

FLIGHT MANUAL VC SUPPLEMENT (v1.1)

XTREME PROTOTYPES SERIES

X-15-2/3

ADD-ON ROCKET AIRCRAFT FOR FLIGHT SIMULATOR

This publication supplements sections IV and V of XP-X1523-1E. Reference to this supplement will be made on the title page of the basic manual by personnel responsible for maintaining this add-on software documentation in current status.

1. PURPOSE

To provide additional information on the installation and use of version 1.1 of subject add-on rocket aircraft package in Microsoft® Flight Simulator X and Flight Simulator 2004.

2. GENERAL

Version 1.1 contains many new features in addition to the ones previously found in version 1.0, mainly:

- a. Four fully functional 3D virtual cockpits (VC), each with over 900 parts and 200 animations;
- b. An automatic ignition sequence that is initiated at the touch of a single "magic" button;
- c. Basic autopilot modes (X-15-3 with MH-96 system only);
- d. Sound sets for both FSX and FS2004 versions of the aircraft;
- e. Ten camera definitions or views (FSX version);
- f. Twelve saved flights based on actual X-15 historical missions.

Some known technical issues have also been corrected or improved.

3. INSTRUCTIONS

Refer to the present **VC supplement** for a complete description of the new features and changes in version 1.1. Refer to the **basic (v1.0) utility flight manual** and the **FSX supplement** for more information and for complete procedures and check list.



X-15-2/3 VC (v1.1) FOR FLIGHT SIMULATOR

We thank you for purchasing or upgrading to version 1.1 of our X-15-2/3 add-on rocket aircraft package for Microsoft® Flight Simulator. Version 1.1 is a major revision of version 1.0 and contains many new features in addition to those found in the original version, including fully functional virtual cockpits. Some known issues have also been dealt with and most have been corrected or improved, within the limits of the simulator.

Our addons are designed to evolve with time, according to the feedback we receive from the flight simulation community and X-15 fans around the world. Many thanks to all those who submitted their comments and ideas and contributed to the making of version 1.1.

WHAT'S NEW IN VERSION 1.1?

Fully functional 3D virtual cockpits (VC) — Each of the four aircraft comes with its own 3D fully functional virtual cockpit which contains over 900 parts and nearly 200 animated gauges, switches, levers, light indicators and flight instruments. The VC is compatible with both FSX and FS2004 but will perform better in

FSX. As with the 2D instrument panels and the exterior models, each virtual cockpit has been meticulously created to conform as closely as possible to the cabin of the real X-15 rocket aircraft.



New switches and levers — The VC comes with new switches, control sticks, handles and levers which are fully described in the present document. Some lights and switches have also been replaced on the 2D panels to conform better to the real-world X-15 panels. All the

switches in the VC are clickable except for the circuit breakers on the right console.

Side views for the main 2D panel — The main 2D panel now has multiple side views (actually, 3D cockpit views) that can be scanned using the numeric keypad (with Num Lock selected) or the joystick top hat switch.



An automatic ignition sequence — The X-15 can now be started automatically at the touch of a single "magic" red button (icon) located on the breaker panel, on the right console in the VC and on the main 2D panel. This is similar to pressing CTRL+E with conventional FS aircraft. However, the red button initiates all X-15 internal custom systems, including her three-propellant rocket fuel management system. You can use this button instead of CTRL+E to properly start the engine



without going through the normal procedures and check list described in section V of the manual or the quick-start procedures in appendix 1.

New X-15 sound sets — The X-15 now comes with her own sound sets for both FSX and FS2004. In addition to the basic FS sound set, extra sound effects (APUs, turbopump, engine precool/prime and fuel jettison effects) are included in the FSX version.

Ten aircraft camera definitions or views (FSX version) — Version 1.1 for FSX now has ten new aircraft camera views, some of them corresponding to the real-world X-15 external bug-eye cameras located on the top and bottom portions of the fuselage and in the front section of the wing-tip pods on some aircraft. These



cameras show the vertical rudder, speed brakes, horizontal stabilizer and wing flaps. In addition to the X-15 camera views, the FSX version also has both left and right canopy views, a rear engine view and a "B-52 window" view showing the X-15 from her top left side. Users can cycle forward or backward the different camera views using the S and A keys (or SHIFT+S/SHIFT+A) or a joystick button. The aircraft camera views are also available from the main FS top menu bar.

New cockpit spotlights — The VCs and external models feature new cockpit spotlights that are lit when the cockpit lighting switch on the right side panel is turned on. Try flying the X-15 at night, dusk or dawn to see how the VC is beautifully lit.





“Invisible” VC canopy mode — The yellow canopy internal emergency jettison handle on the right side panel can now be activated and will allow for flying the X-15 add-on aircraft from within the VC without the clamshell-type canopy on. The emergency canopy release handle does not open the canopy. It simply makes it “invisible” for the virtual pilot. The canopy is still present on the external model.



Basic autopilot modes (MH-96 adaptive flight control system, X-15-3 only) — X-15-3 now has basic autopilot functions (attitude and heading hold modes) with control switches located on the MH-96 main and side control panels.

Twelve saved flights based on actual X-15 historical missions — It is now easier to prepare the X-15 for takeoff or simulate an X-15 launch at a high altitude from a carrier aircraft over different dry lakes in the Mojave Desert by loading one of the twelve new saved

flights. There are two categories of X-15 flights: the “takeoff” flights and the “high-altitude launch” flights. Each category contains many flights that are based on actual X-15 historical missions.

Some known technical issues have also been corrected or improved:

- Exterior model cockpit instrument panels are no longer lit until power is applied to the aircraft.
- FSX 2D instruments and gauges no longer emit light at night when electrical power is not applied.
- FSX external model cockpit spotlights no longer appear black when lit.
- FSX canopy window display issues have been solved (FSX Service Pack 2 recommended).
- SAS indicator lights are now flashing when in SAS test mode to conform to the real-world X-15 SAS test mode (X-15-2).
- MH-96 lights and switches have been modified and basic autopilot modes have been added to conform to the real-world MH-96 self-adaptive FCS (X-15-3).
- Turning off the PRIME switch on the XLR-99 panel now stops the ignition sequence, as in the real X-15 aircraft.
- Flight model has been improved to increase stability.
- Altitude and speed issues in FSX with Acceleration Pack have been solved.

COMPATIBILITY

The Xtreme Prototypes X-15 for Flight Simulator series of add-on rocket aircraft was originally designed and optimized for Microsoft® Flight Simulator 2004. The software is now compatible with Microsoft® Flight Simulator X (Service Pack 2 highly recommended) and Windows® Vista™ but some aircraft features may not behave or look exactly the same in both game environments. Some new FSX features in version 1.1 (such as the X-15 aircraft camera views) may not be available in FS2004. Flight models and add-on aircraft operation, procedures and check list, as described in the manual, are the same on both platforms.

Note that there seems to be no limit to the maximum



altitude to be attained by the X-15 add-on aircraft in FSX (which was limited to 100,000 feet in FS2004). For example, it is now possible to recreate the highest flight of the X-15 program achieved by X-15-3 on August 22, 1963 (354,200 feet). Unfortunately, speed is still limited to approximately Mach 4.65 on both platforms.

As a rule of thumb, if Microsoft® Flight Simulator runs properly on your computer, you should be able to fly the X-15 for Flight Simulator without problems. The new VC features and some special visual effects such as rocket engine flames and exhaust contrails might reduce your frame rate on slower processors and video cards. Adjust your Flight Simulator display parameters to correct this problem if necessary. Note that the VC instruments and gauges will perform better in FSX (that is, the needle movement will be more fluid). Reducing the traffic and weather settings in FS while flying the X-15 might also improve the overall system performance.

Consult the documentation included with your version Microsoft® Flight Simulator for information about minimum system requirements and how to optimize your display settings.

