
- A friendly aircraft that is not equipped with an IFF system compatible with yours
- A hostile aircraft

This is why Datalink and IFF are meant to be used together in order to complement the information gathered by your radar, radar warning receiver and other datalink information donors. This minimizes the chances of friendly fire.
PART 14 – RADIO TUTORIAL

RADIO SYSTEM OVERVIEW

The F-16 uses two radio sets: one for UHF frequencies (AN/ARC-164, or COM1) and one for VHF frequencies (AN/ARC-222, or COM2).

- **COM1** covers the UHF band (225.000 – 399.975 MHz) and is used for primary voice communications.
- **COM2** covers the VHF band (108.000 – 173.975 MHz) and is used as a backup for voice communications.
- Radio transmission is done with the **Communications UHF/VHF Transmit Switch**. AFT (COM1 UHF, “RALT+”) or FWD (COM2 VHF, “RCTRL+”)

The **ICP (Integrated Control Panel)** is used to tune radios rapidly using preset or manual frequencies in either VHF or UHF frequency bands.

- The Main CNI (Communication, Navigation & Identification) DED (Data Entry Display) page appears when pressing the Dobber Switch LEFT (RTN). This is used as a summary of radio frequencies currently tuned.
- The UHF DED Page is accessed when pressing the COM1 button. Frequencies can be tuned with the ICP.
- The VHF DED Page is accessed when pressing the COM2 button. Frequencies can be tuned with the ICP.
RADIO SYSTEM OVERVIEW

- The **Audio 1 Control Panel** is mainly used to tune UHF COM1 and VHF COM2 radio volume.

- The **Audio 2 Control Panel** is mainly used to tune volume for other auxiliary systems (Intercom, TACAN, ILS)

- The **Backup UHF Control Panel** is the only radio that can function with battery power alone. This means that this panel can be used before engine start or if an engine failure or generator failure has occurred.
  - If you have to use the UHF Radio Backup Control Panel, the C&I switch must be set to BACKUP.
  - During normal operation, you will want to use the regular UHF COM1 and VHF COM2 radios using the ICP (Integrated Control Panel) / UFC (Up-Front Control) panel. To do that, the C&I switch must be set to UFC.

**Audio 1 Control Panel**
Controls the primary communication systems.

**Audio 2 Control Panel**
Provides control to the less frequently used communications system.

**C&I (Communication & Identification) switch**
- For normal UHF/VHF radio operation, set to UFC.
- For the UHF backup radio to operate, set to BACKUP.
Take note that the 20 preset frequencies are set in the Mission Editor. To modify a preset channel:

1. Select COM1 or COM2 button as required (depends on which radio you want to modify)
2. Press the DED Increment/Decrement Switch to select desired Preset Channel that you want to modify. We will select Preset Channel 3.
3. Press Dobber Switch DOWN three times to select the Preset Channel Frequency Data Field (asterisks indicate the field is selected).
4. On the ICP, type in the frequency you want to set the preset channel to (26600 for frequency 266.00 MHz).
5. Press ENTR button to save the frequency to the Preset Channel.
Here’s a cool trick if you intend to operate with preset frequencies and want to switch between preset radio channels rapidly.

1. Normally, you would be flying with your CNI (Communication, Navigation & Identification) page, which can be selected by pressing Dobber Switch LEFT (RTN).
2. If you press the Dobber Switch UP/DOWN, you can set the “DED Increment/Decrement arrows” next to the UHF or VHF data fields.
3. Pressing the DED Increment/Decrement Switch will then allow you to quickly change the Preset Channel selected.

Take note that this trick only works with Preset Channels. This will not work with manual frequencies.
AN/ARC-164 UHF RADIO (COM1)

COMPONENTS

- **UHF Radio Antenna Selection Switch**
  - Upper/Norm/Lower Antenna

- **Communications UHF/VHF Transmit Switch (4-Way)**
  - AFT: transmits on UHF radio (RALT+1)

- **COMM 1 (UHF) Radio Power Knob**

- **COMM 1 (UHF) Radio Mode Knob**
  - OFF / Squelch / Guard Frequency

- **Dobber Switch**
  - Selected UHF Frequency
  - Radio Transmission Status (Toggled with Dobber Switch RIGHT (SEQ))

- **UHF DED Page**
  - Selected UHF Frequency
  - Radio Frequency/Channel Input Data Field
  - NB (Narrow Band) / WB (Wide Band) Selector

- **CNI DED Page**
  - Selected UHF Frequency

- **COM 1 Button**
  - Frequency of Preset Channel
  - Preset Channel
AN/ARC-164 UHF RADIO (COM1)

TUTORIAL (MANUAL FREQUENCY)

1. Set COMM1 UHF Radio Power/Volume knob – ON (Volume as required)
2. Set COMM1 Radio Mode Switch – SQL (Squelch)
3. Set C&I (CNI, Communication, Navigation aids, and Identification) Switch to UFC (Upfront Control). This enables control of primary communications, navigation and identification functions from the upfront controls.
4. Press COM1 button on the ICP (Integrated Control Panel)
5. Set UHF Radio Function as desired using the Dobber Switch Right (SEQ).
   • MAIN means transmissions are received only on the main UHF receiver.
   • BOTH means transmissions are received on both the main and guard frequency (243.000) receivers.
6. To set manual frequency, enter the frequency on the ICP keypad (25950 for 259.500 MHz)
7. Press ENTR button to confirm. DED (Data Entry Display) page will automatically switch back to CNI (Communications, Navigation & Identification) DED page.
8. To transmit on UHF COM 1 radio, press the Communications Transmit Switch AFT (RALT+). UHF text will be highlighted when transmitting.

Communications UHF/VHF Transmit Switch (4-Way)
• AFT: transmits on UHF radio (RALT+)

C&I (Communication & Identification) switch
• For normal UHF/VHF radio operation, set to UFC.
• For the UHF backup radio to operate, set to BACKUP.
**AN/ARC-164 UHF RADIO (COM1)**

**TUTORIAL (PRESET FREQUENCY)**

1. Set COMM1 UHF Radio Power/Volume knob – ON (Volume as required)
2. Set COMM1 Radio Mode Switch – SQL (Squelch)
3. Set C&I (CNI, Communication, Navigation aids, and Identification) Switch to UFC (Upfront Control). This enables control of primary communications, navigation and identification functions from the upfront controls.
4. Press COM1 button on the ICP (Integrated Control Panel)
5. Set UHF Radio Function as desired using the Dobber Switch Right (SEQ).
   - MAIN means transmissions are received only on the main UHF receiver.
   - BOTH means transmissions are received on both the main and guard frequency (243.000) receivers.
6. You can check the associated frequency to a preset channel by toggling the channel with the DED Increment/Decrement Switch. This will NOT tune the radio to this channel; this is merely used to see the channel’s frequency (i.e. Preset Channel 2 is set to 269.00 MHz).
7. To select preset frequency, enter the frequency on the ICP keypad (“2” for Preset Frequency #2)
8. Press ENTR button to confirm. DED (Data Entry Display) page will automatically switch back to CNI (Communications, Navigation & Identification) DED page.
9. To transmit on UHF COM 1 radio, press the Communications Transmit Switch AFT ( RALT+ ). UHF text will be highlighted when transmitting.
AN/ARC-222 VHF RADIO (COM2)

COMPONENTS

Communications UHF/VHF Transmit Switch (4-Way)
- FWD: transmits on VHF radio (RCTRL+فلپ)

Selected VHF Frequency

CNI DED Page

Dobber Switch

Selected Preset Channel

Frequency of Selected Preset Channel

VHF DED Page

Radio Transmission Status

COMM 2 (VHF) Radio Mode Knob
OFF / Squelch / Guard Frequency

Radio Frequency/Channel Input Data Field

COMM 2 (VHF) Radio Power Knob

Selected Preset Channel

NB (Narrow Band) / WB (Wide Band) Selector

Radio Frequency/Channel Input Data Field
AN/ARC-222 VHF RADIO (COM2)

TUTORIAL (MANUAL FREQUENCY)

1. Set COMM2 VHF Radio Power/Volume knob – ON (Volume as required)
2. Set COMM2 Radio Mode Switch – SQL (Squelch)
3. Set C&I (CNI, Communication, Navigation aids, and Identification) Switch to UFC (Upfront Control). This enables control of primary communications, navigation and identification functions from the upfront controls.
4. Press COM2 button on the ICP (Integrated Control Panel)
5. To set manual frequency, enter the frequency on the ICP keypad (12950 for 129.500 Mhz)
6. Press ENTR button to confirm. DED (Data Entry Display) page will automatically switch back to CNI (Communications, Navigation & Identification) DED page.
7. To transmit on VHF COM 2 radio, press the Communications Transmit Switch AFT (RCTRL+). VHF text will be highlighted when transmitting.

