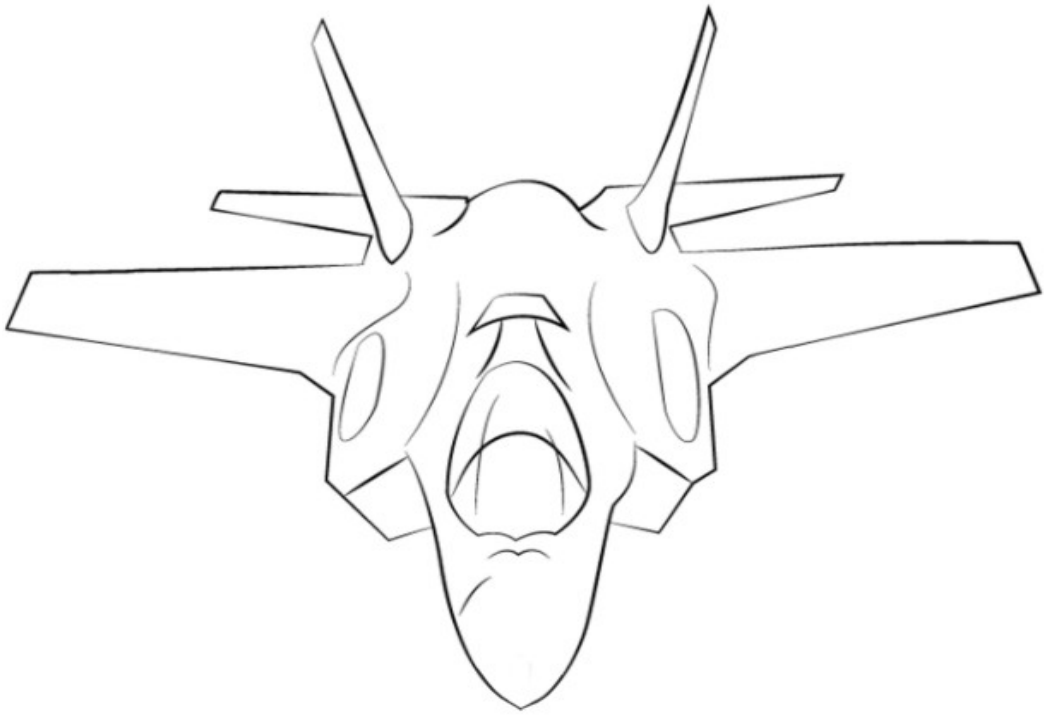
INDIA FOXT ECHO
VISUAL SIMULATIONS

F-35 LIGHTNING II AIRCRAFT for Microsoft Flight Simulator

USER MANUAL



Product Version 1.2.4 – May 2023

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

CHANGE LOG

1.2.4
23-May-23

MINOR FIX

GENERAL
- Fixed minor bug in radar reflectors menu

F-35C
- Fixed minor mistake in engine materials assignment
- Fixed minor mistake in main surfaces composite texture
- Fixed minor mapping mistake in fuselage texture (visible only in CF-01 livery)

1.2.3
19-May-23

GENERAL
- Fixed minor bug preventing functionality of some AP buttons if LITES menu is also selected
- Fixed minor glitch in AOA Bracket animation
- Changed engine sound fall-off profile
- Reorganized sound files
- Fixed minor bug causing incorrect IPP lights behaviour in rare occurrences
- Replaced behavior templates of throttle lever, landing light switch, parking brake, rudder trim
- Revised animation of rudder pedals
- Added afterburner detent
- Added bespoke engine covers to several liveries
- Major refactoring of pilot model (new oxygen hose, additional details, new animation, new harness)
- Added pilot shoulder patch (bespoke for various countries and squadrons)
- Added "headless" option to pilot body visualization (visibility cotrol now cycles between no pilot, headless pilot and full model)
- Added native canopy variable (for smoother anuimation and multiplayer sync)
- Added "refuel and repair" option to PCD MENU screen
- Added "radar reflectors" mount/unmount option to PCD MENU screem
- Added live ordnance textures (with multiple variants and warheads) to several liveries
- Updated manual

F-35A
- Fixed minor mistakes in 18-5343 livery
- Changed tail font in 08-0747 livery
- Added Wisconsin ANG livery
- Added AF-01 prototype livery

F-35B
- Fixed minor UVW mapping misalignments
- Fixed minor polygon smoothing issues
- Fixed minor modeling glitches
- Added VMFA-213 "Black Sheep" liveries (hi-viz and lo-viz)
- Added BF-01 protoptye livery

F-35C
- Fixed mapping mistake on left taileron upper surfaces
- Fixed minor mistake in engine nozzle geometry
- Fixed minor mistake in remove-before-flight ribbons geometry
- Fixed minor mistake in air intake geometry
- Fixed minor mistakes in Top Gun, VFA-147 and VFA-97 liveries
- Fixed incorrect stencils on VMFA-314 livery
- Added CF-01 prototype livery
- Added VFMA-311 livery
- Added VFMA-314 VW300 livery
- Added VFA-101 NJ101 livery

1.2.2
03-Apr-23

GENERAL
- Fixed minor graphical glitch in FCS page
- ASR zoom can now be adjusted
- DAS switched to front view, turns to downward view in hover mode.
- TFLIR now has NAV and AS modes (AS modes is horizon stabilized)
- DAS and TFLIR views can be adjusted in pitch
- Fixed minor bug on TSD target designation
- Improved engine geometry on all models
- Added ground crew access panels to all models
- Solved minor glitch when selecting INOP pages
- FCS RESET BUTTON now switches from AUTO to MAN mode, also added button animation
- NAV SOURCE can be changed also on ASR, DAS and TFLIR pages
- Fixed minor bug preventing correct AoA visualization on HMD
- Minor revision to -B and -C markings
- Fixed minor bug causing slightly different engine readings in FAB and PCD ENG page
- Refined APU exhaust geometry on all models
- Fixed minor bug causing aural alert to play even without electical power in some instances

F-35A
- Added USAF 17-5281 livery with Demo Team covers
- Added USAF 13-5081 livery
- Added JASDF 69-8701 livery
- Added IAF 911 livery
- Added IAF 909 livery
- Fixed minor mistake in Aggressor livery

F-35B
- Fixed minor regressions in 3D model (incorrect UVW) and redone minor details
- Changed taileron behavior during STOVL operation to better match the real aircraft

F-35C
- Tweaks to arrested landing and recovery dynamics to improve compatibility with third party carriers

1.2.1
04-Mar-23

GENERAL
- Fixed minor AO mistake in cockpit textures for -A and -C models
- Fixed minor formatting issue in HMD altitude digits
- Solved bug in anti-ice system causing incorrect behavior in AUTO and ON modes
- Solved bug causing incorrect PCD start conditions
- Replaced anti-collision effects with a much brighter one
- Reworked MENU->LITES interface so that console, indicator, formation and strobe lights can be dimmed.
- Reworked landing lights rendering
- Solved minor bug in TACAN bearing pointer indication on EFI page
- Solved minor issues in HUD altitude text formatting for smaller digits.
- Solved bug preventi FAB bar to display GCAS status correcty
- Draft implementation of GCAS system (OFF/Manual/AUTO) - when set to AUTO the plane will try and avoid ground collision
- Safety pins can now be reinstalled (by clicking on the left console blank banel)
- Draft implementation of In-flight refuel. While in-flight:
a) open refuel receptacle door/extend probe
b) click on the fuel quantity summary
c) keep the plane within 50ft and 10 kts from the initial condition
Note: refuel rate is dependent on refuel system
(about 5800lbs/min for A, 2500 lbs/min for B and C)
- Updated FUEL page layout

- Added DUMP Cutoff functionality
- ENGINE switch now linked to "mixture" control, can switch off the aircraft if set to OFF and throttle is retarded
- Minor tweaks to CHECKLIST page
- Minor tweaks to in-game checklists
- MFD now defaults to "Blank" configuration if powered off
- Optimization of VR collision mesh
- Improved GCAS symbology

F-35A
- Solved minor visual interference with landing gear structure and cockpit

F-35B
- Change Lift Fan door animation, angles and speed to better match the real one
- Fixed minor visual glitch in refuel probe geometry

F-35C
- Fixed minor visual glitch in refuel probe geometry

PC-ONLY
- Basic implementation of VSD functionality
- Fixed several bugs in TSD rendering
- Increased number of radar tracks to 42
- Added TSD target tracking capability (clicking on the center of the TSD screen will update the target)

1.2.0
31-Jan-23
GENERAL:
- Fixed minor AO issue on ejection seat models
- Removed unnecessary duplicate goemetry (Zeroize knob) from all cockpit models
- Cleanup of AITraffic settings
- Cleanup of unnecessary code
- General update of the product manual

SYSTEMS:
- Changed clock code to display 00:00:00 instead of 24:00:00
- Minor optimizations to clock code
- Increased autotrim reaction speed
- Reworked flap system
- TRIM RESET now resets trim on all axis, and toggles FCC if it is switched off
- FLAP LEVER now disables FCC and AUTOTRIM
- If FCC is running (and autotrim is active) the "AUTO" caption appears alongside the trim value
- FCS DEGRADED warning appear if airspeed is above 400 knots and user has disabled FCC
- Defog handle now controls canopy de-icing
- Rewritten Anti-Ice system (now implements Anti-Ice On-Auto-Off modes)
- Added Air Data System Heat (ADS HT) control to ENG page and implemented system simulation
- Tweaks to ENG page
- PHM and ICAWS now report FCS DEGRADED if FCC is switched off
- Fixed bug preventing Oxygent Test and BOS switches to be highlighter by the mouse
- Fixed minor text misalignment in FUEL page
- Cleanup of unnecessary code
- Fixed incorrect altitude variable in PCD HUD pages (page was reporting real altitude as opposed to indicated altitde)
- Fixed bug preventing wind direction from showing on PCD control bar
- Fixed bug preventing input of ALOW altitude in certain conditions
- Changed canopy control code so that it is now impossible to open the canopy if airspeed is above 50 kts
- Rewritten code for automatic speedbrake retraction during touch'n'go (speebrakes will retract if throttle is above 70% travel)
- Solved minor glitch on HUD page
- Added MACH HOLD AT functionality, Mach input capped at 1.60

- Added Backcourse option for AP (does not work too well)
- Fixed minor glitch in AP control interface if on right PCD side
- Autopilot has now default setting of 15000 ft, autothrottle has now a default settin to 400 kts
- Fixed minor bug preventing correct rendering of DAS imagery in some cases
- Added MAP mode to TSD screens
- Added VSD option to TSD screens (INOP, for future implementation)
- Improved interface and rendering of all imagery services
- Tweaked nose wheel steer settings

F-35A:
- Changed base color to multiple liveries for a better match with late Block3 and Block 4 colors
- Fixed reversed characters on landing gear door and other minor details in USAF livery 08-0747
- Fixed reversed characters on landing gear door and other minor details in Australian livery A35-040
- Clean up of F-35I prototype livery
- Updated Italian Air Force 6-01 livery
- Added Italian Air Force 32-13 livery (courtesy of Christoph Tantow)
- Added Royal Australian Air Force A35-001 livery 2nd OCU

F-35B:
- Changed base color to multiple liveries for a better match with late Block3 and Block 4 colors
- Fixed minor modeling and texturing misalignment in Lift-Fan door area
- Fixed minor modeling misalignment in roll post door location
- Fixed minor modeling errors in weapon bay harnessings
- Added U.S.M.C VMFA-242 "Bats" DT-01 livery
- Added U.S.M.C VMFA-242 "Bats" DT-02 livery
- Added Italian Air Force 32-14 livery
- Fixed incorrect AI configuration entry

F-35C:
- Changed nose cone color of VFA-147 and Top-Gun liveries and fixed minor other details
- Miscellaneous improvements to VFA-97 livery

XBOX:
- Fixed minor geometry issue in F-35A (IR sensor leftover from PC build)
- Fixed missing wheelchocks, ribbons and covers from F-35B
- Reduced video memory footprint for better stability

1.1.9
15-Jan-23
Internal evaluation build – not released to the public

1.1.8
11-Dec-22
- Fixed minor glitch in F-35B model geometry
- Minor adjustments to supersonic drag coefficients
- Adjusted waterline position
- Fixed minor mistakes in flight_model.cfg entries
- Minor optimization of FCS code
- Redone and optimized animation code of rudders, slats, tailerons and flaperons for higher frame rates and better multiplayer propagation
- Improved tires dynamics
- Tweaks to afteburner effect graphics
- Changed afterburner settings for a more gradual power curve
- Minor adjustment to engine covers (B only)
- Moved localization files to specific folders in preparation of SU11
- Removed unnecessary legacy variables
- Fixed bug preventing correct TACAN channel from displaying when in Y mode
- Fixed bug preventing user from changing TACAN mode unless new TACAN code was entered
- Fixed bug preventing correct tuning of TACAN channels 01X to 16Y
- Fixed bug preventing correct TACAN location to show on TSD in some instances
- Fixed bug preventing correct TACAN channel to show on HMD in some instances
- Added F-35C VFA-97 Warhawks Repaint

- Added F-35A 77Sqn Repaint (courtesy of Christoph Tantow)
- Added F-35B VMFAT-502 Repaint (courtesy of Christoph Tantow)
- Solved minor bug preventing user from selecting HUD on Portal in rare cases
- Corrected approach speed on PCD checklist
- Fly-by-wire control low changed to fly_by_wire_from_flaps =1
- Fixed minor bug in FCS page values
- Fixed bug causing trim control to be reversed if an analog controller was used
- Tweaked wheelchocks geometry
- AI sound aliased from stock F/A-18E on request of the users

1.1.7
13-Sep-22
- Fixed duplicate geometry issue causing flickering of the PCD in the C variant
- Minor optimization to XML code (unnecessary code removed)
- Improved accuracy of distance measurement for TACAN stations
- Improved identification of TACAN stations

1.1.6
12-Sep-22
- Fixed minor geometry issue on F-35A model
- Fixed bug preventing fly-by-wire from working if flight is started cold and dark
- Minor tweaks to FLT files
- FCS RESET button now resets trims and controls surfaces

1.1.5
11-Sep-22
- Minor tweaks to VMFA-225 livery
- Increased toe brakes effectiveness
- Tweaked differential braking
- Fixed HMD horizon (now -90 to +90 degrees, was -85 to +85)
- Fixed HMD waterline
- Added zenith/nadir symbols to HMD and EFIS
- Minor tweaks to drag coefficients at high Mach
- Minor adjustments to reference speeds
- Complete rework of flap dynamics, which should allow better behavior during landing and correct APP mode functionality
- Minor tweak to canopy AO for F-35B model
- Fixed minor gaps in external 3D models
- Added multiple brightness levels to HMD and PCD
- Improved HMD Off-boresight limits
- Solved minor glitch in FAB bar
- Corrected HYDA and HYDB captions on ENG page
- Changed engine sound samples
- Implemented sonic boom and Mach cone
- Redone Mapping and materials of B variant to solve a minor AO glitch
- Redone afterburner sound and visual effects
- Fixed BOS switch animation
- (Very) minor fix to lif fan door geometry
- Added LH/RH captions on canopy actuators on F-35B (previously missing)
- Minor graphical optimization of F-35B and C models
- Manual moved to Docs folder in the main package folder (as opposed to the SimObjects)

PC Only
- Fixed minor mistake in wheelchocks position for F-35B

1.1.4
28-Aug-22
INTERNAL BUILD – NO PUBLIC RELEASE

1.1.3
11-Aug-22
- Fixed incorrect fuel quantity on F-35C

- Fixed incorrect range for F-35C in UI
- Redone all thumbnails as wheelchocks were not compliant with Microsoft thumbnail policy
- Change parking entry from “ANY” to “MIL_COMBAT”
- Fixed conflict between “fuel and payload” menu and SMS page

PC ONLY:
- Fixed incorrect illumination of covers and streamers

10-Aug-22
- Fixed engine performance at high altitude for F-35A
- Minor tweaks to supersonic drag to the F-35A
- Fixed spelling error for Danish Air Force
- Removed HOVER / V/S HOLD SUBMODE (useless in MSFS and causing multiple problems with FBW)
- Minor tweak to HOVER logic to prevent non-zero target speed upon HOVER engagement
- Minor tweak to HOVER logic to prevent forward motion when performing vertical takeoff
- Modifications to autopilot code
- Redone all thumbnails and added "thumnail_small.jpg" where missing
- Added 58th FS livery courtesy of Christoph Tantow
- Added VMFA-225 livery courtesy of Christoph Tantow

PC only (non-marketplace version):
- Aircraft configuration can now be changed from the SMS page

XBox only:
- Increased resolution of fuselage normal and composite textures
- Increased resolution of the textures in some areas of the cockpit

1.1.1
1-Aug-22
- Fixed bug preventing TACAN bearing to show in some instances
- (PC only) Added "remove before flight" streamers and covers
- Modified autopilot logic for less erratic behavior with the new flight model
- Added Vermont ANG livery courtesy of Christoph Tantow
- (SU10 and above) HMD "Off-Boresight" symbology now must be selected by the user in the MENU functions.

1.1.0
25-Jul-22
- Fixed animation of F-35B Lift Fan
- Fixed animation of F-35B In-flight refuel probe
- Added missing USAF roundels to 495th FS livery
- Added missing USAF roundels to 356th FS livery
- Changed custom fonts from OTF to TTF due to NanoVG incompatibility in SU10 preview
- Draft implementation of full fly-by-wire/FCS flight model
- Draft implementation of off-boresight HMD symbology
- Changes to arrestor hook logic for better compatibility with moving carriers
- Draft implementation of TCAS / Air-to-air awareness (via WASM module):tracks are reported on TSD screens (PC only)
- Fixed animation glitch on F-35B nozzle
- Fixed bug causing incorrect toggling of autopilot modes on F-35 at approximately 20000 feet
- Improvement to afterburner self-illuminating textures
- Added VR stick entries (untested)

1.0.9
02-Jul-22
AUTOPILOT, CARRIER FUNCTIONALITY AND DRAGON LIVERY UPDATE

IMPORTANT!
Starting from this release, the key binding for HOOK/STOVL is changed to the TOGGLE TAIL HOOK LEVER command.
Also, in order to use the catapult launch functionality, in addition to extending the launch bar and setting the throttle to full military, you now have to apply brakes.

- solved minor bug causing incorrect button description in some MENU areas
- changed Autopilot Hold code so that multiple slots are ignored, so that the altitude hold should be more reliable now
- added autotrim function: autotrim is active when AP is not engaged and gear is up. Can be toggled with the TRIM button on the stick.
- added "dragon" aggressor livery, courtesy of Christoph Tantow
- slight increase to turn capability (all models)
- draft implementation of autopilot APProach mode
- it is now possible to input the AP vertical speed (although there seems to be a 3000 ft/min hardcoded limit)
- summary of AP status is reported on FAB (similarly to real aircraft)
- replaced APP HOLD with VS HOLD
- fixed range and ceiling values in aircraft selection UI
- changed "catapult launch" logic: it is now necessary to hold the brakes (along with extending the launch bar and incresing RPM) - releasing the brakes will start the launch
- changed "catapult launch" and "arrestor wire" logic, so this is now limited to altituded compatible with carrier decks
- changed arrestor hook configuration and logic to support “Top Gun” carriers
- restricted STOVL altitude for realism
- restored HMD default setting to "UNCAGED" following user feedback
- fixed bug preventing canopy effects to show on F-35A canopy
- fixed bug causing excessive icing effect on F-35C canopy
- change HOOK/STOVL proxy command to TOGGLE TAIL HOOK HANDLE
- added "RELEASE BRAKESFOR CATAPULT LAUNCH" caption to FCS page
- fixed minor glitch in full-page FCS mode

1.0.8
06-Jun-2022
HOTFIX
- Fixed Israeli 924 livery
- Fixed AI configuration issue preventing correct functionality of autopilot
- Removed heat blur effect from lift fan
- Engine sound volume furtherly increased
- Added steering arrow and deviation Scale to HUD (toggled by EFI CDI command)
- Fixed minor bug in PCD-HSI mode
- Changed 3BSM roll animation (now linked to yaw control, more accurately)
- Fixed minor polygon smoothing glitch in F-35A fuselage

1.0.7
03-Jun-2022
HOTFIX
- solved minor texturing glitch on F-35A cockpit
- solved minor texturing glitch on F-35C cockpit
- slight change to default sensor configuration
- sensor imagery now does not work on battery only (like IRL)

1.0.6
24-May-2022
QUALITY OF LIFE AND GRAPHICS UPDATE
- Fixed bug in PULL UP PCD cues
- Fixed minor mistake in PCD 3D model
- General graphics optimization for lower memory consumption
- Removed duplicated texture files
- Removed unnecessary files
- Removed outdated HUD/HMD code
- Replaced landing light with better LED light effect
- Increased luminosity of afterburner exhaust
- Solved minor bug while toggling full screen mode on Portal 2
- Draft implementation of DAS (downward camera only)
- Draft implementation of FLIR (via synthetic vision)
- Draft implementation of ASR terrain mapping function

- Added automatic retraction of speed brake at high AoA and changed RPM limit to 90% for automatic retraction
- Disabled usage of the F-35 model as AI traffic
- Fixed minor geometry error in control stick model
- Fixed minor mistake in PCD checklist
- Fixed bug that allowed launch bar, tailhook and wing fold operation with aircraft not powered
- Electrical power is now required for canopy movement, IFR probe extraction and weapon door operation
- Fixed bug preventing correct PCD operation if in SWAP mode and IFF pop-up was selected
- Fixed several typos in cockpit labels
- Added departure and destination waypoints in TSD screen
- Fixed bug preventing NAV SOURCE selection on Portal 3
- Added NAV SOURCE selection functionality also to TSD screens
- Fixed bug preventing Transpoder State to be correctly diplayed in identification menu
- Transpoder state can now be manually set in the identificaton menu
- Fixed bug preventing CDI needle to move correctly in EFIS page
- Fixed incorrect movement scale of CDI needle
- Fixed bug causing limited rudder pedal animation in some cases
- Added special effects from SU9 (wing vapor, low altitude, etc.)
- Added speed-brake deployment indication on HUD
- Fixed modeling bug preventing tail formation lights geometry to show
- Added 06-01 Italian Air Force livery
- Added F-35I Test Bed Israeli Air Force Livery
- Fixed minor mistakes in F-35C liveries
- More realistic drag versus Mach profile in the transonic region
- Tweaks to handling characteristics to limit max G forces and improve low speed handling and turn capability
- Tweaks to autoflap schedule for better maneuverability in certain circumstances
- Full intergration between external model and cockpit model (better cockpit detail in external views, and lower video memory footprint)
- Fixed minor glitch in FCS wing status symbology for C variant
- Changed surface deflection symbology on FCS page (now closer to reality)
- Minor geomerty and texture fixes to F-35B model
- Minor smoothing glitch fixed in A and B models
- Improved canopy glass material
- Fixed helmet visor animation bug
- Improved pilot textures
- Fixed animation glitch in steering mechanism (C-version)
- Integrated "Better Camera Mod" by Archer374
- Added camera-dependant visibility conditions to HMD to eliminate overlap with PCD
- Revised instrument overlay for external views
- HMD now defaults to "CAGED" mode
- Added arms and legs animations to pilot figure
- Pilot figure can now be toggled in cockpit by clicking the venting port
- Solved minor bug when toggling full screen mode
- Major optimization of cockpit collision mesh
- Fixed minor AO glitch in crew access ladder (C model)
- Added L: variables list to the manual, for reference of third party modders

