

## Lockheed-Martin F-35A Lightning II



# Table of Contents

1. Requirements, Recommendations, and Information.....	4
1.1 Requirements.....	4
1.2 Recommendations.....	4
1.3 Things to Know.....	4
1.4 Information.....	4
1.5 Credits.....	4
2. Installation Procedure.....	5
2.1 Install OpenAL Sound Driver.....	5
2.2 Install F-35.....	5
2.3 Configure Display.....	5
2.4 Install Alternate Exterior Aircraft Lights.....	5
3. Setup.....	6
3.1 X-Plane Joystick Setup.....	6
3.1.1 Guns.....	6
3.1.2 Target Select.....	6
3.2 Setting up X-Plane for Air Combat.....	6
3.3 Other X-Plane Settings.....	6
3.4 Setting Flight Model Cycles in X-Plane.....	6
3.5 F-35-Specific Joystick Setup.....	6
3.5.1 Weapon Release.....	7
3.5.2 Nose Wheel Steering.....	7
3.5.3 Air-Air Mode.....	7
3.5.4 Air-Surface Mode.....	7
3.5.5 INS Waypoint Up/Down.....	7
3.5.6 Cycle HUD Modes.....	8
3.5.7 Cycle Weapons.....	8
3.5.8 Cycle Weapon Sub-Mode.....	8
3.5.9 Cycle Targets.....	8
3.5.10 Extend/Retract Speed-brakes.....	8
3.5.11 Joystick Paddle – Autopilot Interrupt.....	8
3.5.12 Fire Guns.....	8
3.6 Predefined Hot Keys.....	8
3.7 Preferences.....	9
4. Key Command Menu.....	10
4.1 General Equipment.....	10
4.2 Navigation Functions.....	10
4.3 HUD Functions.....	10
4.4 Autopilot Functions .....	10
4.5 Lighting.....	10
4.6 Display Settings.....	11
4.7 Emergency Operation.....	11
4.8 Integrated Power Package (IPP).....	11
4.9 Multiplayer Aircraft Info.....	11
5. Ordnance.....	12
5.1 Air-to-Air Weapon Selection.....	12
5.2 Air-to-Surface Weapon Selection.....	12

5.2 Supported Ordnance Types.....	13
6. Air-to-Ground Combat.....	14
6.1 Guided Bombs.....	14
6.2 Freefall Bombs.....	15
6.2.1 CCRP Bombing Mode.....	15
6.2.2 CCIP Bombing Mode.....	16
6.3 AGM-88 HARM Anti-Radiation Missile.....	17
6.4 Surface to Air Missiles (SAMs).....	19
7. Air-to-Air Combat.....	20
7.1 AIM-120 Missile Mode.....	20
7.2 AIM-9 Missile Mode (NOT CURRENTLY SUPPORTED).....	22
7.3 M61A2 20mm Cannon.....	23
7.3.1 Enhanced Envelope Gun Sight (EEGS).....	23
7.3.2 Lead Computing Optical Sight (LCOS) .....	24
8. Navigation and Landing.....	26
9. Autopilot.....	28
10. Refueling.....	29
10.1 Preparation for Refueling.....	29
10.2 Manual and Auto Refueling.....	29
10.3 Refueling Procedures.....	30
10.4 Pilot Director Lights (PDL).....	32
11. Engine and Fuel Systems.....	33
11.1 Starting the Engine.....	33
11.2 Shutting Down the Engine.....	33
12. Hydraulic System.....	34
12.1 Normal Operation .....	34
12.2 Emergency Operation.....	34
13. Sounds.....	35
Appendix A – F35Glass Interface.....	36

# 1. Requirements, Recommendations, and Information

## 1.1 Requirements

- This plugin will not function without the OpenAL sound driver. Read the installation instructions for further details.

## 1.2 Recommendations

- Programmable Stick and Throttle Controls
- Dual Monitors

## 1.3 Things to Know

- When flying the plane for the first time you will have to power on the HUD and set the HUD Remote Control Panel switches to turn on all of the HUD symbols. See section [4.3 HUD Functions](#).
- Do not use the standard X-Plane interface to load custom weapons on the F-35, including all air-ground ordnance. Use the custom interface as described in section [Error: Reference source not found](#).
- Do not use the standard X-Plane interface to set fuel levels. Use the custom interface as described in section [11. Engine and Fuel Systems](#).
- Do not modify the F-35 in PlaneMaker and expect your changes to have any effect. The plugin controls most settings related to engine thrust, fuel flow, and control surface functions. The plugin code has a built in Fly-by-Wire system, a custom engine model, a custom hydraulic system, and a custom electrical system.

## 1.4 Information

This version of the F-35 has been designed to work with a full F-35 cockpit simulator built by Flight Dynamix and their software called "F35glass".

## 1.5 Credits

- F-35 Model by [Francesco Missarino](#) of Aircraft3D
- Pilot by Bob Feaver

## 2. Installation Procedure

### 2.1 Install OpenAL Sound Driver

The F-35 plugin uses some advanced sound features supported by OpenAL. If you are using a PC, you have to install the OpenAL sound driver for the plugin to work. The plugin will not function at all if this is not installed. You can get the OpenAL sound driver here:

<http://connect.creativelabs.com/openal/Downloads/Forms/AllItems.aspx>

Download the oalisint file and run it to install the OpenAL sound driver.

### 2.2 Install F-35

1. Extract the files from the F-35A zip file into any folder of your choosing under the **X-Plane/Aircraft** folder.
2. Move the **ClassicJetSimUtils** folder from the zip file to the main X-Plane folder so that you have a folder called **X-Plane/ClassicJetSimUtils**.
3. Move the **tacan.dat** from the **Extras** folder from the zip file to your **X-Plane/Resources/default data** folder. This folder has other navigation data files used by X-Plane.
4. Move the **F-35\_route\_1.fms** file from the Extras folder from the zip file to your **X-Plane/Output/FMS plans** folder.

### 2.3 Configure Display

See the section on Display Settings ([4.6 Display Settings](#)). These should be set to draw the HUD as desired the first time you run the sim.

It is recommended that a lateral Field of View (FOV) of around 66 degrees be used if using the full-screen HUD view on one monitor. To set the FOV, go to the X-Plane **Settings-Rendering Options** window.

### 2.4 Install Alternate Exterior Aircraft Lights

While not required, it is highly recommended that the adjusted light textures be downloaded and installed. The normal exterior aircraft lights in X-Plane are way too bright and don't look very nice. These ones are much better. They can be found here:

<http://forums.x-plane.org/index.php?app=downloads&showfile=9687>

## 3. Setup

This section describes how to setup X-Plane and the F-35 to get the most out of the simulation. You may not have full systems functionality if you do not setup X-Plane and the F-35 as recommended.

### 3.1 X-Plane Joystick Setup

These are the recommendations for setting up your controls in X-Plane. From X-Plane, select the **Settings - Joystick, Keys & Equipment** menu to configure your joystick.

#### 3.1.1 Guns

Select the **Buttons:Basic** tab from the X-Plane **Joystick, Keys, & Equipment** menu and assign your joystick trigger or desired button to the **Fire Guns** option in the 4th column.

#### 3.1.2 Target Select

Select the **Buttons:Basic** tab from the X-Plane **Joystick, Keys, & Equipment** menu and assign joystick buttons to the **Target Select Down** and **Target Select Up** options in the 4<sup>th</sup> column. If you're short on joystick buttons, you can get by with just the Target Select Up option.

### 3.2 Setting up X-Plane for Air Combat

The missiles in X-Plane will not destroy targets unless air combat is enabled. To enable air combat go to the **Aircraft – Aircraft & Situations** menu in X-Plane. Set the number of aircraft to 2 or more. Note that the higher number of aircraft you have, the greater the impact on your frame rate. Set your team color to a color and then set the color of the enemy aircraft to another color.

### 3.3 Other X-Plane Settings

The tail hook is animated and functional. You can even land on a carrier. You may assign a joystick button to toggle the tail hook from the X-Plane **Settings - Joystick, Keys, and Equipment** menu. Click on the **Buttons: Adv** tab. The toggle tail hook command is in the **flight controls** section.

You may also configure joystick buttons for chaff and flare. The canopy is also animated so you may configure a joystick button for that.

### 3.4 Setting Flight Model Cycles in X-Plane

Go to the X-Plane **Settings – Operations & Warnings** menu. Make sure that the **Flight Model Cycles** value is set to 2. This should prevent any oscillation problems with the aircraft, especially with the autopilot turned on. Send me an e-mail if you find issues and let me know the aircraft altitude, speed, and weight at the time as well as the frame rate. This helps many X-Plane aircraft and is the recommended value.

### 3.5 F-35-Specific Joystick Setup

These are the recommendations for setting up controls inside of the F-35 Plugin. From the X-Plane **Plugins - F-35 Systems** menu, select the **Joystick & Throttle Setup** option. This menu shows a list of joystick buttons not supported by X-Plane and specific to the F-35. To associate a joystick button with one of the listed functions, first press a button on your joystick. A number will be displayed under the **Joystick Number** text. Next check the box next to the command that you wish to associate that joystick button to.



*Illustration 1: Joystick Configuration Window*

### **3.5.1 Weapon Release**

This must be a different button than the one used by X-Plane to fire guns (see section [3.1.1 Guns](#)). This button is used to fire missiles and drop bombs. No X-Plane button need be configured to fire missiles or drop bombs.

### **3.5.2 Nose Wheel Steering**

This should be a momentary button. Pressing it once will activate nose wheel steering and pressing it again will deactivate nose wheel steering.

### **3.5.3 Air-Air Mode**

This should be a switch. The Cougar HOTAS control is very well suited for this but a fixed position switch should be used for Air-to-Air Mode. This switch is not required but what it does do is put the weapon system into missile mode immediately. The weapon system will stay in this mode until this switch is turned off.

### **3.5.4 Air-Surface Mode**

This should be a switch. The Cougar HOTAS control is very well suited for this but a fixed position switch should be used for MRM Mode. This switch is not required but what it does do is put the weapon system into Air-to-Surface mode immediately. The weapon system will stay in this mode until this switch is turned off.

### **3.5.5 INS Waypoint Up/Down**

These should be buttons. Pressing either button will increment or decrement the waypoint in the currently active route. If you are short of joystick buttons, you can get by with just the increment waypoint button.

### 3.5.6 Cycle HUD Modes

This should be a button. It is used to cycle through the main HUD modes, those being Navigation, Air-to-Ground Weapons, and Air-to-Air Weapons.

### 3.5.7 Cycle Weapons

This should be a button. Once air-to-air or air-to-ground mode has been selected, this button can be used to cycle through available weapons in that mode.

### 3.5.8 Cycle Weapon Sub-Mode

This should be a button. Some weapons can be fired in different ways. The gun has two firing modes, those being EGS and LCOS. The free-fall bombs can be dropped in Guided, CCIP, or CCRP modes. This button toggles between these modes.

### 3.5.9 Cycle Targets.

This should be a button. It should be the same button used to advance the target in X-Plane (see section [3.1.2 Target Select](#)). X-Plane uses the button to cycle between airborne targets. The F-35 plugin uses the button to cycle between ground targets such as any radar stations currently in range that are emitting.

### 3.5.10 Extend/Retract Speed-brakes

These should be switches. The F-35 (and most fighter jets) have a more complex speed-brake system than that supported by X-Plane. These switches will extend or retract the speed-brakes until the switches are placed off so that the speed-brakes can be left in an intermediate position, not fully open or fully closed.