NOTE: Speed and altitude issues under Microsoft® Flight Simulator X Acceleration Pack reported with earlier versions of the Xtreme Prototypes X-15 for Flight Simulator Series have been corrected and are no longer issues. If the “Light bloom” option is selected in the FSX display settings, the X-15 add-on aircraft may not appear in the aircraft preview window and during flight with the screen becoming all white. To avoid this problem, unselect the “Light bloom” option in the FSX display settings page. This might also improve your frame rate. This is a model-related issue and cannot be corrected in version 1.1. We are currently working on this issue to avoid this problem in future versions of the software.

Check our web site regularly for frequently asked questions, fixes, patches and upgrades.

If you need additional support, please visit our web site: www.xtremeprototypes.com

MINIMUM SYSTEM REQUIREMENTS

Flight Simulator: Microsoft® FSX (FSX SP2 recommended, Acceleration Pack optional), FS2004
Operating System: Windows® XP SP2 (256 MB RAM), Windows® Vista™ (512 MB RAM)
Processor: 1.0 GHz
Hard Drive: 15 GB (space required to install Flight Simulator)
Available Disk Space: 300 MB (space required to install the X-15 add-on software and documentation)
Video Card: 64 MB (128 MB or more recommended), DirectX® 9.0
Other: Sound card and speakers, joystick, wheelmouse, Adobe® Reader® 8.0 or later

NOTE: Xtreme Prototypes X-15 addons are quite complex and require more processing power and RAM than other more conventional add-on aircraft packages. Increased performance will be noticed on more powerful systems. FSX SP2 minimum system requirements recommended.

Note to Windows® Vista™ with DirectX® 10 users: DirectX® 10 Preview option box in FSX display settings must be unchecked for proper aircraft display. The current version of the software does not support certain DirectX® 10 features.

UTILITY FLIGHT MANUAL, FSX AND VC SUPPLEMENTS

Included with the software are the English and French versions of the **X-15-2/3 utility flight manual** (X-15-2-3_manual_eng_01.pdf), the **FSX supplement** (X-15-2-3_fsx_supplement_eng_01.pdf) and the present **VC supplement** (X-15-2-3_VC_supplement_eng_01.pdf), all available in a printable PDF format (Adobe® Reader® 8.0 or later required).

To download Adobe® Reader®, visit: www.adobe.com/products/acrobat/



The 100-page flight manual and supplements contain the necessary information for the installation and operation of the X-15-2 and X-15-3 virtual aircraft and associated instrument panels. They contain instructions and procedures for XLR-99 rocket engine operation, on the X-15-2/3 for Flight Simulator.

The end-user is authorized and encouraged to print copies of the manual and of the supplements for his/her own use, in conjunction with the enclosed add-on simulation software. The best way to keep the manual handy for easy reference during flight is to organize it in a durable presentation binder.

PACKAGE DESCRIPTION

The installation disk (or the downloaded package) contains the following:

- ❑ A “**read me**” file (readme.txt) that contains the present installation instructions and other important information.
- ❑ A copy of the **end-user license agreement** (eula.rtf).
- ❑ English and French versions of the **utility flight manual** and of the **FSX and VC supplements** in a printable PDF format.
- ❑ A self-executable **Setup program file** (X-15-2-3_VC11_setup.exe) that is launched automatically when the disk is inserted into your computer disk drive. This program can also be launched manually by double-clicking the Setup icon in the disk folder.

If you have downloaded the software, the manuals and the documentation are included in the Setup program file.

The Setup program file contains the necessary software components to be installed on your computer:

1. The two X-15-2 VC and the two X-15-3 VC add-on **aircraft** and associated **2D panels** and **3D virtual cockpits**:
 - ❑ **2 versions of the X-15-2 VC aircraft (s/n AF-56-6671) with the XLR-99 rocket engine**:
 - “Dirty” version with the (interim) NACA vane-type boom nose and the original (XLR-99) black panel;

- “Dirty” version with the NACA/ Nortronics ball nose, gray thermo-paint on nose and canopy, and an alternate (XLR-99) black panel.
- ❑ **2 versions of the X-15-3 VC aircraft (s/n AF-56-6672) with the XLR-99 rocket engine**:
 - “Dirty” version with the NACA/ Nortronics ball nose and the original (XLR-99) black panel;
 - “Dirty” version with the NACA/ Nortronics ball nose, wing-tip pods, tail-cone box and the (XLR-99) light blue-gray panel.



2. A cabinet (.cab) file that contains all the **gauges, switches, lights, instruments and systems** for the X-15-2/3 VC advanced panels.
3. All the **special visual effects** for the X-15-2/3 aircraft (e.g.: rocket engine flame effects, propellant jettison effects, APU and engine turbopump exhaust effects, etc.).
4. The new X-15 **custom sound packages**.
5. The new **saved flights**.

INSTALLATION INSTRUCTIONS

Refer to the FSX section for installation in Flight Simulator X. Refer to the FS2004 section for installation in Flight Simulator 2004.

NOTE: The installation program will not erase nor replace the previous version (1.0) of the software, if installed on your computer. The new version will be installed in different folders. You may choose to delete or keep the previous version before installing version 1.1.

INSTALLATION IN FSX



The X-15-2 VC and X-15-3 VC for Flight Simulator are installed like any other add-on aircraft in your default "Microsoft Flight Simulator X" folder.

DOWNLOAD

If you have downloaded the software, simply run the Setup program (X-15-2-3_VC11_setup.exe) and follow the instructions that appear on screen. Enter your product registration key when asked. You must accept the end-user license agreement and enter a valid registration key before you can install and use this product. If FS2004 is also installed on your computer, select if you want the X-15-2/3 add-on aircraft to be installed in FSX, FS2004 or both. The installation program will copy the necessary files into their default locations in the "Microsoft Flight Simulator X" and/or "Flight Simulator 9" folder(s) on your computer.

CD-ROM

If you have purchased the CD-ROM package, insert the enclosed disc into your CD-ROM drive and follow the instructions that appear on screen.

Enter your product registration key when asked. You must accept the end-user software license agreement and enter a valid registration key before you can install and use this product. If FS2004 is also installed on your computer, select if you want the X-15-2/3 add-on aircraft to be installed in FSX, FS2004 or both. The installation program will copy the necessary files into their default locations in the "Microsoft Flight Simulator X" and/or "Flight Simulator 9" folder(s) on your computer. (If your computer does not support automatic installation, click Start on the Windows® taskbar and select **Control Panel**. Double-click the **Add/Remove Programs** icon and click **Add New Programs**. Follow the instructions that appear on screen.)

Once the add-on aircraft are installed, they will be available on the **Select Aircraft** page in Flight Simulator.

Note that the X-15-2/3 utility flight manual and the FSX and VC supplements are copied by default in the "C:\Program Files\Xtreme Prototypes\X-15-2-3 VC Documentation" folder for your convenience and future reference. They are available in the "Start\Programs\Xtreme Prototypes" section of the Windows® taskbar.

Refer to the FSX supplement for more information about how to install the software in FSX. Refer to section V of the basic (v1.0) utility flight manual for complete procedures and check list.

FILE STRUCTURE

The X-15 aircraft, panels and sounds are installed in your "Microsoft Flight Simulator X\SimObjects\Airplanes" folder, under different names. Each aircraft and associated components are contained in a different folder. The X-15 gauge cabinet is installed in your "Microsoft Flight Simulator X\Gauges" folder, the X-15 special effects are installed in your "Microsoft Flight Simulator X\Effects" folder and the X-15 saved flights are installed in your "...My documents\Flight Simulator X Files" folder on your computer.

NOTE: The FSX saved flights are installed in your "...My documents\Flight Simulator X Files" folder and not in your "Microsoft Flight Simulator X\Flights" folder, like in FS2004.

INSTALLATION IN FS2004



The X-15-2 VC and X-15-3 VC for Flight Simulator are installed like any other add-on aircraft in your default "Flight Simulator 9" folder.

DOWNLOAD

If you have downloaded the software, simply run the Setup program (X-15-2-3_VC11_setup.exe) and follow the instructions that appear on screen. Enter your product registration key when asked. You must accept the end-user license agreement and enter a valid registration key before you can install and use this product. If FSX is also installed on your computer, select if you want the X-15-2/3 add-on aircraft to be installed in FS2004, FSX or both. The installation program will then copy the necessary files into their default locations in the "Flight Simulator 9" and/or "Microsoft Flight Simulator X" folder(s) on your computer.