1.0.4
20-Mar-2022
Minor update
- Restored Norwegian livery
- Temporarily removed polygons for video rendering (as they are causing issues with third party mods)
- Added HMD CAGE / UNCAGE functionality (in HUD page)
- Added option to turn off GCAS (and all ground proximity warnings)
- Solved minor bug in HUD/HMD XML script
- Reorganization of 3d model files
- Fixed bug preventing PULL UP cues to show on PCD in certain configurations
- Unified GCAS Warnings

1.0.3

14-Mar-2022
Systes upgrade
- Added missing functionality to the "new" HMD:
a) "dial" graphics for altitude and airspeed when gear is down
b) general rework of HMD graphics
c) improved STOVL symbology
d) improved compass symobology
e) improved naavigation symbology
f) added autopilot captions
g) added clock
h) added Master Arm and RAD status
i) added radio altimeter
j) added hours indication on Time To Steer on the HMD
k) added ground speed indication
- Fixed Time To Steer calculation bug
- Added basic support (Bearing and range) for pure TACAN stations
- Removed legacy tailhook and launch assistance entries
- Fixed missing polygons on the tip of the radar radome (external model only)
- Fixed animation issue of downwash effects in F-35B cockpit
- Fixed minor animation issue of F-35B Lift-Fan door in VC
- Fixed minor smoothing issue of F-35B Lift-Fan door in VC
- Fixed minor texturing and shadowing issue on F-35 wing roots area
- Fixed Incorrect color coding of TACAN radiosource in EFIS page
- Fixed minor animation issue of F-35B tailerons
- Added Koninklijke Luchtmacht F-001 special color
- Corrected position of PCD in all cockpit models, and redone AO accordingly
- Fixed minor glitch on FCS page braking captions

1.0.2 HOTFIX
31-Jan-2022
- Add-on repackaged (previous build had missing files and configurations)
- Minor improvement to tailhook logic
- Minor fix to FCS page (“HOOK” caption was overlapping other captions)
- IPP Cabin Pressurization knob now defaults to NORM

1.0.2
31-Jan-2022
GENERAL STABILITY UPDATE (NEW HMD), NEW REPAINTS AND MISCELLANEOUS FIXES/IMPROVEMENTS

- (Old HMD) Removed obsolete Javascript code for HUD collimation
- (Old HMD) Removed obsolete Javascript code for Flight Director functions
- (Old HMD) Removed unused Javascript code for Boeing FMA, ILS and Vertical Speed indicator
- (Old HMD) Improved symbology collimation
- NEW HMD: Entirely rewritten on the basis of the F/A-18E HUD from Asobo, with several improvements and customizations
- Changed engine sound samples and modified volume
- Added VMFA-314 livery for the F-35C (courtesy of Richard Luycx)
- Added VMFA-211 high and low viz liveries for F-35B (courtesy of Richard Luycx)
- Added VMFA-122 high and low viz liveries for F-35B (courtesy of Richard Luycx)
- Fixed texture mirroring issue on F-35B NLG Doors
- Fixed US roundel position on F-35C wings lower surfaces
- Fixed incorrect painting of air intakes inner surfaces (all models)
- Added different downwash effects (neutral, water and dust) for F-35B when in STOVL mode
- Improved Low Altitude warning logic
- Fixed incorrect material assignment in F-35C intakes (virtual cockpit only)
- Fixed visual hole in aircraft ground shadow (when viewed from the Virtual Cockpit)
- Added several sounds missing from the virtual cockpit (safety ribbons, ejection seat lever and some switches)
- Added "click" sound to PCD interaction for improved feedback
- Minor fix to ICAO codes and model names
- Reworked pilot visibility conditions (hopefully this shoudl work in multiplayer)

- Automatic speedbrake retraction if throttle is above 85%
- Automatic speedbrake extension during landing ground roll
- Added "radio noise" filtering to LSO voices
- Improved "Prandtl-Glauert" singularity visibility conditions
- Special Effects are now visible from the cockpit *

*** - NOTE: due to a glitch in the sim, if you change view when an effect is playing it may stick to "on" condition on the new view. Cycling views will typically fix the glitch.**

IMPORTANT – Due to several reports of random CTD issues, we have indentfied the HMD code to be a cause of potential instability on some systems. To fix the problem we have created a new HMD basing it on the Asobo SuperHornet code – however it is missing some functionalities of the "complete" version. The new HMD is the default, the old one can be re-activated by following the instructions at the end of the panel.cfg file in the F-35A panel folder. DO NOT ATTEMPT to change this is you are not familiar with .cfg file editing, although backup .cfgs are included.

1.0.1
14-Jan-2022
SYSTEMS UPDATE, THROTTLE FIX AND MISCELLANEOUS IMPROVEMENTS

- Added reference to Asobo Common behaviors to fix throttle issue introduced by 1.21.18.0
- Added missing lights on IPP control panel
- Added IPP BIT sequence (slightly shorter than IRL) and cooldown
- Fixed color of BINGO line on MFD (was while, is yellow IRL)
- Added missing IPP "BURN" indication on MFD
- Rectified trim symbology in FCS page
- Rectified wing fold symbology in FCS (for C model) and added aileron icons
- Rectified hook symbol in FCS page
- Rectified trim setting color in FCS page
- Fixed ICAO code for F-35B
- Changed ATC codes for all aircraft
- Fixed missing entries in F-35A and C engine models
- Fixed engine rating for F-35B
- Increased battery capacity for all variants
- Fixed mismatched mouse areas in COMMunications page if FAB is SWAPPED
- Fixed non working mouse areas in LITES page if FAB is SWAPPED
- Added trim readout
- Changed Wing Fold caption (now reads spread or fold, in reality they are separate commands)
- Added numerical reading on control surfaces on FCS page
- Added custom AI sound package

INITIAL RELEASE
03-Jan-2022

WELCOME

The F-35 Lightning II is an American family of single-seat, single-engine, all-weather stealth multirole combat aircraft that is intended to perform both air superiority and strike missions. It is also able to provide electronic warfare and intelligence, surveillance, and reconnaissance capabilities. The aircraft has three main variants: the conventional takeoff and landing (CTOL) F-35A, the short take-off and vertical-landing (STOVL) F-35B, and the carrier-based (CV/CATOBAR) F-35C.

The aircraft descends from the X-35, which in 2001 beat the X-32 to win the Joint Strike Fighter (JSF) program. Its development is principally funded by the United States, with additional funding from program partner countries from NATO and close U.S. allies, including the United Kingdom, Australia, Canada, Italy, Norway, Denmark, the Netherlands, and formerly Turkey. Several other countries have ordered, or are considering ordering, the aircraft.

The F-35B entered service with the U.S. Marine Corps in July 2015, followed by the U.S. Air Force F-35A in August 2016 and the U.S. Navy F-35C in February 2019. The F-35 was first used in combat in 2018 by the Israeli Air Force. The U.S. plans to buy 2,456 F-35s through 2044, which will represent the bulk of the crewed tactical airpower of the U.S. Air Force, Navy, and Marine Corps for several decades. The aircraft is projected to operate until 2070.

The scope of this package is to provide, within the limits of Microsoft Flight Simulator, a medium fidelity simulation of all the F-35 variants. Most systems and procedures have been implemented in an “as realistic as practical” fashion, on the basis of the publicly available information, while other systems are vastly simplified or not implemented at all, due to software limitations or missing information.

IMPORTANT! THIS PRODUCT IS NOT ENDORSED OR SUPPORTED BY THE REAL WORLD AIRCRAFT MANUFACTURER.

While we have tried to provide a reasonably realistic depiction of the F-35 and we have carefully studied all the publicly available information, the performance, operations and procedures shall be considered purely fictional and not representative of the performance of the real aircraft and its systems.

MINIMUM HARDWARE REQUIREMENTS

Due to the high-detail model and textures, we suggest to use the F-35 on systems that meet or exceed the following requirements:

CPU: 3.5GHz quad core processor or better
GPU: at least 6Gb dedicated memory, Nvidia 1060 or better recommended
RAM: 8.0Gb minimum
Hard Disk: 3.8Gb required for installation

INSTALLATION

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

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

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

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

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

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

Go to Options / General.

1.Click on "Developers" which you will find at the bottom of the list on the left.
2.Switch Developers Mode on.
3.On the Dev Menu select Tools / Virtual File System.
4.**The community folder location can be found under "Watched Bases"**

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

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

2. Rename the package folder from “indiafoxtecho-f35” to anything short and recognizeable such as “f35” or just “35”

3. Place the renamed package folder in the Community folder

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

HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\FileSystem

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

IMPORTANT NOTE ON THE FLIGHT MODEL

Please note that the F-35 flight model is designed to work with the new Flight Simulator flight model (Options->General->Flight Model->MODERN) . This is the default option for Microsoft Flight Simulator and it should be your setting unless you have changed it.

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

With the modern flight model, the F-35 should behave well and be quite stable and easy to fly within the regular flight envelope – although it may exhibit a some instability in extreme flight or weather conditions.

CREDITS

Alessandro Schimicci.....	Cockpit 3D modeling
Giuseppe Didiano.....	Flight model
Dino Cattaneo ….....	Development lead, 3D modeling, texturing, coding, Project management

STOVL code based on Rob Barendregt code for P3D / FSX.

The aircraft external models are partially based on 3D meshes by Camelot Inc. , licensed through TurboSquid

F-35 text description taken from Wikipedia.

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

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

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ABOUT THIS MANUAL

As the F-35 is still classified, this manual is the product of educated guess-work based on any publicly available information on the real-world aircraft. However this manual may not reflect the real-world aircraft flight manual, aircraft operation or procedures.
THIS MANUAL SHALL NOT BE CONSIDERED A SOURCE FOR REAL-WORLD INFOMATION OR OPERATION OF THE F-35 AIRCRAFT.

UPDATES

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

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...let alone the fact that the world of simulation communities is small, and we receive notifications of copyright infringements or reverse engineering attempts directly from our loyal fans very quickly.

LICENSE RESTRICTIONS

This F-35 rendition for Microsoft Flight Simulator is provided solely for non-professional use. Please contact IndiaFoxtEcho Visual Simulations for inquiries about professional applications.

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

SPECIAL CONTROLS

The F-35 package features a number of special controls and features. All of them can be completely controlled in the virtual cockpit with mouse interaction, however a couple of them have been mapped to unused standard controls of Flight Simulator, so that they can be associated to an arbitary control.

HOOK/STOVL BUTTON

The HOOK/STOVL BUTTON is located on the upper left part of the front panel. On the F-35A and C models this button controls the extraction / retraction of the tailhook (note: the F-35A is only equipped with an emergency tailhook which has no functionality in the sim).
On the F-35B, this button toggles the STOVL-mode conversion, provided that proper conditions are met (airspeed below 240 knots, limited bank and pitch)
This command is also associated to the **TOGGLE TAIL HOOK LEVER** command in Flight Simulator.

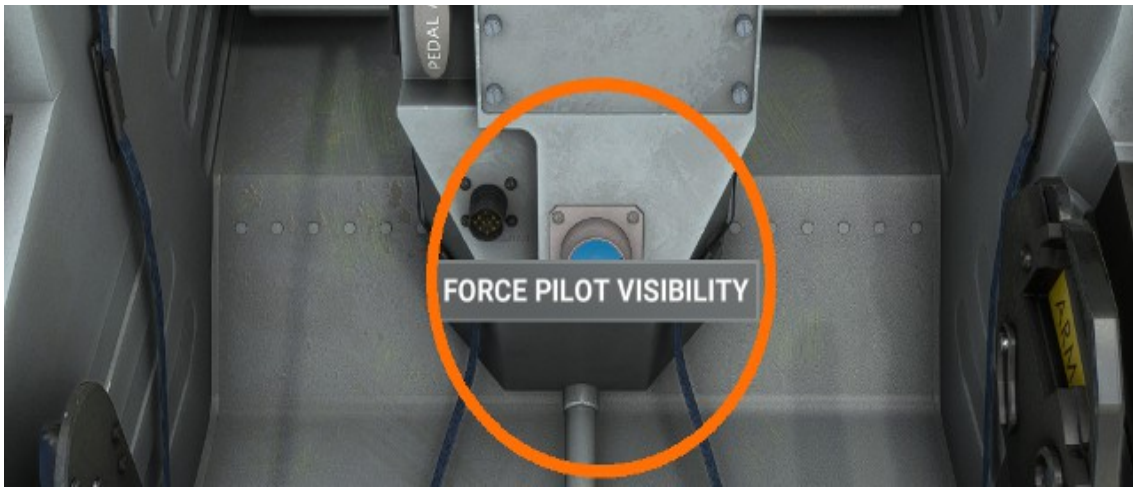
HOVER MODE
If the F-35 is in STOVL mode and the gross weight is below 40600 lbs, the aircraft can be switched to HOVER mode (see specific chapter on STOVL mode) by selecting the HOVER option in the FCS page.
This command is also associated to **AUTOPILOT HEADING HOLD** command in Flight Simulator.

EXTERNAL CODE

Several other features are controlled by L: (Local) variables, please see APPENDIX A for a list of the main variables employed by the F-35 (for use of third party modders).

PILOT FIGURE TOGGLE
It is possible to force the visibility of the pilot figure inside the cockpit. This feature is mostly meant for videomakers. To do this, the user must click on the venting port in the cockpit pedestal.

NOTE: starting for version 1.2.3, the first “click” on the designated area will activate the “Sleepy Hollow” mode, that is the pilot figure will be headless – this is mostly tought for VR users who profer this (at the expense of control accessibility). The second click witll show the entire figure and a further click will make the pilot figure disappear.



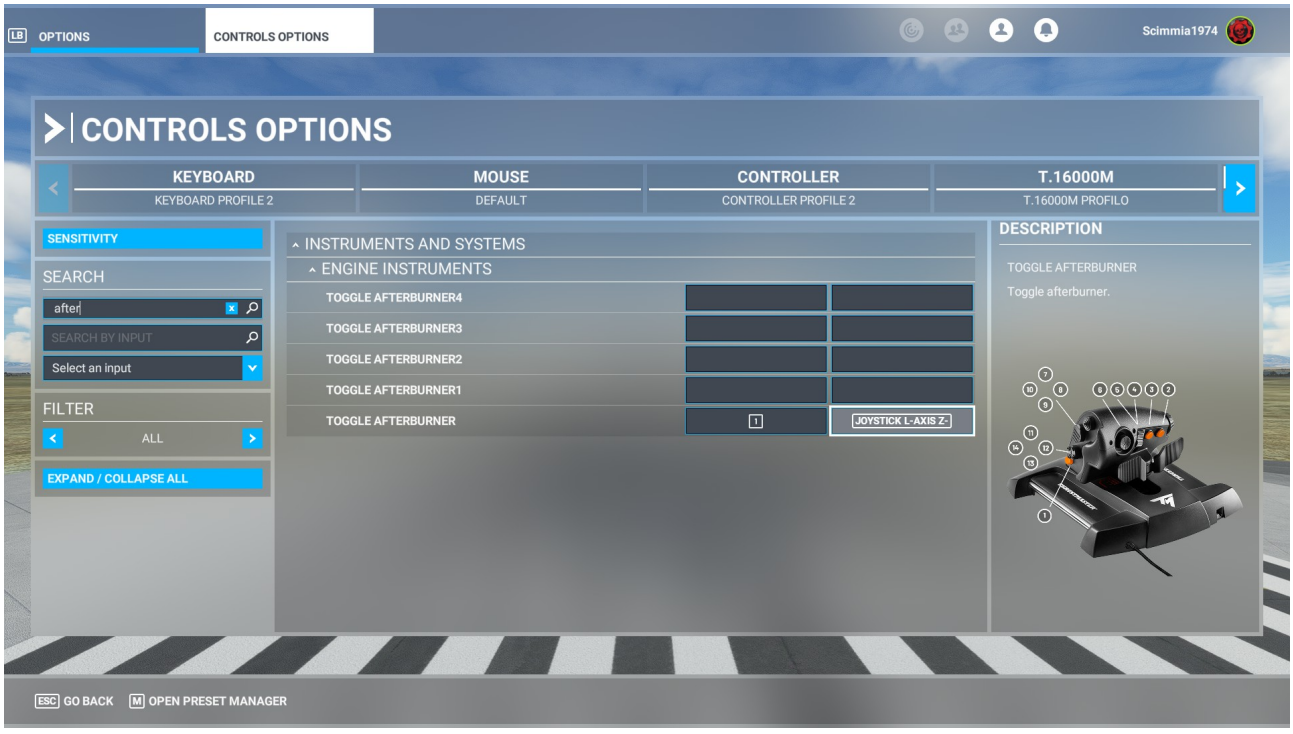
FLY-BY-WIRE TOGGLE

Following user feedback, we have allowed the user to disconnect the fly-by-wire system. This is commanded with the FLAP LEVER control: if the FLAP LEVER is in the RECTRACTED position the fly-by-wire (including auto-trim and G-limiter) is active – this is shown by the AUTO caption on the FCS page. Any other FLAP LEVER position willl disconnect the FBW – this is shown by the MAN caption on the FCS page.
See FLIGHT MODEL section for further details.

AFTERBURNER TOGGLE / DETENT

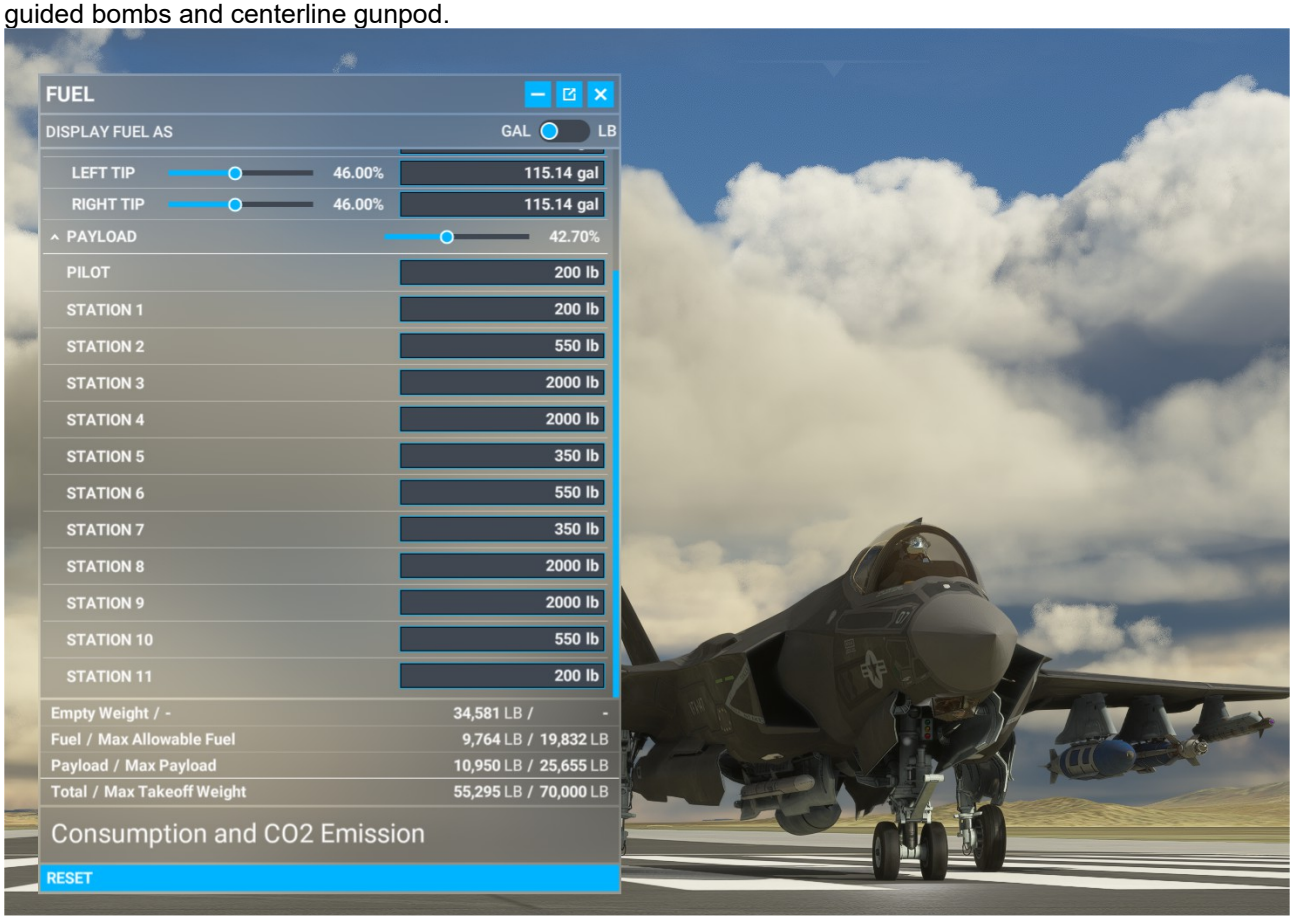
Starting from version 1.2.3, and following user feedback, this F-35 includes afterburner toggle/detent controls. This means that, much like the default F/A-18, the afterburner will not engage unless the pilot actively presses a specific “toggle” button – this is done in order to mimic the afterburner detent which is present in the real world throttle lever, and it is meant to prevent an inadvertent activation from the pilot. This control is not assigned in many control presets.so you may need to add it.

NOTE: if you do not wish to to have the afterburner toggle functionality, or you have a mechanical detent on your throttle, you can set the “TOGGLE AFTERBURNER” control to your throttle axis (as in the figure below) so that the TOGGLE is associate to throttle movement.



EXTERNAL LOADS

The external visual model includes inert air-to-air missiles (AIM-9X and AIM-120), GBU-12 and GBU-31 guided bombs and centerline gunpod.



IMPORTANT - The weapon models will only we available on copies purchased outside the Microsoft Marketplace, as weapons are not allowed on that platform.

To make weapons appear, you need to enter the proper weights in the FUEL AND PAYLOAD SECTION.

Weights are as follows:

200lbs for AIM-9X SIDEWINDER – only on STATION 1 and 11

350lbs for AIM-120 AMRAAM – only on STATION 5 and 7

550lbs for centerline gunpod – only on STATION 6, -B and -C models only

550lbs for GBU-12 laser guided bomb – on STATION 2,3,4,8,9 and 10

2000lbs for GBU-31 GPS guided bomb – on STATION 3 and 9 for all models, on STATION 2,4,8 and 10 for -A dn -C models

IMPORTANT – Typical weapon presets can be selected by clicking the center of the SMS page (only for non-Microsoft Marketplace copies).

THE F-35 LIGHTNING II

The F-35 Lightning II is a fifth-generation, single-seat, single-engine stealth multirole fighter that can perform close air support, tactical bombing, and air defense missions.
The F-35 has three different models: The F-35A is a Conventional Take-Off and Landing variant, the F-35B is a Short Take-Off and Vertical Landing variant, and the F-35C is a Carrier-based Variant.