### 3.5.11 Joystick Paddle – Autopilot Interrupt

This should be a button or the paddle on your joystick if you have one. The paddle's main function is to interrupt the autopilot to perform a corrective maneuver.

### 3.5.12 Fire Guns

This should be set to the same button as the button to fire guns in the X-Plane joystick setup menu (see section [3.1.1 Guns](#)).

## 3.6 Predefined Hot Keys

The following function keys have been defined:

**F12** – Key Command Menu – Pop-up menu to control various F-35 functions

**F1** – Fuel Idle/Cutoff Key – The key is used to toggle fuel flow to and from the engine. It is used for startup in conjunction with the Start Button from the F12 Key Command menu.

**F7** – KC-10 Toggle – Toggles display of the KC-10 Tanker.

**F8** – Target Camera Key – Press this to get an external camera view of the current aircraft or ground target being tracked.

**F9** – Missile Camera Key – Press this to watch the AGM-88 or SAM home in on its target.

**r** – Master Caution Reset – Press to stop continuous warning sounds

**x** – Master Arm Toggle – Press to toggle the Master Arm switch on and off.

**y** – Roll Control Switch – UP

**h** – Roll Control Switch – DOWN

**u** – Pitch Control Switch – UP



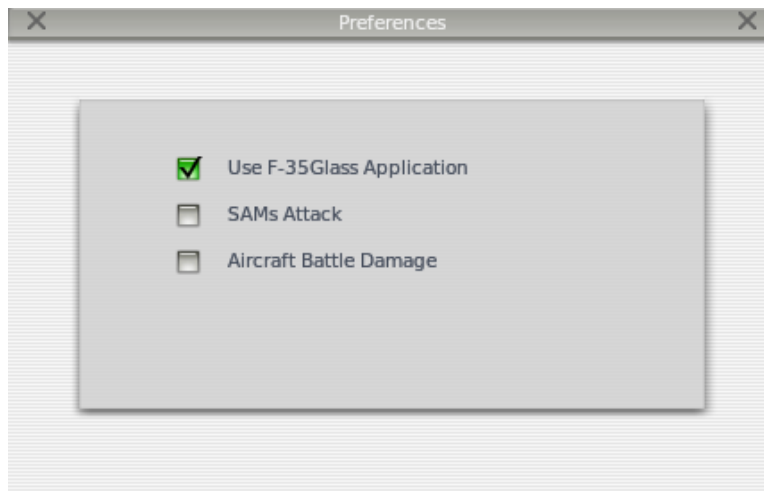
- j – Pitch Control Switch – DOWN
- i – Toggle ILS Mode On and Off

The following keys work on the numeric key pad:

- 0 – Turns HUD on or off
- 1 – Cycles between HUD Master Modes (can also use joystick button)
- 2 – Cycles between weapons
- 3 – Cycle between weapon modes (EEGS/LCOS for guns and Guided/CCIP/CCRP for bombs)
- 4 – Not implemented
- 5 – Change HUD Color
- 6 – HUD Brightness Mode – see F12 key command menu for settings
- 8 – FPM Switch - see F12 key command menu for settings
- 9 – Velocity Switch - see F12 key command menu for settings

### 3.7 Preferences

Preferences specific to the F-35 can be set from the preferences menu. Open it using the X-Plane **Plugins – F-35 Systems – Preferences** option.



*Illustration 2: Preferences Window*

- **Use F-35Glass Application** - This is checked if the F-35Glass application is present. The interface to this will be enabled. Leave it unchecked if running the F-35 standalone.
- **SAMs Attack** - Check this box if you want the SAMs to attack your aircraft.
- **Aircraft Battle Damage** – Check this box if you want SAMs to damage your aircraft.

## 4. Key Command Menu

A pop-up menu will be displayed in the top right corner of the screen by pressing the F12 function key. This menu allows you to control several F-35 functions and is especially useful when running standalone without F35Glass.

### 4.1 General Equipment

1. Engine Start - Pressing this once will start the engine. Fuel must be flowing as well to start the engine. Pressing the F1 function key will toggle fuel flow on and off. The engine start sequence is automatic on the F-35. When engine start is initiated, the Integrated Power Package (IPP) will power up and run as a motor to start the engine. The IPP will run as a generator when the engine is running. IPP status can be viewed separately from its own menu.
2. Engine Fuel Cutoff – Pressing this toggles fuel flow to the engine on and off. The F1 hotkey may also be used for this.
3. Front Refuel Probe – Pressing this extends and retracts the front refuel probe. No X-Plane support or plugin support is present at this time to use this probe for refueling but will be added in a future release.
4. Open/Close Refuel Door - Pressing this will toggle the refueling door on top of the F-35 open or closed. Opening the door allows for mid-air refueling by the KC-10.
5. Master Arm Switch – Pressing this toggles the position of the Master Arm Switch.
6. Manual Weapon Bay Doors – Pressing this will manually open or close the weapon bay doors. Normally they open automatically when weapons are released.

### 4.2 Navigation Functions

1. Waypoint – Advances the waypoint of the currently selected route file.
2. Route File – Advances the route file. Route files are placed in the **X-Plane/Output/FMS Plans** folder and are of the format **F-16\_route\_N.fms** where N is from 1 to 20. These files can be edited manually or be created in another X-Plane aircraft that allows you to create and save route files. Note that all waypoints must be lat/lon positions.

### 4.3 HUD Functions

These functions duplicate the functions of the HUD Remote Control Panel in the F-35.

1. Scales Switch – Turns on and off heading tape and bank reference indicator.
2. FPM Switch – Turns on and off HUD Pitch Ladders and Velocity Vector
3. DED Data Switch – Turns on and off DED Data. F35Glass is required for this function.
4. Not implemented on F-35
5. Altitude Switch – Not currently implemented.
6. Brightness Control Switch – Sets HUD brightness to Auto, Night, or Day modes.
7. HUD Color – Sets HUD Color to Green, White, or Black.
8. Power Switch – Turn the power to the HUD on or off.

### 4.4 Autopilot Functions

1. Pitch Control Switch – Set the pitch control switch to OFF, Altitude Hold, or Attitude Hold
2. Roll Control Switch – Set the roll control switch to Heading Hold, Steering, or Attitude Hold
3. Auto Refuel – Fly at 24,000 feet at a constant heading to make refueling easier.

### 4.5 Lighting

1. Landing/Taxi Lights
2. Navigation Lights
3. Strobe Light
4. Beacon
5. Refuel Light – Used at night to light refueling port for mid-air refueling with the KC-10

## 4.6 Display Settings

These are settings that should be set after installation or when your screen size parameters have been changed.

0. Vertical FOV – This is used to adjust the position of the horizon up or down as desired. This does not affect the default X-Plane settings for other aircraft. It is recommended that the horizon be placed close to the middle of the screen especially if you will be doing a lot of refueling with the KC-10. With the consumer version and the virtual cockpit, this becomes less important.
1. HUD Vertical Position – This function “levels” the HUD. The first time you run the F-35 you will find that the horizon line on the HUD may be drawn too high or too low. To set this, first change the rendering option in X-Plane so that runways do NOT follow terrain contours. Next start the plane moving down the runway at a slow speed of around 20 knots. Now adjust the HUD vertical position so that the horizon line and velocity vector are aligned with the real horizon or the end of the runway. The reason that the aircraft must be slowly moving is that X-Plane only provides the plugin code with “local” data. The world in X-Plane is a series of planes forming a sphere and in local coordinates, and being level in this world is not necessarily being level in the real world. Once the plane starts moving the code can determine the error between real world and local coordinates.
2. Top of HUD Display – This option displays a horizontal line. Move the line up or down to clip the top of where information is displayed on the HUD.
3. Bottom of HUD Display – This option displays a horizontal line. Move the line up or down to clip the bottom of where information is drawn on the HUD.
4. Horizontal Offset – This option can be used to shift the HUD horizontally onto another monitor if using multiple monitors.
5. These last 3 options let you change the default green color of the HUD to whatever you desire using R/G/B color settings between 0 and 255.

## 4.7 Emergency Operation

1. Eject
2. Canopy Jettison
3. Stores Jettison – Drops all stores excluding missiles.
4. Fuel Tank Jettison – Drops all external fuel tanks.
5. Pylon Jettison – Drops empty pylons.
6. Emergency Gear Extension – Used after a hydraulic systems failure.
7. Emergency Gear Reset Button – This must be pressed before the gear can be raised if the Emergency Gear Extension option was used and the hydraulic system has recovered.
8. Clear Failures – Clears all failures.

## 4.8 Integrated Power Package (IPP)

This option provides IPP status information and allows the user to override the automatic operation of the IPP. The aircraft's integrated power package (IPP) combines into a single system the functions traditionally performed by the auxiliary power system, emergency power system, and environmental control. At the heart of the IPP is a small gas-turbine engine "turbomachine" that provides power to the engine-mounted starter/generator, bringing the engine to its threshold starting speed. The engine then increases to idle speed and the electrical system, which includes the engine-mounted starter/generator (ES/G) transitions from operating as a motor to operating as a generator. The IPP is also available for in-flight emergency power. There is a single switch used to override automatic operation of the IPP:

1. IPP Switch – This can be set to ON to turn on the IPP on the ground with the engine not running.

The menu also shows several status values. The IPP turbine rpms will normally be at 100% when on and running as a motor. The various light status values reflect the status of the IPP. This menu also shows the status of the electrical system and pressures of the hydraulic systems. These can be failed from the X-Plane **Plugins – F-35 Systems – System Failure Configuration** window.

## 4.9 Multiplayer Aircraft Info

This menu displays position and speed information for the aircraft currently selected as a target. It can be used as a way to find and track the multiplayer aircraft prior to locking onto them with the aircraft radar.

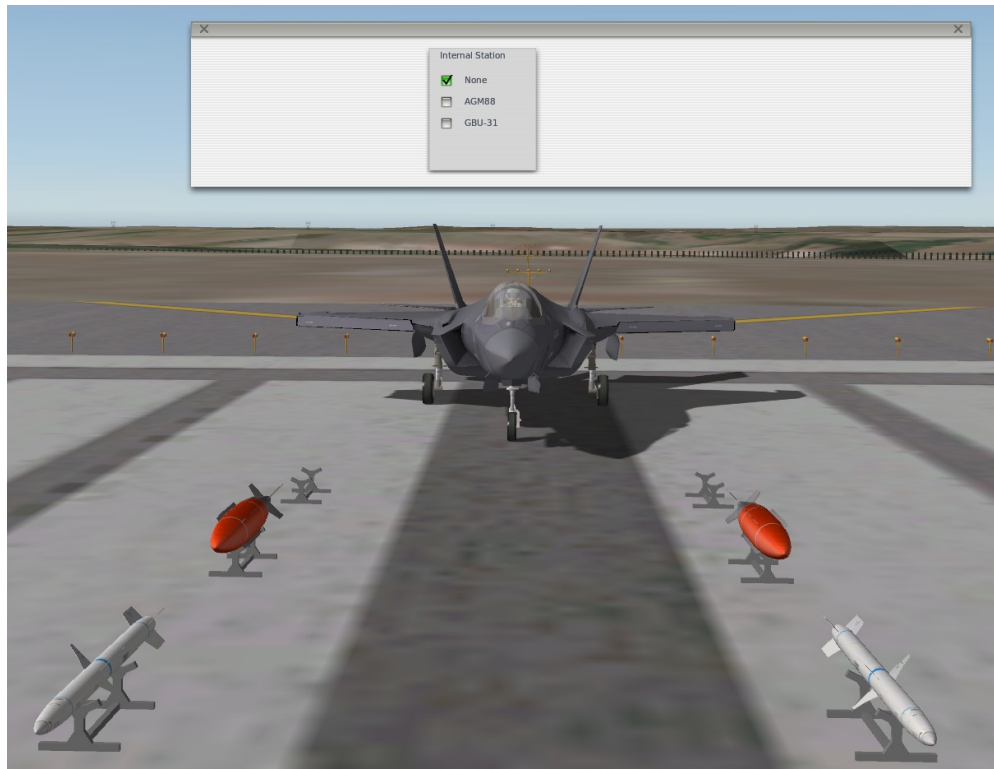
## 5. Ordnance

### 5.1 Air-to-Air Weapon Selection

To select air-to-air ordnance to be loaded on the aircraft, follow this procedure.