CD-ROM

If you have purchased the CD-ROM package, insert the enclosed disc into your CD-ROM drive and follow the instructions that appear on screen. Enter your product registration key when asked. You must accept the end-user software license agreement and enter a valid registration key before you can install and use this product. If FSX is also installed on your computer, select if you want the X-15-2/3 add-on aircraft to be installed in FS2004, FSX or both. The installation program will then copy the necessary files into their default locations in the "Flight Simulator 9" and/or "Microsoft Flight Simulator X" folder(s) on your computer.

(If your computer does not support automatic installation, click Start on the Windows® taskbar and select **Control Panel**. Double-click the **Add/Remove Programs** icon and click **Add New Programs**. Follow the instructions that appear on screen.)

Once the add-on aircraft are installed, they will be available on the **Select Aircraft** page in Flight Simulator.

Note that the X-15-2/3 utility flight manual and the FSX and VC supplements are copied by default in the "C:\Program Files\Xtreme Prototypes\X-15-2-3 VC Documentation" folder for your convenience and future reference. They are available in the "Start\Programs\Xtreme Prototypes" section of the Windows® taskbar.

Refer to section II of the basic (v1.0) utility flight manual for more information about how to install the software in FS2004. Refer to section V of the manual for complete procedures and check list.

FILE STRUCTURE

The X-15 aircraft, panels and sounds are installed in your "Flight Simulator 9\Aircraft" folder, under different names. Each aircraft and associated components are contained in a different folder. The X-15 gauge cabinet is installed in your "Flight Simulator 9\Gauges" folder, the X-15 special effects are installed in your "Flight Simulator 9\Effects" folder and the X-15 saved flights are installed in your "Flight Simulator 9\Flights" folder.

BEFORE CREATING A FLIGHT

The following section supplements section V of the basic (v1.0) utility flight manual:

X-15 CUSTOM FUEL MANAGEMENT SYSTEM

Conventional aircraft in Microsoft® Flight Simulator use only one type of fuel (either aviation gasoline or jet fuel). Propellant consumption is automatically calculated and managed by the simulator's engine.

Like the real-world rocket airplane, the X-15 for Flight Simulator uses at least three different types of propellants: anhydrous (waterless) ammonia as the main engine fuel, liquid oxygen as the oxidizer and hydrogen peroxide as a monopropellant for the engine turbopump, the APUs and the ballistic control system rockets.



The main propellant tanks and the airplane's pneumatic controls in the X-15 aircraft are pressurized with helium.

Concurrently, the two auxiliary power units (APUs) in the X-15 consume hydrogen peroxide under helium pressure from separate tanks. The APUs provide both electrical power and hydraulic power to the aircraft.

Finally, the airplane air conditioning and pressurization systems use liquid nitrogen pressurized by helium.

In order to simulate as closely as possible the true operation of the X-15 aircraft, **special built-in systems** have been designed and integrated into the X-15 for Flight Simulator instrument panels. These custom systems bypass the simulator's fuel management system and need some special settings:

1. Under the "Aircraft" menu in the main Flight Simulator window, select **REALISM SETTINGS**.
2. On the "Settings – Realism" page, under "Engines", select the **UNLIMITED FUEL** option.

IMPORTANT **PLEASE READ CAREFULLY!**

1. **Do not use CTRL+E** — The engine autostart command in Flight Simulator (**CTRL+E**) **must not be used** to start the X-15 engine to allow for the true simulation of the X-15 rocket engine ignition sequence procedures described in section V and/or appendix 1 of the flight manual.

For a quick start, **use the new automatic ignition sequence start red button (icon)** located on the breaker panel on the right console in the VC and on the main 2D panel instead. This is similar to pressing CTRL+E with conventional FS aircraft. However, the red button initiates all X-15 internal custom systems, including her three-propellant rocket fuel management system.

2. **All systems are reset when a new X-15 aircraft is loaded** — The correct initialization and ignition sequence procedures (including pressing the red "magic" button, if preferred) must be performed before flight each time a new X-15 aircraft is loaded in the simulator. This is because the add-on X-15 aircraft uses its own proprietary internal variables in addition the system (FS) variables. If the panels appear "frozen" after a new aircraft has been loaded **while in flight**, simply end the current flight and **start a new flight** with the new X-15 aircraft.

RECOMMENDED FLIGHT SIMULATOR INITIAL SETTINGS

The X-15 for Flight Simulator special visual effects replace the default simulator aircraft lights and need some special settings:



1. On the "Settings – Realism" page in FS, under "Instruments and Lights", select the **PILOT CONTROLS AIRCRAFT LIGHT** option.

The following settings are to make your flight in the X-15 more enjoyable:

1. On the "Settings – Realism" page in FS, set the following:
 - a. All "Flight Model" settings – **50%** (cursor in the middle).
 - b. Enable gyro drift – **SELECTED**.

- c. Display indicated airspeed – **SELECTED**.
 - d. Ignore crashes and damage – **SELECTED**.
 - e. G-effects – **UNSELECTED**.
2. Click **OK** to close the “Settings – Realism” page and return to the game.

CREATING A FLIGHT

You can load one of the twelve new X-15 saved flights included with version 1.1 as a “template” for a new flight. This has the advantage of presetting all X-15 internal systems to OFF and preventing the rocket plane from moving by itself on the runway at the beginning of a flight because the engine was running in the previous flight, in the last saved flight or in the default flight. Refer to the FSX supplement an/or section V in the basic (v1.0) flight manual for complete instructions on how to create an X-15 flight in Flight Simulator.

3D VIRTUAL COCKPITS



The main center of interest and certainly the most requested feature in version 1.1 are the fully functional virtual cockpits that allow a total 3D immersion into the X-15 flying environment. The X-15-2/3 package contains four different virtual cockpits, one for each add-on aircraft.

Each VC contains over 900 parts and nearly 200 animated gauges, switches, levers, light indicators and flight instruments. The VC is compatible with both FSX and FS2004 but will perform better in FSX (the needle movement will be more fluid).

As with the 2D instrument panels and the exterior mod-

els, each virtual cockpit has been meticulously created to conform as closely as possible to the cabin of the real X-15 rocket aircraft. The VC comes with new switches, control sticks, handles and levers. All the switches in the VC are clickable (except for the circuit breakers on the right console) and can be used to simulate nearly every step and procedure required in a typical X-15 mission.

The VC has cockpit spotlights attached to the inside of the canopy that are lit when the cockpit lighting switch on the right side panel is turned on. Try flying the X-15 at night, dusk or dawn to see how the VC is beautifully lit.

Another interesting feature of the VC is the possibility to render the canopy “invisible” to create the impression that the aircraft is equipped with a “bubble” glass canopy. Though not realistic in the case of a real X-15 mission, the “invisible” canopy gives more visibility to the pilot and allows him to admire the landscape. Try it while in outer space in FSX for a spectacular view of the Earth, the Moon and the stars while in the VC.

To render the canopy “invisible”, simply pull the yellow canopy internal emergency jettison handle on the right side panel. Note that the canopy emergency jettison handle does not open the canopy. It simply makes it “invisible” for the virtual pilot in the VC. The canopy is still present on the external model.

The virtual cockpit is available in both FSX and FS2004 environments from the “Views” menu in the main FS menu bar at the top. Users can cycle forward or backward the different views using the S key (or SHIFT+S) or a joystick button. Going back to the 2D main panel in FSX can also be done by cycling the different cockpit views with the A key (or SHIFT+A).