F-35A, F-35B and F-35C flying in formation nearby Eglin AFB.

DESIGN OVERVIEW

The F-35 resembles a smaller, single-engine sibling of the twin-engine F-22 Raptor and drew elements from it. The exhaust duct design was inspired by the General Dynamics Model 200 design, proposed for a 1972 supersonic VTOL fighter requirement for the Sea Control Ship. Although several experimental designs have been developed since the 1960s, such as the unsuccessful Rockwell XFV-12, the F-35B is to be the first operational supersonic, STOVL stealth fighter.

Some improvements over fourth-generation fighter aircraft are:

- Durable, low-maintenance stealth technology, using structural fiber mat instead of the high-maintenance coatings of legacy stealth platforms
- Integrated avionics and sensor fusion that combine information from off- and onboard sensors to increase the pilot's situational awareness and improve target identification and weapon delivery, and to relay information quickly to other command and control (C2) nodes
- High speed data networking including IEEE 1394b and Fiber Channel
- The Autonomic Logistics Global Sustainment (ALGS), Autonomic Logistics, Information System (ALIS) and Computerized Maintenance Management System, (CMMS) are to help ensure aircraft uptime with minimal maintenance manpower

- Electro-hydrostatic actuators run by a power-by-wire flight-control system
- A modern and updated flight simulator, which may be used for a greater fraction of pilot training in order to reduce the costly flight hours of the actual aircraft.

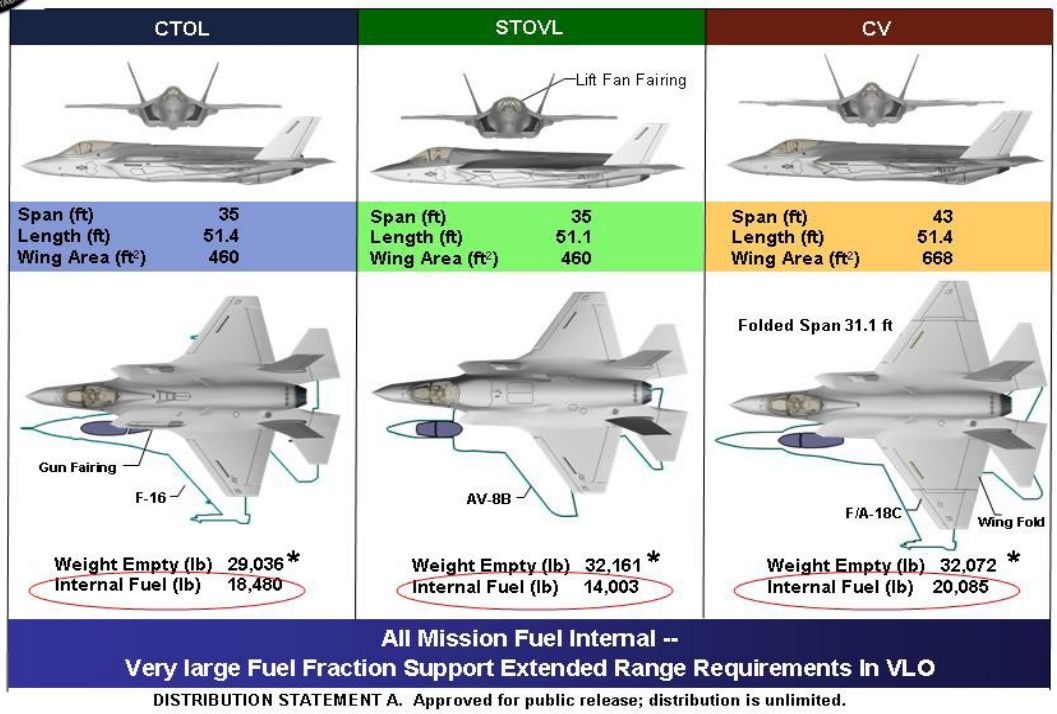
The F-35 will be the first mass produced aircraft to include structural nanocomposites, namely carbon nanotube reinforced epoxy.

F-35 VARIANTS

The real F-35 is planned to be built in three different versions to suit the needs of its various users. The F-35A is the Conventional Take-Off and Landing (CTOL) variant, the F-35B is the Short Take-Off and Vertical Landing (STOVL) variant, and the F-35C is the CATapult Launch But ARrested Landing (CATOBAR) version for U.S. Navy carriers.

Differences between variants

	F-35A CTOL	F-35B STOVL	F-35C CATOBAR
Length	50.5 ft (15.4 m)	50.5 ft (15.4 m)	50.8 ft (15.5 m)
Wingspan	35 ft (10.7 m)	35 ft (10.7 m)	43 ft (13.1 m)
Wing Area	460 ft² (42.7m²)	460 ft² (42.7 m²)	668 ft² (62.1 m²)
Empty weight	29,098 lb (13,199kg)	32,300 lb (14,700 kg)	34,800 lb (15,800 kg)
Internal fuel	18,498 lb (8,390kg)	13,326 lb (6,045 kg)	19,624 lb (8,900 kg)
Max takeoff weight	70,000 lb class (31,800 kg)	60,000 lb class (27,300 kg)	70,000 lb class (31,800 kg)
Range	1,200 nmi (2,220 km)	900 nmi (1,670 km)	1,400 nmi (2,520 km)
Combat radius on internal fuel	613 nmi (1,135 km)	469 nmi (845 km)	610 nmi (1,130 km)
Thrust/weight			
• full fuel:	0.87	0.90	0.75
• 50% fuel:	1.07	1.04	0.91



F-35A
The CTOL variant is intended for the US Air Force and other air forces. It is the smallest, lightest F-35 version and it is the only variant equipped with an internal cannon, the GAU-22/A. The F-35A is expected to match the F-16 in maneuverability, instantaneous and sustained high-g performance, and outperform it in stealth, payload, range on internal fuel, avionics, operational effectiveness, supportability and survivability. It also has an internal laser designator and infrared sensors, equivalent with the Sniper XR pod carried by the F-16, but built in to remain stealthy.
The A variant is primarily intended to replace the USAF's F-16 Fighting Falcon, beginning in 2013, and the A-10 Thunderbolt II starting in 2028.

F-35A, the Conventional Take-Off and Landing version (CTOL) in flight

The CTOL version can be easily recognized by the absence of the big fan door of the STOVL version and by the presence of the gun on the port side of the fuselage and by the retractable refuel receptacle.

The peculiar characteristics of the -A version are:

- It is the lightest and the fastest version
- It is the only version to feature an internal gun
- It is the only version equipped with a refuel receptacle instead of a probe
- In this version, pressing the “HOOK/STOVL” button in the cockpit extends an emergency tail hook.

F-35B

Similar in size to the A variant, the B sacrifices some fuel volume to make room for the vertical flight system. Takeoffs and landing with vertical flight systems are by far the riskiest, and in the end, a decisive factor in design. Like the AV-8B Harrier II, the B's guns will be carried in a ventral pod. Whereas F-35A is stressed to 9 g, the F-35B is stressed to 7 g. Unlike the other variants, the F-35B has no landing hook; the "STOVL/HOOK" button in the cockpit initiates conversion instead of dropping the hook.
The British Royal Air Force and Royal Navy plan to use this variant to replace their Harrier GR7/GR9s. The United States Marine Corps intends to purchase 340 F-35Bs to replace all current inventories of the F/A-18 Hornet (A, B, C and D models), and AV-8B Harrier II in the fighter, and attack roles.
One of the British requirements was that the F-35B design should have a Ship-borne Rolling and Vertical Landing (SRVL) mode so that wing lift could be added to powered lift to increase the maximum landing weight of carried weapons. The U.S.Marine Corps are investigating the use of the SRVL method to operate F-35Bs from CVNs without disrupting carrier operations as the landing method uses the same pattern of approach as wire arrested landings. However, the aircraft is able to "bring back" 2 x 1K JDAM, 2 x AIM-120 and reserve fuel to a vertical landing.

F-35B performing a vertical landing

The Short Take Off and Vertical Landing version can be easily recognized, in normal flight, by the shape of the fuselage which hosts the Lift-Fan system.
The peculiar characteristics of the -B version are:

– It is the only version capable of STOVL and it is the only operational supersonic, stealth STOVL aircraft in the world. It can hover, land or take-off vertically if its gross weight is below 40,600lbs.

– The internal weapons bay is smaller than the other versions to make room for the lift-fan engine, therefore some weapons cannot be mounted in the internal bay.

– Weapon carriage on outermost wing pylons is limited to 1,500lbs to reduce the airframe stress and extend its life.

– This version is equipped with a refuel probe.

– In this version, pressing the “HOOK/STOVL” button in the cockpit activates the conversion to STOVL mode. See the specific manual section for STOVL mode controls.

F-35C

The F-35C carrier variant has a larger, folding wing and larger control surfaces for improved low-speed control, and stronger landing gear and hook for the stresses of carrier landings. The larger wing area allows for decreased landing speed, increased range and payload, with twice the range on internal fuel compared with the F/A-18C Hornet, achieving much the same goal as the heavier F/A-18E/F Super Hornet.
The United States Navy and the United States Marine Corps will be the sole users for the carrier variant. The first production F-35C was rolled out on July 29, 2009.

F-35C in preparing for a catapult-assisted take-off from a USS Nimitz-class carrier

The F-35C is the CATOBAR version and can be easily recognized by the much larger, foldable wing and bigger control surfaces and by the different nose landing gear, with two wheels and a launch bar for catapult assisted take off. Also, the tail hook is much bigger than the one of the F-35A.

The peculiar characteristics of the -C version are:

– It is the heaviest, and slowest version, but it is also the version with the longest range

– It has a much larger wing allowing for lower approach speed and it is equipped with spoilers for better low-speed maneuverability.

– The wing can be folded to save space on the carrier deck

– It has a more robust landing gear to tolerate the stress of naval operations

– Like the F-35B this version is equipped with a refuel probe.
– Pressing the “HOOK/STOVL” button in the cockpit extends the tail hook for carrier landings.

– The LBAR button on the MFD/FCS page extends/retracts the launch bar.

– The WINGS button on the MFD/FCS page fold/unfolds the wings.

ENGINE

The F-35 is powered by a Pratt & Whitney F135 a mixed-flow afterburning turbofan derived from the F119 engine with a new fan and LP turbine.
There are 3 F135 variants with the -400 being similar to the -100, the major difference being the use of salt-corrosion resistant materials. The STOVL F-35B is outfitted with a Lift System composed of a lift fan, drive shaft, two roll posts and a "Three Bearing Swivel Module" (3BSM). The 3BSM is a thrust vectoring nozzle which allows the main engine exhaust to be deflected downward at the tail of the aircraft. The lift fan is near the front of the aircraft and provides a counterbalancing thrust using two counter-rotating blisks. It is powered by the engine's low-pressure (LP) turbine via a drive shaft and gearbox.
During slow flight most of the bypass flow is ducted to the wing nozzles, known as roll posts. Some is used for cooling the rear exhaust nozzle. At the same time an auxiliary inlet is opened on top of the aircraft to provide additional air to the engine with low distortion during the hover. The lift fan is driven from the LP turbine through a shaft extension on the front of the LP rotor and a clutch.
The engine is operating as a separate flow turbofan with a higher bypass ratio. The power to drive the fan (about 30,000 SHP) is obtained from the LP turbine by increasing the hot nozzle area.
Improving engine reliability and ease of maintenance is a major objective for the F135. The engine has fewer parts than similar engines which should improve reliability. All Line Replaceable Components (LRCs) can be removed and replaced with a set of six common hand tools.

Specifications (F135-PW-100)

General characteristics

Type: afterburning turbofan
Length: 220 in (559 cm)
Diameter: 46 in (120 cm) max., 43 in (110 cm) fan inlet
Dry weight: 3,750 lb (1,700 kg)

Components

Compressor: 3-stage fan, 6-stage high-pressure compressor
Combustors: annular combustor
Turbine: 1-stage high-pressure turbine, 1-stage low-pressure turbine

Performance

Maximum thrust: 43,000 lbf (190 kN) max., 28,000 lbf (125 kN) intermediate
Overall pressure ratio: 28:1 overall pressure ratio
Specific fuel consumption: 0.886 lb/hr·lbf or 25.0 g/kN·s (dry)
Thrust-to-weight ratio: 7.47:1 (dry), 11.467:1 (wet/afterburning)

Specifications (F135-PW-600 for F-35B)

General characteristics:
Type: Afterburning Turbofan with shaft driven remote lift fan
Length: 369 in (937.3 cm)
Diameter: 46 in (116.8 cm) maximum, 43 in (109.2 cm) fan inlet, 53 in (134.6 cm) lift fan inlet

Components

Compressor: 3 stage fan, 6 stage high-pressure compressor, 2 stage, contra-rotating, shaft driven lift fan
Combustors: annular combustor
Turbine: Single stage high pressure turbine, 2-stage low pressure turbine

Performance

Maximum thrust: 41,000 lbf (182.38 kN) max, 27,000 lbf (120.1 kN) intermediate
Overall pressure ratio: 28:1 overall pressure ratio (conventional), 29:1 overall pressure ratio (powered lift),
Specific fuel consumption: ~0.886 lb/(hr·lbf) or ~25,0 g/kN·s (w/o afterburner)

INTEGRATED POWER PACKAGE

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.

SENSORS AND AVIONICS

NOTE – DUE TO MICROSOFT FLIGHT SIMULATOR LIMITATIONS THE MISSION SYSTEMS AND SENSORS ARE NOT SIMULATED IN THIS RENDITION. IN DETAIL, RADAR, EOTS, DAS, TWR AND ECM ARE NOT OPERATIONAL IN THE SIM.
THE FOLLOWING PARAGRAPHS ARE PROVIDED FOR GENEAL INFORMATION ONLY.

The F-35's sensor and communications suite has situational awareness, command and control and network-centric warfare capabilities. The main sensor on board is the AN/APG-81 Active electronically scanned array-radar, designed by Northrop Grumman Electronic Systems. It is augmented by the nose-mounted Electro-Optical Targeting System (EOTS) that provides the capabilities of an externally mounted Sniper Advanced Targeting Pod with a reduced radar cross-section. The AN/ASQ-239 (Barracuda) system is an improved version of the F-22's AN/ALR-94 electronic warfare suite, providing sensor fusion of Radio frequency and Infrared tracking functions, advanced radar warning receiver including geolocation targeting of threats, multispectral image countermeasures for self-defense against missiles, situational awareness and electronic surveillance, employing 10 radio frequency antennae embedded into the edges of the wing and tail. In September 2015, the "Advanced EOTS" was unveiled. It offers short-wave infrared, high-definition television, infrared marker, and superior image detector resolution capabilities. Offered for the Block 4 configuration, it fits into the same area as the baseline EOTS with minimal changes while preserving stealth features.
Six additional passive infrared sensors are distributed over the aircraft as part of Northrop Grumman's electro-optical AN/AAQ-37 Distributed Aperture System (DAS), which acts as a missile warning system, reports missile launch locations, detects and tracks approaching aircraft spherically around the F-35, and replaces traditional night vision devices. All DAS functions are performed simultaneously, in every direction, at all times. The electronic warfare systems are designed by BAE Systems and include Northrop Grumman components. Functions such as the Electro-Optical Targeting System and the electronic warfare system are not usually integrated on fighters. The F-35's DAS is so sensitive, it reportedly detected the launch of an air-to-air missile in a training exercise from 1,200 mi (1,900 km) away, which in combat would give away the location of an enemy aircraft even if it had a very low radar cross-section.

The communications, navigation and identification (CNI) suite is designed by Northrop Grumman and includes the Multifunction Advanced Data Link (MADL), as one of a half dozen different physical links. The F-35 will be the first fighter with sensor fusion that combines radio frequency and IR tracking for continuous all-direction target detection and identification which is shared via MADL to other platforms without compromising low observability. The non-encrypted Link 16 is also included for communication with legacy systems. The F-35 has been designed with synergy between sensors as a specific requirement, the aircraft's "senses" being expected to provide a more cohesive picture of the battlespace around it and be available for use in any possible way and combination with one another; for example, the AN/APG-81 multi-mode radar also acts as a part of the electronic warfare system.

Much of the F-35's software is written in C and C++ due to programmer availability, Ada83 code also is reused from the F-22. The Integrity DO-178B real-time operating system (RTOS) from Green Hills Software runs on COTS Freescale PowerPC processors.
The electronic warfare and electro-optical systems are intended to detect and scan aircraft, allowing engagement or evasion of a hostile aircraft prior to being detected.

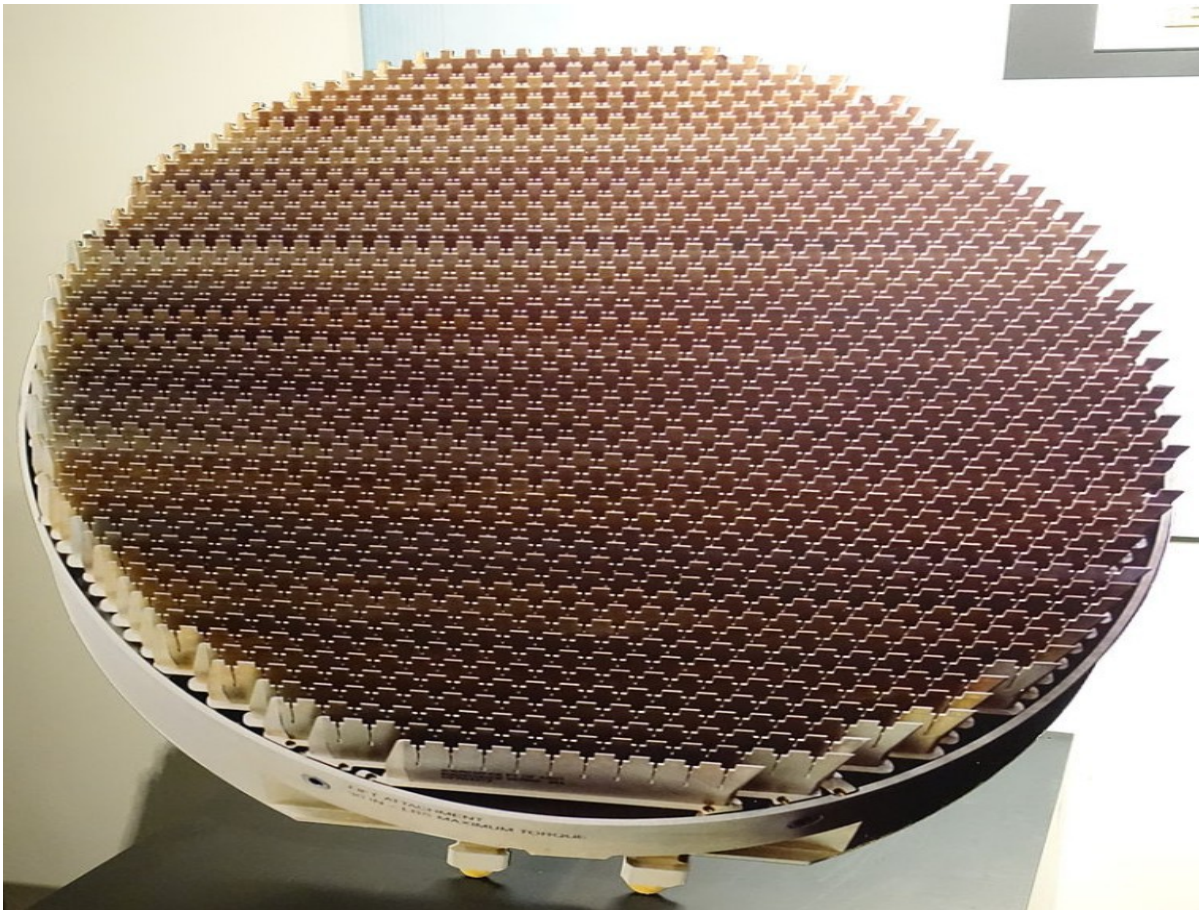
AN/APG-81 AESA RADAR

The F-35 is equipped with the AN/APG-81 Active Electronically Scanned Array (AESA) radar system designed by Northrop Grumman Electronic Systems.

The Joint Strike Fighter AN/APG-81 AESA radar is a result of the US government's competition for the world's largest AESA acquisition contract. Westinghouse Electronic Systems (acquired by Northrop Grumman in 1996) and Hughes Aircraft (acquired by Raytheon in 1997) received contracts for the development of the Multifunction Integrated RF System/Multifunction Array (MIRFS/MFA) in February 1996. he AN/APG-81 is a successor radar to the F-22's AN/APG-77. Over three thousand AN/APG-81 AESA radars are expected to be ordered for the F-35, with production to run beyond 2035, and including large quantities of international orders. As of October 2013, over one hundred APG-81s have already been produced and delivered. The first three blocks of radar software have been developed, flight tested, and delivered ahead of schedule by the Northrop Grumman Corporation. Capabilities of the AN/APG-81 include the AN/APG-77's air-to-air modes, plus advanced air-to-ground modes, including high resolution mapping, multiple ground moving target indication and track, combat identification, electronic warfare, and ultra- high bandwidth communications. The current F-22 production radar is the APG-77v1, which draws heavily on APG-81 hardware and software for its advanced air-to-ground capabilities.

A demonstration of the AN/APG-81 capabilities can be seen here:

https://www.youtube.com/watch?v=wIwAOupjMeM



AN/AAQ-37 DISTRIBUTED APERTURE SYSTEM

The AN/AAQ-37 electro-optical Distributed Aperture System (DAS) is the first of a new generation of sensor systems being fielded on the F-35 Lightning II Joint Strike Fighter. DAS consists of six high resolution Infrared sensors mounted around the F-35 airframe in such a way as to provide unobstructed spherical (4π steradian) coverage and functions around the aircraft without any pilot input or aiming required.

The DAS provides three basic categories of functions in every direction simultaneously:

- Missile detection and tracking (including launch point detection and countermeasure cueing)

- Aircraft detection and tracking (Situational awareness IRST & air-to-air weapons cueing)

- Imagery for cockpit displays and pilot night vision (imagery displayed onto the helmet mounted display)

The F-35's DAS was flown in military operational exercises in 2011 and has also demonstrated the ability to detect and track ballistic missiles to ranges exceeding 800 miles (1300 kilometers) and has also demonstrated the ability to detect and track multiple small suborbital rockets simultaneously in flight.