C&I (Communication & Identification) switch
- For normal UHF/VHF radio operation, set to UFC.
- For the UHF backup radio to operate, set to BACKUP.
PART 14 – RADIO TUTORIAL

AN/ARC-222 VHF RADIO (COM2)

TUTORIAL (PRESET FREQUENCY)

1. Set COMM2 VHF Radio Power/Volume knob – ON (Volume as required)
2. Set COMM2 Radio Mode Switch – SQL (Squelch)
3. Set C&I (CNI, Communication, Navigation aids, and Identification) Switch to UFC (Upfront Control). This enables control of primary communications, navigation and identification functions from the upfront controls.
4. Press COM2 button on the ICP (Integrated Control Panel)
5. You can check the associated frequency to a preset channel by toggling the channel with the DED Increment/Decrement Switch. This will NOT tune the radio to this channel; this is merely used to see the channel’s frequency (i.e. Preset Channel 3 is set to 136.00 MHz).
6. To select preset frequency, enter the frequency on the ICP keypad (“3” for Preset Frequency #3)
7. Press ENTR button to confirm. DED (Data Entry Display) page will automatically switch back to CNI (Communications, Navigation & Identification) DED page.
8. To transmit on VHF COM 2 radio, press the Communications Transmit Switch AFT (RCTRL+). VHF text will be highlighted when transmitting.

Communications UHF/VHF Transmit Switch (4-Way)
- FWD: transmits on VHF radio (RCTRL+)
UHF RADIO BACKUP CONTROL

COMPONENTS

Communications UHF/VHF Transmit Switch (4-Way)
- AFT: transmits on UHF radio (RALT+1)

UHF Radio Function Knob
OFF / Main / Both / ADF (Automatic Direction Finder)

UHF Radio Tone Button
Functions related to anti-jam frequency hopping

UHF Radio Volume Control Knob

UHF Radio Test Display Button

UHF Radio Preset Frequency Placard

UHF Radio Preset Channel Indicator

UHF Radio Manual Frequency Indicator

UHF Radio Status Button

UHF Radio Mode Knob
- MNL: Manual Frequency
- PRESET: Preset Frequency
- GRD: Guard Frequency

C&I (Communication & Identification) switch
- For normal UHF/VHF radio operation, set to UFC.
- For the UHF backup radio to operate, set to BACKUP.
UHF RADIO BACKUP CONTROL

TUTORIAL (MANUAL FREQUENCY)

1. Set UHF Radio Backup Function knob – MAIN or BOTH
   • MAIN means transmissions are received only on the main UHF receiver.
   • BOTH means transmissions are received on both the main and guard frequency (243.000) receivers.

2. Set C&I (CNI, Communication, Navigation aids, and Identification) Switch to BACKUP. This allows you to use the UHF Backup Radio.

3. On CNI (Communication, Navigation & Identification) page, the “UHF BUP” text shows that the UHF Backup Radio is ON.

4. Set Volume knob as required
5. Set Squelch switch – ON
6. Set UHF Radio Mode Knob to MNL (Manual Frequency)
7. To tune manual frequency, use UHF Radio Manual Frequency Selectors
8. To transmit on UHF Backup radio, press the Communications Transmit Switch AFT (RALT+"). UHF text will be highlighted when transmitting.
PART 14 – RADIO TUTORIAL

UHF RADIO BACKUP CONTROL

TUTORIAL (PRESET FREQUENCY)

1. Set UHF Radio Backup Function knob – MAIN or BOTH
   - MAIN means transmissions are received only on the main UHF receiver.
   - BOTH means transmissions are received on both the main and guard frequency (243.000) receivers.
2. Set C&I (CNI, Communication, Navigation aids, and Identification) Switch to BACKUP. This allows you to use the UHF Backup Radio.
3. On CNI (Communication, Navigation & Identification) page, the “UHF BUP” text shows that the UHF Backup Radio is ON.
4. Set Volume knob as required
5. Set Squelch switch – ON
6. Set UHF Radio Mode Knob to PRESET
7. To select preset frequency channel, use UHF Radio Preset Channel knob
8. To transmit on UHF Backup radio, press the Communications Transmit Switch AFT ( RALT+\ ). UHF text will be highlighted when transmitting.

Communications UHF/VHF Transmit Switch (4-Way)
- AFT: transmits on UHF radio ( RALT+\ )

C&I (Communication & Identification) switch
- For normal UHF/VHF radio operation, set to UFC.
- For the UHF backup radio to operate, set to BACKUP.
Like the F/A-18 and the Mirage 2000C, the F-16 is equipped with a fly-by-wire system. **Fly-by-wire (FBW)** is a system that replaces the conventional manual flight controls of an aircraft with an electronic interface. The movements of flight controls are converted to electronic signals transmitted by wires (hence the fly-by-wire term), and flight control computers determine how to move the actuators at each control surface to provide the ordered response. The fly-by-wire system also allows automatic signals sent by the aircraft’s computers to perform functions without the pilot’s input, as in systems that automatically help stabilize the aircraft, or prevent unsafe operation of the aircraft outside of its performance envelope.

Flying the F-16 feels different from other fighter jets like the F-15. Control surfaces are controlled by a computer: you merely tell the aircraft what you want it to do.

I highly recommend this article about the F-16’s fly-by-wire system. It is very instructive and quite interesting. [http://www.ausairpower.net/AADR-FBW-CCV.html](http://www.ausairpower.net/AADR-FBW-CCV.html)
The FLCS (Flight Control System, also nicknamed “Flickiss”) is a digital four-channel system which hydraulically positions control surfaces. The FLCS has a certain level of control over pitch, roll and yaw control inputs. Pitch motion is controlled by symmetrical movement of the horizontal tails. Roll motion is controlled by differential movement of the flaperons and horizontal tails. Yaw motion is controlled by the rudder. Roll coordination is provided by an ARI (Aileron-Rudder Interconnection). The ARI function is not available whenever main landing gear wheel speed exceeds 60 knots or if the angle of attack exceeds 35 degrees.
FLCS (FLIGHT CONTROL SYSTEM)

FLCS OPERATIONAL MODES (GAINS)

The Flight Control System (FLCS) can use three main operation modes, also called “gains”. These gains will modify how the fly-by-wire system will move the control surfaces.

• Cruise Gains (Normal Operating Mode)
  • Active during normal aircraft flight (landing gear up, no FLCS failure)

• Takeoff & Landing Gains
  • Active below 400 kts when landing gear is deployed, or when ALT FLAPS switch is set to EXTEND, or when the air refueling trap door is open

• Standby Gains
  • Active when flight control computer has detected a FLCS failure

GUN COMPENSATION

The FLCS automatically compensates for the off-center gun firing and the gun gas emissions during gun firing by moving the rudder and flaperons. Gun compensation is optimized for 0.7 – 0.9 Mach. Firing outside of those speeds may create adverse effects.

LEF (LEADING EDGE FLAPS) and TEF (TRAILING EDGE FLAPS)

Leading Edge Flaps are controlled by the FLCS as a function of Mach Number and Angle of Attack.

Trailing Edge Flaps are controlled by the FLCS as a function of the Landing Gear handle position, ALT FLAPS switch position andairspeed.
The Flight Control Computer takes a number of input parameters in order to calculate adequate movements for your flight control surfaces. FLCS controller gains are scheduled by air data inputs, and sideslip angle and rate is calculated based on the Inertial Navigation System (INS) inputs. Here is a simplified representation of the FLCC (Flight Control Computer).

**PITCH INPUTS**
- Pitch Trim ——> Mechanical Limit
- Horizontal Tail Stick Force
- Angle of Attack
- Pitch Rate
- Normal Acceleration
- Impact Pressure

**ROLL INPUTS**
- Roll Trim ——> Mechanical Limit
- Aileron Stick Force
- Roll Rate

**YAW INPUTS**
- Yaw Trim ——> Mechanical Limit
- Rudder Pedal Force
- Yaw Rate
- Lateral Acceleration

**GUN COMPENSATION INPUT**
- Gun Fire

**INERTIAL NAVIGATION SYSTEM INPUTS**
- Angles and Velocities

**FLIGHT CONTROL COMPUTER**
FLCS (FLIGHT CONTROL SYSTEM)

FLCS CONFIGURATION MODES & LIMITERS

The Flight Control System (FLCS) can use two main configuration modes: CAT I and CAT III.

Depending on the weapon and external fuel tank loadout, the aircraft will automatically detect what CONFIG setting you should be in. The STORES CONFIG warning indicates that the FLCS Stores Configuration switch is not set properly.