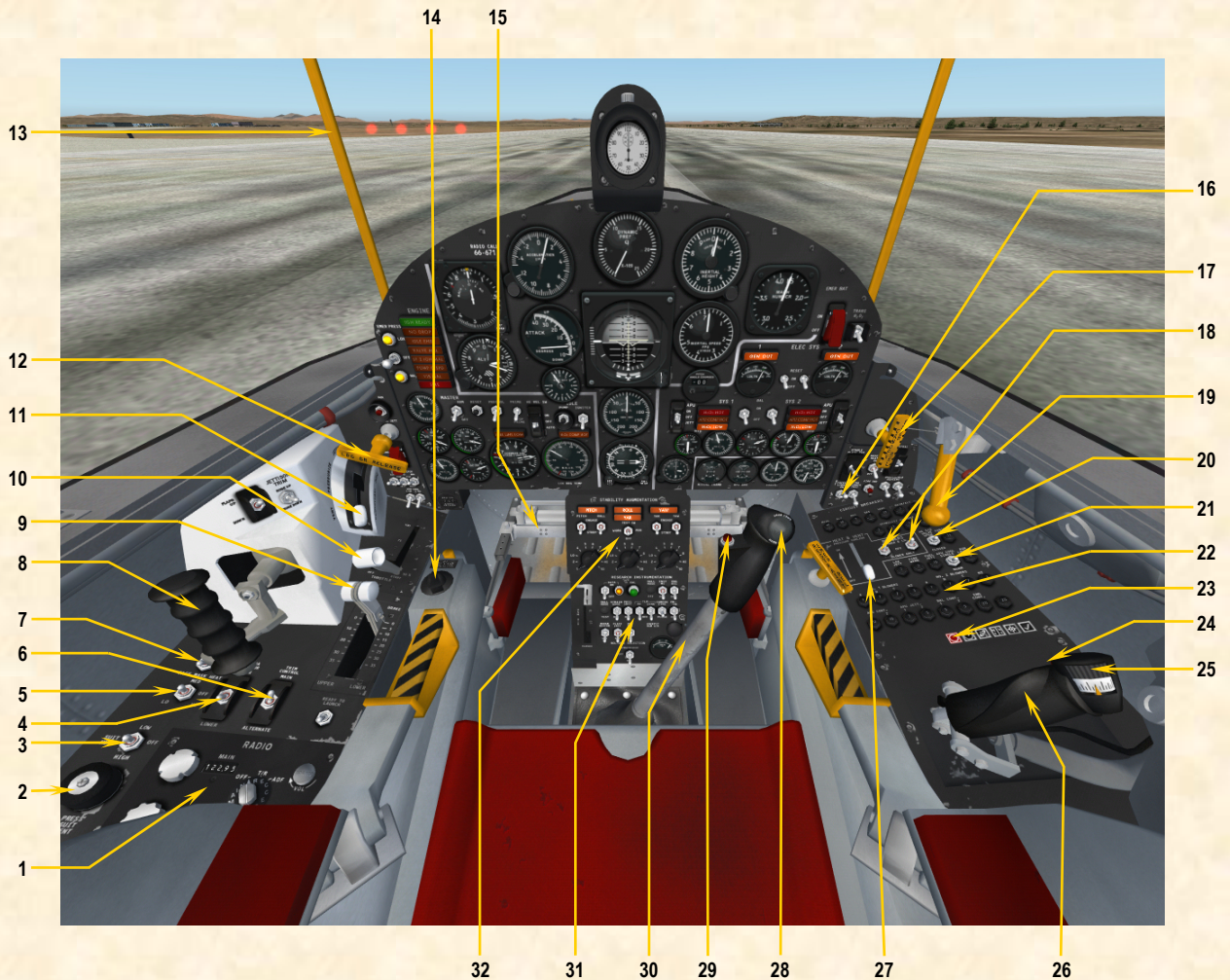


Figure 1

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|---------------------------------------------|---------------------------------------------------------|------------------------------------------------------|
| 1. RADIO/ADF PANEL | 15. RUDDER PEDALS | 26. CONSOLE STICK |
| 2. PRESSURE SUIT VENT KNOB | 16. COCKPIT LIGHTING SWITCH | 27. HEAT VENT LEVER |
| 3. VENT SUIT HEATER SWITCH | 17. CANOPY INTERNAL EMERGENCY JETTISON HANDLE | 28. ALTERNATE TRIM SWITCH (TOP HAT) |
| 4. RADIO ANTENNA SELECTOR SWITCH | 18. BLOWER SWITCHES | 29. MICROPHONE PTT SWITCH |
| 5. FACE MASK HEATER SWITCH | 19. CANOPY INTERNAL HANDLE | 30. CENTER STICK |
| 6. TRIM CONTROL SELECTOR SWITCH | 20. CABIN SOURCE HELIUM SHUTOFF VALVE SWITCH | 31. CENTER PEDESTAL (RESEARCH INSTRUMENTATION PANEL) |
| 7. INTERCOMMUNICATION SWITCH | 21. APU NITROGEN COOLING SWITCH | 32. SAS PANEL |
| 8. BALLISTIC CONTROL STICK (HANDLE) | 22. BREAKER PANEL | |
| 9. SPEED BRAKE LEVERS | 23. AUTOMATIC IGNITION SEQUENCE START BUTTON (RED ICON) | |
| 10. THROTTLE | 24. MICROPHONE PTT SWITCH | |
| 11. VENT, PRESSURIZATION AND JETTISON LEVER | 25. TRIM KNOB | |
| 12. LANDING GEAR HANDLE | | |
| 13. CANOPY HOLDER | | |
| 14. PILOT'S OXYGEN SELECTOR KNOB | | |

Refer to section IV in the basic (v1.0) utility flight manual for a complete description of the different instrument panels.