A demonstration of the DAS system can be seen here:

https://www.youtube.com/watch?v=e1NrFZddihQ

ELECTRO-OPTICAL TARGETING SYSTEM (EOTS)

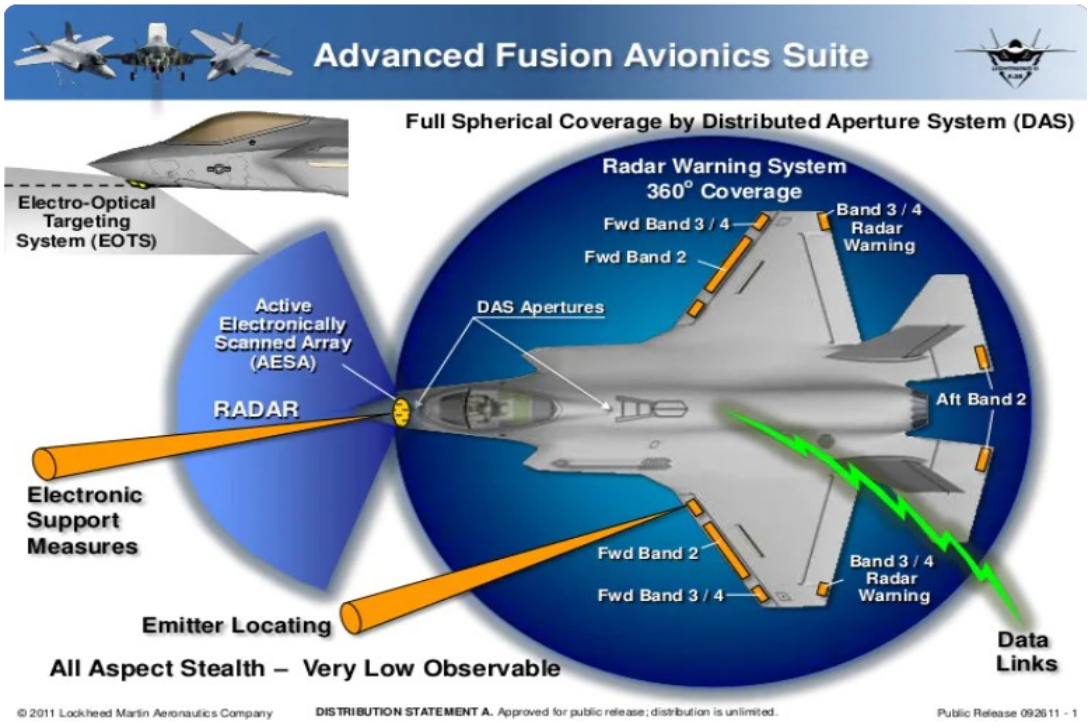
The Electro-Optical Targeting System (EOTS) for the F-35 Lightning II is an affordable, high-performance, lightweight, multi-function system that provides precision air-to-air and air-to-surface targeting capability. The low-drag, stealthy EOTS is integrated into the F-35 Lightning II's fuselage with a durable sapphire window and is linked to the aircraft's integrated central computer through a high-speed fiber-optic interface. Advanced EOTS, an evolutionary electro-optical targeting system, is available for the F-35's Block 4 development. Designed to replace EOTS, Advanced EOTS incorporates a wide range of enhancements and upgrades, including short-wave infrared, high-definition television, an infrared marker and improved image detector resolution.

A demonstration of the EOTS system can be seen here:

https://www.youtube.com/watch?v=vZ0nwQ4wO2s

SENSOR FUSION

A key feature of 5th generation fighters is sensor/information fusion: information coming from different subsystems (Radar, Radar Warning Systems, EOTS, DAS and datalink) is collected, compared and integrated in a single intuitive battlespace depiction in the Tactical Situation Display, providing the pilot with unparalled situational awareness. The F-35 can also easily share this information with other assets.



FLIGHT CONTROL SYSTEM

The F-35 FCS uses Electro-Hydrostatic Actuation System (EHAS) to power its primary and secondary flight control surfaces. This is a departure from predecessor legacy combat aircraft powered by hydraulics. The conventional system design was reliable and had a mature design concept, but it added substantial weight and volume and drove the hydraulics system's sizing and redundancy.
The FCS architectures are largely common for all three F-35 variants for the primary control of horizontal tails, flaperons, rudders, and leading edge flaps. However, the F-35A and F-35C variants also incorporate horizontal tail centering actuators, and the F-35C variant also incorporates conventional hydraulically powered ailerons.

IMPORTANT NOTES FOR THE SIMULATION:

FLAPS – Flaps are completely computer controlled. In the simulation, flap will deploy automatically during takeoff (half) and landing (full) depeding on speed and landing gear status. They will also deploy automatically during maneuvering at any time in which they will provide an advantage to the aircraft maneuvarability and handling.

AUTO-TRIM – The real aircraft has an auto-trim functionality, so that trim action is not required by the pilot. In the simulated version, following feedback from the testers, the autotrim feature was disabled from the initial release. The aircraft will react to pilot flap inputs in MSFS, but will almost immediately revert to the scheduled position.

VIRTUAL SPEED BRAKED – The aircraft does not have dedicate speed-braking surfaces. When pilot commands speed brakes to deploy, control surfaces are actuated in a way to maximize drag – therefore provide a braking effect.

AUTOMATIC LIFT DUMP – The real-world aicraft has an automatic lift dump function, so that, after touchdown, control surfaces are actuated to minimize lift and braking distance. This feature is not present in the initial release of the simulated aircraft.

REALISM AND SIMULATION FIDELITY – LIST OF KNOWN INACCURACIES

While we tried our best to provide a reasonable simulation fidelity and a level of realism that we hope can be considered acceptable for most users, this package is a very simplified simulation of the F-35.
Much of the information about this aircraft is classified including actual flight envelope and precise information on avionics.
On the other hand, there is also a lot of information publicly available – and there are more pictures, articles, pilot reports, and YouTube videos than you would think, and we advise you to check them out for very interesting information about this fantastic flying machine.

We tried to achieve a reasonable compromise between realism, educated guess-work, usability in a home-computer simulation environment and development time and resources.

It is not perfect, but we hope that the complexity and the quality will be satisfactory for most users. Here is a short list of some of the most outstanding inaccuracies and shortcomings of the package:

• Multi-function display – some pages of the MFD are quite accurate, at least if compared to the latest screenshots and training videos. Still, several pages are either INOP or incomplete – mostly because MSFS does not support specific sensors or functions. Also, in the real F-35 the TSD screen can zoom and pan to specific locations.

• Radar and sensor fusion – one of the most amazing feature of the F-35 is its radar and the ability to merge the information coming from a wide variety of sources in order to provide the pilot an unprecedented situational awareness. Unfortunately, we did not have the skill and resources to mimic this in the simulation.

Anyway, with all the inaccuracies of this package, we have good reasons to believe that this is the most realistic and complete rendition of the Lightning II ever seen in a home environment and we hope it provides an acceptable rendition of what it is like to fly what is most likely THE most advanced fighter in the world today.

Please find below a list of Youtube videos that have been used as source material for the development of this project and may be an useful introduction to the aircraft. Please note that these videos reflect different versions of the real-world software.

PRIMARY CONTROL DISPLAY OVERVIEW AND OPERATION:

https://www.youtube.com/watch?v=1oyCzT6sB_4

PRIMARY CONTROL DISPLAY OPERATION, AA AND AG MODES:

https://www.youtube.com/watch?v=5lPZDc8mzsY

F-35 SIMULATOR

https://www.youtube.com/watch?v=mmC7sJUDCqw

F-35 SIMULATOR

https://www.youtube.com/watch?v=vGU3noa1PEU

F-35 WALKAROUND

https://www.youtube.com/watch?v=4QpFUvBIqkY

F-35 WALKAROUND

https://www.youtube.com/watch?v=FolbyrJFNaE

FLIGHT SIMULATOR FLIGHT MODEL

This F-35 rendition for Microsoft Flight Simulator features a flight model which is based on all of the publicly released performance data released either by official or unofficial but very reputable sources, however, as of today, the performance manual of the aircraft is classified.

The three variants have slightly different flight models which reflect the differences in the real-world counterparts.

The implementation is fly-by-wire, non-CFD enabled MSFS “Modern” flight model. This means that the flight control system is governed by MSFS/Asobo fly-by-wire system: while features some customizations and tweaks, it is still affected by some minor bugs.

FLY-BY-WIRE SETTINGS:

The fly-by-wire control law is set to **fly_by_wire_from_flaps** = 0. This means that the fly-by-wire will be in load factor hold mode above 50ft AGL and in direct mode below 50ft AGL. Note that this causes an abrupt change in the control laws at 50ft AGL, which may be annoying to some users during landing as the load factor hold mode is less sensible to stick movement.

This control scheme implements an “always on” auto-trim – however we have allowed the user to disable the fly-by-wire controls if if this is preferred in some phases of flight: this is commanded by the FLAPS LEVER control:

- if the FLAP LEVER is in the RECTRACTED position the fly-by-wire (including auto-trim and G-limiter) is active (this is shown by the AUTO caption on the FCS page).

- any other FLAP LEVER position willl disconnect the FBW (this is shown by the MAN caption on the FCS page).

NOTE: disabling the FBW if the indicated air speed is above 400 kts will toggle the FCS DEGRADED caution message, as it is possible to exceed the structural limits of the aircraft.

NOTE: after disconnecting the FBW, the auto-trim will continue working for a couple of seconds.

KNOWN FLY-BY-WIRE ISSUES

The MSFS fly-by-wire implementation is quite robust and provides good controllability in most cases. However there are a couple of bugs which may be affect the user experience. These are extremely rare cases and very unlikely to happen unless the plane is actively driven to extreme conditions.

- Extremely high AoA issues: forcing the plane into extremely high AoA conditions can lock the flaperons and the tailerons into an high-AoA condition. If this happens pilot should maneuver the plane to increase airspeed and reduce the AoA (possibly even with a half barrel roll).

- Roll bias issues: after exiting extreme roll maneuvers coupled with asymmetric high AoA conditions on the wings, may result in biasing the roll control (plane tends to roll left or right). This is usually solved by either resetting the FCS.

- Control law change: since the flight control laws switch at 50ft AGL, trying to maneuver the plane at extremely low altitudes may result in an abrupt change of maneuverability which can be dangerous in some cases.

STOVL / HOVER MODE FLIGHT MODEL

The STOVL-hover flight model is custom coded on top of the conventional flight model. In its current implementation, the code is written in XML which is limited to 18 frames-per-second: this causes micro-stutters to some flight model variables (e.g. the flight path marker). See the **SPECIAL INSTRUCTIONS FOR STOVL OPERATIONS** chapter for more details.

COCKPIT

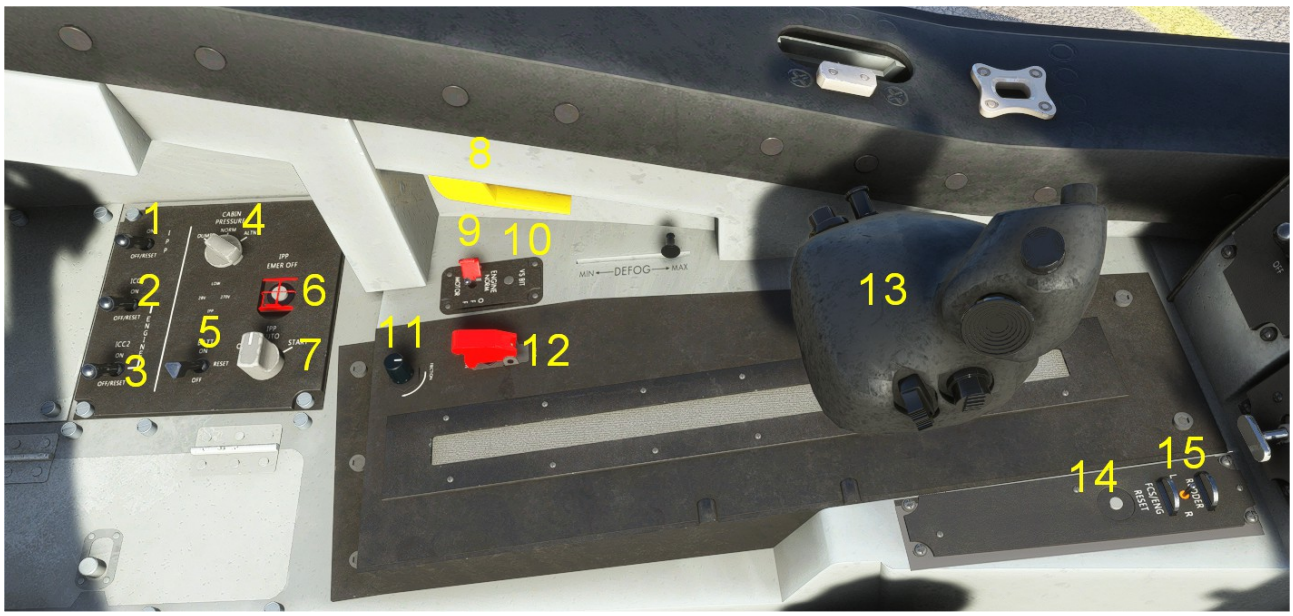
The F-35 features a full-panel-width "Panoramic Cockpit Display" (PCD) glass cockpit, with dimensions of 20 by 8 inches (50 by 20 centimeters).

A cockpit speech-recognition system (Direct Voice Input) provided by Adacel is planned to improve the pilot's ability to operate the aircraft over the current-generation interface.
The F-35 will be the first US operational fixed-wing aircraft to use this system, although similar systems have been used in AV-8B and trialed in previous US jets, particularly the F-16 VISTA. In development the system has been integrated by Adacel Systems Inc. with the speech recognition module supplied by SRI International. The pilot flies the aircraft by means of a right-hand side stick and left-hand throttle.

A helmet-mounted display system (HMDS) is fitted to all models of the F-35. While some fighters have offered HMDS along with a head up display (HUD), this will be the first time in several decades that a front-line tactical jet fighter has been designed to not carry a HUD.
Most of the pilot interaction happen through the multifunction display touch-screen, although, for safety and procedural reasons, several physical switches still exist.

The Martin-Baker US16E ejection seat is used in all F-35 variants. The US16E seat design balances major performance requirements, including safe-terrain-clearance limits, pilot-load limits, and pilot size. It uses a twin-catapult system that is housed in side rails.
The following pictures provide an overview of the cockpit left-to-right.

COCKPIT GENERAL VIEW – cockpit layout is identical for -A, -B and -C variants.
The geometry of -B variant cockpit is slightly different, with poorer backward visibility,
to make room for the Lift-Fan system intake.



Cockpit, left side – This area of the cockpit hosts most of the physical switches, which cover basic functions like IPP controls and engine start / stop functions. These switches are rarely operated during normal flight.

1 – Integrated Power Package (IPP) Master Switch

2 – Inverter/Controller/Converter 1 (ICC1) Switch

3 - Inverter/Controller/Converter 2 (ICC2) Switch

4 – Cabin pressurization control knob

5 – Battery Switch

6 – IPP EMERGENCY OFF pushbutton

7 – Engine Starter

8 – Canopy control lever

9 – Engine/Motor Switch – *NOTE: acts as ignition switch in MSFS*

10 – V/S BIT Pushbutton – *NOTE: INOP in the initial release*

11 – Throttle Friction knob – *NOTE: No function in MSFS*

12 – Throttle Active Switch - *NOTE: No function in MSFS*

13 – HOTAS Throttle (nicknamed “cow pie”)

14 – FCS RESET Button – *NOTE: No function in MSFS*

15 – Rudder Trim Switch

Cockpit, front – The cockpit is dominated by the Panoramic Cockpit Display (PCD). The PCD is the core instrument to interact with the aircraft. It is divided to 5 areas: a top Function Access Buttons (which continuously displays critical information and provides quick-access buttons to core information and four vertical "portals". Each portal can be configured to show one of the twenty-one functional screens (called "pages") along with two sub-portals, or can be maximized to occupy a full quarter of the screen or furtherly enlarged to occupy half screen.

16 – Emergency Jettison Control – *NOTE: No function in MSFS*

17 – Remaining Parking Brake Applications

18 – Parking Brake Switch

19 – HOOK/STOVL Button (extends arrestor hook on F-35A and -C version, engages STOVL mode in F-35B, provided that proper conditions are met)

20 – Landing Gear Lever

21– Emergency Landing Gear Extension Button (guarded)

22 – Landing Light Switch

23 – Panoramic Cockpit Display

24 – Head Mounted Display (HMD) brightness control – NOTE: in MSFS allows toggles between two brightness levels, total brightness depends on the HMD mode selector.

25 – HMD mode selector – *NOTE: if set to AUTO brightness will automatically change at night*

26 – HMD video brightness control - *NOTE: No function in MSFS*

27 – HMD video contrast control - *NOTE: No function in MSFS*

28 – Panoramic Cockpit Display (PCD) day / night mode selector.

29 – PCD brightness control – NOTE: in MSFS allows toggles between two brightness levels, total brightness depends on the HMD mode selector

30 – COM A Tuning Knob

31 – COM B Tuning Knob

32 – COM C / Backup Radio Tuning Knob

33 – MASTER ARM

34 – Backup Flight Instrument (BFI)

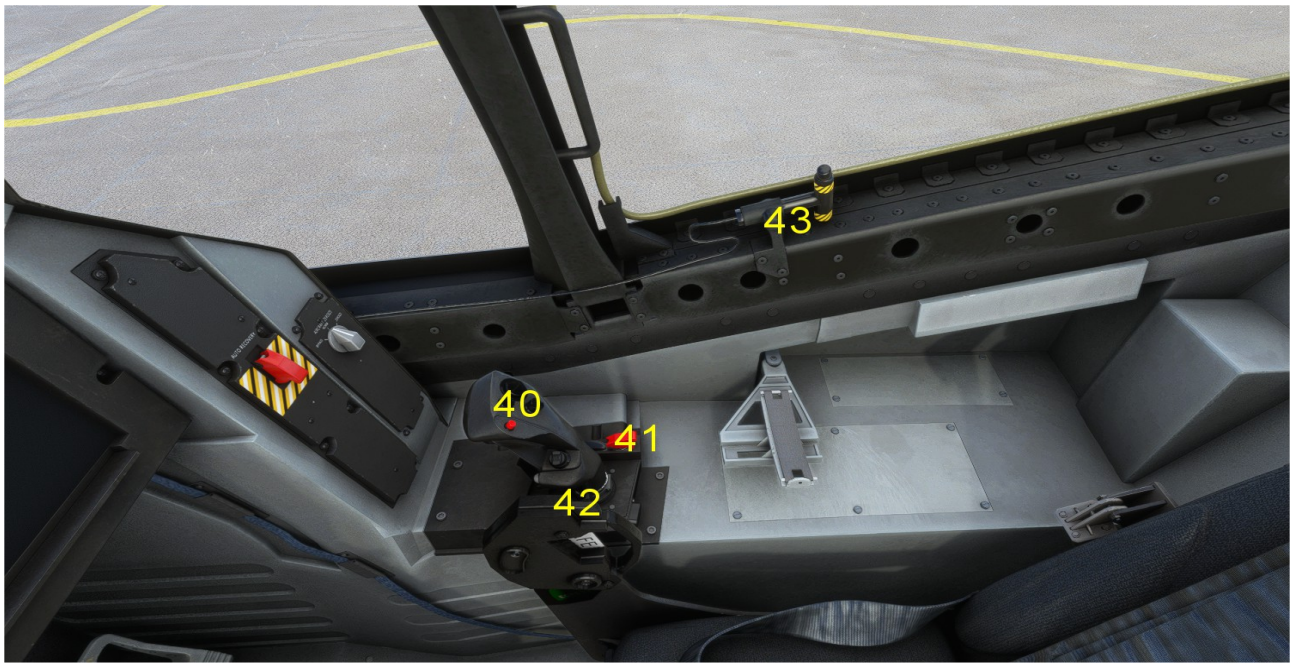
35 – BFI ALIGN button - *NOTE: No function in MSFS*

36 – BFI brightness

37 – BFI barometric setting

38 – AUTO RECOVERY switch

39 – Aircraft zeroize selector



Cockpit, right – The right side of the cockpit hosts only the main control stick and its arm rest.

40 – HOTAS Control Stick

41 – Control Stick Active switch - *NOTE: No function in MSFS*

42 – Ejection seat SAFE/ARM control - *NOTE: Requires removal of safety pin to be operated*

43 –Canopy Mild Detonating Cord (MDC) control - *NOTE: No function in MSFS*

PANORAMIC COCKPIT DISPLAY

The core of the F-35 pilot interface is a 20 by 8 inches (50 by 20 centimeters) multifunction touchscreen display. The display layout can be extensively customized by the pilot.
The vast majority of the aircraft functions can be accessed, controlled, configured and monitored via the multifunction display. In the real aircraft, multifunction display can be operated via touchscreen, cursor hooking or voice commands. In this rendition, only touchscreen (via mouse clicking) is supported.

The multi-function display is divided to five areas. An upper control bar called FAB (Function Access Buttons) and four, interchangeable and customizable sections called **portals.**

The FAB provides a summary of the most important information and quick access to some aircraft functions and systems, through “POP UP” versions of the relevant portal (namely, left to right ENG, FUEL, SMS, FCS, ICAWS, Autopilot, Communications, Navigation, Additional MENU screen, Identification and Barometric/GCAS settings).

Each portal is furtherly divided into three parts. A main window, called **main portal**, and two small windows, **called sub-portals.**

Every main portal and every sub-portal can be assigned individually to any of the 21 functions (“pages”) of the display. Therefore, each portal can host three functions at any given time. Pages are selected from a grid in a specific page called **MENU**.

COLOR CODING

Information in the PCD is color coded as follows:

CYAN- active / TACAN pointer in EFIS screen

WHITE- on / selected

RED - threat or warning

YELLOW - unknown or caution

GREEN - friendly or advisory / ROUTE pointer in EFIS screen

MAGENTA- off board navigation / VOR pointer in EFIS screen

GREY- info box / unavailable function

LIGHT PURPLE- fuel

FUNCTION ACCESS BUTTONS

The FAB provides a summary of critical aircraft systems status, as well as quick access to the a “POP UP” version of some of the MFD pages. POP UP portal versions are identified by a magenta POP UP indication on the upper left corner. To make the POP UP window disappear, and make the portal return to its original page, user can either click the upper left corner of the portal, or click on the relevant portion of the FAB.

From left to right, the upper FAB is divided as follows:

1 - ENGINE area – RPM and throttle settings are displayed - NOTE: when afterburner is engaged, this area is surrounded by a yellow/black striped box.

2 - FUEL area – reports aircraft gross weight, total, internal and external fuel. The fuel quantity is also displayed with light purple rectangles, with white bars indicating the JOKER and BINGO values.

3 – WEAPON STATUS – MRM, SRM, GUN and Bombs quantities are shown – NO FUNCTION IN MSFS

4 – FLIGHT CONTROL SYSTEM – three green lights indicate that landing gear is down and locked. Clicking in this area will bring the FCS– POP UP page on the portal immediately

5- ICAWS (Integrated Caution, Advisory and Warning System) area – the left part indicates specific conditions that may require pilot attention while the right side indicates general warning and caution status. Clicking in this area will bring the FCS– ICAWS page.

6 - AUTOPILOT area – This indicates weather the autopilot and auto-throttle are currently engaged. Clicking in this area will bring the AUTOPILOT – POP UP page on the portal immediately below the click area.

7 - SWAP button – clicking this button will swap the left and right sides of the top bar. The status of the portals will not be changed.

8 – COMMUNICATIONS - This area reports status of COM A, COM B and COM C radios. Clicking on this area will invoke the COMMUNICATIONS pop-up portal

The VIDEO RECORDER button is inoperative.