1. From X-Plane, select the **Aircraft - Weight & Fuel** menu.
2. Click the **Ordnance** tab at the top.
3. Click the **Re-Arm to Default Specs** option.

### 5.2 Air-to-Surface Weapon Selection



*Illustration 3: Ordnance Loadout Window*

To select the air-to-surface (custom) ordnance to be loaded on the aircraft, do not use the X-Plane option to select specific ordnance. Instead, follow this procedure.

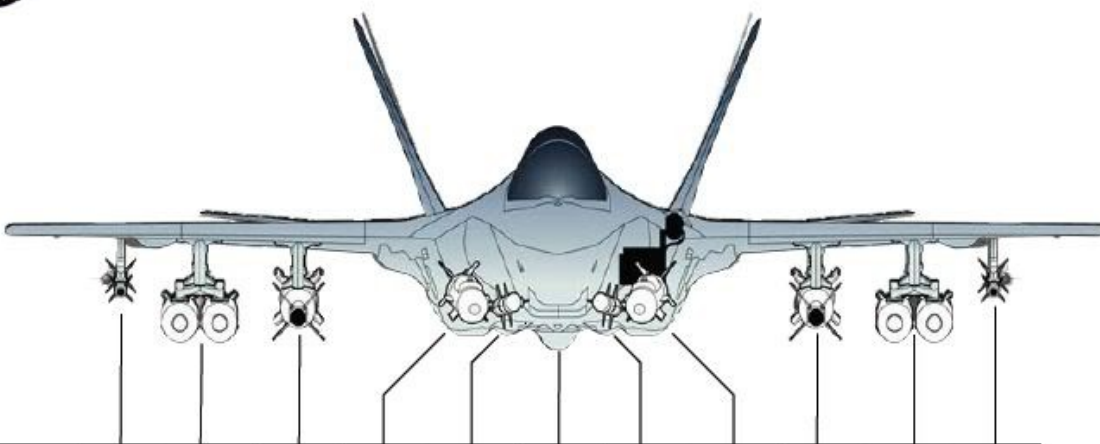
1. From X-Plane, select the **Plugins – F35 ASystems – Custom Weapon Loadout** menu. You must do this on the ground to get the ordnance selection menu. If you do it in the air, the default weapons will be re-installed.
2. From inside or outside of the plane, you'll see all of the weapons available to you sitting on weapon stands in front of the jet. A window also appears allowing you to select which weapon you want on each wing station.
3. Either close the window or start moving to activate the changes and make the weapons on the stands disappear.

## 5.2 Supported Ordnance Types

The chart below show the type of weapons supported on the F-35. At this time only a subset of these is supported in X-Plane as described below the table. More will be added in future F-35A releases.



### Weapons Stations



Station	11	10	9	8	7	6	5	4	3	2	1
Store	A/A	A/A, A/S	A/A, A/S	A/A, A/S	A/A	A/S	A/A	A/A, A/S	A/A, A/S	A/A, A/S	A/A
Weight	300	2,500*	5,000	2,500*	350	1,000	350	2,500*	5,000	2,500*	300

- Over 18,000 Lbs Ordnance Capacity
- Non-pyrotechnic Suspension and Release

\* STOVL Stations 2/10 & 4/8 Reduced to 1,500 (SWAT)

A/A Weapons Supported

- AIM120 AMRAAM missile.

A/S Weapons Supported

- GBU-31 JDAM bomb ins guided or unguided modes
- AGM-88 HARM missile

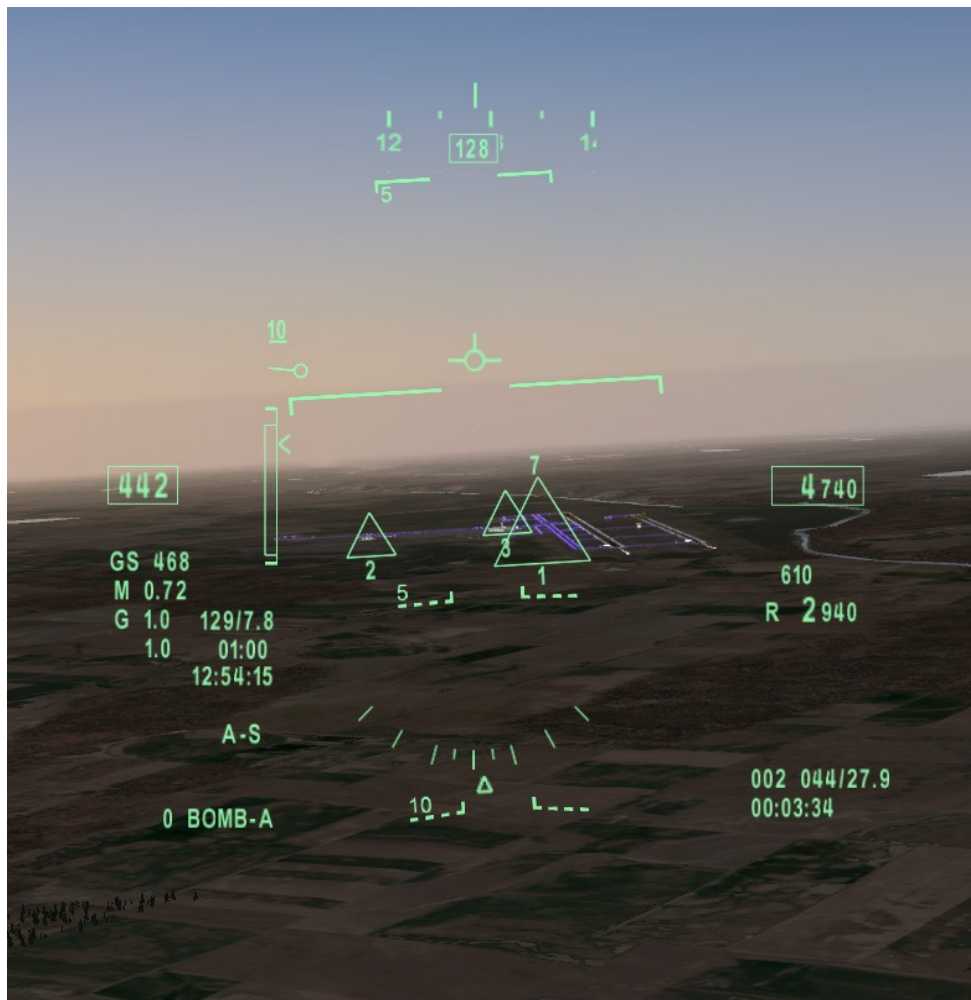
Stations 4, 5, 7, and 8 are only supported at the current time.

## 6. Air-to-Ground Combat

Before any bombs can be dropped, the Master Arm switch needs to be turned on. You can use the **x** key to toggle the position of this switch. The F12 Key Command Menu, selection **1, General Equipment**, displays the position of this switch and allows you to change the position as well. The text **ARM** will be displayed on the lower left of the HUD when the Master Arm switch is set.

### 6.1 Guided Bombs

The GBU-31 GPS-guided bomb may be dropped using the guided bombing mode. Currently surface targets must be pre-defined in a file called `ground_targets.txt` in the main F-35A folder. Latitude, Longitude, and Altitude can be entered for up to 10 ground targets. Target information is displayed on the HUD when ground targets are in the HUD field of view as shown in the below screenshot.



*Illustration 4: GPS – Guided Bombing Mode*

Ground targets are identified on the HUD as triangles. There is a number under each triangle representing the order the targets are defined in the `ground_targets.txt` file. The designated target will be the large triangle with the distance to it in nautical miles displayed on top of the target. Targets are designated automatically. Initially, the closest target is designated until it is attacked by dropping a bomb on it. After that the next closest target becomes the designated target. An attacked target can not be re-designated again until the aircraft is reloaded and re-armed in X-Plane.



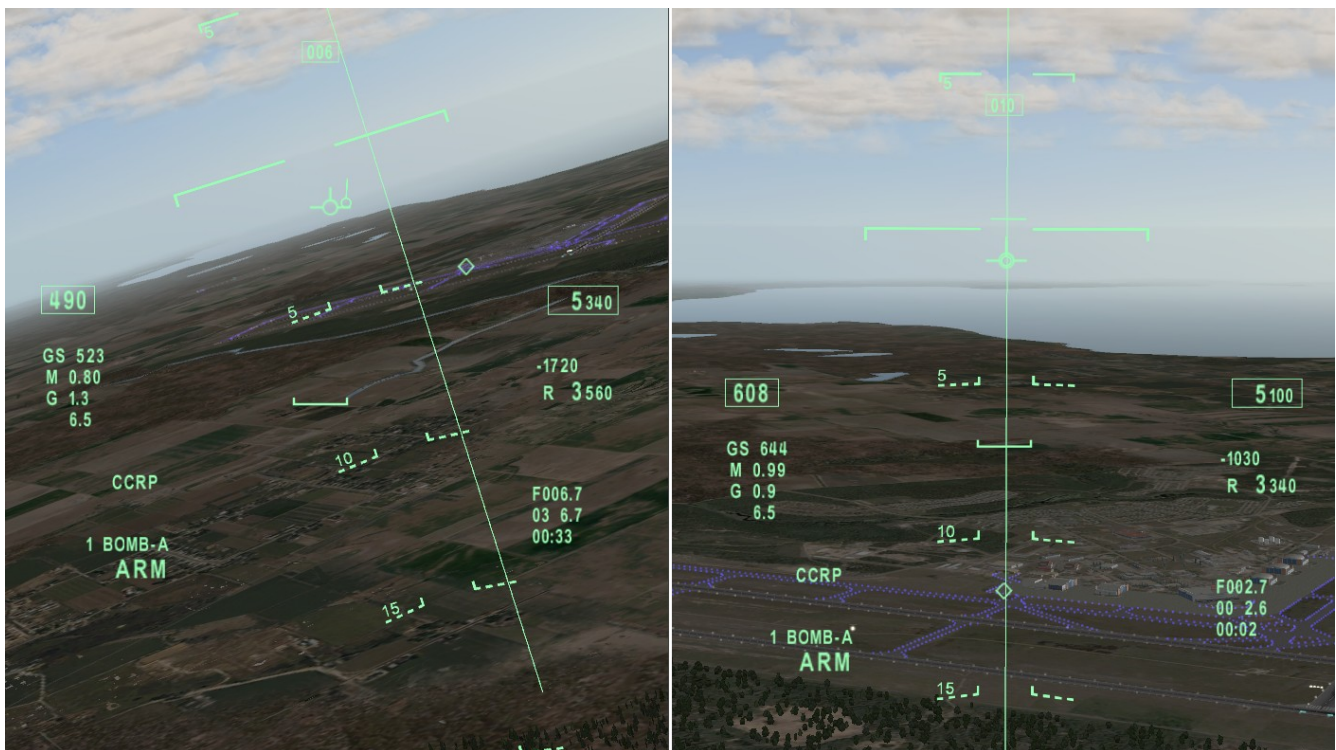
A launch envelope is displayed on the left side of the HUD. There is a box in the middle of varying sizes with the top of the box representing the maximum range at which a bomb can be dropped and the bottom of the box representing the minimum range at which a bomb can be dropped. This launch envelope box will increase in size as altitude and aircraft speed increase. There is a caret to the right of the box showing the current range of the bomb if it were to be dropped in free-fall mode. Once this caret is inside the launch envelope box, the bomb can be released and will guide itself to the target.