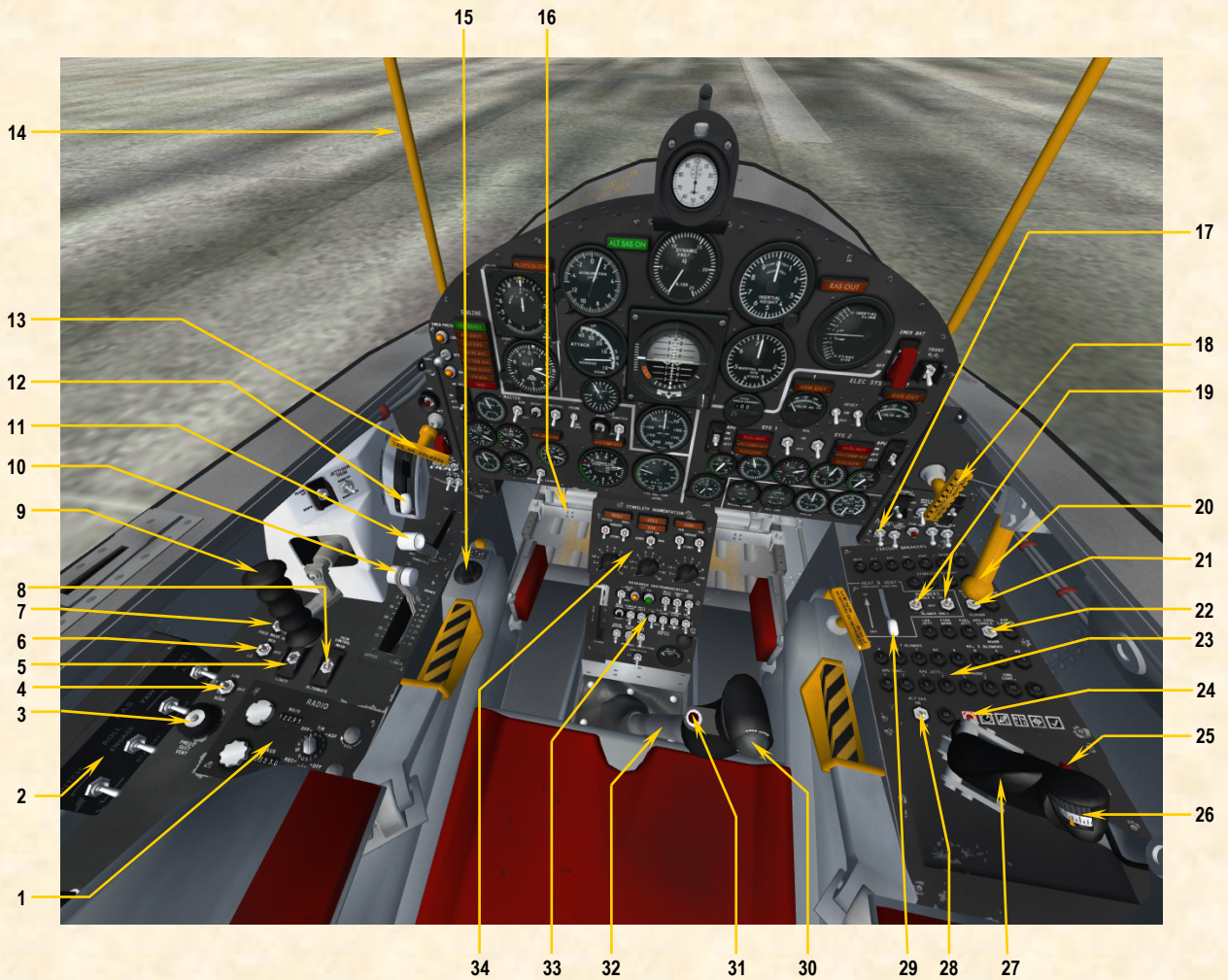


Figure 2

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|---------------------------------------------|---------------------------------------------------------|------------------------------------------------------|
| 1. RADIO PANEL | 15. PILOT'S OXYGEN SELECTOR KNOB | 26. TRIM KNOB |
| 2. RAS CONTROL BOX | 16. RUDDER PEDALS | 27. CONSOLE STICK |
| 3. PRESSURE SUIT VENT KNOB | 17. COCKPIT LIGHTING SWITCH | 28. ALT SAS SWITCH |
| 4. VENT SUIT HEATER SWITCH | 18. CANOPY INTERNAL EMERGENCY JETTISON HANDLE | 29. HEAT VENT LEVER |
| 5. RADIO ANTENNA SELECTOR SWITCH | 19. BLOWER SWITCHES | 30. ALTERNATE TRIM SWITCH (TOP HAT) |
| 6. FACE MASK HEATER SWITCH | 20. CANOPY INTERNAL HANDLE | 31. MICROPHONE PTT SWITCH |
| 7. INTERCOMMUNICATION SWITCH | 21. CABIN SOURCE HELIUM SHUTOFF VALVE SWITCH | 32. CENTER STICK |
| 8. TRIM CONTROL SELECTOR SWITCH | 22. APU NITROGEN COOLING SWITCH | 33. CENTER PEDESTAL (RESEARCH INSTRUMENTATION PANEL) |
| 9. BALLISTIC CONTROL STICK (HANDLE) | 23. BREAKER PANEL | 34. SAS PANEL |
| 10. SPEED BRAKE LEVERS | 24. AUTOMATIC IGNITION SEQUENCE START BUTTON (RED ICON) | |
| 11. THROTTLE | 25. MICROPHONE PTT SWITCH | |
| 12. VENT, PRESSURIZATION AND JETTISON LEVER | | |
| 13. LANDING GEAR HANDLE | | |
| 14. CANOPY HOLDER | | |

Refer to section IV in the basic (v1.0) utility flight manual for a complete description of the different instrument panels.



Figure 3

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|----------------------------------------------|---------------------------------------------------------|------------------------------------------------------|
| 1. RADIO PANEL | 15. RUDDER PEDALS | 27. MICROPHONE PTT SWITCH |
| 2. INTERCOMMUNICATION SWITCH | 16. MH-96 SYSTEM INDICATOR LIGHTS | 28. TRIM KNOB |
| 3. PRESSURE SUIT VENT KNOB | 17. MH-96 CSS (AUTOPILOT OFF/ON) SWITCH | 29. CONSOLE STICK |
| 4. FACE MASK HEATER SWITCH | 18. MH-96 ROLL TRIM KNOB | 30. HEAT VENT LEVER |
| 5. TRIM CONTROL SELECTOR SWITCH | 19. COCKPIT LIGHTING SWITCH | 31. ALTERNATE TRIM SWITCH (TOP HAT) |
| 6. VENT SUIT HEATER SWITCH | 20. CANOPY INTERNAL EMERGENCY JETTISON HANDLE | 32. MICROPHONE PTT SWITCH |
| 7. MH-96 (AUTOPILOT) HOLD REFERENCE SWITCHES | 21. BLOWER SWITCHES | 33. CENTER STICK |
| 8. BALLISTIC CONTROL STICK (HANDLE) | 22. CANOPY INTERNAL HANDLE | 34. CENTER PEDESTAL (RESEARCH INSTRUMENTATION PANEL) |
| 9. SPEED BRAKE LEVERS | 23. CABIN SOURCE HELIUM SHUTOFF VALVE SWITCH | 35. MH-96 ADAPTIVE FLIGHT CONTROL SYSTEM MAIN PANEL |
| 10. THROTTLE | 24. APU NITROGEN COOLING SWITCH | 36. MH-96 (AUTOPILOT) YAW DAMPER SWITCH |
| 11. VENT, PRESSURIZATION AND JETTISON LEVER | 25. BREAKER PANEL | 37. MH-96 (AUTOPILOT) AOA OR PITCH VERNIER SWITCH |
| 12. LANDING GEAR HANDLE | 26. AUTOMATIC IGNITION SEQUENCE START BUTTON (RED ICON) | |
| 13. CANOPY HOLDER | | |
| 14. PILOT'S OXYGEN SELECTOR KNOB | | |

Refer to section IV in the basic (v1.0) utility flight manual for a complete description of the different instrument panels.

WITH INERTIAL ALL-ATTITUDE FLIGHT DATA SYSTEM, MH-96 ADAPTIVE FLIGHT CONTROL SYSTEM AND XLR-99 ENGINE (X-15-3B)