9 – NAVIGATION - This area reports the current NAVIGATION SOURCE (Nav source): RTE (GPS Route), VOR or TACAN - Clicking on this area will invoke the NAVIGATION pop-up portal.

10 - MENU button – Clicking in this area will make an additional MENU page to appear. This page allows the pilot to access a number of additional functions such as lights control (LITES)

11 – IDENTIFICATION - This area reports the current IFF Transponder codes - clicking on this area will invoke the IDENTIFICATION pop-up portal

12 – BARO / CABIN PRESSURIZATION / GCAS / ALOW - This area reports the current Barometric setting, cabin pressurization information, Ground Collision Avoidance System (GCAS) status and ALOW (Altitude Low Warning) setting - clicking on this area will allow the pilot to set BARO and ALOW values

13 – ZULU/LOCAL TIME / WIND DIRECTION AND SPEED – This area reports the current time, along with the wind direction and speed information. Clicking on this area will toggle time indication between ZULU and Local.

PORTALS AND PAGES CONTROL

Each portal is identical and interchangeable with the other three and is controlled in the same way. The picture below shows a typical layout with the portal control areas highlighted:

1 - Clicking on the upper left corner of the portal will invoke the MENU page, unless the portal is displaying a pop-up function. In that case, the pop-up page will disappear and the portal will be restored to its previous status. This area shows the title of the page and the current master mode.

2 - Clicking on one sub-portal (or its tab if the portal is maximized) will swap the functions of the sub-portal and the main portal. If the sub-portal had no function assigned, the MENU screen will be shown and the pilot shall select the page he or she wants to assign.

3 - Clicking on the “DOWN” arrow in a portal, will cause the main portal to maximize and sub-portals to collapse to tabs.

4 - Clicking on the “UP” arrow in a maximized portal will restore the sub-portals to its normal size.

5 - Clicking on the “LEFT” or “RIGHT” arrows will cause the current page to be expanded to occupy two portals, while sub-portals are collapsed to tabs. NOTE: at the moment of initial release, only the following pages can be maximized to full screen: EFI, FUEL, FCS, ENG, HUD, TSD1, TSD2, TSD 3.

PORTALS MENU

Clicking on the top-left corner of each portal invokes a MENU page that allows the pilot to select the function of each portal.

Available pages are:

ASR> Air-to-Surface Radar (starting from version 1.0.6 – draft implementation)

CHKLST> Checklist

CNI> Communications Navigation and Identification (Inoperative in MSFS – CNI functions are accessed by the FAB)

DAS> Distributed Aperture System (starting from version 1.0.6 – draft implementation)

DIM> Data and Information Management page (Inoperative in MSFS)

EFI> Electronic Flight Instrumentation

ENG> Engine

FCS> Flight Control System

FUEL> Fuel page

HUD> Head-Up Display

ICAWS> Integrated Caution, Advisory and Warning System

PHM> Prognostics and Health Management

SMS> Stores Management System

SRCH> Search page (Inoperative in MSFS)

TFLIR> Targeting Forward Looking Infra-Red (starting from version 1.0.6 – draft implementation)

TSD-1> Tactical Situation Display 1

TSD-2> Tactical Situation Display 2

TSD-3> Tactical Situation Display 3

TWD> Threat Warning Display (Inoperative in MSFS)

WPN-A> Air to Air weapons (Inoperative in MSFS)

WPN-S> Air to Surface weapons (Inoperative in MSFS)

Aircraft master modes are:

NAV – Navigation

A-A – Air to Air

A-S – Air to Surface

ASR – AIR TO SURFACE RADAR

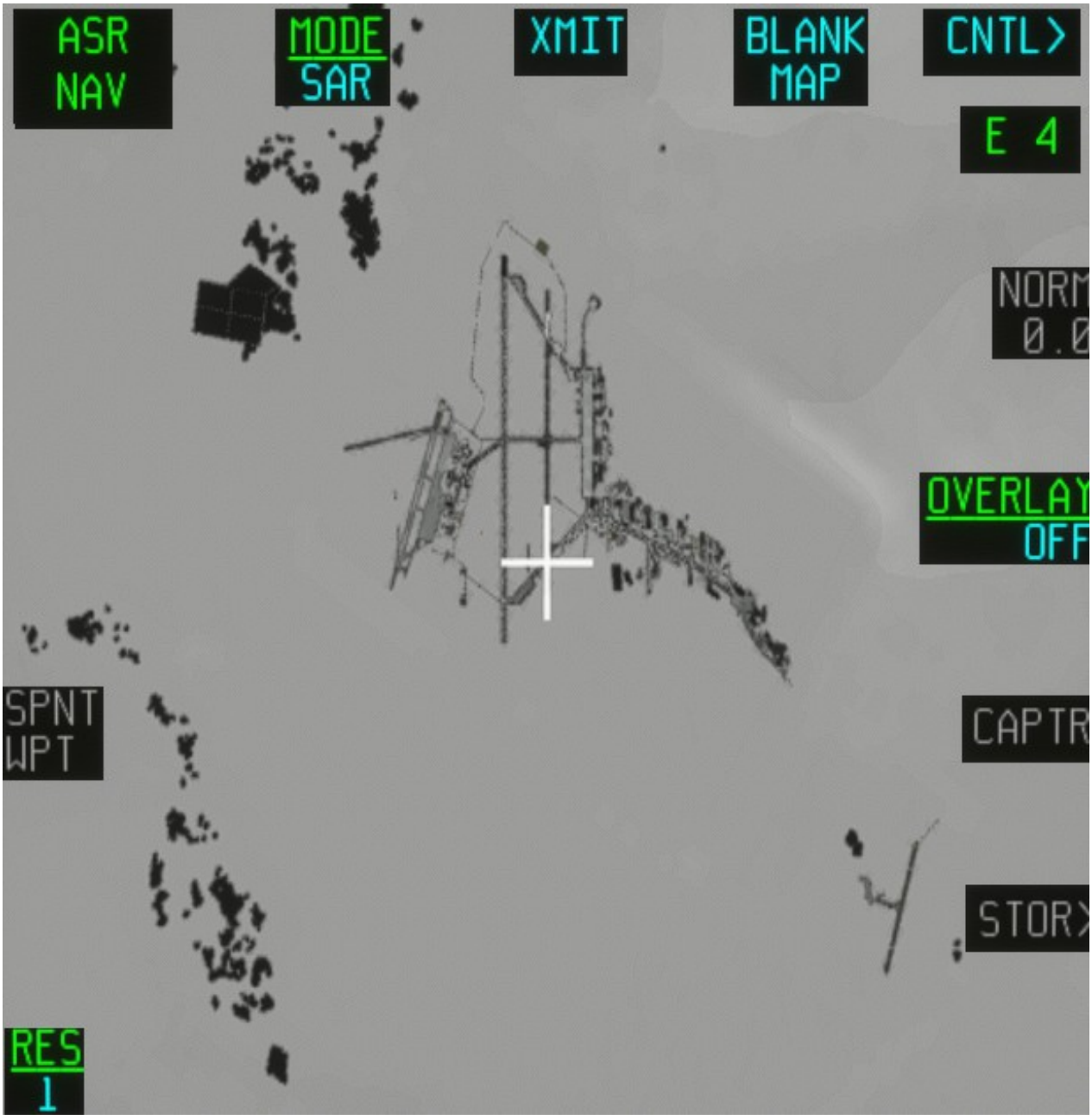
In the real aircraft this page is used to operate the air-to-surface radar functionalities, including mapping, image generation, target identification and designation.

These functionalities are currently not supported by Microsoft Flight Simulator. In this simulation, the synthetic imagery service is used to generate a greyscale imagery of the surrounding areas of the aircraft that mimics the appearance of the real-world page.
Note that the synthetic imagery system represents only terrain altitude and some ground polygons (such as airports) – so structures, buildings, vehicles and ships are not portrayed in the sim.

In order to get a valid image, a minimum of 5000 ft AGL is required.

Scrolling the mouse wheel over the “RES” caption, allows the user to select different zoom levels.

Nav source can also be controlled from this page by clicking on the CNTL> area.



CKLST – Checklist

In the real aircraft this page will show the normal and emergency checklists.
The rendition in the simulation shows only basic checklists for normal operation and the page interface has been vastly revised from the real one. Also checklists are generic and for the most part fictional (since the real-world checklists are still classfied) but based on the ones of comparable real-world aircrafts.
The user can select the desired checklists from the menu on the left side.

Detailed in-game checklists are also provided and are accessible from the checklist menu.

DAS – DIGITAL APERTURE SYSTEM

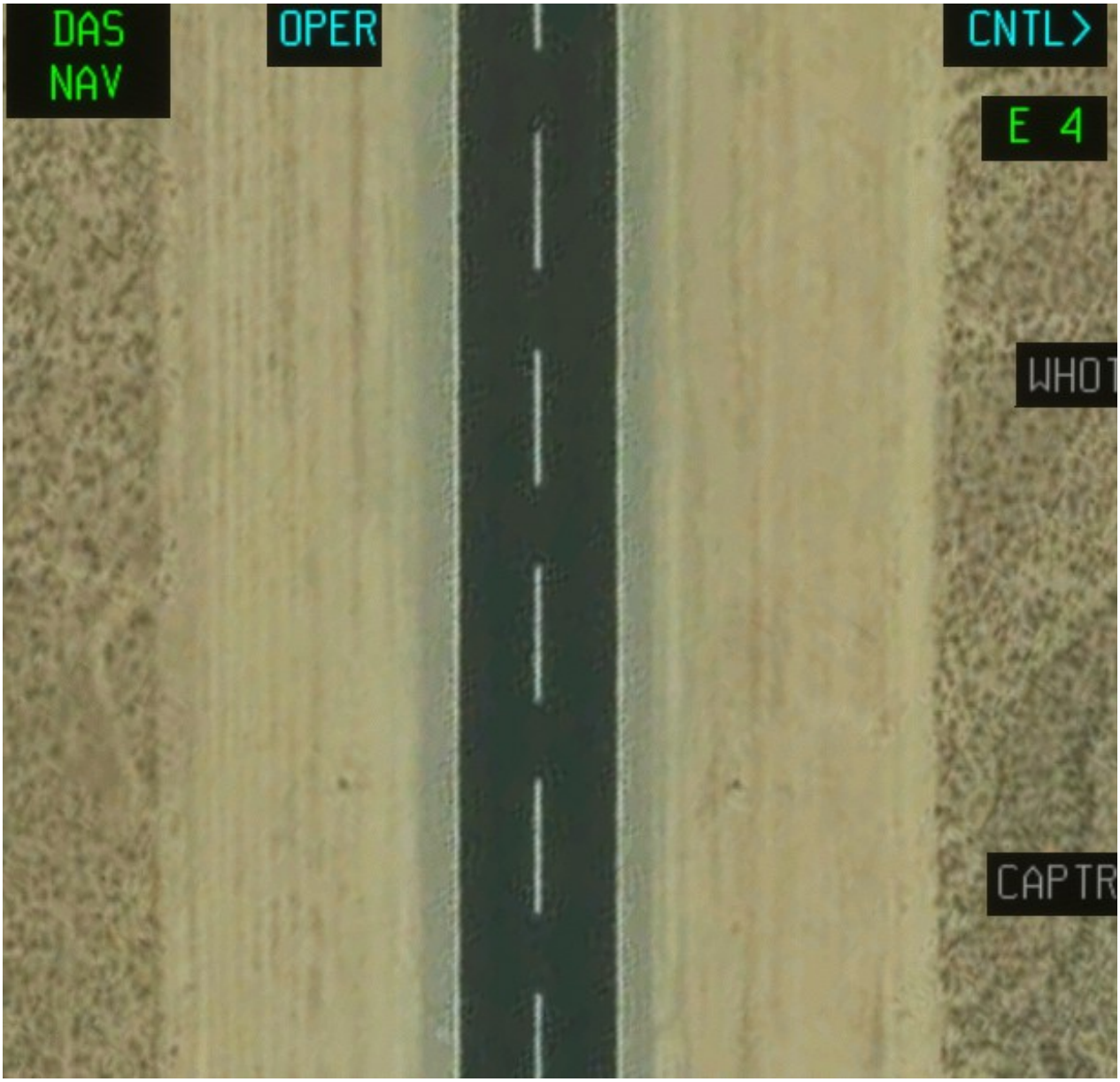
In the real aircraft this page is used to operate the AN/AAQ-37 Electro-optical Distributed Aperture System (DAS), or DAS.
In the real aircraft, DAS consists of six high-resolution infrared sensors mounted around the F-35's airframe in such a way as to provide unobstructed spherical (4π steradian) coverage and functions around the aircraft without any pilot input or aiming required.
The DAS provides three basic categories of functions in every direction simultaneously:

- Missile detection and tracking (including launch point detection and countermeasure cueing)
- Aircraft detection and tracking (situational awareness IRST and air-to-air weapons cueing)
- Imagery for cockpit displays and pilot night vision (imagery displayed onto the helmet mounted display)

These functionalities are currently not supported by Microsoft Flight Simulator. In this simulation, the synthetic imagery service is used to generate a Bing Map image below the aircraft in a way that mimics the appearance of the page in the real aircraft.

Scrolling the mouse wheel over the center of the image, allows the user to adjust the camera pitch angle.

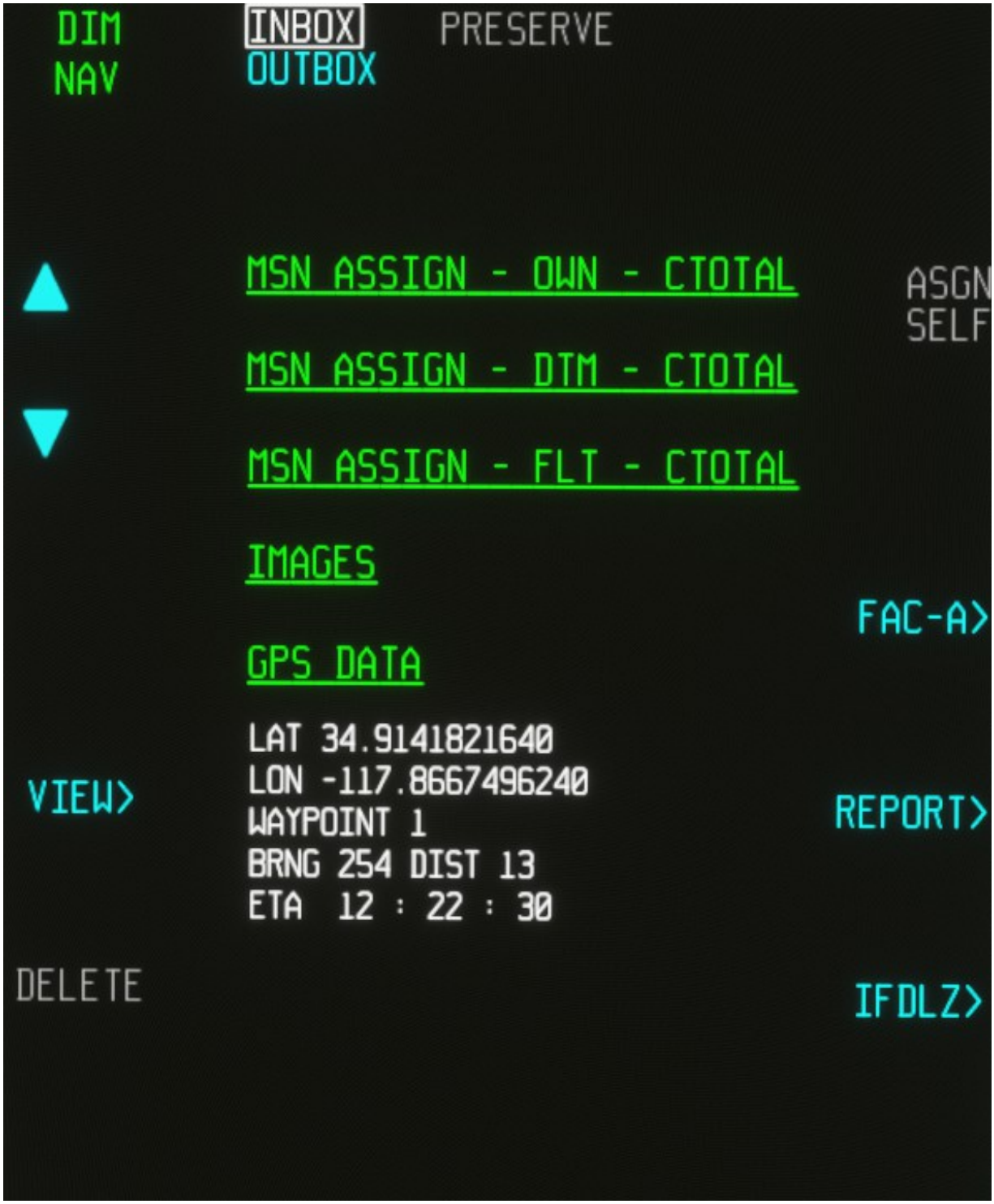
Nav source can also be controlled from this page by clicking on the CNTL> area.



DIM - Data and Information Management page

In the real aircraft this page is used to generate, send and receive data, including tactical information, images and videos – for example, an image acquired by the ASR can be sent to another F-35 or other allied assets.

These functionalities are not available in Microsoft Flight Simulation and, while the page closely mimics the real-world one, it only shows current GPS data along with basic flight plan information.



EFI – Electronic Flight Instrumentation

This page will show a quite complete Electronic Flight Instrumentation page, including Attitude and Direction Indicator and Horizontal Situation Indicator.
The layout of the page changes if the page is not maximized: if the page is maximized the ADI occupies the upper part of the portal, while a partial HSI is shown in the lower part; if the page is not maximized, the pilot can select either the ADI or the HSI views. Note that if the portal is maximized and then minimized, the selection will be preserved.

In this page, the navigation source / navaids data is displayed with the following color convention:

GREEN – RTE (GPS route) – will only be displayed if a flight plan is loaded.

CYAN – TACAN – will only be displayed if a TACAN station is currently tuned.

MAGENTA – VOR – will only be displayed if a VOR station is currently tuned.

NOTE: When shown in a sub-portal, the page will always display basic ADI information regardless of the current selection.

In this page the pilot can:

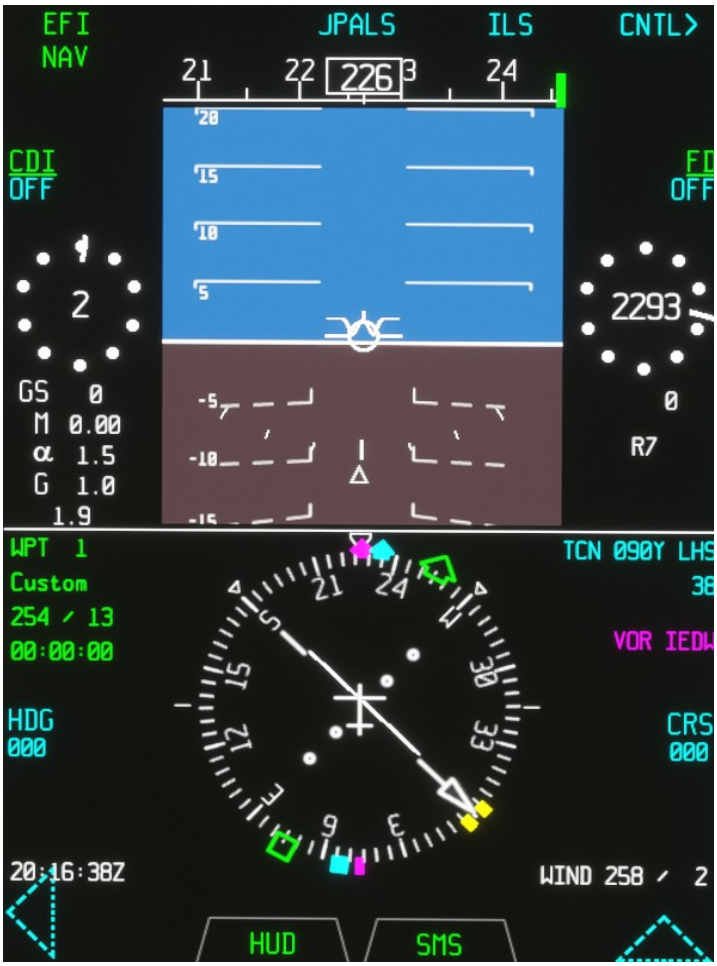
– Switch ADI and HSI views if the portal is not maximized

– Select HEADING and CouRSe angles, by clicking on their respective areas

– Toggle the Course Deviation Indicator (CDI) on/off

– Toggle the Flight Director on/off

- Select the NAV SOURCE (RTE, VOR or TACAN)



ENG – Engine

This page will show the following engine status and performance data:

THRUST (as percentage of maximum thrust)

EGT

NOZZLE OPENING

N1 RPM percentage

N2 RPM percentage

OIL pressure

FUEL FLOW

HYDRAULIC PRESSURE (1 and 2)

Any condition that may require pilot attention will be highlighted in red.

The page also hosts the controls of the Anti Ice System (A-ICE) and the Air Data System Heat (ADS HT).
The Anti-Ice system provides engine de-icing functionalities, while the Air Data System Heat provides heat to all the air data system sensors.
Both systems have three settings: OFF, AUTO and ON. If the AUTO option is selected, the systems will be automatically turned on if potential icing conditions are detected.

FCS – Flight Control system

This page will show the flight control system status. This page reports the positions of control surfaces (flaperons, horizontal tails, rudders and LEFs), the trim setting, the positions of the landing gear, virtual speed brakes and, on F-35A and F-35C, of the tail hook, and on the F-35C only, of the launch bar and the folding wing mechanism.
On the F-35B, this page will also show the status of the Direct Lift System, including the nozzle and lift-fan flow direction and commanded speed. Also, the current total aircraft weight is shown, as well as the maximum G limit of the selected model.
NOTE: this is the maximum G limit for the clean aircraft, and it is not updated with the load-out configuration. The FCS has some G-limiting authority but it may be possible, in some instances, to overstress the aircraft.