• **CAT I:** Air-to-Air configuration, used when Air-to-Air weapons and centreline fuel tank is loaded.
  - FCS limits aircraft acceleration from -3 G to +9 G until 15 deg AoA (Angle of Attack) is reached.
  - Above 15 deg, max G is a function of AoA and airspeed (+7.3 G at 20 deg AoA, +1G at 25 deg AoA)
  - FCS limits max AoA to 25 deg
  - Max rudder deflection starts decreasing around 14 deg AoA, then cannot be deflected at 26 deg AoA

• **CAT III:** Air-to-Ground configuration, used when air-to-ground weapons are mounted and external wing fuel tanks are mounted.
  - FCS limits aircraft acceleration from -3 G to +9 G until 15 deg AoA (Angle of Attack) is reached.
  - FCS limits max AoA to 15.5 - 15.8 deg
  - Commanded roll rate is reduced by 40 % of max commanded roll rate in CAT I in order to reduce risks of roll-coupled departures from flight
  - Max rudder deflection starts decreasing at 3 deg AoA, then cannot be deflected at 15 deg AoA

**Notes:**

• Note 1: the CAT Config switch is not a "G limiter" selector switch per se. It limits Angle of Attack, which in turn limits maximum attainable G based on a function of AoA and airspeed.
• Note 2: When the landing gear is deployed (during takeoff/landing), the FLCS gains operate as a pitch rate command system until 10 deg AoA. Above 10 deg AoA, the FLCS operates as a pitch rate/AoA command system.
• Note 3: Above 35 deg AoA, yaw rate limiter provides roll and yaw axis anti-spin control inputs. It also cuts out stick roll commands.
• Note 4: Below -5 deg AoA and less than 170 kts, yaw rate limiter provides anti-spin rudder inputs.
The F-16 has a number of autopilot “relief modes” that assist the pilot in flying the aircraft.

**AUTOPILOT MODES**

1. **PITCH ATT HOLD**: Attitude Hold in the pitch axis. Aircraft will maintain the existing pitch attitude, as long as the attitude is +/- 60 degrees in pitch.
2. **ROLL ATT HOLD**: Attitude Hold in the roll axis. Aircraft will maintain the existing roll attitude, as long as the attitude is +/- 60 degrees in roll.
3. **ALT HOLD**: Barometric Altitude Hold. When engaged, aircraft will maintain current barometric altitude
4. **HDG SEL**: Heading Select. Aircraft will turn to and fly the heading as set on the EHSI (Electronic Horizontal Situation Indicator).
5. **STRG SEL**: Steering Select. Aircraft will turn to and fly to the active steerpoint.

Take note that pitch and roll modes can be combined together. As an example, you could set STRG SEL and ALT HOLD simultaneously. The aircraft would then follow the active steerpoint while maintaining your current altitude.
AUTOPilot

AUTOPilot Limits

The autopilot will automatically disengage if one of the following conditions is met:

- Paddle Switch (on Stick) is pressed
- TRIM A/P Disc Switch is set to DISC
- Landing Gear is DOWN
- Air Refueling Trap Door is open
- ALT Flaps (Alternate Flaps) switch is set to EXTEND
- Angle of Attack is greater than 15 deg
- DBU (Digital Backup Flight Control Mode) is engaged
- MPO (Manual Pitch Override) switch is held in OVRD
- Autopilot failure or FLCS failure has occurred
- Stall Horn is active

Manual Pitch Override Switch

In case of a deep stall departure, the pitch override switch allows you to command greater authority from the stabs to help get the nose pointed downhill so you can pick up speed for controlled flight.

Digital Backup (DBU) Switch

Allowing the pilot to manually select a backup software state of the FLCS

Alternate Flaps Extend Switch

Paddle Switch

Overrides Autopilot when depressed

Trim/AP Disc Switch

- NORM: Stick trims are energized and autopilot is possible
- DISC: Stick trims and autopilot are inhibited
**AUTOPILOT**

**AUTOPILOT ALT HOLD (ALTITUDE HOLD) MODE**

1. Fly at the desired altitude you want to maintain
2. Set Autopilot Pitch Mode Switch to ALT HOLD. Your current altitude will become the «reference altitude».
3. Autopilot will maintain altitude when autopilot was engaged +/- 100 ft.
   - Note: Vertical velocity above +2000 ft/min or below -2000 ft/min will prevent the autopilot from capturing the required altitude.
4. If you want to set a new reference altitude while autopilot is engaged (i.e. the autopilot is maintaining 10,000 ft and you want to fly to climb and level off at 15,000 ft):
   a) Press and hold the Autopilot Paddle switch, and move stick to make the aircraft climb to desired altitude
   b) Autopilot will be disengaged as long as the Paddle switch is held
   c) When new target altitude is reached, release the Autopilot Paddle switch.
   d) Upon release the Paddle switch, the autopilot will take the new actual altitude as the «reference altitude» and maintain this altitude.
5. To disengage autopilot, set Autopilot Pitch Mode Switch to A/P OFF. Paddle Switch can be held to override autopilot.

**NOTE:** ALT HOLD can be combined with any Autopilot Roll Mode.
**AUTOPILOT**

**AUTOPILOT PITCH ATT HOLD (ATTITUDE HOLD) MODE**

1. Set aircraft in desired pitch attitude
2. Set Autopilot Pitch Mode Switch to ATT HOLD.
3. Autopilot will maintain current pitch attitude. Angles above 60 deg in pitch will not be captured.
4. While autopilot is engaged, aircraft pitch can be changed with stick input. Any time the stick is moved, the attitude hold mode will capture this new attitude and maintain it.
5. To disengage autopilot, set Autopilot Pitch Mode Switch to A/P OFF. Paddle Switch can be held to override autopilot.

**AUTOPILOT ROLL ATT HOLD (ATTITUDE HOLD) MODE**

1. Set aircraft in desired roll attitude
2. Set Autopilot Roll Mode Switch to ATT HOLD.
3. Autopilot will maintain current roll attitude. Angles above 60 deg in roll will not be captured.
4. While autopilot is engaged, aircraft roll angle can be changed with stick input. Any time the stick is moved, the attitude hold mode will capture this new attitude and maintain it.
5. To disengage autopilot, set Autopilot Pitch Mode Switch to A/P OFF. Paddle Switch can be held to override autopilot.

**NOTE:** PITCH ATT HOLD and ROLL ATT HOLD can be combined together or with other autopilot modes.
AUTOPILOT

AUTOPILOT HDG SEL (HEADING SELECT) MODE

1. Turn the HDG knob on the EHSI (Electronic Horizontal Situation Indicator) and set the Heading Select Bug to the desired heading you want to capture.
2. Set Autopilot Pitch Mode Switch to either ATT HOLD (Attitude) or ALT HOLD (Altitude Hold), as desired. Without a Pitch mode active, the autopilot will not be able to engage any roll mode.
3. Set Autopilot Roll Mode Switch to HDG SEL to engage the Heading Select mode.
4. Autopilot will limit bank angle to 45 deg and steer towards the selected heading until it is captured.
5. To disengage autopilot, set Autopilot Pitch Mode Switch to A/P OFF.

**Note:** Paddle Switch will not disengage autopilot while in HDG SEL.
**AUTOPilot STRG SEL (Steering SELECT) MODE**

1. Select steerpoint you want to navigate to.
   a) CNI (Communication, Navigation & Information) page must be selected beforehand (Dobber switch pressed LEFT to RTN)
   b) Use DED Increment/Decrement Switch to select desired steerpoint. We will select Steerpoint 2.
      • Alternatively, you can also select a steerpoint by pressing “STPT (4)” button on the ICP, entering the Steerpoint Number (i.e. “2” button for Steerpoint 2), then pressing “ENTR” button.
   c) Selected steerpoint will be visible on your HSD (Horizontal Situation Display) as a white circle
   d) Access STPT page by pressing STPT (4) button on the ICP (Integrated Control Panel).
   e) Press the Dobber Switch RIGHT (SEQ) to toggle between MANUAL and AUTOMATIC Steerpoint Sequencing mode as desired.

2. Set Autopilot Pitch Mode Switch to either ATT HOLD (Attitude) or ALT HOLD (Altitude Hold), as desired. Without a Pitch mode active, the autopilot will not be able to engage any roll mode.

3. Set Autopilot Roll Mode Switch to STRG SEL to engage the Steering Select mode.

4. Autopilot will limit bank angle to 45 deg and steer towards the selected steerpoint until it is captured.
   • AUTOMATIC sequencing means that when reaching the vicinity of the currently selected steerpoint, the autopilot STRG SEL mode will steer to the next steerpoint automatically.
   • MANUAL sequencing means that when reaching the vicinity of the currently selected steerpoint, the autopilot STRG SEL mode will circle the steerpoint at a 30 deg bank angle.