VIRTUAL COCKPIT

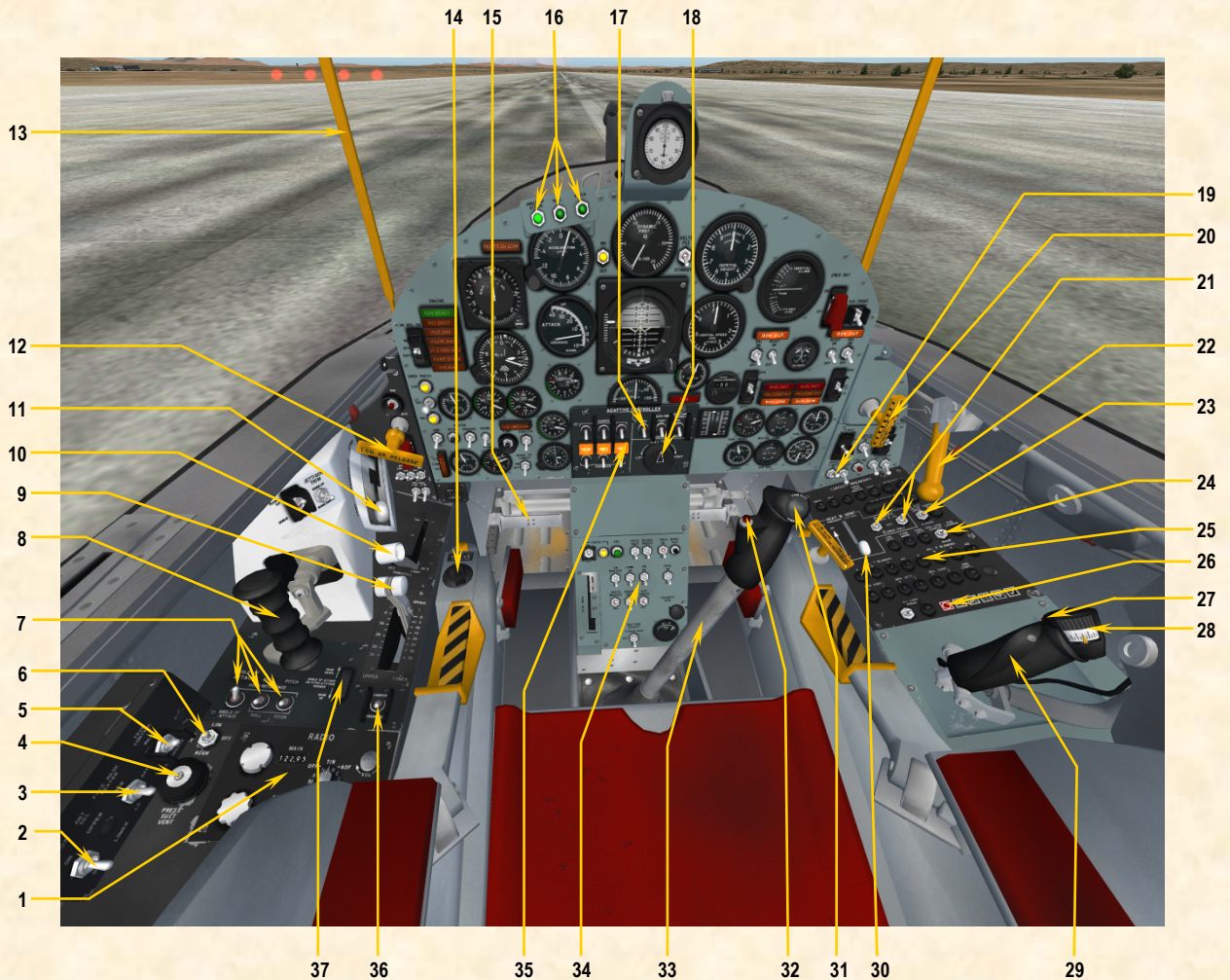


Figure 4

- | | | |
|----------------------------------------------|---------------------------------------------------------|------------------------------------------------------|
| 1. RADIO PANEL | 15. RUDDER PEDALS | 27. MICROPHONE PTT SWITCH |
| 2. INTERCOMMUNICATION SWITCH | 16. MH-96 SYSTEM INDICATOR LIGHTS | 28. TRIM KNOB |
| 3. FACE MASK HEATER SWITCH | 17. MH-96 CSS (AUTOPILOT OFF/ON) SWITCH | 29. CONSOLE STICK |
| 4. PRESSURE SUIT VENT KNOB | 18. MH-96 ROLL TRIM KNOB | 30. HEAT VENT LEVER |
| 5. TRIM CONTROL SELECTOR SWITCH | 19. COCKPIT LIGHTING SWITCH | 31. ALTERNATE TRIM SWITCH (TOP HAT) |
| 6. VENT SUIT HEATER SWITCH | 20. CANOPY INTERNAL EMERGENCY JETTISON HANDLE | 32. MICROPHONE PTT SWITCH |
| 7. MH-96 (AUTOPILOT) HOLD REFERENCE SWITCHES | 21. BLOWER SWITCHES | 33. CENTER STICK |
| 8. BALLISTIC CONTROL STICK (HANDLE) | 22. CANOPY INTERNAL HANDLE | 34. CENTER PEDESTAL (RESEARCH INSTRUMENTATION PANEL) |
| 9. SPEED BRAKE LEVERS | 23. CABIN SOURCE HELIUM SHUTOFF VALVE SWITCH | 35. MH-96 ADAPTIVE FLIGHT CONTROL SYSTEM MAIN PANEL |
| 10. THROTTLE | 24. APU NITROGEN COOLING SWITCH | 36. MH-96 (AUTOPILOT) YAW DAMPER SWITCH |
| 11. VENT, PRESSURIZATION AND JETTISON LEVER | 25. BREAKER PANEL | 37. MH-96 (AUTOPILOT) AOA OR PITCH VERNIER SWITCH |
| 12. LANDING GEAR HANDLE | 26. AUTOMATIC IGNITION SEQUENCE START BUTTON (RED ICON) | |
| 13. CANOPY HOLDER | | |
| 14. PILOT'S OXYGEN SELECTOR KNOB | | |

Refer to section IV in the basic (v1.0) utility flight manual for a complete description of the different instrument panels.



IMPORTANT
PLEASE READ CAREFULLY!

The main 2D panel **must be loaded first** — In order for the X-15 special internal systems to initialize and work properly, the 2D main instrument panel **MUST BE LOADED FIRST**. This is because the custom X-15 systems are integrated in the main 2D panel. The X-15 add-on aircraft will not work properly if, for example, the VC is loaded first and the main 2D panel is not loaded at all. This is especially true in FSX where the VC is the default aircraft panel view. The main 2D panel **only needs to appear once** at the beginning of a flight and until a new X-15 aircraft is loaded in the simulator. The VC (or the 2D panel) can then be used as the main cockpit environment.

X-15-2/3 VIRTUAL COCKPITS

The following section describes the new components included in the X-15-2/3 VC that are not necessarily found in the 2D panels. Refer to section IV in the basic (v1.0) utility flight manual for more information about the different X-15-2/3 instrument panels.

Automatic Ignition Sequence Start Button (Red Icon)

[23, fig. 1; 24, fig. 2; 26, fig. 3-4]

The X-15 can now be started automatically at the touch

of a single "magic" red button (icon) located on the breaker panel on the right console in the VC and on the main 2D panel. This is similar to pressing CTRL+E with conventional FS aircraft. However, the red button initiates all X-15 internal custom systems, including her three-propellant rocket fuel management system. You can use this button instead of CTRL+E to properly start the engine without going through the normal procedures and check list described in section V of the manual or the quick-start procedures in appendix 1. **It takes about 20 seconds** for the XLR-99 engine to ignite with this method. Simply **click the red icon once** and you can sit and relax and watch all the switches and gauges move all by themselves in the cockpit while the auto ignition sequence executes the procedures described in appendix 1 of the manual and ignites the rocket.



NOTE: By default, the automatic ignition sequence **turns on** the unlimited fuel option switch on the X-15 service panel. If you prefer a more realistic X-15 flight with a limited engine burn time (about 90 seconds with the XLR-99 engine), **turn off** the unlimited fuel option switch on the service panel before the automatic ignition sequence turns on the engine master switch on the main panel. Once the engine master switch is turned on, the unlimited fuel option switch on the service panel cannot be changed. Refer to sections IV and V in the flight manual for more details about this switch.



Center Stick
[30, fig. 1; 32, fig. 2; 33, fig. 3-4]

The center stick is designed for use during normal periods of longitudinal and vertical accelerations. **Clicking the black handle disables the ballistic control stick** and enables the center stick and the right console stick. **The center stick is enabled by default.**

Console Stick

[26, fig. 1; 27, fig. 2; 29, fig. 3-4]

The console stick on the right console enables the pilot to control the airplane throughout the periods of high longitudinal and vertical accelerations. The console stick movements are synchronized with the center stick. **Clicking the black handle** disables the ballistic control stick and enables the console stick and the center stick. **The console stick is enabled by default.**



NOTE (X-15-3 only): The X-15-3 aircraft was equipped with the Minneapolis Honeywell MH-96 self-adaptive flight control system which integrated both the aerodynamic and reaction controls in the right console stick, allowing the pilot to use only one hand for control during air-to-space transitions, which improved handling qualities and reduced pilot workload.

Trim Control Selector Switch

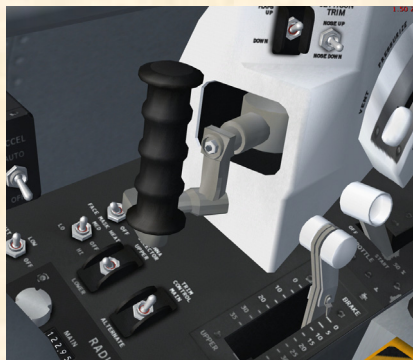
[6, fig. 1; 8, fig. 2; 5, fig. 3-4]

This two-position switch on the left console (or on the left side control box) controls the selection of normal or alternate trim. With the switch at the **NORMAL** position, the center stick trim control switch (top hat) [28, fig. 1; 30, fig. 2; 31, fig. 3-4] is inoperative and the console stick pitch trim knob [25, fig. 1; 26, fig. 2; 28, fig. 3-4] is activated. With the switch at the **ALTERNATE** position, the console stick pitch trim knob [25, fig. 1; 26, fig. 2; 28, fig. 3-4] is inoperative and the center stick trim control switch (top hat) [28, fig. 1; 30, fig. 2; 31, fig. 3-4] is activated.