Within this page the pilot can:

- engage/disengage the autopilot

- retract/extend the launch bar (F-35C only)

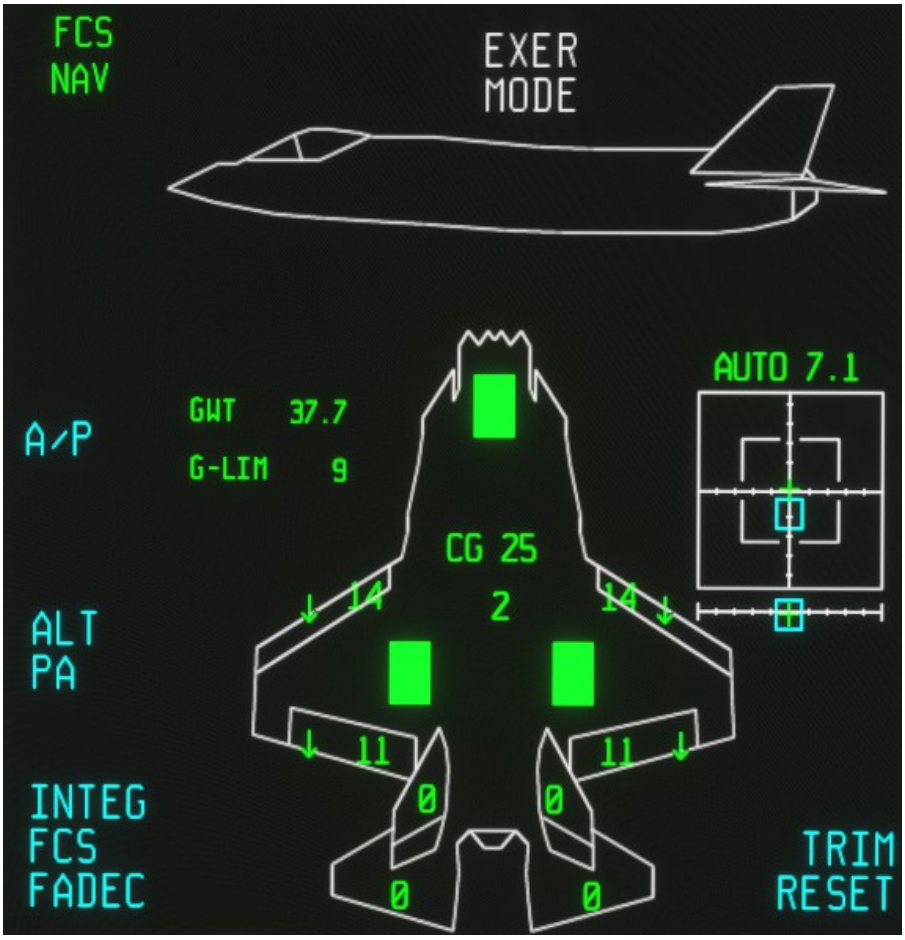
- fold/spread the wings (F-35C only, and only if a/c is on the ground and speed is very slow)

- command the Direct Lift System to enter the automatic hover mode, (F-35B only – see details on the “Special Instructions for STOVL mode” section below).

- allows the selection of the AUTO TAKE OFF option (F-35B only, only if the aircraft is static on the ground, wheel brakes are pressed and STOVL Mode is engaged)

NOTE: HOVER can only be commanded if the total aircraft weight is below 40600 lbs.

NOTE: Starting from version 1.2.0 above the TRIM display, the AUTO caption indicates that the fly-by-wire system is engaged and the autotrim active, while the MAN caption indicates that the fly-by-wire system is disengaged and the TRIM is in manual mode. If the system is in MANUAL mode and the airspeed is above 400 kts, the FCS DEGRADED message is displayed.



FUEL – Fuel system management

This page shows the total fuel quantity available, as well as the quantity in each individual fuel tank and the status of the refuel system.
Within this page the pilot can:

– Toggle the opening of the fuel dump valve with the DUMP command (requires confirmation from the pilot).

– Toggles the opening of the refuel receptacle doors in the F-35A or the extension and retraction of the refuel probe in the F-35B and F-35C with the REFUEL SYSTEM command.

– Activate the Main Fuel Shut-Off Valve in case of emergency with the MFSOV command (requires confirmation from the pilot). NOTE it is necessary that the throttle is below 15% of its total travel.

– Set the BINGO fuel alert with the BINGO command – a numeric keypad appears and the pilot shall enter the desidered BINGO fuel value. Expected format is X.Y (e.g. 2 0 becomes 2000 lbs.)

– Set the JOKER fuel alert with the JOKER command - a numeric keypad appears and the pilot shall enter the desidered JOKER fuel value. Expected format is X.Y (e.g. 4 2 becomes 4200 lbs.)

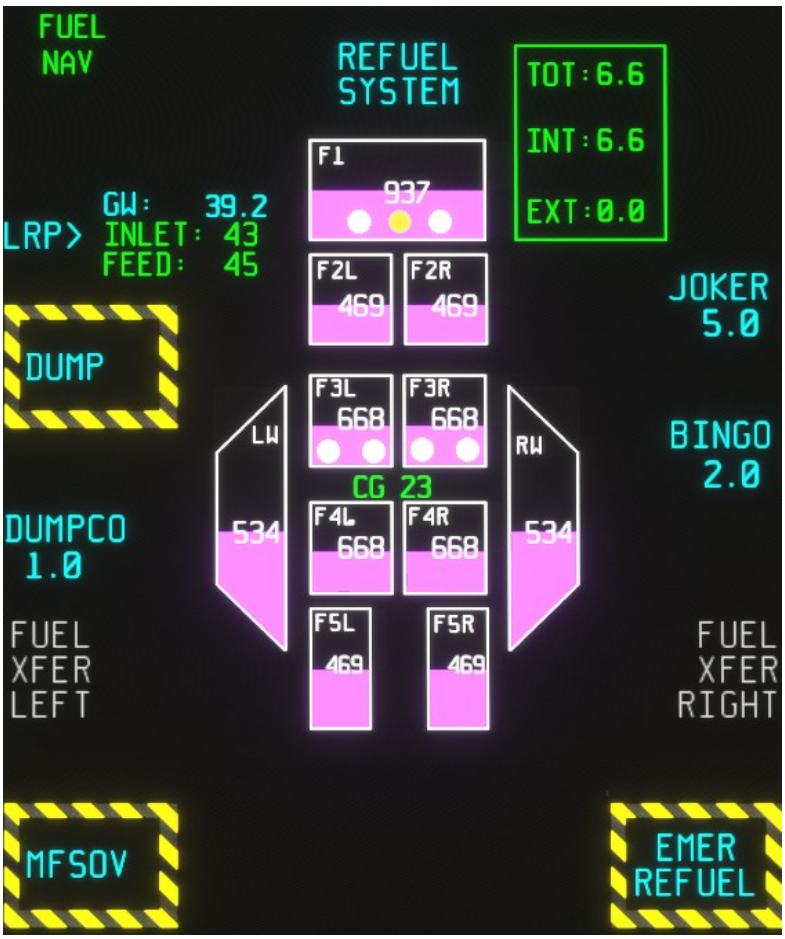
– Set the DUMP CUT OUT quantity with the DUMPCO command - a numeric keypad appears and the pilot shall enter the desidered DUMPCO fuel value. Expected format is X.Y (e.g. 1 2 becomes 1200 lbs.). Fuel dump will stop at that quantity.

An EXPERIMENTAL in-flight refuel functionality is provided, and work as follows:

- once the plane is airborne and ready to initiate the refuel procedure, press the “REFUEL SYSTEM”

- press “REFUEL SYSTEM” to open the refuel receptacle / extend the fuel probe

- clicking on the gren “fuel quantity” box will initiate refueling. Pilot must keep the plane withing +/-50 feet alititude and +/- 7 knots otherwise the refuel system will be disconnected.



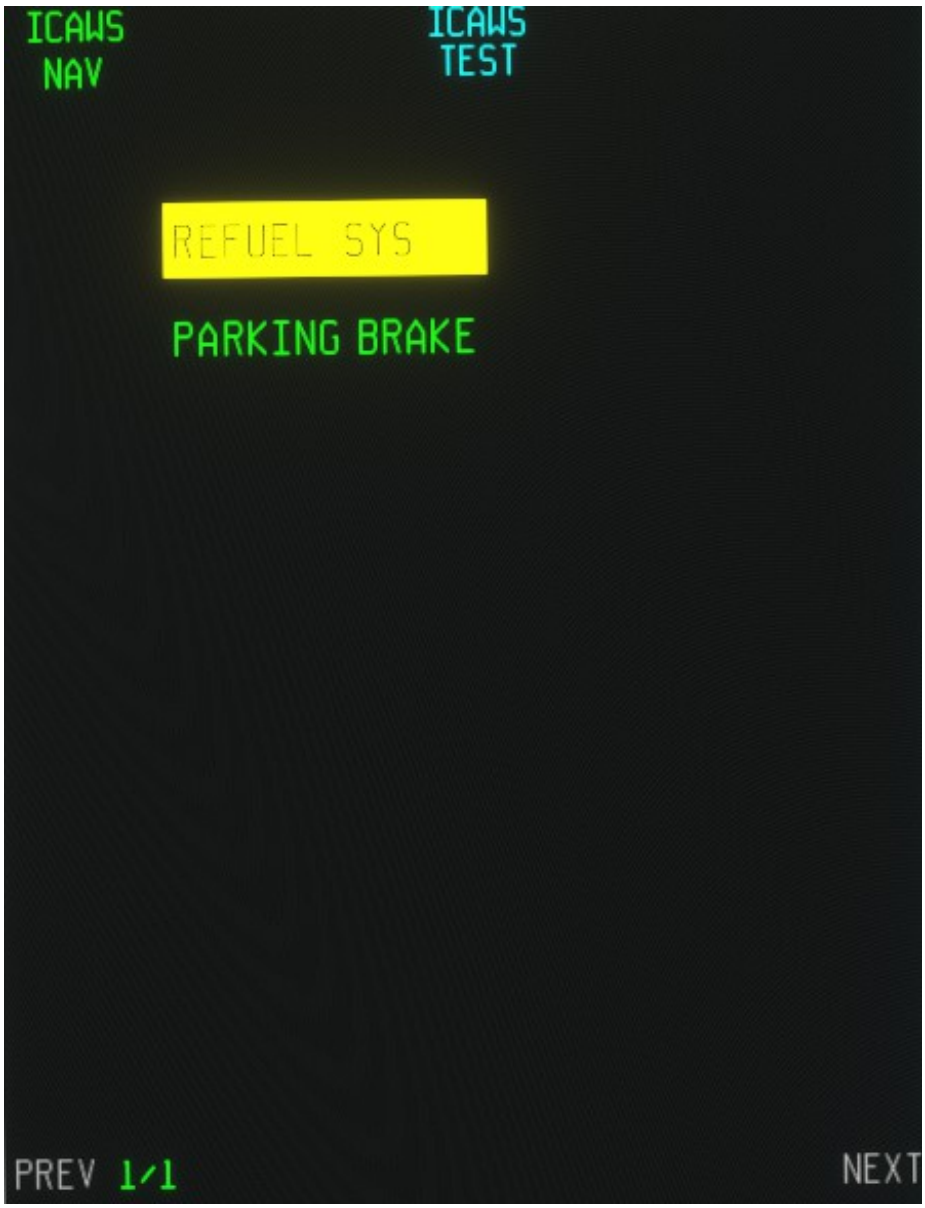
HUD – Head Up Display

This page shows on the MFD the same information shown on the Virtual Head Up Display function of the Helmet-Mounted Display.
For several reasons, however, only the main data are shown in this rendition.
Specifically, most of the essential flight data information is shown, but the weapons information is not.
Within this page the pilot can use the TFLIR command to slave the TFLIR sensor to the boresight of the aircraft.

In this page, the pilot can select the CAGE / UNCAGE option of the HUD pitch ladder and symbology.

ICAWS – Integrated Caution, Advisory and Warning System

The Integrated Caution and Warning Systems collects all the advisory messages from the various F-35 systems and presents them in a clear and unified way.
In the real thing, this page is also used to command the BIT (Built-In Test) procedures.
In this rendition, only a few systems are monitored and presented and BIT is not implemented. However, the ICAWS conditions are correctly color coded and implemented.



Messages are color coded as follows:

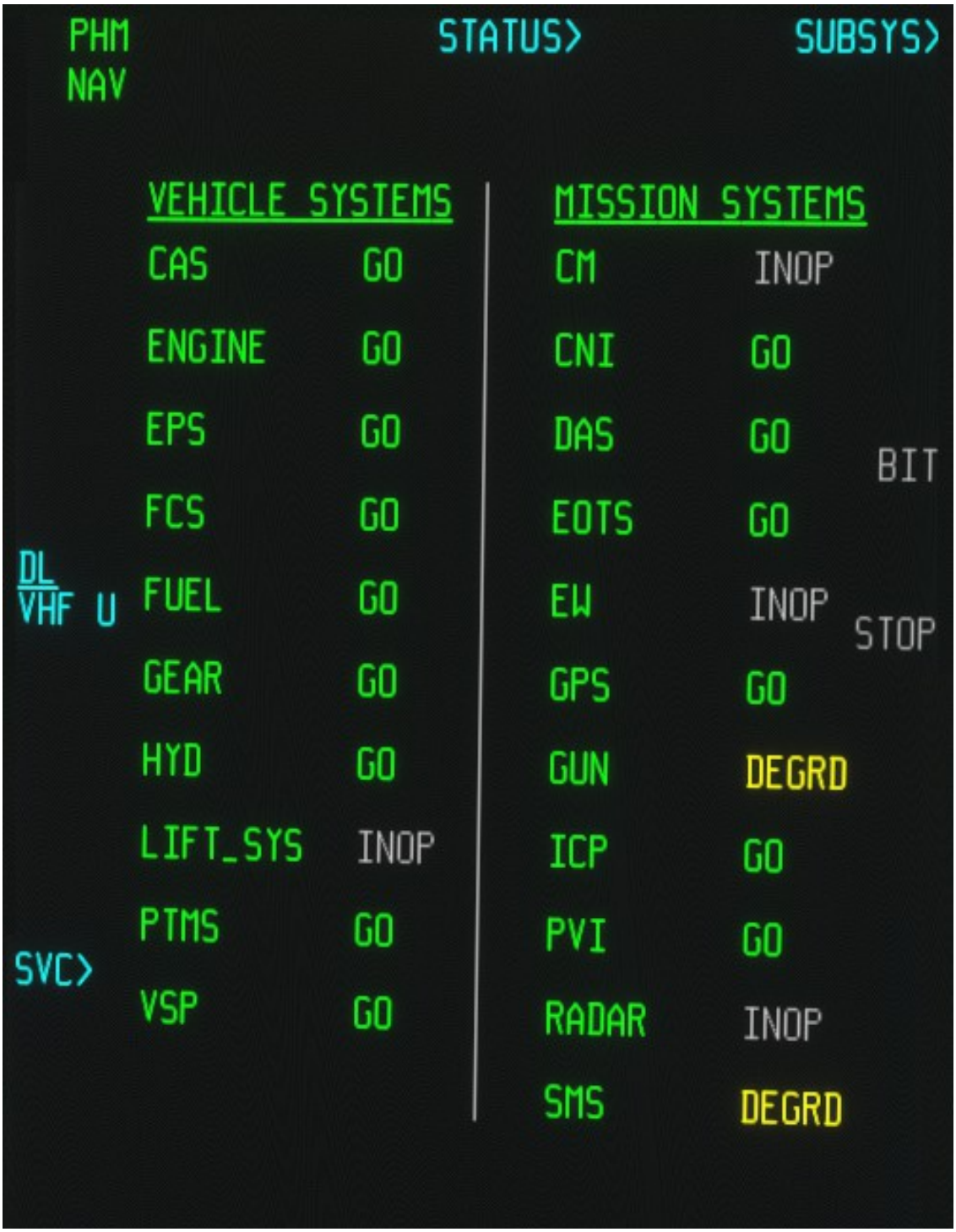
RED (WARNING) – These conditions require immediate pilot attention and corrective actions as they represent major risks of injuries, fatalities or loss of the aircraft.

YELLOW (CAUTION) – These are potentially dangerous condition which require immediate pilot attention, however do not expose the aircraft or the pilot to immediate risk.

GREEN (ADVISORY) – These alerts represent conditions which require pilot attention, but should not represent a risk condition.

PHM – Prognostics and Health Management

This page shows the status of the Prognostics and Health Management (PHM) system.
This system, which is central to the program's Performance Based Logistics (PBL) approach, is built on incremental capability deployment and a careful balance of on-aircraft and off-board software, systems and processes. The system is capable of monitoring the “health” status of the aircraft and report it to remote servers to allow the ground crew and the industry to plan for maintenance and relevant logistics actions.



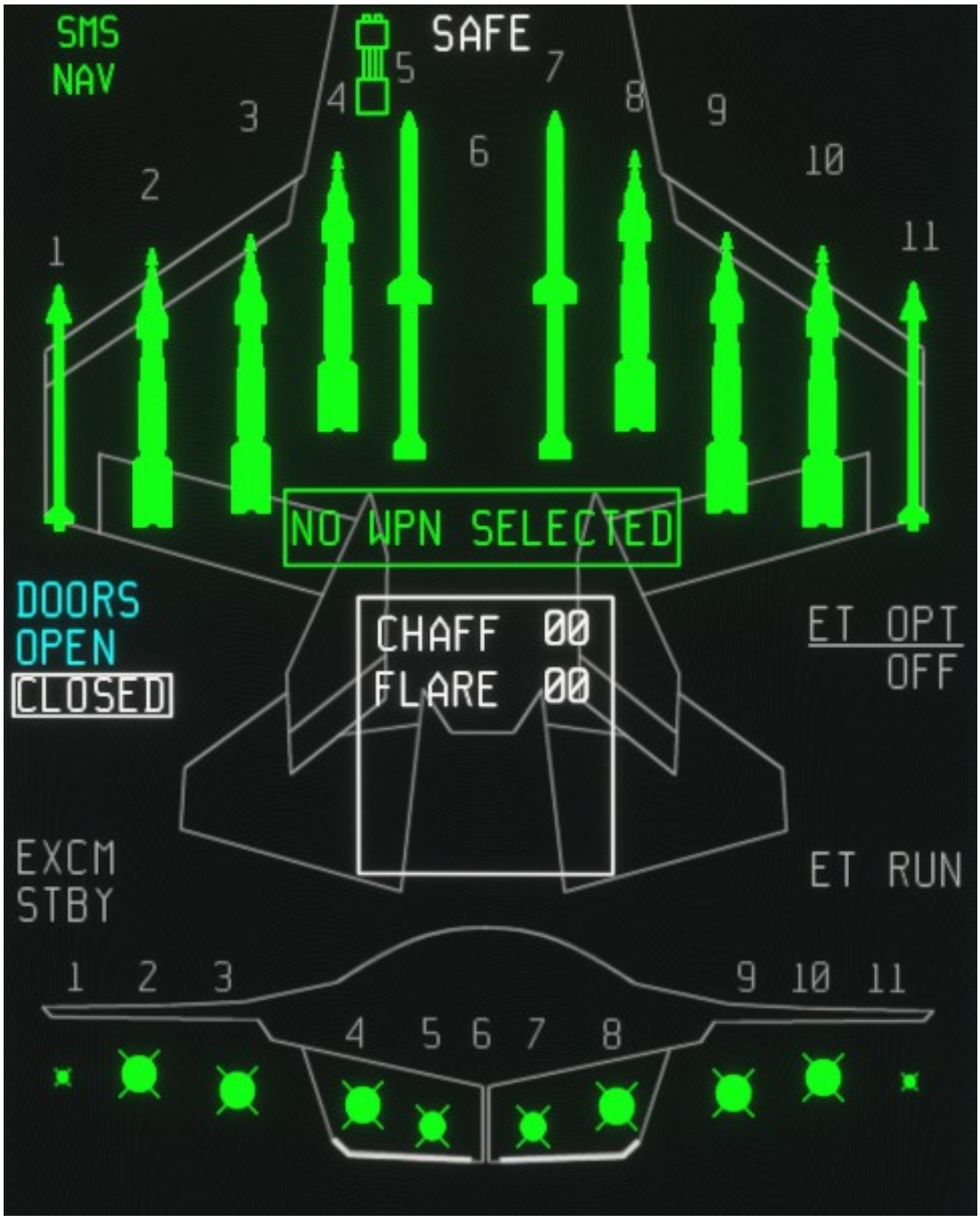
SMS – Stores Management System

This page shows the status of the Stores Management System, with a graphical depiction of both internal and external weapons, shows the currently selected weapon and its status, as well as the Master Arm status and the CHAFFS and FLARES count.

Within this page, the pilot can select individual weapons and manually command the opening of the weapon bay doors if necessary.

In the Microsoft Flight Simulator rendition the only operable command in this page is the DOOR OPEN/CLOSE control.

This page can be also used to select the aircraft configuration by clicking on its center. This option is only available for copies purchased outside the Microsoft Marketplace.



TFLIR – Targeting Forward Looking Infra-Red

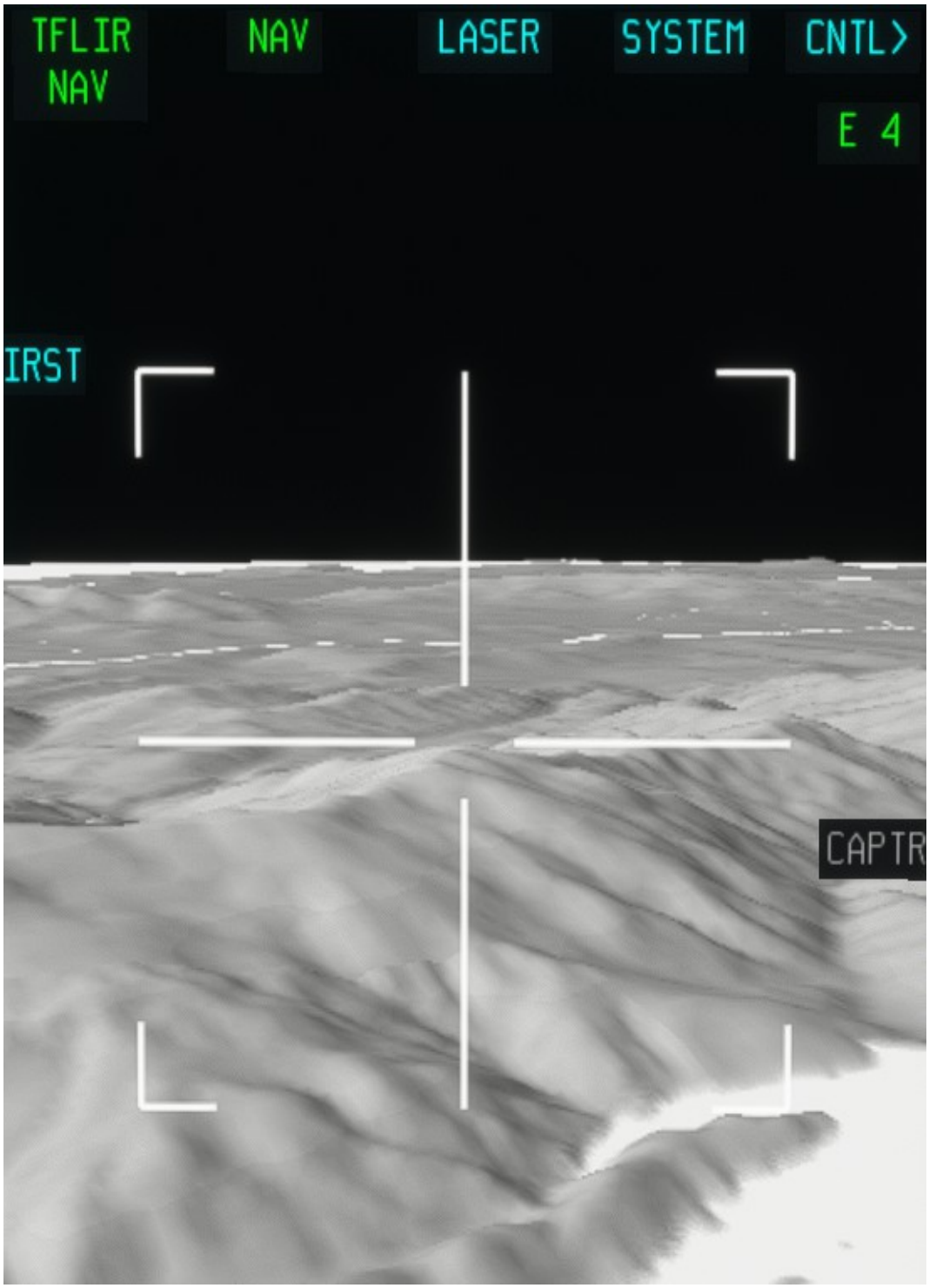
In the real aircraft this page is used to operate the Infra-Red sensors of the EOTS system, which is mostly used for target identification and designation, night and bad-weather navigation and IR imagery.