## 6.2 Freefall Bombs

The MK-84 free-fall bomb (or GBU-31) may be dropped in free-fall mode using the Continuously-Computed Release Point (CCRP) bombing mode or the Continuously-Computed Impact Point (CCIP) bombing mode.

### 6.2.1 CCRP Bombing Mode

Switch to Air-to-Ground weapon delivery mode using the HUD Mode button on your joystick that you defined in section 3.5.6 [Cycle HUD Modes](#). The first displayed air-to-ground mode will be STRF as indicated on the bottom left of the HUD. Change to bombing mode using the Cycle Weapon button on your joystick that you defined in section 3.5.7 [Cycle Weapons](#). The HUD will now show CCRP bombing symbology as shown below:



*Illustration 5: CCRP Bombing Mode*

CCRP bombing mode is an automatic mode. The bomb will release automatically if you are holding the Weapon Release Button (WRB, defined in section 3.5.1 [Weapon Release](#)) when the computed release point is reached. The target coordinates are the same as the waypoint coordinates as defined in the route file. The target coordinates may also be entered by the F35Glass application when the target cross-hairs on the MFD are slewed to a new position.

When in CCRP mode, a vertical line called the Azimuth Steering Line (ASL) appears on the HUD to provide steering information to the target. The aircraft is steered until the Velocity Vector is directly over the ASL. The bottom right of the HUD displays distance to the target and below that, the time to release. When the aircraft is within 10 seconds of the release point, the WRB should be pressed down. A horizontal line called the Release Line will appear at the top of the HUD. It will travel down the ASL and when it intercepts the Velocity Vector, the bomb will be dropped as long as the WRB is still being pressed. The image to the right shows the Release Line below the Velocity Vector indicating that the bomb has been released. The target is that large aircraft sitting on

the ramp and its lat/lon coordinates have been defined in the route file. The F9 key may be used to watch your bomb as it falls.

### 6.2.2 CCIP Bombing Mode

Switch to Air-to-Ground weapon delivery mode using the HUD Mode button on your joystick that you defined in section 3.5.6 [Cycle HUD Modes](#). The first displayed air-to-ground mode will be STRF as indicated on the bottom left of the HUD. Change to bombing mode using the Cycle Weapon button on your joystick that you defined in section 3.5.7 [Cycle Weapons](#). This gets you to CCRP bombing mode. Finally change the sub-mode to CCIP using the Cycle Submode button on your joystick that you defined in section 3.5.8 [Cycle Weapon Sub-Mode](#). The HUD will now show CCIP bombing symbology as shown below:



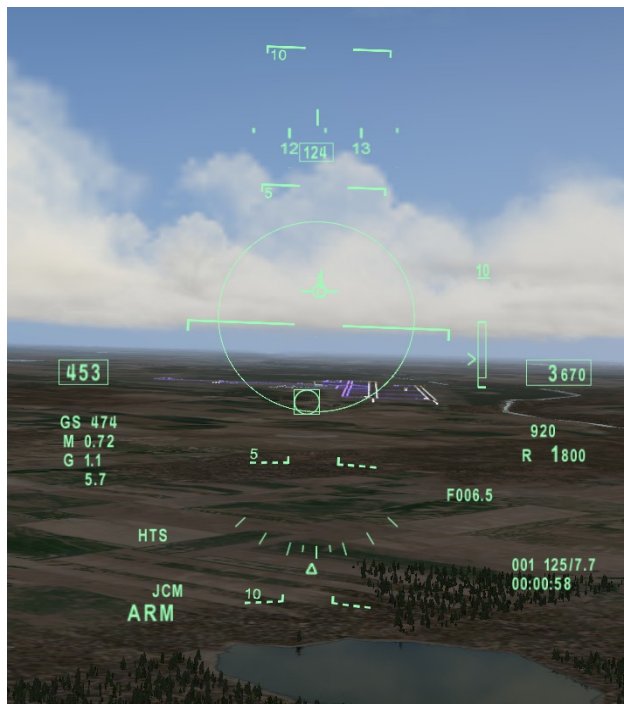
*Illustration 6: CCIP Bombing Mode*

A line will extend down from the velocity vector to a circle which indicates the computed impact point of the bomb if it were to be immediately dropped. Typically a 10 degree dive angle is used and the aircraft is steered so that the impact circle crosses the desired target. The radar is used to determine ground elevations in front of the target so that the computed impact point will be adjusted correctly for hilly terrain. When the impact circle is over the target, release the bomb by pressing the Weapon Release Button on your joystick that you defined in section 3.5.1 [Weapon Release](#). The F9 key may be used to watch your bomb as it falls.



### 6.3 AGM-88 HARM Anti-Radiation Missile

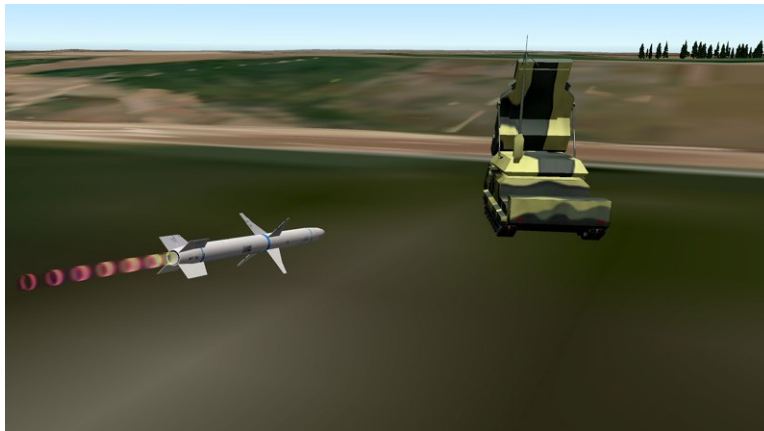
Switch to Air-to-Ground weapon delivery mode using the HUD Mode button on your joystick that you defined in section 3.5.6 [Cycle HUD Modes](#). The first displayed air-to-ground mode will be STRF as indicated on the bottom left of the HUD. Change to HTS mode (displayed in lower left corner of HUD) using the Cycle Weapon button on your joystick that you defined in section 3.5.7 [Cycle Weapons](#). The HTS HUD symbology will be displayed as shown below:



*Illustration 7: HTS AGM-88 HARM Missile Mode*

Any detected radar stations are displayed on the HUD bracketed by a target designator box. On the right side of the HUD next to the altitude is the Missile Launch Envelope (MLE). Above the MLE is a number, (20 in this image), showing the range scale of the MLE. The caret on the left of the MLE shows the distance to the target. The caret must be inside the upper and lower limits of the MLE to ensure a successful missile hit. The large circle in the HUD will start flashing when the release parameters for missile launch are acceptable.

You must be in the air, within line-of-sight, and in detection range to detect ground radar stations. Use the Cycle Targets button you've configured to cycle between ground radar stations. A target locator line will point you to the selected ground target if it is outside of your HUD view. Use the weapon release button to fire your AGM-88s. Use the F8 Target track camera view to see your target get destroyed. You can also watch the missile using the F9 weapon track camera view.



*Illustration 8: AGM-88 in Missile Track Camera View*

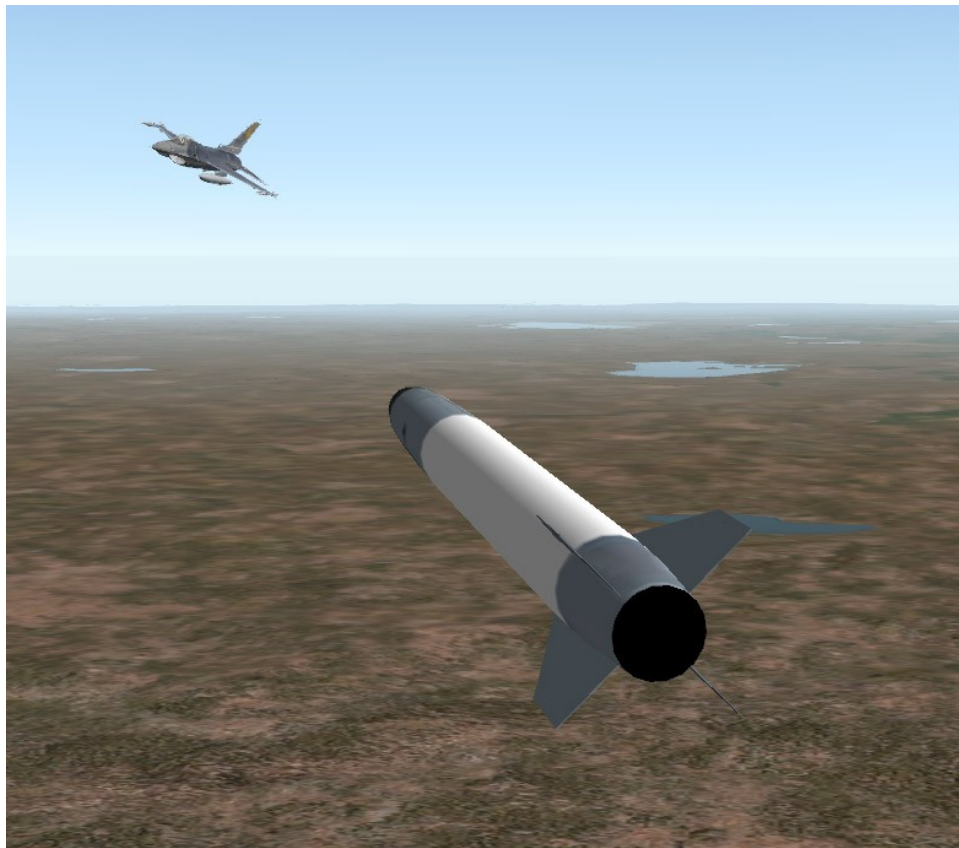
When in range of a radar station, you will hear chirps from the Radar Warning Receiver (RWR) as the radar station tracks your aircraft. These will of course go away after you've destroyed these targets.

Targets may be defined in the **vehicles.txt** file in the **X-Plane/ClassicJetSimUtils/x-combat/Vehicles** folder. This file specifies the location of various ground objects. So far 2 different objects have been defined, "S-300" and "9S32". You can create your own objects and add the definitions to this file. These objects can be placed at locations of your choice. You can set type to 0 or 1 for radar, in which case it will be detectable when you have AGM-88s selected. I've placed a few objects around the Cold Lake air base (CYOD) but you can place them wherever you want. More radar types will be supported in the future.

## 6.4 Surface to Air Missiles (SAMs)

The S-300 as described in the previous section will fire back at you if enabled. To enable SAMs, open the X-Plane **Plugins – F-35 Systems – Preferences** window. Check the box to enable SAMs and the one to enable Aircraft Battle Damage if desired.