5. To disengage autopilot, set Autopilot Pitch Mode Switch to A/P OFF.

*Note:* Paddle Switch will not disengage autopilot while in STRG SEL.

**PART 15 – FLIGHT CONTROLS & AUTOPILOT**

**Autopilot Pitch Mode Switch**
- ALT HOLD (Altitude Hold)
- A/P OFF (Autopilot OFF)
- ATT HOLD (Attitude Hold)

**Autopilot Roll Mode Switch**
- HDG SEL (Heading Select)
- ATT HOLD (Attitude Hold)
- STRG SEL (Steering to selected steer point in the DED, Data Entry Display)
NAVIGATION SECTION STRUCTURE

- 1 – Navigation Introduction
- 2 – HSD (Horizontal Situation Display)
- 3 – EHSI (Electronic Horizontal Situation Indicator)
- 4 – Navigation Point Types
- 5 – Steerpoints
  - 5.1 – Steerpoint Navigation
    - 5.1.1 – Steerpoint Database
    - 5.1.2 – Manual vs Auto Sequencing
    - 5.1.3 – Steerpoint Navigation Tutorial
    - 5.1.4 – Steerpoint Selection via HSD or FCR (Not implemented yet)
  - 5.2 – How to Add Steerpoints
  - 5.3 – How to Edit Steerpoints
- 6 – Markpoints
  - 6.1 – Markpoint Navigation (Not implemented yet)
  - 6.2 – How to Add Markpoints (Not implemented yet)
- 7 – TACAN Navigation
- 8 – Bullseye
- 9 – CRUS (Cruise) Page (Not implemented yet)
- 10 – ILS (Instrument Landing System) Tutorial
Navigation in the F-16C is mostly done through the HSD (Horizontal Situation Display), EHSI (Electronic Horizontal Situation Indicator), HUD (Heads-Up Display) and ADI (Attitude Director Indicator) localizer & glide slope reference bars. The Standby Magnetic Compass can also be used as a backup. The DED (Data Entry Display) and ICP (Integrated Control Panel) allow you to consult and edit navigation data. The FCR (Fire Control Radar) page also displays steerpoints. Take note that while TACAN and ILS beacons are supported in the F-16, NDB (Non-Directional Beacons) navigation with an ADF (Automatic Direction Finder) is not supported.
2 – HSD (HORIZONTAL SITUATION DISPLAY)

HSD Main Page

The HSD (Horizontal Situation Display) is one of the most important tools at your disposal for navigation.

The HSD displays a plan-view of your current tactical situation with the symbols representing your aircraft position (Ownship), current steerpoint, active flight plan, and range rings.
2 – HSD (HORIZONTAL SITUATION DISPLAY)
HSD Main Page

View Position of HSD
- DEP: Depressed (Default) Position
- CEN: Centered Position

Current zoom level on the HSD
- NORM (normal view)
- EXP1 (area around your aircraft is expanded)
- EXP2 (area around your aircraft is expanded further)

View Coupled (CPL) or De-coupled (DCPL) from FCR (Fire Control Radar) Range

Displays Datalink Message (MSG)

HSD DataLink XMT (Transmit) Option
- OFF
- L16 (LINK-16)
- IDM (Improved Data Modem)

HSD FZ (Freeze) Function. HSD will freeze in its current position, and will not turn with your aircraft or reposition itself to keep you centered.

HSD DataLink Contact Filter
- FR ON: All Friendly Contacts
- FL ON: Flight Leaders Only
- FR OFF: Friendly Contacts OFF

Display Declutter (DCLT) Function. Removes information from HSD to make it more readable.
If you press on the CNTL (Control) OSB (Option Select Button) of the HSD page, you can configure what kind of data is displayed.

- **AIFF:** Toggles the display of Advanced IFF (Identify-Friend-or-Foe) responses from other aircraft.
- **PRE (Pre-Programmed):** Toggles the display of enemy targets that were programmed into your aircraft's computer before takeoff.
- **FCR:** Toggles display of the radar scan area and the "ghost" cursor showing the position of your FCR (Fire Control Radar) cursor.
- **NAV1:** Toggles the display of your navigational route 1.
- **NAV2:** Toggles the display of your navigational route 2.
- **NAV3:** Toggles the display of your navigational route 3.
- **RINGS:** Toggles the display of range rings around your aircraft.

**HSD CNTL (Control) Sub-Page**

- **LINE1:** Toggles the display of map information line 1 on the HSD (i.e. Forward Line of Troops).
- **LINE2:** Toggles the display of map information line 2 on the HSD.
- **LINE3:** Toggles the display of map information line 3 on the HSD.
- **LINE4:** Toggles the display of map information line 4 on the HSD.

Access to CNTL Page 2
If you press on the CNTL (Control) OSB (Option Select Button) of the HSD page, you can configure what kind of data is displayed.

**PDLT RNG (Primary Datalink Track Range):** HSD range scale automatically increases to maintain the PDLT within the HSD Field of View.

**A TGTS:** Toggles the display of air threats/targets uploaded to your computer from data link.

**G TGTS:** Toggles the display of ground threats/targets uploaded to your computer from data link.

**SAM:** Toggles the display of SAM (Surface-to-Air Missile) symbols and threat rings.

**SHIP:** Toggles the display of Ship symbols uploaded to your computer from data link.

**A IDM:** Not Functional

**REF PT:** Not Functional

**L16 ENG:** Not Functional

**A SURV:** Toggles the display of surveillance air threats/targets uploaded to your computer from data link.

**G FRND:** Toggles the display of friendly ground units uploaded to your computer from data link.

**LAR:** Toggles Launch Acceptable Range (LAR) Symbology from HSD.

**MP:** Not Functional

Access to CNTL Page 1
An interesting feature of the F-16 is how seamlessly integrated the Fire Control Radar page and the Horizontal Situation Display page are. For instance, Datalink symbology and selected steerpoint information is available on both pages. Also, radar spotlight scan lines are visible on both pages, but in a slightly different form.

You can couple (CPL) or de-couple (DCPL) HSD view from the Fire Control Radar as desired. To toggle the coupling mode, press the OSB (Option Select Button) next to CPL/DCPL. This coupling feature allows you to change the FCR range, and then automatically scale the HSD accordingly. This way, you do not need to change the scale on each display individually, which reduces your workload significantly in a target-rich environment.
The EHSI is your primary gauge to assist in navigation to steerpoinst and TACAN beacons. While you will likely be using HUD symbology for most of your navigation purposes, a firm understanding of the EHSI is necessary for access to additional navigation data that is not present on the HUD or DED displays, and in case of battle damage.

**EHSI Mode Selector Button**
Toggles between the following modes:
- NAV: Navigation
- PLS/NAV: Precision Landing System (ILS) / Navigation
- TCN: TACAN
- PLS/TCN: Precision Landing System (ILS) / TACAN

**EHSI Brightness Control Knob** (when pressed IN)
Scroll mousewheel to turn knob, left click to press in.

**Course Setting Knob** (when OUT)
EHSI Brightness Control Knob (when pressed IN)
Scroll mousewheel to turn knob, left click to press in.
These are the available Navigation Point types used in the F-16:

- **Steerpoints**
  - Steerpoints (or Waypoints) are pre-planned navigational points of reference for you to follow on route to your area of operation. You can create new ones, edit their coordinates and create flight plans with them.

- **Markpoints**
  - Markpoints are used to "mark" a point of interest, whether flying over an interesting area or an enemy sighting.

- **Anchor Point / Bullseye**
  - Also referred to as a "Bullseye", an anchor point serves as a common geographic reference for a mission amongst friendly forces.
### STEERPOINT DATABASE

<table>
<thead>
<tr>
<th>Steerpoint #</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 24</td>
<td>Reserved for Navigation Route / general flight planning</td>
</tr>
<tr>
<td>25</td>
<td>Reserved for Bullseye (automatically assigned)</td>
</tr>
<tr>
<td>26 to 30</td>
<td>Reserved for Ownship Markpoints</td>
</tr>
<tr>
<td>31 to 54</td>
<td>Reserved for HSD lines (4 lines with up to 6 points in each line)</td>
</tr>
<tr>
<td>56 to 70</td>
<td>Reserved for Pre-planned threats</td>
</tr>
<tr>
<td>71 to 80</td>
<td>Reserved for Datalink Markpoints</td>
</tr>
<tr>
<td>81 to 89</td>
<td>Open (not used, but available to store coordinates as desired by the pilot)</td>
</tr>
<tr>
<td>90 to 99</td>
<td>Used for AGM-84 HARPOON Anti-Ship Missiles in certain F-16 Blocks, but in the Block 50 these steerpoints are open (not used, but available to store coordinates as desired by the pilot).</td>
</tr>
</tbody>
</table>
5 – STEERPOINTS
5.1 – Steerpoint Navigation
5.1.2 – Manual vs Auto Sequencing

When following a flight plan and reaching the steerpoint you have currently selected, “sequencing” modes determine whether you need to manually select the next steerpoint with the DED Increment/Decrement Switch (MAN Sequencing) or if the navigation computer will automatically select the next steerpoint in your flight plan (AUTO Sequencing).