Ballistic Control Stick

[8, fig. 1; 9, fig. 2; 8, fig. 3-4]

The ballistic control stick, above the left console, con-



trols the flow of hydrogen peroxide to selected rockets in the nose and wings of the aircraft, when the ballistic control system is operating. Yaw control is obtained by direct left or right movement of the stick. Roll control is obtained by rotation of the stick. Pitch control is obtained by direct up or down movement of the stick. **Clicking the black handle** disables the center stick and the right console stick and enables the ballistic control stick. **The ballistic control stick is disabled by default.**

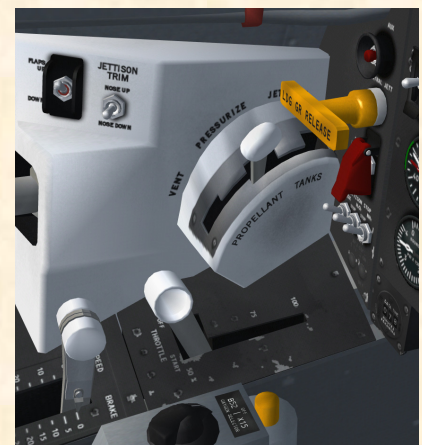
NOTE: Flight Simulator does not provide ballistic control or reaction augmentation systems for rocket airplanes at this time. Consequently, the BCS and RAS controls and switches on the X-15-2/3 panels do not perform any specific simulator function in this software version, other than being animated to simulate BCS and RAS-related procedures. The ballistic control stick in the VC is linked to the simulator control stick and will control the aircraft at high altitude, simulating BCS operation.

NOTE (X-15-3 only): The X-15-3 aircraft was equipped with the Minneapolis Honeywell MH-96 self-adaptive flight control system which integrated both the aerodynamic and reaction controls in the right console stick, allowing the pilot to use only one hand for control during air-to-space transitions, which improved handling qualities and reduced pilot workload.

Vent, Pressurization and Jettison lever

[11, fig. 1; 12, fig. 2; 11, fig. 3-4]

This lever controls the aircraft pressurization system. With the lever at **VENT**, the pressurization valves close and the vent valves open, venting the three propellant tanks. In order to obtain engine operation, the lever must be moved to **PRESURITIZE**, opening the propellant system pressurization and closing the vent valves. With the lever at **PRESURITIZE**, the three propellant tanks are pressurized with helium. When the lever is positioned at **JETTISON**, the jettison valves are open and helium pressure



will start pushing the three propellants overboard (if the jettison stop switches are at JETT). Simply **drag the white lever** in the VC to the desired position (VENT, PRESSURIZE or JETTISON).

Landing Gear Handle

[12, fig. 1; 13, fig. 2; 12, fig. 3-4]

When this yellow handle, on the left side panel, is **pulled (dragged) straight aft**, the nose gear door up-locks are released, the spring-loaded scoop door in the nose door swings downward into the airstream, and the nose gear extension initiator fires. Gravity and air loads cause the main gear to extend and lock. Air load on the nose gear scoop door forces the nose gear down and locked. Note that in the real world, the X-15 landing gear could not be retracted by the pilot when deployed. However, dragging the landing gear handle back to its original position in the VC will retract the landing gear.



NOTE: If the “Ignore crashes and damage” option has not been selected in the “Settings – Realism” page in FS and the aircraft exceeds a certain speed limit (about 300 KIAS) just after takeoff with the landing gear still deployed, the gear will be damaged and will not retract. To avoid this problem, always check the airspeed and retract the landing gear promptly after takeoff or select the above realism option in Flight Simulator.



Throttle (XLR-99 engine)

[10, fig. 1; 11, fig. 2; 10, fig. 3-4]

To start the engine after the normal ignition sequence procedures have been performed, simply **left click the**

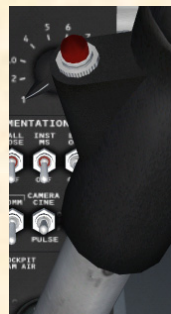
white throttle handle on the left console to move the throttle inboard to **START (50%)** and ignite the main thrust chamber. **Drag the handle** to the desired level of thrust during normal engine operation. To shut down the engine, simply **move the throttle aft to 50%** then **right click the white handle** to stop the engine and move the throttle outboard back to its **OFF** position.

NOTE: The throttle can also be controlled with the standard FS methods (keyboard and/or joystick).

Speed Brake Levers

[9, fig. 1; 10, fig. 2; 9, fig. 3-4]

The upper and lower speed brake levers (handles) on the left console are locked together and can be **dragged** to the desired position in the VC. When the levers are moved to a given setting, the speed brakes will open to the position selected.



PTT Switches

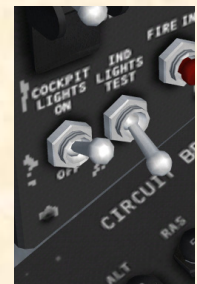
[24, 29, fig. 1; 25, 31, fig. 2; 27, 32, fig. 3-4]

The microphone Push-To-Talk (red) switches are located on the black handles of the center stick and of the right console stick. **Clicking the PTT switch** in the VC will open the ATC window in the simulator.

Cockpit Lighting Switch

[16, fig. 1; 17, fig. 2; 19, fig. 3-4]

The cockpit lighting switch is located on the right side panel. When the aircraft is powered, turning this switch to **ON** will light the two cockpit spotlights that are attached to the inside of the canopy, illumi-





nating the cockpit (and the VC).

Canopy Internal Emergency Jettison Handle

[17, fig. 1; 18, fig. 2; 20, fig. 3-4]

In the real aircraft, this yellow T-type handle mounted on the right side panel, jettisons the canopy without firing the ejection seat. **Pulling (dragging) this handle** in the VC will make the canopy “invisible” from within the VC. The canopy emergency jettison handle



does not open the canopy. It simply makes it “invisible” for the virtual pilot. The canopy is still present on the external model.

Canopy Internal Handle

[19, fig. 1; 20, fig. 2; 22, fig. 3-4]

This canopy internal handle (a yellow handle with a ball at one



end) is located on the right side of the cockpit, just below the canopy sill. This handle locks or unlocks the canopy. Simply **click on the yellow handle** in the VC to open or close the X-15 clamshell-type canopy.

MH-96 ADAPTIVE FLIGHT CONTROL SYSTEM (X-15-3 ONLY)



NOTE: Refer to the basic (v1.0) X-15-2/3 utility flight manual for information about the Westinghouse stability augmentation system (SAS) and reaction control system (RAS) installed in the X-15-2.

A key element of the specialized flight instrumentation and displays that rendered the X-15-3 especially suitable for high-altitude/high-speed flight research was the Minneapolis Honeywell MH-96 self-adaptive flight control system [35, fig. 3-4], originally developed for the cancelled X-20 “Dyna-Soar” program.

The MH-96 automatically compensated for the aircraft’s behaviour at different regimes, combining aerodynamic surfaces and the reaction controls into a single control unit. Unlike in the two other X-15, this allowed the pilot to use only one hand for control during air-to-space transitions, which improved handling qualities and reduced pilot workload. Only the right console control stick [26, fig. 1; 27, fig. 2; 29, fig. 3-4] needed to be used, providing automatic blending of the aerodynamic and the ballistic control system.

The MH-96 system automatically provided adjustment of gain to maintain a desirable dynamic response of the airplane. It compared the response of the airplane with pre-programmed “ideal” response in terms of pitch, roll and yaw, to provide stability augmentation.

In addition, the MH-96 had a basic “autopilot” feature that maintained the desired attitude except during control inputs. It provided angle-of-attack hold, heading hold and pitch and roll (attitude) hold. Controls were also incorporated to provide control stick steering



(CSS), yaw damping in addition to electrical trimming of the pitch and roll axes.

The MH-96 main control panel is installed in the upper section of the center pedestal or in the lower middle section of the main instrument panel in X-15-3 [35, fig. 3-4].