The S-300 can fire SA-10 missiles at you any time you are in range anywhere with 50 Nm of the launcher vehicle. In this version, once the S-300 has fired its missile, it won't fire another missile until you fly out of range or low enough for the radar to lose its lock on you, and then fly back in range. Missile guidance is overly accurate. Missile will fly an intercept course towards you and there is no currently no way to confuse the missile. You may however, out maneuver it by breaking into it as it closes. The missile can turn at 20 G but it is also cruising up to M 5.0 so a hard turn at the right time can defeat it.



*Illustration 9: SA-10 in Missile Track Camera view*

A missile padlock view will be added in a future version as well as missile smoke to help you spot the SAM as it flies towards you. Without smoke, the SAM is very hard to spot, but you may use the missile track camera, **F9**, to follow it towards you and turn your plane into it as you see the missile approach your aircraft.

If you have the preference selected to enable Aircraft Battle Damage, your plane will sustain damage in a varying amount depending on how close the SAM detonates next to your aircraft. Be ready to eject if your aircraft becomes uncontrollable!

## 7. Air-to-Air Combat

First ensure that air combat is enabled in X-Plane. See section [3.2 Setting up X-Plane for Air Combat](#) for more information.

Before any ordnance can be fired, the Master Arm switch needs to be turned on. You can use the **x** key to toggle the position of this switch. The F12 Key Command Menu, selection **1, General Equipment**, displays the position of this switch and allows you to change the position as well. The text **ARM** will be displayed on the lower left of the HUD when the Master Arm switch is set.

### 7.1 AIM-120 Missile Mode

Switch to Air-to-Air weapon delivery mode using the HUD Mode button on your joystick that you defined in section [3.5.6 Cycle HUD Modes](#). The first displayed air-to-air mode is Medium Range Missile Mode as indicated on the bottom left of the HUD (AIM). Alternately, you can switch to Missile Mode by pressing the Missile Override switch on your controls that you defined in section [3.5.3 Air-Air Mode](#).



*Illustration 10: Medium Range Missile Mode*

The above image shows the HUD with MRM symbology. The key elements are:

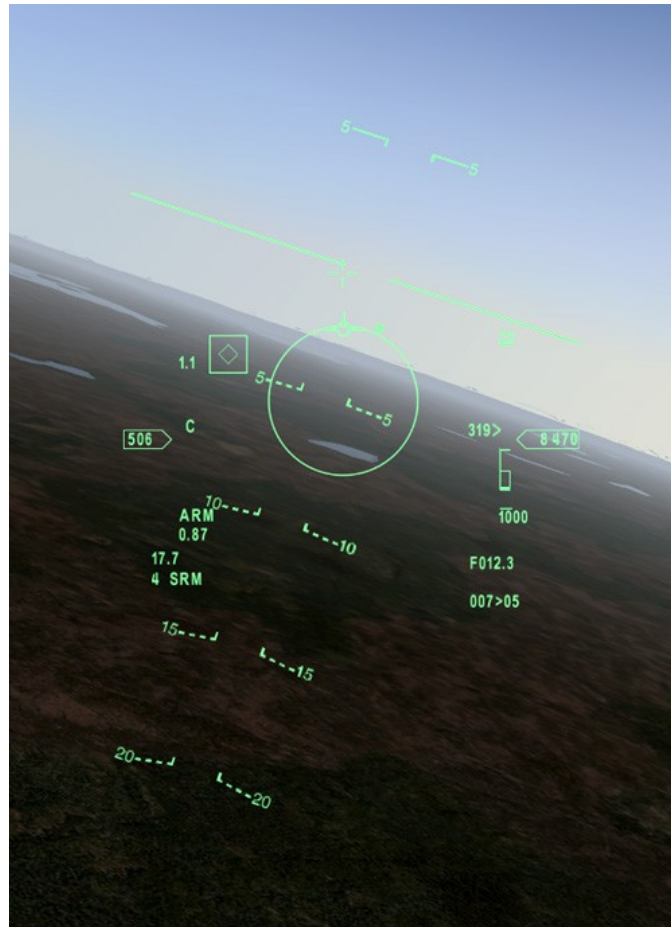
- Target Designator Box – This box appears over the target aircraft when the radar is locked onto it.
- Intercept Circle – A small circle will appear indicating the intercept path to the target. In the above example this circle is shown to the right of the target. Turning the aircraft so that this circle is in the middle of the reticle will put your aircraft on an intercept path to the target. (needs fixing in release 1.1)
- Reticle – The circle in the middle of the view is the aiming reticle. The reticle changes size in relation to the target's position within the MLE. When the target is outside of the MLE, the reticle will be small. It will start increasing in size once the aircraft is inside of the MLE and moves into the maneuvering region of the MLE. Inside of this area the reticle will be drawn at the maximum size. The reticle will flash when a firing solution exists and the text “SHOOT” will be displayed.
- Target Aspect – The triangle that moves around the reticle indicates aspect angle to the target. When the triangle is on top of the reticle as in the above case, this indicates that the target is heading towards

you. When the triangle is on the bottom of the reticle, this indicates that the target is moving away from you. Ideally, you should be behind the target to have the best chance of hitting it.

- **Missile Launch Envelope (MLE)** – This is displayed to the left of the altitude. Above the MLE is the MLE range, which is 20 Nm in this case. The caret to the left of the MLE shows the target range relative to the MLE. The number next to the caret is the closing rate, in this case 1019 knots. The MLE has 2 areas. The upper and lower lines indicate the range that the target must be inside of to have any chance of hitting it with the missile. The inner lines indicate the range that the target should be inside of, if it is maneuvering. In the example above, the target is out of range.
- **Distance to Target** – This text is displayed below the MLE, “F012.5” in this case, indicating that the aircraft is 12.3 Nm away.
- **Missile Travel Time** – Under the MLE, the time is displayed indicating how long it will take the missile to reach the target. In this case the text reads “A26” or a travel time of 26 seconds.
- **Number of Missiles** – On the bottom right of the HUD is text showing the number of missiles remaining and the HUD mode. In this example, “4 MRM” is displayed indicating 4 short range missiles remain.

## 7.2 AIM-9 Missile Mode (NOT CURRENTLY SUPPORTED)

Switch to Air-to-Air weapon delivery mode using the HUD Mode button on your joystick that you defined in section 3.5.6 [Cycle HUD Modes](#). Next use the cycle weapon button that you defined in section 3.5.7 [Cycle Weapons](#) to switch to Short Range Missile (SRM) mode. Alternately, you can switch to SRM mode by pressing the Dogfight switch on your controls that you defined in section 3.5.3 [Air-Air Mode](#). This mode also allows you to fire the cannon in EEGS mode.



*Illustration 11: Approaching target head-on*

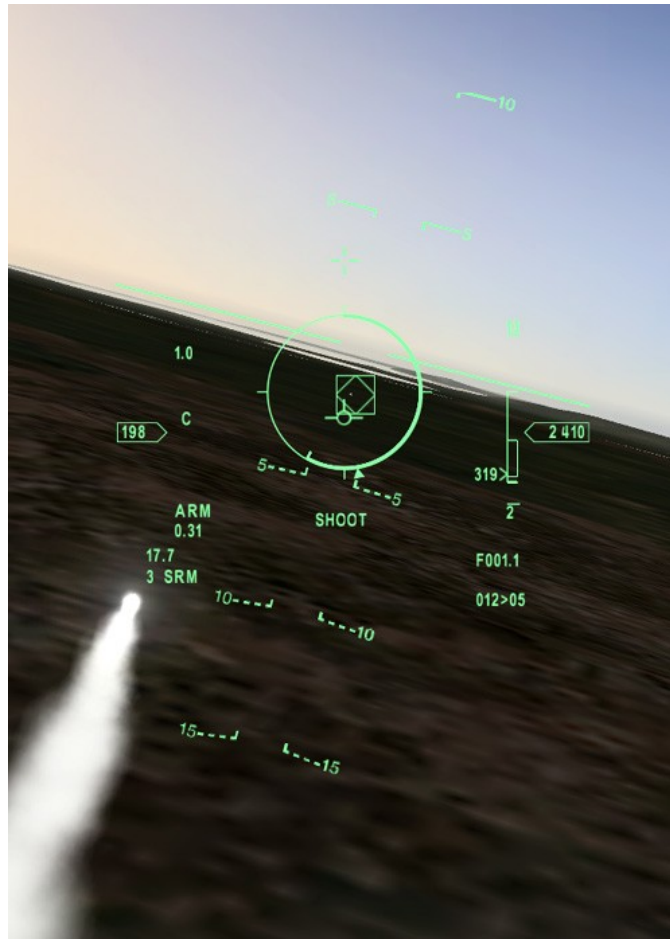
The above image shows the HUD with SRM symbology. The key elements are:

- Target Designator Box – This box appears over the target aircraft when the radar is locked onto it. The small diamond inside the box indicates that the missile is caged. When the target is in range, the missile will un-cage and the diamond will become large.
- Reticle – The circle in the middle of the view is the aiming reticle. This will flash when a firing solution exists and the text “SHOOT” will be displayed.
- Target Aspect – The triangle that moves around the reticle indicates aspect angle to the target. When the triangle is on top of the reticle as in the above case, this indicates that the target is heading towards you. When the triangle is on the bottom of the reticle, this indicates that the target is moving away from you. Ideally, you should be behind the target to have the best chance of hitting it.
- Missile Launch Envelope (MLE) – This is displayed to the left of the altitude. Above the MLE is the MLE range, which is 20 Nm in this case. The caret to the left of the MLE shows the target range relative to the MLE. The number next to the caret is the closing rate, in this case 319 knots. The MLE has 2 areas. The upper and lower lines indicate the range that the target must be inside of to have any chance of hitting it with the missile. The inner lines indicate the range that the target should be inside of, if it is maneuvering. In the example above, the target is out of range.
- Distance to Target – This text is displayed below the MLE, “F012.3” in this case, indicating that the



aircraft is 12.3 Nm away.

- Number of Missiles – On the bottom right of the HUD is text showing the number of missiles remaining and the HUD mode. In this example, “4 SRM” is displayed indicating 4 short range missiles remain.



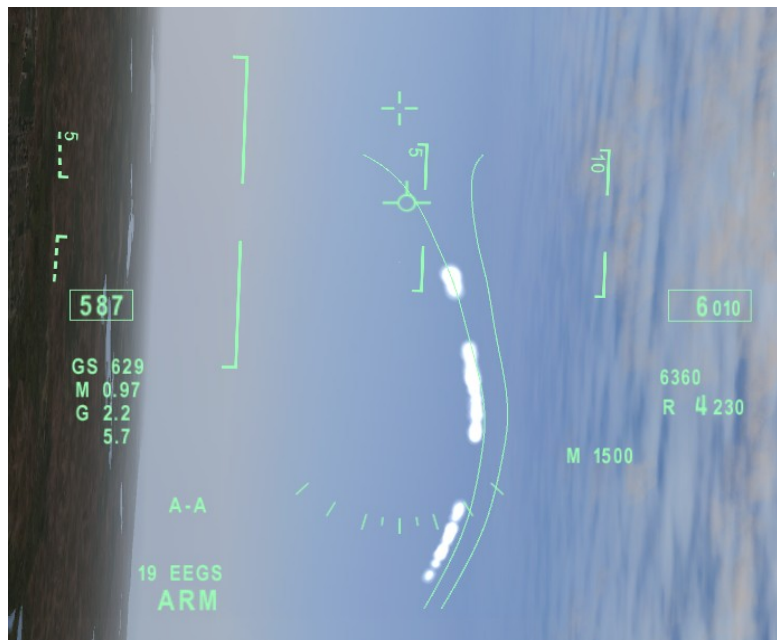
*Illustration 12: Firing AIM-9 at target aircraft*

In the above image, a good firing solution exists as indicated by the flashing SHOOT text. The range caret is inside of the maneuvering zone inside of the MLE. The range is 1.1 Nm. The aspect triangle indicates that you are behind the target which improves your chances as well.