These functionalities are currently not supported by Microsoft Flight Simulator. In this simulation, the synthetic imagery service is used to generate a synthetic mapping image pointing forward in a way that mimics the appearance of the page in the real aircraft when used in the navigation mode.

Scrolling the mouse wheel over the center of the image, allows the user to adjust the camera pitch angle.

User can select NAV (forward looking) or AS (horizon stabilized) modes.

Nav source can also be controlled from this page by clicking on the CNTL> area.



TSD-1 – Tactical Situation Display 1 – 2 – 3

In the real aircraft, the Tactical Situation Displays show, in a simple and effective way, the tactical information available to the aircraft, along with basic navigation information.
As a result of the sensor-fusion and network sharing approach, the data presented is a synthesis of what the aircraft knows from its own sensors, and what it has been detected from any friendly asset capable of sharing information.

The data can be displayed in two ways: Horizontal Situation Display (HSD) or Vertical Situation Display (VSD).
Along with sensor fusion data and shared data, in the real aircraft the display is also capable of showing radar cross section information, estimated coverage of other radars and can be used to select targets or assign targets or waypoints to other aircrafts or assets.

Three independent pages can be shown and controlled separately.
In the simulation rendition, the functionality is limited by MSFS constraints and scope. The following modes are available:

HSD – Horizontal Situation Display, custom coded to mimic the real-world TSD screen, but with limited functionality. This view can also be enlarged to full screen.

HSD/MAP – Horizontal Situation Display, MAP mode (generated through the MSFS mapping service – only one map zoom

VSD - Vertical Situation Display

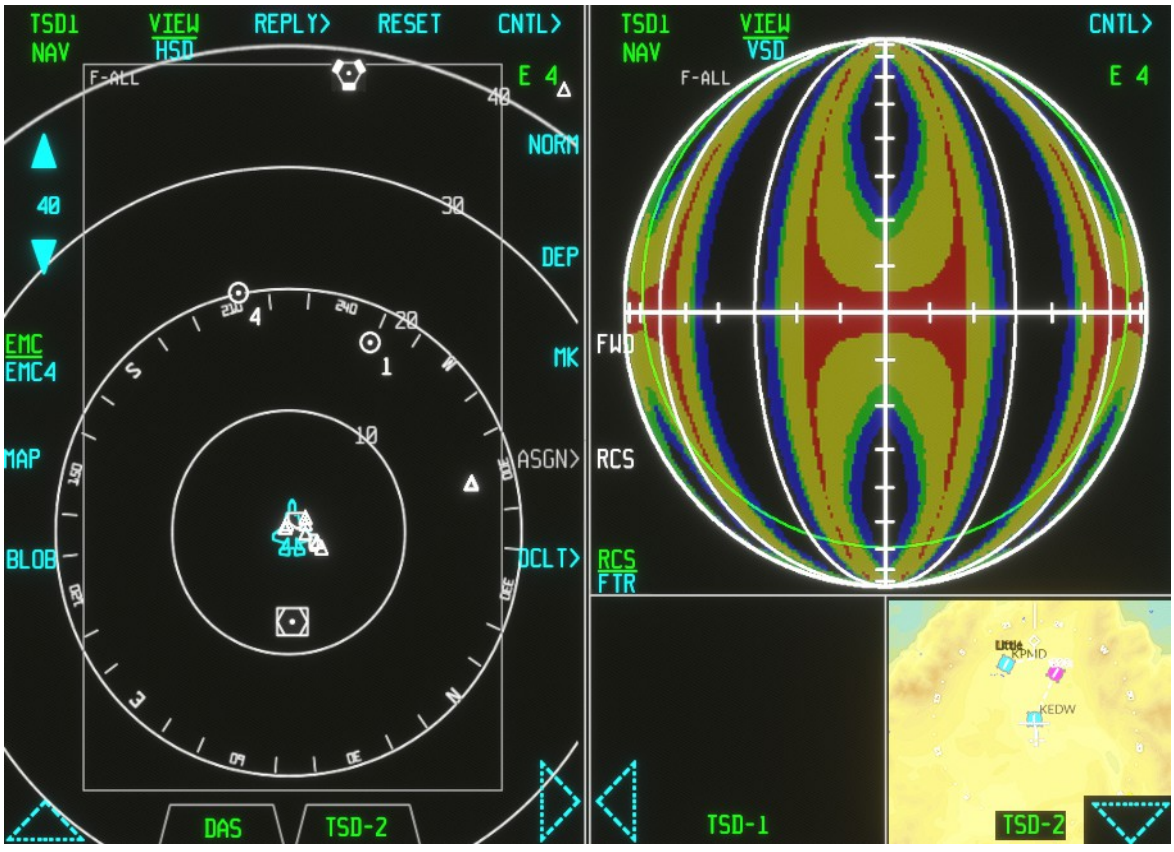
The controls available in this page are:

CNTL > This allows the pilot to select the nav source

VIEW > Toggles HSD or VSD modes

MAP > Toggles the HSD MAP mode

RANGE CONTROLS > Allow the pilot to select the zoom level for the HSD modes. Separate zoom levels are available for the three TSD screens except for the MAP mode, which has the same zoom level for all three.



HORIZONTAL SITUATION DISPLAY

This presentation will show:

A - the departure waypoint (a flight plan is loaded), displayed as a small pentagon

B – the next waypoint of the current flight plan (if one is loaded), displayed as a small circle with a dot and the waypoint number

C – the destination waypoint of the current flight plan, displayed as a small circle with a dot and the waypoint number

D - the location of the VOR station currently tuned, if detected, with a specific symbol

E - the location of the TACAN station currently tuned, if detected, wih a specific symbol

F – Air-to-Air tracks, displayed as a square with a small line. The small line repesents the direction of the motion of the track.

G – Air-to-Ground tracks, displayed as a small triangle.

The (E) and (G) items, at the moment of the release, are based on WASM code and are only available on PC versions (and not on Xbox). This data is based only on the Traffic data from Flight Simulator, so that basically only SimObject generated as Traffic are reported.

TSD RADAR TRACKING FUNCTIONALITY (EXPERIMENTAL – PC ONLY)

Starting from version 1.2.1, on PC ONLY, a radar tracking functionality is available.
Targets are selected by clicking in the central area of the TSD screen – a left click will move to the next track, while mouse wheen can be used to scroll between tracks.

Tracks are detected even out of the radar cone to simulate the sensor-fusion tecnology, typical of the F-35.

Master Mode will switch automatically between AA and AS, depending on the the fact that the track is airborne or not.

Tracks are marked with their speed (in Mach), altitude (thousand feet) and number.

Airborne tracks are reported also on the VSD.

COMMUNICATIONS PAGE

This page is accessible through the FAB and allows the pilot to type-in the COM radio frequencies.

The following controls are operable in the sim:

COM A frequency type-in (expected format XYZ.ABC, therefore 1 2 0 7 0 0 becomes 120.700)

COM B frequency type-in (expected format XYZ.ABC)

COM C frequency type-in (expected format XYZ.ABC)

MUTE COM A or COM B

Select the previous COM A, COM B or COM C frequency.

NAVIGATION PAGE

This page is accessible through the FAB and allows the pilot to type-in the navaids data.

The following controls are operable in the sim:

VOR/ILS frequency type-in (expected format XYZ.ABC, therefore 1 1 0 5 0 0 becomes 110.500)

TACAN channel (expected forma XYZ, therefore 0 4 2 becomes 042)

TACAN band X or Y

Select previous or next waypoint (<WAYPT or WAYPT>)

IDENTIFICATION PAGE

This page is accessible through the FAB and allows the pilot to type-in the IFF transponder data.

The following controls are operable in the sim:

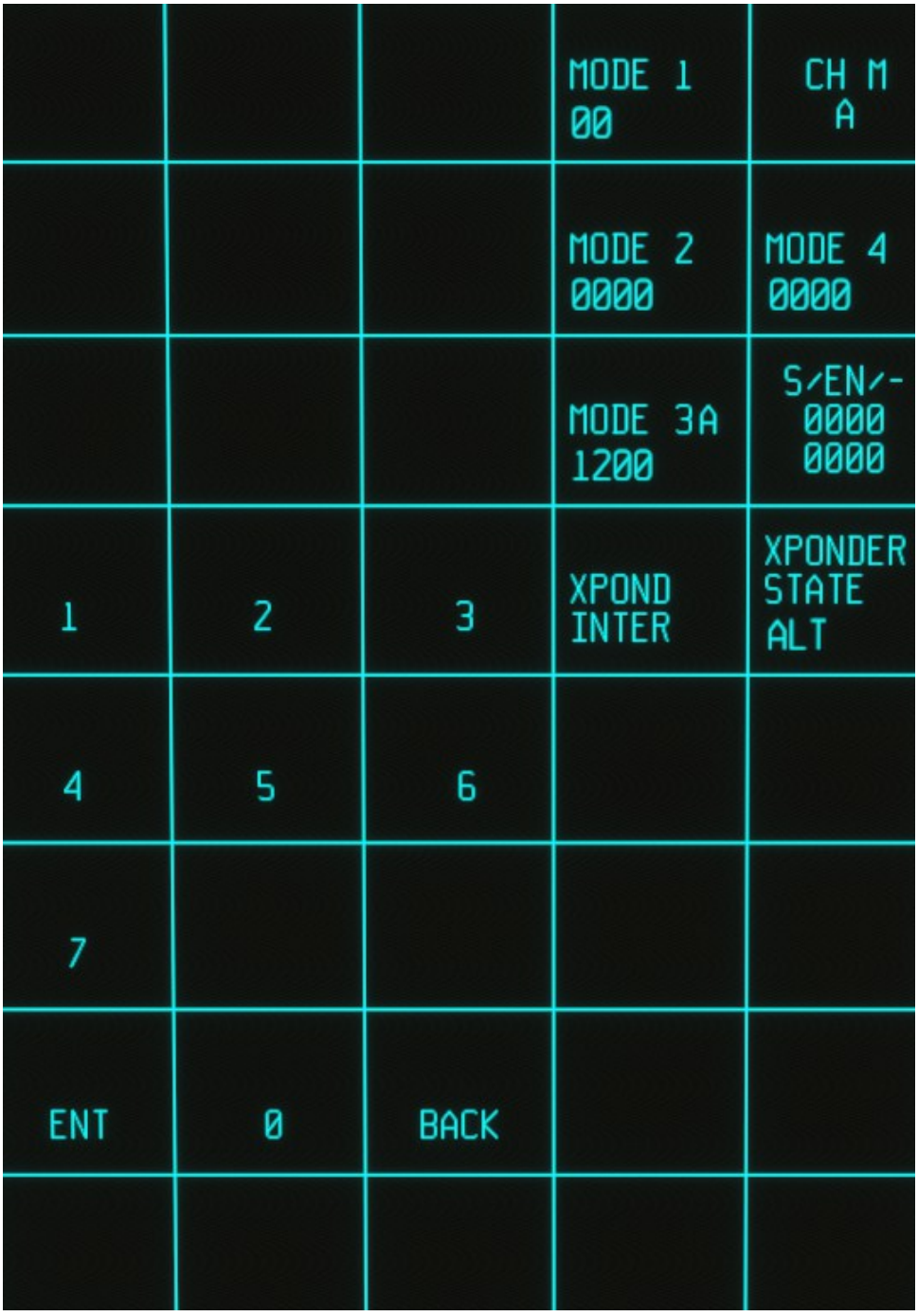
MODE 1

MODE 2

MODE 3

MODE 4

NOTE: in Flight Simulator, only MODE 3 is actually used in the sim. Other modes are implemented only for future developments but have no effect in game.



BAROMETER SETTING PAGE

This page is accessible through the FAB and allows the pilot to type-in the barometric setting, in inHG or in hPa. This page also allows the pilot to set the Altitude Low Warning (ALOW).

The following controls are operable in the sim:

INHG – Barometric setting in INHG (expected format X Y Z W, therefore 2 9 9 3 becomes 29.92 inHG) – this also changes the barometric display to inHG.

HPA – Barometric setting in hPa (expected format X Y Z W, therefore 1 0 1 2 becomes 1012 hPa) – this also changes the barometric display to hPa.

ALOW – Altitude Low Warning Type-in (expected format X Y , therefore 05 becomes 500 feet)

ADDITIONAL MENU PAGE

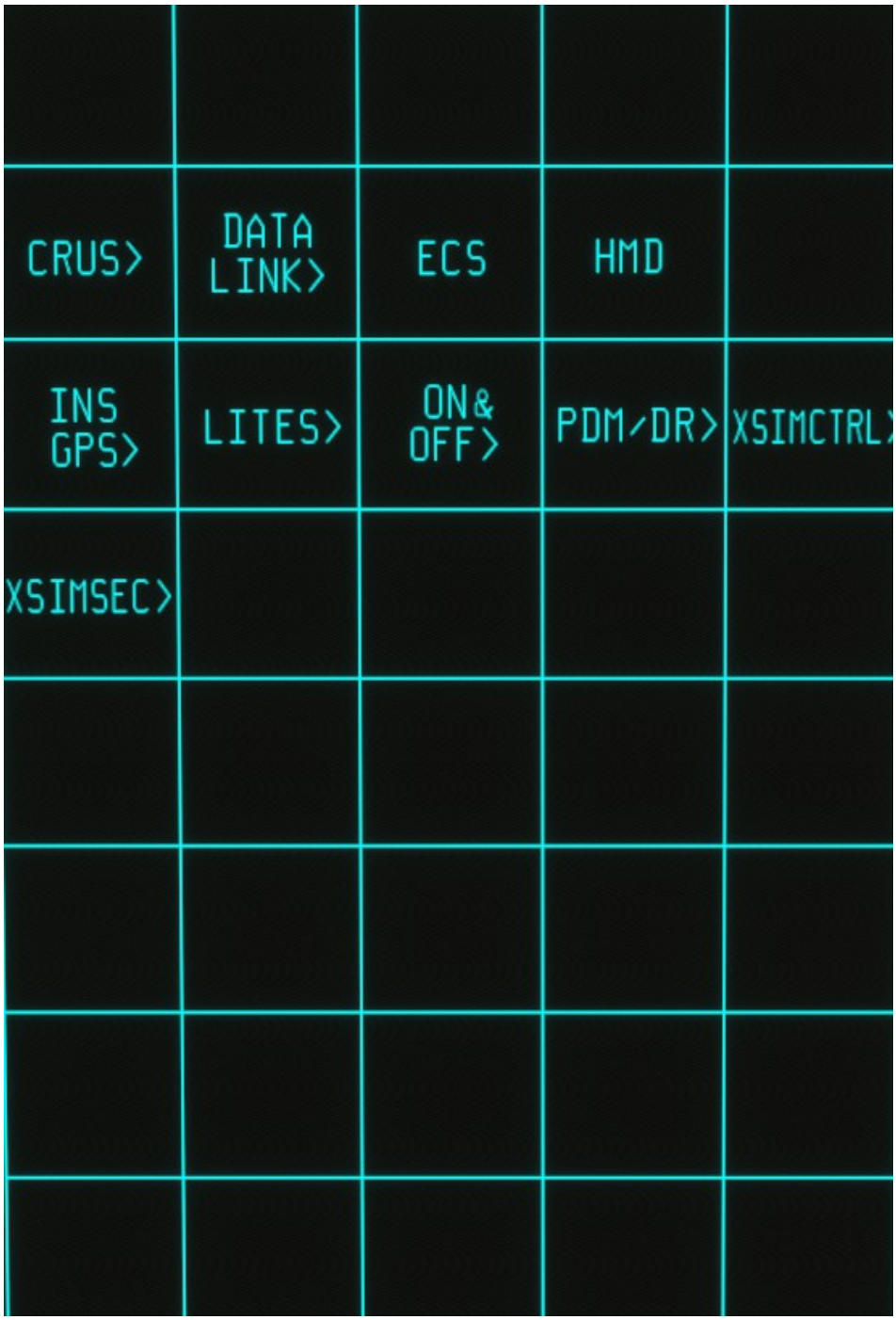
This page is accessible through the FAB and allows the pilot to access a number of additional functions.

For the initial release only two options are selectable:

CRUS > will restore the PCD configuration to the default

LITES > allows the access to the LITES page

HMD > allows the activation the off-boresight symbology of the HMD



LITES PAGE

This page is accessible from the additional MENU page though the LITES> button.

In this page the following functions are selectable:

CONSL - toggles the cockpit console pages

POSIT – toggles the wing navigation lights

STROB – toggles the strobe lights

FORM – toggles the formation lights

Brightness of console, position and formation lights are adjustable by selecting the “BRT” controls and adjust the brightness with the keypad.

It is also possible to adjust the balance between left and right halves of the Primary Control Display.

AUTOPILOT PAGE

This page is accessible through the releavant FAB area and allows the control and setting of the autopilot and autothrottle functions.
The interface is similar to the real one, but has been reworked to fit to the default MSFS AP functionalities upon which the simulation code relies – basically this page acts as a front-end interface for the default autopilot, allowing the user to enter data through the virtual keypad.

The system will also react to default autopilot commands.

AP > TOGGLES AUTOPILOT MASTER SWITCH (autopilot will not react if not engaged)

AT > TOGGLES AUTOTHROTTLE MASTER (autothrottle will not react if not enaged, also SPEED HOLD and MACH HOLD modes cannot be engaged)

ALT HOLD > toggles autopilot altitude hold mode: autopilot will try to reach and hold the target altitude in the ALT box. If the ALT box indictaion is zero, the current aircraft altitude will be used instead.

ALT box > this area allows the pilot to enter the target altitude via the virtual keypad

HDG HOLD > toggles autopilot heading hold mode: autopilot will try to reach and hold the target heading in the HDG box. This function will disable the VOR HOLD, APP HOLD, BACK CRS and RTE HOLD.

HDG box > this area allows the pilot to enter the target altitude via the virtual keypad

SPD HOLD > toggles autothrottle indicated speed hold mode: autothrottle will try to reach and hold the target speed in the SPD (in knots) box. If the SPD box indication is zero, the current aircraft indicated airspeed will be used instead. This function can be switched to the MACH hold function via the IAS MACH command.
To engage this functionality, the master AT must be engaged.

MACH HOLD > toggles autothrottle Mach number hold mode: autothrottle will try to reach and hold the target speed in the SPD (in Mach) box. If the SPD box indication is zero, the current aircraft Mach number will be used instead. This function can be switched to the SPD hold function via the IAS MACH command.
To engage this functionality, the master AT must be engaged.

SPD box > this area allows the pilot to enter the target speed (in knots or Mach number depending on the selection) via the virtual keypad.

VOR HOLD > toggles autopilot VOR mode, using the course value set in the CRS box. This function disengages the HDG HOLD and RTE HOLD modes. This is equivalent to set the standard autopilot to NAV HOLD mode, with GPS DRIVES NAV option to false.

NOTE: NAV Source must be set to VOR prior to engaging this function for this function to work.

CRS box > this area allows the pilot to enter the Course angle via the virtual keypad

RTE HOLD > toggles autopilot altitude RTE mode: autopilot will try to follow the loaded flight plan if present. This function disengages the HDG HOLD and VOR HOLD modes. This is equivalent to set the standard autopilot to NAV HOLD mode, with GPS DRIVES NAV option to true.

NOTE: NAV Source must be set to RTE prior to engaging this function for this function to work.

APP HOLD > toggles the APProach mode.

NOTE: NAV Source must be set to VOR/ILS prior to engaging this function for this function to work and a valid ILS function must be entered first.

NOTE: this functionality is sometimes erratic and in any case will not lead the plane to a smooth landing. It is suggested to land the plane manually.

BACK COURSE > toggles the backcourse mode

IAS/MACH > toggles the Mach hold autothrottle mode

NOTE: The autopilot RTE generally works if engaged immediately after takeoff and the plane should follow the flight plane smoothly without significant deviations, provided that a target altitude is entered and ALT HOLD engaged.

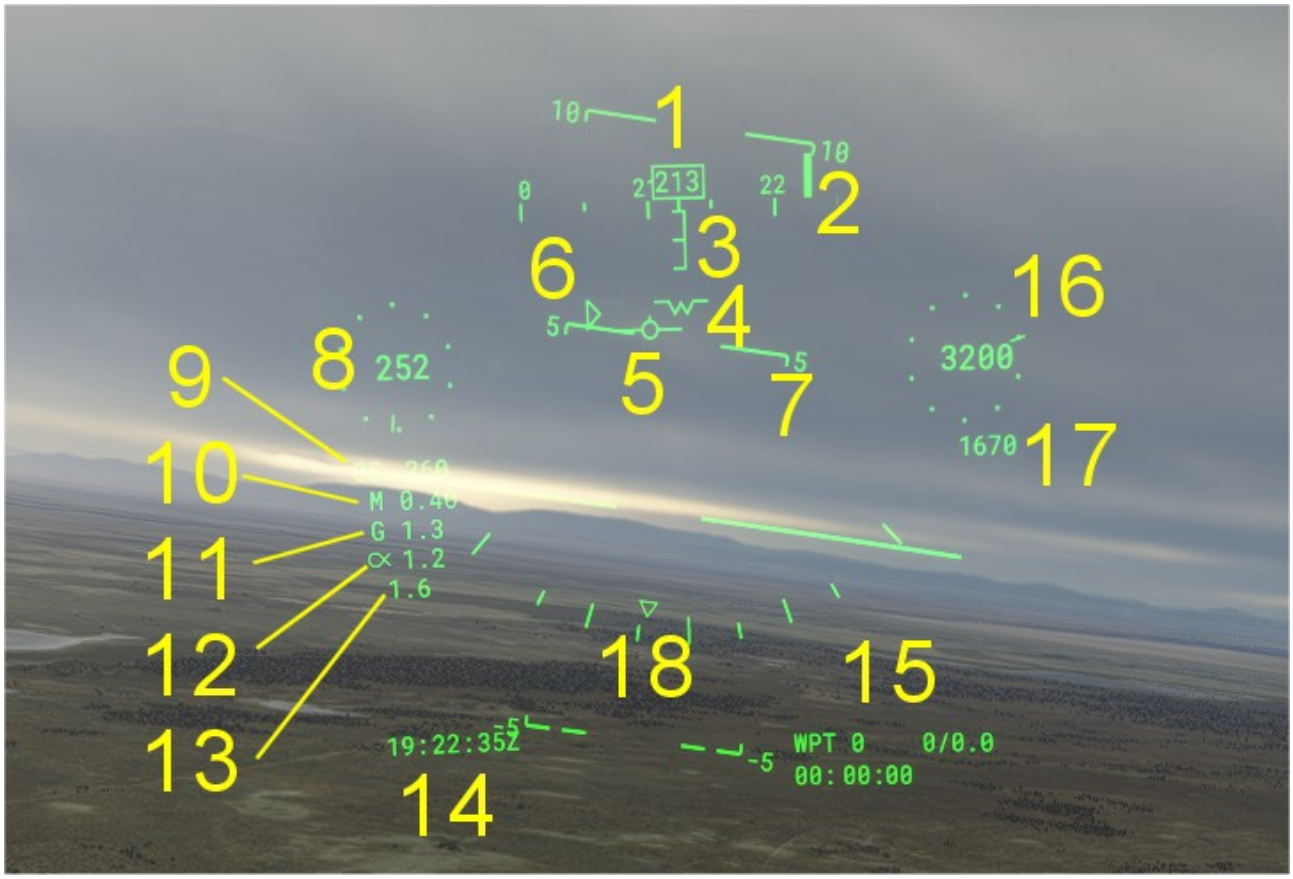
The autopilot, however may have an erratic behavior in some cases – this can be usually normalized by switching WAYPOINT number in the NAV page.