To select Automatic or Manual Steerpoint Sequencing:

1. CNI (Communication, Navigation & Information) page must be selected beforehand (Dobber switch pressed LEFT to RTN).
3. Press the Dobber Switch RIGHT (SEQ) to toggle between MANUAL and AUTOMATIC Steerpoint Sequencing modes.
5 – STEERPOINTS
5.1 – Steerpoint Navigation
5.1.3 – Navigation Tutorial

1. Select CNI (Communication, Navigation & Information) page by setting Dobber switch LEFT (RTN).
2. Use DED Increment/Decrement Switch to select desired steerpoint. We will select Steerpoint 2.
   - Alternatively, you can also select a steerpoint by pressing “STPT (4)” button on the ICP, entering the Steerpoint Number (i.e. “2” button for Steerpoint 2), then pressing “ENTR” button.
3. Selected steerpoint will be visible on your HSD (Horizontal Situation Display) as a white circle.
4. If you want to see steerpoint 2 coordinates, access STPT page by pressing STPT (4) button on the ICP (Integrated Control Panel). Then, use DED Increment/Decrement Switch to select steerpoint 2.
5. Select Manual or Automatic Sequencing as desired. This is done by setting Dobber switch RIGHT (SEQ).

LATITUDE COORDINATES
LONGITUDE COORDINATES
ELEVATION (ft)
TOS (Time Over Steerpoint)
5. Set EHSI (Electronic Horizontal Situation Indicator) Navigation Mode to NAV by pressing the “M” (EHSI Mode Selector) button to toggle between modes.

6. If you want to intercept the steerpoint from a specific direction, set desired course using the CRS knob. In our case, we will leave the intercept course to 000.

7. Verify that NAV Master Mode is selected on the Heads-Up Display (HUD). If either A-A or A-G mode is selected, pressing their respective ICP button will revert the master mode back to NAV.

8. Direction and range to the Steerpoint are indicated on the HUD. Consult Diamond and Tadpole symbols.

9. Direction and range to the Steerpoint are indicated on the EHSI as well.
5.1 – Steerpoint Navigation
5.1.3 – Navigation Tutorial

11. Fly towards selected steerpoint by aligning the Steerpoint Tadpole with the FPM (Flight Path Marker). When flying towards the steerpoint, the tadpole should be pointing up and be centered.

Steerpoint Tadpole
Line points towards steerpoint (UP = In Front of You / DOWN = Behind You). Steerpoint is in front of us.

Steerpoint Diamond
Diamond indicates STPT is within the HUD's field of view. Steerpoint is in front of us.

Direction to Steerpoint
Selected Steerpoint

FPM (Flight Path Marker)
5 – STEERPOINTS
5.1 – Steerpoint Navigation
5.1.3 – Navigation Tutorial

Steerpoint Tadpole Representation

Tadpole pointing to Steerpoint 1
Tadpole pointing to Steerpoint 2
Tadpole pointing to Steerpoint 3
Tadpole pointing to Steerpoint 4
Tadpole pointing to Steerpoint 5
Tadpole pointing to Steerpoint 6
5 – STEERPOINTS
5.1 – Steerpoint Navigation
5.1.4 – Steerpoint Selection via HSD or FCR

As of 2020/04/27, Steerpoints cannot be selected with the FCR (Fire Control Radar) page or with the HSD (Horizontal Situation Display) page in the DCS F-16.
5 – STEERPOINTS
5.2 – How To Add Steerpoints

Take note that the F-16 takes coordinates in Degrees, minutes, decimal minutes. By default, map coordinates are given in Degrees, minutes, seconds. To change coordinate format on the F10 map, use "LALT+Y".

1. We will add the coordinates (Deg, minutes, decimal minutes) for Groom Lake AFB:
   - 37°13’08” North 115°47’07” West (Deg, minutes, seconds)
   - 37°13.133’ North 115°47.116’ West (Deg, minutes, decimal minutes)
   - Elevation 4494 ft

2. Our current flight plan has four steerpoints. We will add a fifth one (STPT #5).
3. Select CNI (Communication, Navigation & Information) page by setting Dobber switch LEFT (RTN)
5 – STEERPOINTS

5.2 – How To Add Steerpoints

- Coordinates (Deg, minutes, decimal minutes) for Groom Lake AFB:
  - 37°13'08" North 115°47'07" West (Deg, minutes, seconds)
  - 37°13.133' North 115°47.116' West (Deg, minutes, decimal minutes)
  - Elevation 4494 ft

5. Select Steerpoint by entering the Steerpoint Number (i.e. “5” button for Steerpoint 5), then pressing “ENTR” button. Alternatively, you can also use DED Increment/Decrement Switch to select steerpoint 5.

6. Press the Dobber Switch DOWN to select the LAT (LATITUDE) field. The “*” symbols next to LAT indicate that the LATITUDE field is selected.

7. If coordinate latitude is North, press “2” (N) on the ICP. If coordinate latitude is South, press “8” (S).

8. Enter the latitude of the new steerpoint using the ICP keypad (3713133).

9. Press “ENTR” button on the ICP (Integrated Control Panel) to enter/confirm LATITUDE coordinates.

10. Press the Dobber Switch DOWN to select the LNG (LONGITUDE) field. The “*” symbols next to LNG indicate that the LONGITUDE field is selected.

11. If coordinate longitude is West, press “4” (W) on the ICP. If coordinate longitude is East, press “6” (E).

12. Enter the longitude of the new steerpoint using the ICP keypad (11547116).

13. Press “ENTR” button on the ICP (Integrated Control Panel) to enter/confirm LONGITUDE coordinates.
5 – STEERPOINTS
5.2 – How To Add Steerpoints

- Coordinates (Deg, minutes, decimal minutes) for Groom Lake AFB:
  - 37°13'08" North 115°47'07" West (Deg, minutes, seconds)
  - 37°13.133' North 115°47.116' West (Deg, minutes, decimal minutes)
- Elevation 4494 ft

14. Press the Dobber Switch DOWN to select the ELEV (Elevation) field. The “*” symbols next to ELEV indicate that the ELEVATION field is selected.
15. If steerpoint elevation is negative, press “0 M-SEL” (-) on the ICP. Otherwise, no action is required.
16. Enter the elevation of the new steerpoint using the ICP keypad (4494).
17. Press “ENTR” button on the ICP (Integrated Control Panel) to enter/confirm ELEVATION (in feet).
18. New steerpoint #5 should now be visible and selected on your HUD and HSD.
5 – STEERPOINTS
5.3 – How To Edit Steerpoints

1. We will edit the coordinates of an existing Steerpoint 5 (Deg, minutes, decimal minutes) to the coordinates for Groom Lake AFB, which are:
   - 37°13'08'' North 115°47'07'' West (Deg, minutes, seconds)
   - 37°13.133' North 115°47.116' West (Deg, minutes, decimal minutes)
   - Elevation 4494 ft

2. Our current flight plan has five steerpoints. We will edit the fifth one (STPT #5).

3. Select CNI (Communication, Navigation & Information) page by setting Dobber switch LEFT (RTN)


5. Select Steerpoint 5 (the one that we want to edit) by entering the Steerpoint Number (i.e. “5” button for Steerpoint 5), then pressing “ENTR” button. Alternatively, you can also use DED Increment/Decrement Switch to select steerpoint 5.
5 – STEERPOINTS

5.3 – How To Edit Steerpoints

- Coordinates (Deg, minutes, decimal minutes) for Groom Lake AFB:
  - 37°13'08'' North 115°47'07'' West (Deg, minutes, seconds)
  - 37.218667' North 115.784722' West (Deg, minutes, decimal minutes)
  - Elevation 4494 ft

6. Press the Dobber Switch DOWN to select the LAT (LATITUDE) field. The “*” symbols next to LAT indicate that the LATITUDE field is selected.

7. If coordinate latitude is North, press “2” (N) on the ICP. If coordinate latitude is South, press “8” (S).

8. Enter the new latitude of the existing steerpoint using the ICP keypad (3713133).

9. Press “ENTR” button on the ICP (Integrated Control Panel) to enter/confirm LATITUDE coordinates.

10. Press the Dobber Switch DOWN to select the LNG (LONGITUDE) field. The “*” symbols next to LNG indicate that the LONGITUDE field is selected.