## **7.3 M61A2 20mm Cannon**

### **7.3.1 Enhanced Envelope Gun Sight (EEGS)**

Switch to Air-to-Air weapon delivery mode using the HUD Mode button on your joystick that you defined in section [3.5.6 Cycle HUD Modes](#). Next use the cycle weapon button that you defined in section [3.5.7 Cycle Weapons](#) to switch to EEGS.



*Illustration 13: Cannon shells traveling through EEGS funnel*

The EEGS mode shows 2 lines that are virtually 35 feet apart that form a funnel that the cannon shells will follow. The funnel lines appear closer together the further away the cannon shells travel along their flight path. The funnel lines will move as the aircraft maneuvers showing how the flight path of the cannon shells is affected. The correct gunshot solution exists when the wings of the target aircraft are touching the funnel lines. Keeping the target aircraft within the funnel ensures that you are maneuvering in the same plane as the target. Of course not every aircraft has a wing span of 35 feet, but a typical fighter will be close. The correct procedure when using EEGS is to pull increasing lead on the target, flying it through the funnel as you fire so that at some point the shells will be impacting the target. The great thing about EEGS mode, is that you don't require a radar lock on the target aircraft.

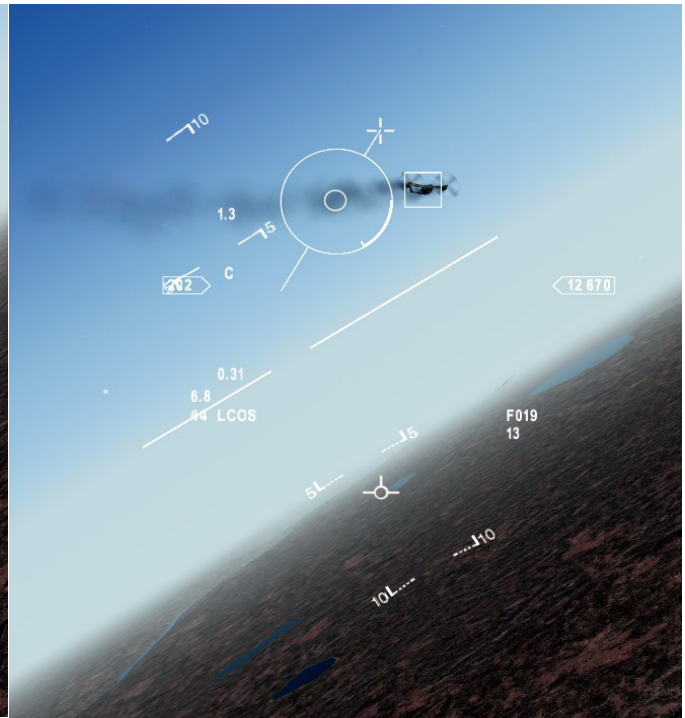
### **7.3.2 Lead Computing Optical Sight (LCOS)**

The LCOS sight displays a circle showing where the cannon shells will pass through at a specific distance. In the case where a radar lock has been obtained on the target aircraft, that distance is the distance to the target aircraft. Without a radar lock, the distance is fixed at 1500 feet. Using LCOS is straight forward; maneuver your aircraft so that the circle is over the target and fire.





*Illustration 14: Cannon shells converging on target in LCOS mode*



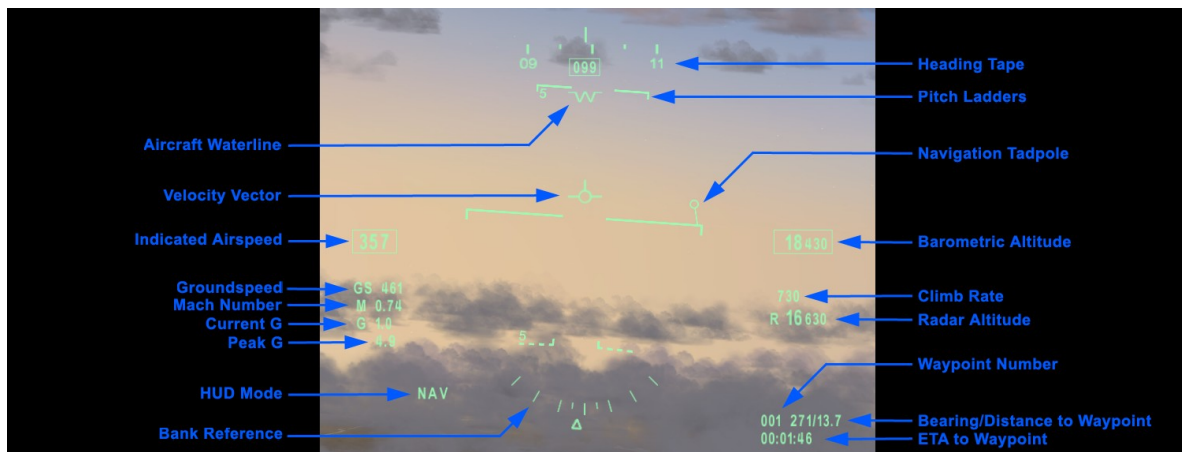
*Illustration 15: Target destroyed using LCOS mode*

## 8. Navigation and Landing

From the F12 Key Command menu, if you select option "2" for Navigation functions, you can now select a route file for navigation. Route files go into the **X-Plane/Output/FMS\_plans** folder. They must all have the file name **F-35\_route\_N.fms** where N is a number from 1 to 20. One route file is attached as an example for 4-Wing Cold Lake. (CYOD). You can create your own though. The file format has a few fields as follows:

- ID - always 29 for a lat/lon waypoint
- text identifier - can be anything
- elevation - altitude in ft ASL of the waypoint
- lat
- lon

Once a route is loaded, route information is displayed on the HUD when it is in NAV mode.



*Illustration 16: HUD NAV Mode*

Information related to the current waypoint is displayed on the bottom right of the HUD.

The tadpole marker, to the left of the velocity vector in this example, provides steering information to the selected waypoint. Turning the aircraft until the tadpole is in the center of the velocity vector places you on a direct heading to the waypoint.

ILS symbology is also displayed on the HUD. ILS frequencies are entered via F35Glass to the dataref **sim/cockpit/radios/nav1\_freq\_hz**



*Illustration 17: HUD ILS Mode*

Press the **i** key to toggle ILS Mode On and Off. Once in ILS Mode, the HUD symbology is slightly different than NAV mode. The text ILS will appear in the bottom left of the HUD to indicate that ILS mode is active. On the bottom right of the HUD, distance to the runway threshold is displayed instead of distance to the current waypoint.

The correct landing technique calls for an AOA of between 9 and 11 degrees. The bracket to the left of the velocity vector is the AOA bracket. The velocity vector should be kept inside of this bracket during landing. With a typical 3 degree angle of descent, this translates to an aircraft pitch of between 6 and 8 degrees. The maximum AOA on touchdown should be no more than 15 degrees to avoid scraping the tail of the aircraft on the ground.

After touchdown, the nose should be kept pitched up at 15 degrees for aerodynamic braking. Use the wheel brakes gently until the nosewheel is flown down to the ground when the aircraft speed drops below 100 knots.

## 9. Autopilot

See section [10. Refueling](#) on how to use the fictional Auto Refuel autopilot mode.

The autopilot is controlled by 2 switches and the Autopilot Interrupt Paddle. The switches can be set from the F12 Key Command Menu (see section [4.4 Autopilot Functions](#) ) or by using the hot keys (see section [3.6 Predefined Hot Keys](#)). The Autopilot Interrupt Paddle is controlled using the joystick button that you configured in section [3.5.11 Joystick Paddle – Autopilot Interrupt](#).

To enable the autopilot, the Pitch Control Switch must be set from OFF to either Altitude Hold or Attitude Hold. The following conditions must be met in order for the autopilot to engage

- Bank angle – Less than 60 degrees
- Landing Gear - UP
- Low-Speed Warning - OFF
- Angle of Attack – Less than 15 degrees
- Controls – Neutral
- Autopilot Interrupt Paddle - Release

Positioning the Pitch Control switch to ALT HOLD enables the autopilot and the aircraft will hold the altitude that the aircraft was at when the switch was set. The altitude reference may be changed by depressing the paddle switch, changing altitude, and releasing the paddle switch.

Positioning the Pitch Control switch to ATT HOLD enables the autopilot and the aircraft will hold the current pitch attitude. Note that in X-Plane, due to limitations, this will hold the current vertical speed.

Positioning the Roll Control switch to HDG SEL causes the aircraft to fly on the heading as set on the HSI. Adjusting the heading will cause the autopilot to steer the aircraft to this new heading. The HSI value used by the autopilot is read from the dataref [sim/cockpit2/radios/actuators/hsi\\_obs\\_deg\\_mag\\_pilot](#)

Positioning the Roll Control switch to ATT HOLD causes the aircraft to fly at the current roll angle. Note that in X-Plane, due to limitations, the available bank angles are 5, 10, 15, 20, 25, and 30 degrees. The autopilot will fly at the bank angle closest to the current roll angle.

Positioning the Roll Control switch to STRG SEL causes the aircraft to fly towards the currently selected waypoint. Upon flying within 2 Nm of the waypoint, the waypoint will advance to the next one defined in the route and the aircraft will turn to fly to this waypoint.

## 10. Refueling



*Illustration 18: Refueling from the KC-10*

### 10.1 Preparation for Refueling

If F-35glass is not being used, you can display your fuel level to the screen. Go to the X-Plane **Settings – Data Input & Output** window and check the fourth box next to fuel weights in the 2<sup>nd</sup> column to have it display on your monitor. The fuel capacities are 6945 lbs and 2410 lbs for the internal and wing fuel tanks respectively.

This application features a custom KC-10 tanker. The one in X-Plane generates too much turbulence to get close to. To activate the custom KC-10, press the F7 key and the KC-10 will appear 1.5 Nm in front of you at your current heading at 24,000 feet and will be flying at 300 knots IAS. You can be on the ground or in the air when activating the KC-10. The KC-10 will fly large race track patterns, 35 Nm in length so after activating the KC-10, you'll be able to find it somewhere around its starting point throughout your flight. You can press F7 again to deactivate the KC-10 and F7 again to reactivate it, if you want to reappear in front of you.

Put the HUD into air-to-air mode and the KC-10 will automatically be locked onto. Once locked onto the KC-10 you will be able to determine your closing speed as it will be shown on the MLE if using missiles or on the bottom right of the HUD if guns are selected. Note that while the KC-10 is active, you can't lock onto other aircraft.

### 10.2 Manual and Auto Refueling

You can refuel by flying the F-35 manually in which case you must manage your attitude manually using the controls. If you are finding refueling too difficult, you may also use the Auto Refueling Mode. To activate this mode, first locate the KC-10 and get behind it at roughly the same heading and within a couple thousand feet elevation difference. Then from the F12 Key Command menu, select the Auto Refuel option from the Autopilot settings (see section [4.4 Autopilot Functions](#)). The F-35 will slowly climb or descend to 24,000 feet and the KC-10 will adjust its flight path to match your heading. You still have to control your airspeed using the throttle. Move your controls to disengage the autopilot and terminate Auto Refuel mode.