IF AUTOPILOT BEHAVES ERRATICALLY, it is possible to reset the FCS variables by pressing (and depressing) the FCS RESET button, and/or disconnect/reconnect the FCC.

HELMET MOUNTED DISPLAY SYSTEM

The F-35 Helmet Mounted Display System (HMDS) displays biocular video and symbology information on the helmet visor, providing pilots with all information necessary to execute both day and night missions under a single integrated configuration.
The flight data are presented to the pilot in a Virtual Head Up Display, that is it appears in front of the pilot like if it were on an exceptionally wide, frameless Head Up display.

In the real-world, the system enables pilots to accurately cue onboard weapons and sensors using the helmet display. Finally, the system also provides “Enhanced Reality” features, like night vision and the possibility to look “through the aircraft” thanks to the Distributed Aperture System (DAS). When the pilot moves his head, part of the VHUD symbology is kept aligned with the aircraft boresight, while the rest follows the pilot head movement.



In the simulation, only the following fixed symology is shown (with refence to the figure above):

1 – Current heading and compass – NOTE: if the autoilot HEADING HOLD mode is selected, the commanded heading will be displayed above the current heading preceeded by the “CMD” caption

2 – heading to the selected nav source

3 – AoA bracket (only if gear is down)

4 – Waterline (only if gear is down or Velocity Vector is outside visibility boundaries)

5 – Velocity Vector

6 – Energy Caret (only if gear is down)

7 – Attitude scale

8 – Current Airspeed – NOTE if the autothrottle SPEED HOLD mode is selected, the commanded speed will be displayed above the current speed preceeded by the “CMD” caption

9 – Ground speed

10 – Current Mach number

11 – Current G value

12 – Current ALPHA angle

13 – Maximum G value achieved after the last reset

14 – Clock

15 – Navigation source data

16 – Current Altitude – NOTE f the autopilot ALTITUDE HOLD mode is selected, the commanded altitude will be displayed above the current altitude preceeded by the “CMD” caption

17 – Radar altitude (if a valid value is available) – NOTE Radalt value will flash if lower than the selected ALOW value

18 – Bank scale

It is also possible to add off-boresight symbology to the HMD, by selecting the option in the MENU page.

NAVIGATION

GENERAL INFORMATION

In the real-world, the F-35 relies primarily on GPS/INS navigation on a pre-programmed flight plan. The aircraft is also equipped with a TACAN receiver and an ILS receiver.

In the MSFS version, for technical reasons and given the nature of the simulator itself, we also added a VOR receiver which can be used for IFR navigation. Therefore the aircraft has three NAV SOURCES, which are color coded in the EFI display:

RTE (GPS route) – in this mode, the navigation systems will follow the Flight Simulator flight plan.

NOTE: in the initial release there is no way to alter the flight plan within the aircraft: flight plan must be created with the game interface of with external tools. It is, however, possible to select a specific flight plan.

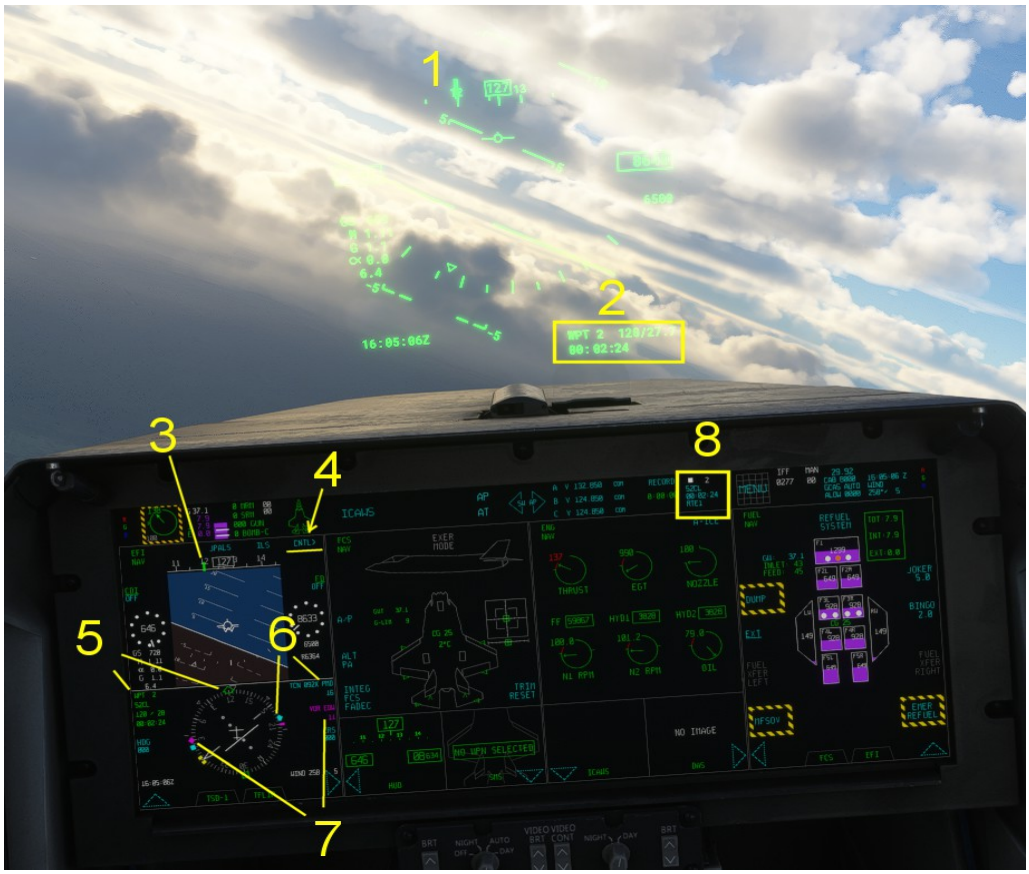
NOTE: RTE is the default navigation mode if a flight plan is loaded. Otherwise no nav source will be selected by default.

VOR/ILS – in this mode, the navigation system will be slaved to the VOR station selected in the NAV menu. If no VOR data is shown in the EFI page, the frequency is either invalid or the aircraft is not receiving any signal on that frequency.

TACAN – in this mode, the navigation system will be slaved to the TACAN station selected in the NAV menu.

NOTE: in the initial release the TACAN system is simulated as a secondary NAV radio. Selected TACAN channels are converted to the equivalent VOR frequency.

NOTE: If no TACAN data is shown in the EFI page, the frequency aircraft is not receiving any signal on this channel on that channel. Note that, if a TACAN station is present in the game but has no associated VOR functionality, it may not show correctly.



The picture above shows a situation in which the selected NAV source is RTE, and the aircraft is also receiving signals from the VOR and TACAN receivers.

With reference to the previous picture:

1 – The vertical steering bar on the HMD shows the bearing to the current NAV source. In this particular case, since the selected NAV source is RTE, it shows the pilot that he/she has to steer left to 120° to be flying towards the next waypoint in the flight plan.

2 – Nav source data is shown on the botton right corner of the HMD.

In this case, the display reports that the navigation system are pointing towards WAYPOINT 2, bearing is 120°, distance is 27.7 nautical miles, estimated time to get to the waypoint is 2 minutes and 24 seconds

3 – The steering bar on the EFI/ADI compass shows the bearing to the current NAV source, similarly to the one on the HMD. The bar will change color depending on the NAV source selected.

4 – The CNTL command allows the pilot to cycle thorugh the NAV sources.

5 – RTE / Waypoint HSI indications: the green captions and arrow in the HSI show information and direction to the next waypoint, if a flight plan is available. The green arrow on the HSI compass will point directly to the waypoint. The system will automatically change the waypoint when needed according to the flight plan.

In this case, WAYPOINT 2, waypoint name is “52CL”, bearing 120°, distance 28 nautical miles, estimated time to get to the waypoint in 2 minutes and 24 seconds.

6 – TACAN indications: the cyan captions and arrow in the HSI show information and direction to the TACAN station currently selected, if a signal is received. The cyan arrow on the HSI compass will point directly to the TACAN station.

In this case, channel is 092X, tacan id is PMD (Palmdale) and the distance is 16 nautical miles

7 – VOR indications: the magenta captions and arrow in the HSI show information and direction to the VOR station currently selected, if a signal is received. The magenta arrow on the HSI compass will point directly to the VOR station.

In this case, VOR id is EDW (Edwards AFB) and the distance is 11 nautical miles

8 – NAVigation area in the FAB bar: this area shows the current nav source and allows access to the NAVigation page.Information shown changes depending on the NAV source, in this case: WAYPOINT 2, waypoint ID 52CL, ROUTE 1*

* - Note: at the moment, unlikethe real aircraft, the simulated F-35 does not support multiple routes – so the RTE number will always be 1.

SPECIAL INSTRUCTIONS FOR STOVL OPERATIONS (F-35B ONLY)

In this rendition, the F-35B has three main configurations:

• **CTOL-config:** for normal takeoffs/landings and cruise flight. Lift-fan doors are closed, nozzle is pointed completely straight backwards.

• **STOL-config:** (STOVL-mode, with Hover-sub-mode OFF): used for slow flight (70 - 200 knots) and short takeoff/landing. Aircraft behavior, and controls, are like in CTOL-config, but with attitude/speed restrictions. Lift-fan doors are open, nozzle is auto-controlled between 30 and 60 degrees. Airspeed depends on throttle, pitch attitude and wind.

• **VTOL-config:** (STOVL-mode, with Hover-sub-mode ON): used for vertical takeoff and landings. Lift-fan doors are open, nozzle is auto-controlled between 75 and 100 degrees. Auto-throttle, and Auto-wind compensation. See below for control details. Please note that, while we tried to emulated the controls and behavior of the real F-35B on the basis of the information publicly available, many changes have been implemented and some artistic license has been taken for better usability within the MSFS environment. Before starting your first STOVL flight, please note that some standard MSFS functions have been used as "proxies" for STOL/VTOL functions, so that user can command these via keys instead of mouse operation only or, preferably, assign stick buttons to these functions:

• **TOGGLE TAIL HOOK LEVER:** this activates and deactivates STOVL-mode. Like in the real aircraft, the conversion to STOVL mode can be activated by pressing the HOOK/STOVL button on the top-left corner of the main control panel.

• **Heading hold:** when in STOVL-mode, this sets VTOL-config (enables the Hover-mode ON). In the real aircraft, the “auto hover” mode is activated by pressing a button on the throttle. In this MSFS rendition, you can activate this also by pressing the HOVER area of the MFD touchscreen in the FCS page (note: the HOVER control appears only when the aircraft in in STOVL mode. If the HOVER button is red, the aircraft exceeds the weight of 40600 lbs. – which is the maximum for hover mode). The aircraft slows down to the target speed (0 by default) and keeps hovering automatically. Control scheme is different from the other modes, but very intuitive.

• **Aileron-trim:** this is used to set the desired ground speed when the aircraft is in the HOVER sub-mode: "aileron trim (center)": set target speed to 0 (no default key, you have to assign one) "aileron trim (left)": increase target speed;

• **Altitude Hold:** this activates (in the air only) and activates Vertical-Speed-hold,
when Hover mode is On. Default key is CTRL + Z

<u>Restrictions to mode conversion are as follows:</u>

• You cannot convert from CTOL-config into STOL-config when the airspeed is above than **250 Knots.**

• In STOL-config, pitch & bank attitude is limited to **30 degrees.**

• In STOL-config, you cannot activate the Hover mode if you are too heavy for VTOL operation (**total weight > 40600 lbs.**); in this case the HOVER button of the FCS will be red. **You may want to dump fuel via the FUEL/DUMP command until the total weight is within the 40600 lbs. limit (HOVER button turns cyan)**

During Hovering controls are as follows:

• Stick (elevator) back: gain altitude, proportionally.

• Stick forward: lose altitude, proportionally.

• Stick neutral: altitude remains constant. When V/S-Hold is On, the current V/S is maintained irrespective on Elevator position, so when V/S-hold is activated when stick is neutral, this means an exact Altitude Hold.

• Stick left (ailerons): roll left and gain lateral speed.

• Stick right: roll right and gain lateral speed.

• Rudder: change heading.

• Throttle: no effect, auto-thrust is engaged: the computer controls thrust/throttle.

Also, while in hover mode, the computer automatically compensates wind, so with set target speed of 0 and stick neutral, the F35B truly hovers in relation to the earth's surface.

Head/tailwind component is compensated by setting nozzle more/less than 90 degrees, while crosswind component is compensated by banking into the wind.
When the disengagement of STOVL mode is commanded in flight, full thrust is set, and the aircraft accelerates quickly; when sufficient airspeed is reached (around 180 Knots),

STOVL mode control is released and you fly the plane as usual.

SHORT TAKE OFF (STO)

The typical take off for the F-35B is the Short Take Off (STO). Performing a short take off is extremely easy:

– When the aicraft is still press the HOOK/STOVL button to initiate the conversion
– After conversion is complete, advance the throttle to FULL
– Perform rotation at about 80kts
– Above 300ft radar altitude retract landing gear
- Above 500 ft and 170 knots depress HOOK/STOVL button to convert to conventional flight.

AUTOMATIC SHORT-TAKE-OFF

The F-35 features an automatic short take-off mode that will bring the airplane in the air in the shortest possible distance. To engage this mode:
- set one portal view to FCS
- engage the STOVL mode
- engage the wheel brakes
- the AUTO TO option in the FCS page will turn light blue
- select the AUTO TO in the FCS screen
- release the brakes when ready to take-off
The plane will automatically acceleate, take-off in the shortest possible distance, pilot must retract the landing gear and convert to conventional flight

SLOW FLIGHT

In order to engage slow flight mode from conventional flight, the aicraft must be below 240 kts IAS, and pitch and bank must be within +/-15 degrees from the horizon. To transition from conventional flight to slow flight mode, the pilot shall:

- Decelerate to below 240 Knots
- Engage the STOVL mode by pressing the HOOK/STOVL.
- You now fly normally, with airspeeds between 75 and 200, depending on your throttle lever setting.
- For stability, pitch/bank attitude is limited to +/- 30 degrees.

VERTICAL LANDING

Perfoming a vertical landing in the F-35 is very easy:

- Make sure that the aicraft gross weight is below 40600 lbs. Dump fuel or drop payload as needed.

- Approach in “slow flight” mode.

- When near the landing spot, convert to auto-hover sub-mode **(note: this is allowed only if the aircraft is within the 40600lbs total weight limit, otherwise command is rejected)**

- The nozzle is set to 103 degrees, and the aircraft quickly decelerates to 0 knots ground speed (“DECEL” shows in the HMD)

- Using stick, rudder and Target Speed control, hover to the landing spot; thrust/throttle is auto-controlled and wind is auto-compensated.

- Target Speed (in the air: ground speed relative to the earth surface) can be set between -20 and 50 Knots.

- When hovering over the landing spot, push the stick forward to land.

- After touchdown, the Hover-sub-mode is set Off, and thrust is set to Idle.

- Set the Parking Brakes, and move your throttle lever/wheel to Idle.

VERTICAL TAKE OFF

The F-35 is capable of vertical takeoff, but this is not the intended operation of the aicraft, since to perform a vertical takeoff the gross weight must be below 40600lbs., with huge constraints to fuel and ordnance load.

1 – HMD STOVL Symbology: engine RPM and nozzle orientation are reported on the HMD whenever STOVL mode is engaged

2 – TARGET SPEED: this can be controlled via the AILERON TRIM command

3 – ENGINER RPM

4 – NOZZLE ORIENTATION

5 – HOVER COMMAND (in reality it is controlled with the thorttle HOTAS). The HOVER caption is RED if hover is not available (aircraft does not meet the condition), cyan if available, and white if engaged.

SPECIAL INSTRUCTIONS FOR CARRIER OPERATIONS (F-35C ONLY)

At the moment of the initial release of the F-35, MSFS does not support carrier operations.
In order to have some (very basic) carrier action for the F-35C, we have added some code to provide launch and arrest functionality.

If LAUNCH BAR is deployed whan the aircraft is on the ground and the throttle is advanced to 80% RPM or more and wheel brakes are engaged, the aircraft will simulate a catapult launch (once the brakes are released). This will work on any surface and any orientation as long as the plane altitude is between 50 and 100 ft (typical carrier deck altitudes).

If TAILHOOK is deployed the aircraft will simulate an arrested landing – this will work on any surface (as long as the plane altitude is between 50 and 100 ft (typical carrier deck altitudes).

If you are using a STATIC carrier scenery, we suggest you set the weather so that a wind of 25-30 knots is blowing from the ship bow, for more realistic landing speeds.

Note: the "TOP GUN" package introduced moving carriers and arrestor hook functionalities. Starting from version 1.0.9 the F-35 supports these native MSFS functionalities, as well as static carriers.

EXPERIMENTAL FEATURE – SIMPLE LSO

During the development of the MSFS F-35 we explored the possibility of creating a simple LSO. The feature is not complete but we decided to leave it in for the release.
The “Simple LSO” is activated by selecting the CALL THE BALL option in the auxiliary menu. Option is only available in the F-35 when the hook is down.

The “simple LSO” will provide basic LSO radio calls (at the moment it is limited to AoA/speed calls and Wave OFF)

CONTACTS

Look for IndiaFoxtEcho on Facebook for the official Facebook page or browse to the official blog at:

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APPENDIX A – LIST OF L:VARIABLES EMPLOYED BY THE F-35

In order to allow thrid party mods to interact with the F-35 avionics and systems, here is a list of some special L: variables (local variables) which can be (safely) used. Note that the BEHAVIOR window in Developer mode can also list all the local variables and their value (and it also allows for direct modification for testing purposes).

PRIMARY CONTROL DISPLAY

(L:MFDX_Screen, number) - Portal X (where X is 1,2,3 or 4) page currently displayed (see list of modes below). For example if L:MFD2_Screen, number) is set to 1, portal 2 will switch to ASR mode.

(L:MFDX_Subportal, bool) – Controls the visibility of subportals on Portal X. 0 = Portals invisible, 1 = Portals are visible. For example if **(L:MFD3_Subportal, bool)** is set to 0, portal 3 will be in the enlarged mode and subportals will not be displayed.

(L:MFDX_SubportalY, number) – This variable controls the page currently displayed on subportal Y of portal X, where X is 1 to 4 and Y is 1 or 2. **(L:MFD3_Subportal1, number)** is set to 1, the first subportal of portal 3 will be set to ASR mode.

(L:MFD_Top_Bar_Swap, bool) – Controls is the top bar is swapped (1) or not.

LIST OF PORTALS AND SUBPORTAL MODES:

Basic modes:

0 → MENU
1 → ASR
2 → CHKLST
3 → CNI
4 → DAS
5 → DTM
6 → EFIS
7 → ENG
8 → FCS
9 → FTA (not used anymore)
10 → FTI (not used anymore)
11 → FUEL
12 → HUD
13 → ICAWS
14 → PHD
15 → SMS
16 → SRCH
17 → TFLIR
18 → TSD1
19 → TSD2
20 → TSD3
21 → TWD
22 → WPNA
23 → WPNS

Full screen modes (NOTE these must be applied to both sides of each screen half, so they must be applied both to MFD1 and MFD2 or to MFD3 and MFD4). The mode codes are the same as the basic modes + 100. Only few modes are available.

106 → EFIS
107 → ENGINE
108 → FCS
111 → FUEL
112 → HUD
118 → TSD1
119 → TSD2

120 → TSD3

Pop up pages – some pages are available also as POP UP. Note: we discourage the modder to invoke these pages unless he/she has a good understanding of how the PCD operates.

207 → ENGINE (only MFD1 and 3)
208 → FCS (only MFD1 and 3)
211 → FUEL (only MFD1 and 3)
215 → SMS (only MFD 1 and 3)
213 → ICAWS (only MFD 2 and 4)

Pages uniquely available as POP UP

224 → AUTOPILOT (only MFD 2 and 4)
225 → MENU (only MFD 1 and 3)
226 → LIGHTS (only MFD 2 and 4)
227 → NAVIGATION (only MFD 1 and 3)
228 → IDENTIFICATION (only MFD 2 and 4)
229 → BARO setting (only MFD 2 and 4)
230 → COMM (only MFD 1 and 3)
231 → ECS (only MFD 1 and 3)

NAVIGATION SYSTEMS

(L:NAVMode,number) – Navigation source currently in use: 0 = none, 1 = GPS / RTE, 2 = VOR/ILS, 3 = TACAN

INTEGRATED POWER PACKAGE

(L:IPPMasterSwitch, bool) - Position of IPP master switch 1 (1 is ON)

(L:ICC1Switch, bool) – Position of ICC switch 1 (1 is ON)

(L:ICC2Switch, bool) - Position of ICC switch 2 (1 is ON)

(L:IPPCabinPressureSelector, enum) – cabin pressure selector 0 = dump, 1 = norm, 2 = alternate

NOTE: IPP battery switch is operated by the default master battery command, IPP START is operated by the default starter command.

MISCELLANEOUS SYSTEMS

(L:CanopyCommand, bool) - controls the commanded canopy position, (0 closed, 1 open)

(L:switch_launch_bar_position, bool) – controls the commanded launch bar position (0 retracted, 1 extended)

(L:lever_tailhook, bool) - controls the commanded tailhook position, also STOVL doors on F-35B (0 retracted, 1 extended)

(L:switch_weapon_doors, bool) - controls the commanded weapon door position, (0 closed, 1 open)

(L:switch_IFR_door, bool) - controls the commanded refuel probe/door position, (0 closed, 1 open/extracted)

(L:MasterArmSwitch,number) – Master arm switch setting (0 = SAFE; 1= ARM)

(L:SafetyPin1, bool) – Safety pin 1 (1 present, 0 removed)

(L:SafetyPin1, bool) – Safety pin 2 (1 present, 0 removed)

(L:EjectionSeatArmPilot, bool) – Ejection seat arming (if safety pin is removed): 1 ARM; 0 SAFE