11. If coordinate longitude is West, press “4” (W) on the ICP. If coordinate longitude is East, press “6” (E).

12. Enter the new longitude of the existing steerpoint using the ICP keypad (11547116).

13. Press “ENTR” button on the ICP (Integrated Control Panel) to enter/confirm LONGITUDE coordinates.
5 – STEERPOINTS
5.3 – How To Edit Steerpoints

- Coordinates (Deg, minutes, decimal minutes) for Groom Lake AFB:
  - 37°13’08” North 115°47’07” West (Deg, minutes, seconds)
  - 37°13.133’ North 115°47.116’ West (Deg, minutes, decimal minutes)
- Elevation 4494 ft

14. Press the Dobber Switch DOWN to select the ELEV (Elevation) field. The “*” symbols next to LAT indicate that the ELEVATION field is selected.
15. If steerpoint elevation is negative, press “0 M-SEL” (-) on the ICP. Otherwise, no action is required.
16. Enter the new elevation of the existing steerpoint using the ICP keypad (4494).
17. Press “ENTR” button on the ICP (Integrated Control Panel) to enter/confirm ELEVATION (in feet).
18. Steerpoint #5 should now have its coordinates updated and its new location will be reflected on your HUD and HSD.
6 – MARKPOINTS
6.1 – Markpoint Navigation

In order to navigate to a markpoint, the method is almost identical to navigating to a steerpoint. Why? Because markpoints are stored in Steerpoints 26 to 30, therefore you will have to access them the same way you would access any other steerpoint.

In this tutorial, we will assume a markpoint has already been created (Steerpoint #26).

1. Select CNI (Communication, Navigation & Information) page by setting Dobber switch LEFT (RTN)
2. Use DED Increment/Decrement Switch to select desired steerpoint. We will select Steerpoint 26.
   • Alternatively, you can also select a steerpoint by pressing “STPT (4)” button on the ICP, entering the Steerpoint Number (i.e. “2” and “6” buttons for Steerpoint 26), then pressing “ENTR” button.
3. If you want to see steerpoint 26 coordinates, access STPT page by pressing STPT (4) button on the ICP (Integrated Control Panel). Then, use DED Increment/Decrement Switch to select steerpoint 26.
6 – MARKPOINTS
6.1 – Markpoint Navigation

4. Set EHSI (Electronic Horizontal Situation Indicator) Navigation Mode to NAV by pressing the “M” (EHSI Mode Selector) button to toggle between modes.

5. If you want to intercept the steerpoint from a specific direction, set desired course using the CRS knob. In our case, we will leave the intercept course to 000.

6. Verify that NAV Master Mode is selected on the Heads-Up Display (HUD). If either A-A or A-G mode is selected, pressing their respective ICP button will revert the master mode back to NAV.

7. Direction and range to the Steerpoint are indicated on the HUD. Consult Diamond and Tadpole symbols.

8. Direction and range to the Steerpoint are indicated on the EHSI as well.
6 – MARKPOINTS
6.1 – Markpoint Navigation

9. Fly towards selected steerpoint (markpoint) by aligning the Steerpoint Tadpole with the FPM (Flight Path Marker). When flying towards the steerpoint, the tadpole should be pointing up and be centered.

Steerpoint Tadpole
Line points towards steerpoint (UP = In Front of You / DOWN = Behind You). Steerpoint is in front of us.

Steerpoint Diamond
Diamond indicates STPT is within the HUD’s field of view. Steerpoint (Markpoint) is in front of us.

Direction to Steerpoint (Markpoint)

FPM (Flight Path Marker)
You must access the MARK (Markpoint) DED (Data Entry Display) page to create a Markpoint:

a) Select CNI (Communication, Navigation & Information) page by setting Dobber switch LEFT (RTN)
b) Press MARK (7) button on the ICP (Integrated Control Panel).
c) Toggle the Dobber Switch RIGHT (SEQ) to cycle through Markpoint Designation modes (FCR, TGP, HUD and OFLY)

There are four main methods to create markpoints:

FCR (Fire Control Radar) Designated Markpoint
- If Master Mode is either NAV or A-G, the FCR page is SOI (Sensor of Interest, performed with DMS DOWN), entering the MARK page will default to MARK FCR. The first markpoint will remain blank.
- Designate the target by slewing the FCR Reticle on the FCR page with the Radar Cursor/Enable Switch, then create markpoint by pressing TMS UP

TGP (Targeting Pod) Designated Markpoint
- If Master Mode is either NAV or A-G, the TGP page is SOI (Sensor of Interest, performed with DMS DOWN), entering the MARK page will default to MARK TGP. The first markpoint will remain blank.
- Designate the target by slewing the Targeting Pod Reticle on the TGP page with the Radar Cursor/Enable Switch, then create markpoint by pressing TMS UP

HUD (Heads-Up Display) Designated Markpoint
- If Master Mode is either NAV or A-G... and neither the FCR page nor the TGP page is SOI (Sensor of Interest, performed with DMS UP), entering the MARK page will default to MARK HUD. The first markpoint will remain blank.
- Designate the target by slewing the HMC (HUD Mark Cue circle) on the Heads-Up Display with the Radar Cursor/Enable Switch. After, press TMS UP to ground stabilise the HMC. Then, create markpoint by pressing TMS UP

OFLY (Overfly) Designated Markpoint
- If Master mode is A-A, entering the MARK page will default to MARK OFLY. Upon A-A Master Mode selection, a markpoint will automatically be created.
6 – MARKPOINTS
6.2 – How to Add Markpoints

Here is an overview of the Markpoint sub-mode logic.

- A-G (Air-to-Ground) or NAV Master Mode Selected
  - A-G FCR is SOI and FCR is designating
  - TGP is SOI and TGP is ground stabilised
  - All Other Cases

- A-A (Air-to-Air) Master Mode Selected

**FCR MARKPOINT**
- Manual, TMS UP

**TGP MARKPOINT**
- Manual, TMS UP

**HUD MARKPOINT**
- Manual, TMS UP x 2

**OFLY MARKPOINT**
- Automatic, upon A-A Master Mode Selection

**MARK Page – FCR Sub-Page**
- MARK
- MKPT 26
- LAT N 37° 13.133'
- LNG W 115° 47.116'
- ELEV 4494FT

**MARK Page – TGP Sub-Page**
- MARK
- MKPT 27
- LAT N 37° 13.133'
- LNG W 115° 47.116'
- ELEV 4494FT

**MARK Page – HUD Sub-Page**
- MARK
- MKPT 28
- LAT N 37° 13.133'
- LNG W 115° 47.116'
- ELEV 4494FT

**MARK Page – OFLY Sub-Page**
- MARK
- MKPT 29
- LAT N 37° 13.133'
- LNG W 115° 47.116'
- ELEV 4494FT

**Master Mode**

**Master Mode Buttons**

**Notes:**
- Markpoints are visible on the HSD page once created as a cyan cross.
- If previous automatic markpoints were recorded, the markpoint rotary will increment and the next available steerpoint in the MARK bank will be selected.
- Ownship markpoints are stored in steerpoint 26 to 30. Once #30 is filled, the next markpoint will overwrite #26 and so on.

As of 2020/04/27, Markpoints cannot be created yet in the DCS F-16.
7 – TACAN NAVIGATION

TACAN (Tactical Air Navigation) stations are navigation aids typically used by the military and provide you directional and distance guidance. TACAN beacons can be installed on airdromes, air refueling tankers or even aircraft carriers. Many VOR stations are collocated with a TACAN. These stations broadcast both signals so they can be used by military and/or civilian aircraft. These stations are known as “VORTACS”.

1. We will track Kutaisi’s TACAN 44X.
2. Set MIDS LVT (Multifunctional Information Distribution System) LVT (Low Volume Terminal) knob on the Avionics Power Panel to the ON position.
   * Take note that the TACAN is part of the MIDS radio system
3. Adjust TACAN audio tone volume as required.
4. Select CNI (Communication, Navigation & Information) page by setting Dobber switch LEFT (RTN)
5. Press T-ILS (1) Button on the ICP (Integrated Control Panel) to access TACAN-ILS DED (Data Entry Display) menu.
6. Press Dobber Switch DOWN to highlight the CHAN field. Use the ICP keypad to type in the new channel (44). Press ENTR to accept the changes.

7. If required, you may change the band by selecting the M-SEL (0) button on the ICP, then pressing ENTR. This toggles the band between X and Y.

8. Toggle the Dobber Switch RIGHT (SEQ) to cycle through TACAN modes until TCN T/R (Transmit-Receive) is selected.

9. The navigation will identify TACAN beacon as beacon KTS, a TACAN station at Kutaisi.

10. Press Dobber Switch LEFT (RTN) to return to CNI (Communication, Navigation & Identification) DED menu. The selected TACAN station will be displayed on it.