### 10.3 Refueling Procedures

Before refueling, ensure the following conditions are met:

- Fuel level is down at least 40 gallons from maximum capacity.
- The refueling door is open on the F-35. See section [4.1 General Equipment](#).

Once the F-35 is within 700 feet of the KC-10, the Ready (RDY FUEL) indication will be displayed on the top right of the HUD. This indicates that all conditions are met to begin refueling.

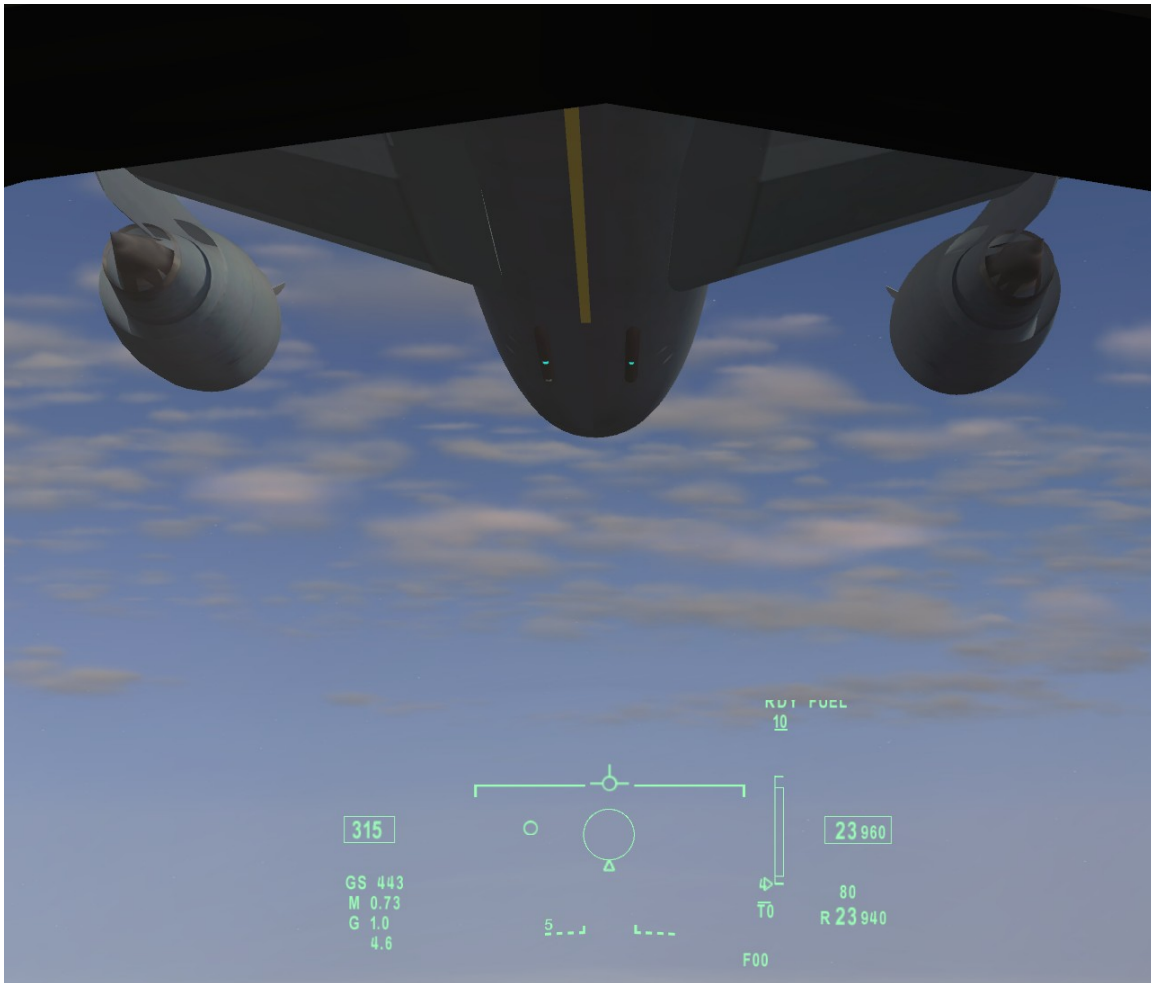


*Illustration 19: Approaching the KC-10*

As you approach the KC-10, it will lower its refueling boom into position. Approach the KC-10 slowly. A good rule of thumb is to get the closing speed less than or equal to the displayed distance from the KC-10. In the example above, distance to the KC-10 is shown as 400 feet (F04 displayed on bottom right of HUD). The displayed closing speed is 0 knots.

Fly slowly under the boom. Don't worry it will rise up to miss you if you are too close. Once under the boom you will see the Pilot Director Lights on the KC-10. Use these lights to guide you into position. Below is an image showing what your position will look like in relation to the KC-10 when you are in optimum position.





*Illustration 20: In position for refueling under the KC-10*

To place your aircraft in the correct position, make tiny adjustments on the the controls and throttle. Rudder should be used to adjust your lateral positions and not ailerons. The Pilot Director Lights (PDL) are used to guide your plane into position and are described in the following section.

## 10.4 Pilot Director Lights (PDL)

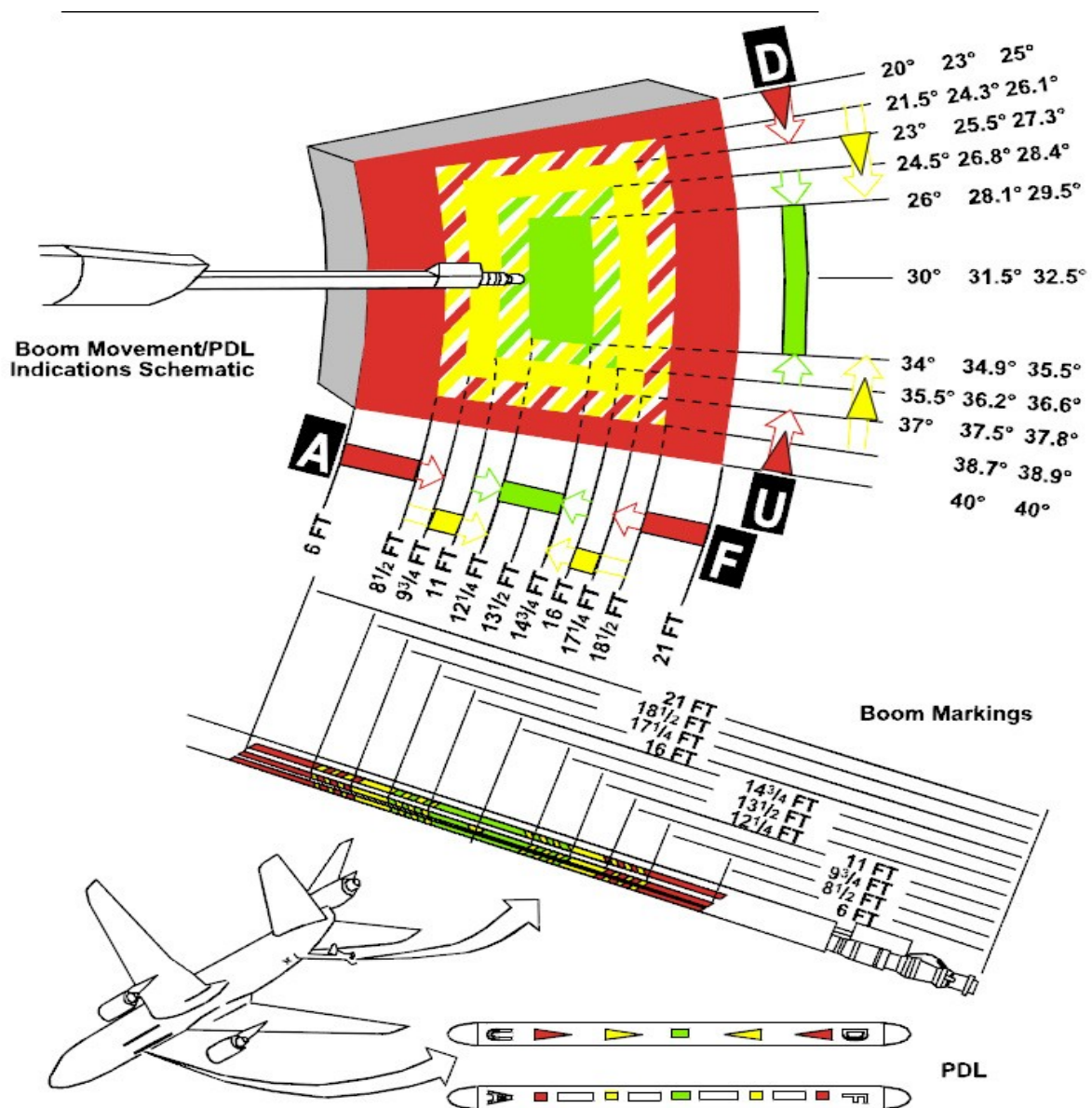


Illustration 21: Pilot Director Lights

The left PDL shows elevation guidance. When the **U** light is illuminated, you should climb slightly until the green light in the center is illuminated indicating perfect position. If the **D** light is illuminated, you are too high and should descend slightly.

The right PDL shows longitudinal guidance. If the **A** light is illuminated, you are too far forward and need to move aft slightly. If the **F** light is illuminated, you are too far back and need to move forward slightly.

When you are in position, wait a couple of seconds for the boom operator to move the boom into position. You will hear it connect and the Refueling (AR) light will illuminate indicating that fuel is flowing into your aircraft. If you move out of position, or make rapid position adjustments, or have full fuel tanks, refueling will cease and the Disconnect light (DSC) will illuminate.



# 11. Engine and Fuel Systems

Custom Engine and Fuel Systems have been built for the F-35 overriding X-Plane's systems. Engine thrust is determined using lookup tables to provide accurate level speed, acceleration, and climb rate numbers to match the performance charts. Fuel flow is also based on table lookups.

Due to the need to override X-Plane's systems, a separate menu has been provided to set fuel levels. From X-Plane, select the **Plugins-F-35C Systems-Fuel Levels** option to open the fuel levels window. The wing tanks must be on the plane before you can change the fuel level in those.

Bingo (low level) fuel level warning is displayed on the HUD and the "bingo" sound is played when the fuel level drops below this limit. To stop the fuel warning from being displayed and the sound, press the "r" key which is the warning reset button. The fuel remaining gets displayed on the bottom left of the HUD when reaching the low fuel level. The bingo fuel level defaults to 1500 lbs if F35Glass is not being used.

## 11.1 Starting the Engine

From the F12 Key Command menu, select option 1, General Equipment.

- Press the **1** key to start the engine.
- Immediately after, press the **F1** key to toggle fuel flow to ON

## 11.2 Shutting Down the Engine

- Press the **F1** key to toggle fuel flow to OFF

## 12. Hydraulic System

### 12.1 Normal Operation

A custom hydraulic system has been modeled overriding X-Plane's functionality. System A also powers the speed-brakes. System B powers the landing gear, wheel brakes, and nose wheel steering. The IPP provides power to system A. Components attached to these systems will be non-functional as their associated hydraulic systems fail. For more information on the IPP, refer to section [4.8 Integrated Power Package \(IPP\)](#).

### 12.2 Emergency Operation

To fail the hydraulic systems, go to the X-Plane **Plugins-F-35 Systems-System Failure Configuration** window. You can fail either system randomly, at a specific time, at a specific altitude, or above a specific speed. The IPP will come on automatically. The systems can be set back to operational by going to the F12 Key Command menu, selecting the "Emergency Operation" menu and selecting option 8, Clear Failures.

The landing gear can be lowered if hydraulic power is lost by going to the F12 Key Command menu, selecting the **Emergency Operation** menu and selecting option 6, **Emergency Gear Extension**. The gear will be locked down. If hydraulic pressure returns, you can use option 7 on that menu, **Emergency Gear Reset Button** and the landing gear handle will function normally again.

## 13. Sounds

The F-35 plugin has a lot of new sound features. Advanced sound support will be added to future versions but here is what is included now:

- External sounds are muffled when inside the plane if the canopy is closed.
- External sounds are much improved. Sound level will decrease as the camera moves away from the plane. Sounds have been added for ground vehicles and the AGM-88 HARM missile.
- Sonic boom and doppler shift effects have been added to the external sounds as well. Try viewing the plane from the tower (push the "t" key) and do some low and high speed supersonic passes to check them out.

## Appendix A – F35Glass Interface

The following custom and standard X-Plane datarefs are used as in interface to the F35Glass application.

### HUD Controls

HUD Controls				
Dataref Name	Type	Access	Values	Comments
cjs/f35/F35Glass_hud_power	xplmType_Int	R/W	0 - Powered Off 1 - Powered On	
cjs/f35/F35Glass_hud_mode	xplmType_Int	R	0 – NAV 1 – AIR-AIR 2 - AIR-SURFACE	
cjs/f35/F35Glass_rcp_fpm_switch	xplmType_Int	R/W	0 – OFF 1 – FPM 2 - ATT / FPM	
cjs/f35/F35Glass_rcp_ded_data_switch	xplmType_Int	R/W	0 - DED Data Off 1 - DED Data On	
cjs/f35/F35Glass_hud_ded_info1	xplmType_Data	W	100 Character Limit	
cjs/f35/F35Glass_hud_ded_info2	xplmType_Data	W	100 Character Limit	
cjs/f35/F35Glass_hud_ded_info3	xplmType_Data	W	100 Character Limit	
cjs/f35/F35Glass_rcp_velocity_switch	xplmType_Int	R/W	0 – Ground 1 – True 2 - Calibrated	
cjs/f35/F35Glass_rcp_altitude_switch	xplmType_Int	R/W	0 – Auto 1 – Baro 2 - Radar	
cjs/f35/F35Glass_color_select	xplmType_Int	R/W	0 – green 1 – white 2 - black	
cjs/f35/F35Glass_rcp_brightness_control_switch	xplmType_Int	R/W	0 – Night 1 – AUTO 2 – Day	
HUD Settings				
cjs/f35/F35Glass_low_alt_setting_ft	xplmType_Int	R/W	Altitude in feet	Altitude at which to sound altitude warning.
cjs/f35/F35Glass_bingo_fuel_level_lbs	xplmType_Float	R/W	Pounds of Fuel	Fuel level at which to sound BINGO warning.
cjs/f35/F35Glass_desired_airspeed_kts	xplmType_Float	R/W	Knots	Not yet implemented on HUD.
Weapon System				
cjs/f35/F35Glass_aa_as_mode	xplmType_Int	R/W	0 – OFF 1 – Air-Air Mode 2 – Air-Ground Mode	To write to this dataref, the preference for “Using F-35Glass Application” must be checked.
cjs/f35/F35Glass_station4_weapon	xplmType_Int	R	0 – NONE 2 – AIM-9 3 – AIM-120 4 – AGM-88	Weapon on station 4

			5 - GBU-31	
cjs/f35/F35Glass_station5_weapon	xplmType_Int	R	0 – NONE 2 – AIM-9 3 – AIM-120 4 – AGM-88 5 - GBU-31	Weapon on station 5
cjs/f35/F35Glass_station7_weapon	xplmType_Int	R	0 – NONE 2 – AIM-9 3 – AIM-120 4 – AGM-88 5 - GBU-31	Weapon on station 7
cjs/f35/F35Glass_station8_weapon	xplmType_Int	R	0 – NONE 2 – AIM-9 3 – AIM-120 4 – AGM-88 5 - GBU-31	Weapon on station 8
cjs/f35/bomb_door_angle_right	xplmType_Float	R	0 – 90 degrees	Angle of outside weapon bay bomb door.
cjs/f35/bomb_door_angle_left	xplmType_Float	R	0 – 90 degrees	Angle of outside weapon bay bomb door.
cjs/f35/missile_door_angle_right	xplmType_Float	R	0 – 90 degrees	Angle of inside weapon bay missile door.
cjs/f35/missile_door_angle_left	xplmType_Float	R	0 – 90 degrees	Angle of inside weapon bay missile door.
<b>Autopilot</b>				
cjs/f35/F35Glass_pitch_control_switch	xplmType_Int	R/W	-1 – ATTITUDE HOLD 0 – OFF 1 – ALTITUDE HOLD	
cjs/f35/F35Glass_roll_control_switch	xplmType_Int	R/W	-1 – HEADING HOLD 0 – ATTITUDE HOLD 1 – STEERING	
sim/cockpit2/radios/actuators/hsi_obs_deg_mag_pilot	Float	R/W	HSI Heading	Used by autopilot when Roll switch is set to Heading Hold mode.
<b>Engine Control &amp; Status</b>				
cjs/f35/F35Glass_engine_rpm_pct	xplmType_Float	R	0 – 110%	Value calculated by plugin – do not use X-Plane value.
cjs/f35/F35Glass_engine_fuel_flow_lb_per_hour	xplmType_Float	R	lbs/hour	Value calculated by plugin – do not use X-Plane value.
cjs/f35/F35Glass_engine_start_switch	xplmType_Int	W	1 - PUSH	
cjs/f35/F35Glass_fuel_cutoff	xplmType_Int	R/W	0 – OFF 1 – ON	
cjs/f35/nozzlepos	xplmType_Float	R	0 – 10	0 – nozzle open 10 – nozzle closed
<b>Fuel System</b>				
cjs/f35/refuel_probe_angle	xplmType_Float	R	0 – 40 degrees	Angle of front refuel probe with 0 being retracted.
cjs/f35/F35Glass_refuel_door	xplmType_Int	R/W	0 – CLOSED 1 – OPEN	Control the refueling door for aerial refueling.

Hydraulic Systems Status				
cjs/f35/F35Glass_hyd1_pres_psi	xplmType_Float	R	psi	Value calculated by plugin – do not use X-Plane value.
cjs/f35/F35Glass_hyd2_pres_psi	xplmType_Float	R	psi	Value calculated by plugin – do not use X-Plane value.
IPP				
cjs/f35/F35Glass_ipp_switch	xplmType_Int	R/W	0 – OFF 1 – OVERRIDE ON	Used to turn on IPP with engine off
cjs/f35/F35Glass_epu_rpm_pct	xplmType_Float	R	0 – 100%	IPP RPM
cjs/f35/F35Glass_epu_hydrazine_level_pct	xplmType_Float	R/W	0 – 100%	IPP Hydrazine level
cjs/f35/F35Glass_epu_run_light_on	xplmType_Int	R	0 – OFF 1 – ON	On when IPP is running as a motor or generator.
cjs/f35/F35Glass_epu_hydrazine_light_on	xplmType_Int	R	0 – OFF 1 – ON	On when IPP is running as a motor.
cjs/f35/F35Glass_epu_air_light_on	xplmType_Int	R	0 – OFF 1 – ON	On when IPP is running as a generator.
ILS				
cjs/f35/F35Glass_ils_on	xplmType_Int	R/W	0 – Nav Mode 1 – ILS Mode	Activates ILS steering on the HUD.
sim/cockpit/radios/nav1_freq_hz	Integer	R/W	Frequency X 100	A frequency of 112.55 would be entered as 11255.
TACAN				
cjs/f35/F35Glass_tacan_channel	xplmType_Int	R/W	Channel Number	If channel is set, distance and bearing to station can be read using below datarefs.
cjs/f35/F35Glass_tacan_distance_nm	xplmType_Float	R	Nm	Returns -1 if TACAN out-of-range.
cjs/f35/F35Glass_tacan_bearing_deg	xplmType_Float	R	Degrees	Returns -1 if TACAN out-of-range.
Routes				
cjs/f35/F35Glass_current_route_num	xplmType_Int	R	1 – 20	Current route number. Use Advance dataref to change route number.
cjs/f35/F35Glass_advance_route	xplmType_Int	W	1	Write 1 to advance route.
cjs/f35/F35Glass_number_of_steerpnts	xplmType_Int	R	Number of steerpoints	Number of steerpoints for current route.
cjs/f35/F35Glass_current_steerpnt	xplmType_Int	R/W	Steerpnt number	Used to set or read the current steerpoint.
cjs/f35/F35Glass_increment_steerpnt	xplmType_Int	W	1	Write 1 to increment the steerpoint.
cjs/f35/F35Glass_decrement_steerpnt	xplmType_Int	W	1	Write 1 to decrement the steerpoint.
cjs/f35/F35Glass_steerpnt_distance_nm	xplmType_Float	R	Nm	Distance to steerpoint.

	at			
cjs/f35/F35Glass_steerpoint_bearing_deg	xplmType_Float	R	Degrees	Bearing to steerpoint.
cjs/f35/F35Glass_time_to_steerpoint_sec	xplmType_Float	R	Seconds	Time to steerpoint.
<b>Lighting</b>				
cjs/f35/F35Glass_landing_taxi_lights	xplmType_Int	R/W	-1 – TAXI Lights 0 – OFF 1 – LANDING Lights	
cjs/f35/F35Glass_nav_lights	xplmType_Int	R/W	0 – OFF 1 – ON	
cjs/f35/F35Glass_strobe_light	xplmType_Int	R/W	0 – OFF 1 – ON	
cjs/f35/F35Glass_beacon_light	xplmType_Int	R/W	0 – OFF 1 – ON	
cjs/f35/F35Glass_refuel_light	xplmType_Int	R/W	0 – OFF 1 – ON	
<b>Emergency Systems</b>				
cjs/f35/F35Glass_emergency_gear_extension_handle	xplmType_Int	R/W	1 – PULL 0 – RELEASE	
cjs/f35/F35Glass_emergency_gear_reset_button	xplmType_Int	W	1 – PUSH	Allows gear handle to work again after emergency handle is pulled if hydraulic pressure returns.
cjs/f35/F35Glass_stores_jettison	xplmType_Int	W	1 - PUSH	
cjs/f35/F35Glass_canopy_jettison	xplmType_Int	W	1 - PUSH	
cjs/f35/F35Glass_eject	xplmType_Int	W	1 - EJECT	
<b>Misc Status</b>				
cjs/f35/tail_hook_door	xplmType_Float	R	0 – 90 degrees	Angle of tail hook door (0 is closed).
cjs/f35/speederpos	xplmType_Float	R	0 – 1	0 is off, 1 is on
cjs/f35/canopypos	xplmType_Float	R	0 – 1	0 is closed, 1 is open
<b>Misc Buttons</b>				
cjs/f35/F35Glass_warning_reset	xplmType_Int	W	1 – PUSH	Push to stop warning tone from playing.
cjs/f35/F35Glass_master_arm	xplmType_Int	R/W	0 – OFF 1 – ON	