11. On the EHSI (Electronic Horizontal Situation Indicator), press “M” (Mode Selector) button to select “TCN” mode. This will slave the EHSI to the TACAN beacon.

12. Set the desired course to the TACAN using the EHSI CRS Course Select knob (068)

**TACAN OPERATION MODES:**

- **REC:** Your TACAN operates in receive mode only and provides bearing, course deviation, and station identification.

- **T/R:** The TACAN acts in a transceiver mode (send and receive) and provides bearing, range, deviation and station identification. This will be your most common selection.

- **A/A REC:** TACAN operates in Air-to-Air mode and can only receive bearing, course deviation and station identification for a TACAN-equipped aircraft.

- **A/A T/R:** TACAN operates in Air-to-Air transceiver mode and provides bearing, range, deviation, and station identification with a TACAN-equipped aircraft.
7 – TACAN NAVIGATION

13. After a few seconds, the EHSI will display DME (Distance Measuring Equipment) distance to the TACAN in nautical miles.

14. Steer the aircraft towards the TACAN CDI (Course Deviation Indicator) Reference Line. As you approach the radial, the line deviation with the centerline of the EHSI will gradually diminish.

15. The direction of the TACAN beacon will be displayed by the Bearing Pointer.

16. CDI (Course Deviation Indicator) will indicate how far off the TACAN radial course (068) you are.

17. The To / From Indicator (White Triangle) will indicate whether you are heading towards the radial or away from it.

18. When CDI Reference line is centered, this means you are on the 068 radial.

19. Then, turn towards the TACAN Bearing Pointer (or Course Pointer) to follow the radial to the runway.
7 – TACAN NAVIGATION

F-16C VIPER

PART 16 – NAVIGATION & ILS LANDING

KTS TACAN Channel 44X

Runway 08 Radial Course 074 (T) – 068 (M)

a b c d

a b c d
A “Bullseye” or “Anchor Point” is a fictional point in space that serves as a common geographic reference for a mission amongst friendly forces. If you know where the bullseye is and the enemy doesn’t, it gives you a way to communicate positions without the enemy knowing where to look from. Your wingmen and AWACS will often refer to “bulls” or “bullseye” on the radio. A bullseye call, used to communicate your position, is done in the following format:

- Bearing from bullseye
- Range from bullseye
- Altitude

Bullseye Explanation by JediLinks: https://youtu.be/vgcXceGb2M
Bearing and range from the Bullseye to your aircraft is displayed in three places: the Heads-Up Display, the FCR (Fire Control Radar) page and the HSD (Horizontal Situation Display) page.
In this example, we are at a bearing of 70 degrees from the bullseye: the reciprocal of that is $70 + 180 = 250$ degrees. Since we are on a heading of 227 degrees, in the example we subtract 250 - 227 to get the 23 degrees we would have to turn in West to get to the bullseye.
Take note that the DED (Data Entry Display) LIST – MISC – BULL page is not yet available. This page allows you to select a particular Steerpoint to be used as a Bullseye. As of 2020-04-24, the Bullseye is set through the Mission Editor.
The CRUS (Cruise) DED (Data Entry Display) page provides you valuable navigation information while cruising. This page is selected by:

1. Selecting CNI (Communication, Navigation & Information) page by setting Dobber switch LEFT (RTN)
2. Pressing CRUS (5) Button on the ICP (Integrated Control Panel) will select the TOS (Time Over Steerpoint) sub-page by default.

The CRUS page has four sub-modes, which can be toggled by using the Dobber Switch RIGHT (SEQ):

- TOS (Time Over Steerpoint)
- RNG (Range)
- HOME
- EDR (Endurance)

Note: When toggling from one submode to another, you must always use the M-SEL (0) Button, which will “mode select” the new CRUS mode. If you don’t do so, the computed airspeed/altitude caret(s) may be computed from the previous CRUS submode.

As of 2020/04/27, CRUS Page is not yet implemented.
9 – CRUS (CRUISE) PAGE

- **TOS (Time Over Steerpoint):** This will provide you airspeed information (Airspeed Caret on HUD speed tape) to ensure that you reach selected steerpoint at the required TOS (Time Over Steerpoint) set for the mission.

- **RNG (Range):** An Airspeed caret is displayed on the HUD speed tape to pinpoint the optimal speed to best conserve fuel at this altitude.

- **HOME:** Two carets are displayed in the HUD on the speed tape and on the altitude tape. Following the computed Airspeed Caret and Altitude Caret will establish the best profile to reach Home Plate (or any steerpoint designated as HMPT).

- **EDR (Endurance):** An Airspeed caret is displayed on the HUD speed tape to pinpoint the optimal speed for best endurance at this altitude. Endurance is the maximum length of time that an aircraft can spend in cruising flight.
Our ILS (Instrument Landing Approach) will be done to Batumi airfield.

- ILS frequency: 110.30
- Runway heading: 120 Magnetic Heading / 126 True Heading
- Radio tower frequency: 131.000
10 – ILS TUTORIAL

1. Set Radar Altimeter Switch ON (FWD) and adjust ILS audio tone volume as required.
2. Select CNI (Communication, Navigation & Information) page by setting Dobber switch LEFT (RTN)
3. Press T-ILS (1) Button on the ICP (Integrated Control Panel) to access TACAN-ILS DED (Data Entry Display) menu.
4. Press Dobber Switch DOWN until the ILS FRQ field is highlighted. Use the ICP keypad to type in the new channel ("11030" for 110.30). Press ENTR to accept the changes.
5. CMD STRG (Command Steering) is highlighted when the ILS signal is being received.
6. Once CMD STRG is highlighted, the CRS (Course) field will automatically be selected. Set the desired course to 120 (runway magnetic heading) by pressing “120” on the ICP, then press ENTR to accept the changes.
7. On the EHSI (Electronic Horizontal Situation Indicator), press “M” (Mode Selector) button until the “PLS/NAV” (Precision Landing System/Navigation) mode is selected. This will slave the EHSI to the ILS station signal.

8. Verify that NAV Master Mode is selected on the Heads-Up Display (HUD). If either A-A or A-G mode is selected, pressing their respective ICP button will revert the master mode back to NAV.

9. Align yourself with the runway using the following tools:
   a) EHSI (Electronic Horizontal Situation Indicator) Bearing Pointer
   b) CDI (Course Deviation Indicator)
   c) ADI (Attitude Director Indicator) Localizer Steering Bar
   d) HUD (Heads-Up Display) Localizer Steering Bar

10. Once you are close enough to the ILS, the Glide Slope Fail Flag will disappear and provide you guidance in the vertical plane to perform an approach with 3 degrees of glide slope.

11. Fly the aircraft to the glide slope by use the Glide Slope Steering bar and Glide Slope Deviation Indicator. Both should be centered. On the HUD, the localizer and Glide Slope bars should form a perfect cross with the Flight Path Marker in the center of this cross.
12. When valid localizer data is received, a Command Steering Symbol will be displayed on the HUD to guide you through the approach (circle). A tic mark appears on the symbol when nearing the center of the glideslope to indicate the pitch steering data is valid.

13. When you have captured the ILS localizer (no lateral deviation from runway axis) and captured the glide slope as well, deploy landing gear. The “E” bracket (HUD AoA Bracket) will appear upon landing gear deployment.

14. Turn on LANDING light (UP).

15. Deploy Speed Brake
16. Trim to an angle of attack (AOA) of 11 deg. Angle of Attack can be monitored with the three following indications:
   - The AOA Indicator
   - The AOA Indexer
   - The HUD (Heads-Up Display) AOA Bracket (with Flight Path Marker)
17. When flying over the “overrun” (portion of the runway before the primary surface starts), shift the Flight Path Marker forward to a point 300-500 ft down the runway.

18. Gently pull back on the stick to flare and reduce the descent rate. DO NOT level off!

19. Pull the throttle back to IDLE and touchdown with a maximum AOA of 13 deg (green circle). More than 15 deg AOA during the landing roll-out may cause the speedbrakes or engine nozzle to smash the runway.
20. Maintain 13 deg nose-up attitude for a two-point aerodynamic braking until your airspeed has reduced to approx. 100 kts. This step is very important since the F-16’s brakes are not very effective.
21. Reduce back stick pressure and lower the nosewheel to the runway.
22. Open speedbrakes fully and maintain full aft stick for maximum braking effectiveness.
23. Apply moderate to heavy braking to slow the aircraft.
24. Engage nosewheel steering when below 30 kts and taxi off the runway.
Note: If flying over an Outer or Inner Marker beacon, the Marker Light will illuminate. Here is an example with Kobuleti's Outer Marker.
PART 16 – NAVIGATION & ILS LANDING

10 – ILS TUTORIAL
INTRODUCTION

AIR-TO-AIR REFUELING – WHY WE ALL HATE IT

Air-to-air refueling is one of the hardest, most hated, and most frustrating tasks in DCS. Ever. Of all time.

Why? Well, one of the main reasons for the difficulty behind refueling is the skill required to do formation flying. Flying in formation with another aircraft requires much more practice than you would initially think. Another reason is pure physics: there is this thing called “wake turbulence”. An aircraft flies through a fluid: air. Just like with any fluid, if you have something that displaces itself through it at a certain speed, the fluid will become disrupted (turbulence). Wingtip vortices and jetwash are both effects of this simple concept. Wake turbulence is the reason why airliners need to wait a minimum time between takeoffs: flying through disrupted air will destabilize the aircraft and it is unsafe, especially during critical phases of flight like takeoff and landing.

Unfortunately, wake turbulence is something a pilot has to deal with during air-to-air refueling. This is why the aircraft will fly just fine when approaching the tanker, but start wobbling around when flying in close proximity of the refueling basket/drogue and tanker engines.

Feel free to consult Redkite’s F-16 Air-to-Air Refueling Tutorial
https://youtu.be/kCews8fZv_o
AIR-TO-AIR REFUELING – HOW TO

1. Read your mission briefing to know the TACAN station channel of your KC-135 Tanker (14X) and the UHF AM channel frequency you can communicate with it (251.000).
2. Power up your TACAN by setting the MIDS LVT switch to ON.
3. Adjust TACAN volume as desired.
4. Press T-ILS Button on the ICP (Integrated Control Panel) to access TACAN-ILS DED (Data Entry Display) menu.
5. Press Dobber Switch DOWN to highlight the CHAN field. Use the ICP keypad to type in the new channel. Press ENTR to accept the changes.
6. If required, you may change the band by selecting the M-SEL (0) button on the ICP, then pressing ENTR. This toggles the band between X and Y.
7. Toggle the Dobber Switch RIGHT (SEQ) to cycle through TACAN modes until TCN A/A TR (Air-To-Air Transmit-Receive) is selected.
8. Press Dobber Switch LEFT (RTN) to return to CNI (Communication, Navigation & Identification) DED menu. The range to TACAN (nm) will be displayed on the DED.
9. On the EHSI (Electronic Horizontal Situation Indicator), press “M” (Mode Selector) button to select “TCN” mode. This will slave the EHSI to the TACAN beacon.
10. Verify that C&I Selector (Communication, Navigation aids, and Identification) is set to UFC (Up Front Control).
11. Press COM1 button on the ICP (Integrated Control Panel) to select UHF Radio.
12. On the ICP, enter frequency the tanker’s UHF frequency as “25100” (251.00 MHz), then press “ENTR” button.
13. Press Communications Transmit Switch AFT and contact tanker (F6).
14. Select “Intent to refuel” in the tanker menu. The tanker will give you an altitude (usually 20,000 ft or 10,000 ft) to rendezvous at and a speed to match (i.e. 300 kts).
AIR-TO-AIR REFUELING – HOW TO

15. Before attempting a refueling, we need to reduce our workload as much as possible. One such measure is to display the BINGO FUEL DED page data on the Heads-Up Display, which means you don’t need to glance at that awkwardly positioned Fuel Quantity Indicator.

16. Set DED (Data Entry Display) Data Switch FWD, which will allow data from the DED to be visible on the HUD.

17. Press the LIST button, then press “2” on the ICP (Integrated Control Panel) to select BNGO (Bingo Fuel) DED Page.
18. Open AIR REFUEL trap door.
   • Note 1: If refueling with external tanks, this must be done 5 to 6 minutes prior to refueling to allow the external tanks to depressurize (required if you want to fill them up with fuel as well).
   • Note 2: When door is open, the Flight Control System (FLCS) will change its control gain to make precise movements easier.
19. Confirm that RDY light illuminates, which indicates that door has opened properly.
20. Set Master Arm switch to OFF.
21. Set RF (Radio Frequency) Switch to SILENT. All electronic signals for the aircraft will be disabled, including the radar, radar altimeter, data link, TACAN transmit, and ECM (Electronic Countermeasures).
AIR-TO-AIR REFUELING – HOW TO

22. Once you are close enough, position yourself 20 ft below the refueling boom and call the tanker to begin pre-contact. If you are lined up properly, he will grant you permission to approach.
23. Make sure you are perfectly trimmed before beginning your approach.
24. Fly formation with the tanker, not the boom.
25. Perform gentle, small stick inputs to move towards the boom. Do not use rudder pedals. Use short bursts of throttle to advance towards the tanker.
26. Allow the boom to pass just left or right of your canopy, about 2-3 feet above your head. This serves as a good first check that you are at the proper height relative to the tanker.

Avoid flying near wingtip vortices
PART 17 – AIR-TO-AIR REFUELING

AIR-TO-AIR REFUELING – HOW TO

27. Continue to move slowly forward, maintaining alignment with the yellow stripe painted on the bottom of the tanker. Use the Pilot Director lights on the bottom of the tanker to maintain a position within the limits of the boom.
AIR-TO-AIR REFUELING – HOW TO

28. The PDI (Pilot Director) lights are directive, meaning they tell you the direction to travel and not your current position.
   In other words, preface the D, U, F and A with the word Go.
   • If the light moves toward the D, go down and if it moves toward the U, go up.
   • If the light moves toward the A, go aft and if it moves toward the F, go forward.
   • A steady light means a substantial correction is required
   • A flashing light means a small correction is required

---

**Boom Envelope Limits (KC-135)**

**RECEIVER DIRECTOR LIGHTS ILLUMINATION PROFILE (KC-135)**

- **Down-Up (D-U) Pilot Director Light**
- **Forward-Aft (F-A) Pilot Director Light**
29. Fly formation on the tanker and allow the boom operator to direct the boom into the refueling receptacle behind the cockpit on your aircraft.
30. The boomer will announce “contact” and “you are taking fuel” when the connection is established.
31. The AR/NWS light will illuminate. Monitor your fuel transfer on the HUD (Heads-Up Display) and BNGO DED (Data Entry Display) page.
32. Keep the aircraft aligned with the tanker using reference points such as its engines and its centerline. This will help you evaluate if your aircraft drifts or not. Correct one axis at a time only.
AIR-TO-AIR REFUELING – HOW TO

33. Refueling procedure will be completed when the “DISC” (Disconnect) warning light illuminates.
34. If you wish to disconnect before that, press your “Nosewheel Steering A/R Disc” button on your HOTAS joystick (or “S” key binding) to unlatch the boom from your fuel trap door.
35. Close AIR REFUEL trap door and resume flight.
   • Note: failing to shut the trap door may result in your aircraft not being able to use fuel from your external tanks.

Reference: Redkite’s F-16 Air-to-Air Refueling Tutorial

NWS A/R DISC & MSL STEP Button
• A/R: When in flight and the AIR REFUEL switch in the OPEN position, depressing the button disconnects boom latching
PART 17 – AIR-TO-AIR REFUELING

F-16C VIPER
USEFUL RESOURCES

T.O. GR1F-16CJ-1
Flight Manual – HAF Series Aircraft – Blocks 50 and 52+
https://info.publicintelligence.net/HAF-F16.pdf

Eagle Dynamics (Official Developer) Work-In-Progress Early Access Guide

TO-BMS1F-16CM-1
Falcon 4.0 BMS Flight Manual - F-16C/D BMS 4.34

TO-BMS1F-16CM-34-1-1
Falcon 4.0 BMS Avionics and Non-Nuclear Weapons Delivery Flight Manual - F-16C/D BMS 4.34

Matt Wagner (Eagle Dynamics Producer) DCS F-16C Viper Video Tutorials
https://www.youtube.com/watch?v=uJrMSNM7X08&list=PLer9oF4AanvFoD2t2Aq3aYRYkJs6v9wG8

Redkite’s Youtube Tutorials
https://www.youtube.com/watch?v=kCews8fZv_o&list=PLml_c09ciucucGNhd843UNNJMeXwhS8t6

F-16.net Website
http://www.f-16.net/

Hoggit Wiki
https://wiki.hoggitworld.com/view/F-16C
THANK YOU TO ALL MY PATRONS

Creating these guides is no easy task, and I would like to take the time to properly thank every single one of my Patreon supporters. The following people have donated a very generous amount to help me keep supporting existing guides and work on new projects as well:

- David Titus
- Goodknight
- John Mouat
- ChazFlyz
- M. D.
- Brandon Glenn
- Patrick
- Teitur Samuelsen
- Jack Nieh
- Jeannette Benoit
- Tim Perry