MH-96's basic autopilot controls are installed in the left console, behind the ballistic control stick and the speed brake panel [7, 36, 37, fig. 3-4].

NOTE: Flight Simulator still does not provide true SAS functions at this time (except for the basic yaw damper function). Consequently, the pitch/roll/yaw damper/gain switches on the X-15-3 MH-96 system main control panel do not perform any specific simulator function in this software version, other than being animated to simulate MH-96-related procedures. However, the yaw damper switch on the left console [36, fig. 3-4] provides FS yaw damping during flight.

MH-96 Control Stick Steering (CSS) Switch

[17, fig. 3-4]

This switch is located on the MH-96 main control panel. Turning this switch to **OFF** (down position) deactivates CSS and activates the autopilot (same as the autopilot master switch on conventional FS aircraft). Turning this switch to **ON** (up position) deactivates the autopilot and reactivates CSS. The switch is set to ON (autopilot OFF) by default.



IMPORTANT NOTE: The aircraft's avionics must be turned on to enable the MH-96 autopilot. This is done



by turning the X-15 radio function selector switch either to **T/R** or **ADF** (center or right position). Turning the radio function selector switch to **OFF** turns off the aircraft's avionics (radio, GPS and autopilot).

MH-96 (Autopilot) Hold Reference Switches

[7, fig. 3-4]

These switches are located on the MH-96 left control panel on the left console.

Turning the **angle-of-attack hold switch** to **ON** only activates the autopilot (there is no angle-of-attack hold mode in FS). Turning the angle-of-attack hold switch to **OFF** will not deactivate the autopilot. The switch is set to OFF by default.

Turning the **roll hold switch** to **ON** activates the (FS) autopilot's heading hold mode. Turning the roll hold switch to **OFF** will deactivate the (FS) autopilot's heading hold mode but will not deactivate the autopilot. The switch is set to OFF by default.

Turning the **pitch hold switch** to **ON** activates the (FS) autopilot's attitude hold mode (wing leveller + pitch hold modes). Turning the roll hold switch to **OFF** will deactivate the (FS) autopilot's attitude hold mode (wing leveller + pitch hold modes) but will not deactivate the autopilot. The switch is set to OFF by default.

NOTE: There are no “stand alone” angle-of-attack hold, roll hold or pitch hold modes in FS. Also, the MH-96 roll mode (FS heading hold mode) and pitch hold mode (FS attitude hold mode) cannot be selected simultaneously in FSX.

MH-96 Yaw Damper Switch

[36, fig. 3-4]

This switch is located on the MH-96 control panel on the left console. Turning this switch to **DAMPER** activates FS yaw damper mode during flight. Turning this switch to **DISENGAGE** deactivates FS yaw damper mode.

MH-96 Angle-of -Attack or Pitch Attitude Vernier Switch

[37, fig. 3-4]

This switch, located on the MH-96 control panel on the left console, provides electrical trimming of the pitch

TYPICAL MH-96 ADAPTIVE FCS EVALUATION FLIGHT

X-15-3 Flight Request

Flight: 3-4-8 (see pages 25-26)

Scheduled Date: 4/20/62

Pilot: Neil Armstrong

Subject of Test: Evaluation of MH-96 Adaptive Flight Control System

Launch: Mud Lake on a magnetic heading of 180° with MH-96 FCS on "Adaptive Damper", BCS #1 "ON" and FCS Reaction Controls "Auto"

ITEM	TIME	ALT	VEL	α	q	Event
1	0	45	790	0		Launch, light engine, increase to 100% T, rotate to 10° α
2	15	47	1400	10	480	Engage \emptyset Hold
3	23	50	1700	10	580	Maintain 10° α until $\theta = 30^\circ$, maintain $\theta = 30^\circ$
4	35	60	2200	4	580	Pushover to zero g, engage α Hold, trim to zero g
5	55	81	3400	0	54	Pull up to 1.4 g ($\alpha \approx 10^\circ$) using CSS button until $\theta = 32^\circ$, maintain $\theta = 32^\circ$
6	81	120	5350	8	200	Shut down engine - trim to zero α
7	156	205	4800	0	9	Peak altitude - engage \emptyset Hold
8	189	185	4900	15	16	Engage α Hold - trim to 20° α Perform right and left roll maneuvers, depress CSS button for 3 seconds
9	252	90	4100	20	530	Max g (≈ 4) disengage α and \emptyset Hold, perform pulse (step inputs) in all axis, reduce α to 6° - extend speed brakes
10	270	90	3400	6	350	Engage \emptyset Hold, check heading hold function
11	280	90	3300	4	350	Engage fixed gain, vector to high key, perform pulses in all axis. Engage adaptive dampers.
12						High key - check ventral armed
13						After touchdown disengage MH-96 FCS
14						Before APU shutdown cycle controls, retract flaps, extend stabilizer to zero, push to test ball nose, data "OFF".

Adapted from the actual NASA X-15 -3 Flight Request Form for flight 3-4-8.

TYPICAL MH-96 ADAPTIVE FCS EVALUATION FLIGHT (Contd.)

Notes:

1. θ vernier will be set at 30° , α cross pointer will be set at 20°
2. Duration of flight approximately 11 minutes
3. Emergency lakes: Mud, Grapevine, Cuddeback

Ground rules for No Launch:

1. MH-96 FCS malfunction as indicated in attached sheets
2. Inertial platform malfunction in attitudes
3. Hot nose malfunction
4. Radio, radar, microwave failure

Alternate situations before launch:

1. MH-96 FCS malfunction in autopilot on reaction controls - proceed but do not operate affected FCS modes.

Alternate situations after launch:

1. If engine does not light within 30 sec after launch, jettison propellants and land at Mud Lake.
2. For delayed engine light, proceed as planned - maintain less than 3 g during rotation and add 5 sec to pushover and pullup (55 sec).
3. For radio, radar or microwave failure, proceed as planned.
4. For adaptive damper failure to fixed gain in any axis, proceed as planned but do not use hold modes in affected axis. Attempt to reengage adaptive damper, turn FCS reaction controls to "ON".
5. For total yaw damper failure, do not increase α above 15° . Attempt to reengage damper.
6. For total pitch or roll damper failure, do not increase α above 12° . Attempt to reengage damper.
7. For ball nose or attitude failure, do not use hold modes. During power phase, pushover to zero g, reduce power to 75%, proceed to Edwards. After shutdown and if α available, make normal entry. If α not available, make entry at $-5^\circ \theta$.
8. For inadvertent engine shutdown prior to 35 sec, return to Mud; 35-60 sec, proceed to Grapevine; 60-65 sec, proceed to Cuddeback; above 65 sec, proceed to Edwards.
9. If H_2O_2 low light comes on prior to entry, turn FCS reaction controls "OFF" and make entry using manual reaction controls.

Symbols:

- q = dynamic pressure
 α = angle-of attack
 θ = roll
 ϕ = pitch

axis during flight.

MH-96 Roll Trim Knob

[18, fig. 3-4]

This knob, located on the MH-96 main control panel, provides electrical trimming of the roll axis during flight.

MH-96 SYSTEM IN-FLIGHT CHECK (X-15-3)

NOTE: This section supersedes related procedures mentioned on pages 5-14, 5-17 and 5-21 of the basic (v1.0) X-15-2/3 utility flight manual.



At a Mach number of about 3.0 and an angle-of-attack greater than 10°, the X-15 was uncontrollable without damping when normal piloting techniques were used. Before launch, perform the following functional check of the MH-96 adaptive flight control system (X-15-3 aircraft only):

1. Reaction controls switch [6, fig. 4-14] – **AUTO (MID)**.
2. Pitch, roll and yaw gain selector switches [8-10, fig. 4-14] – **UP**.
3. Pitch, roll and yaw damper switches [1-3, fig. 4-14] – **DAMPER (UP)**. Check that the roll, pitch, and yaw caution (amber) lights [11, fig. 4-14] are OFF. The MH-96-out (amber) light [42, fig. 4-3; 86, fig. 4-4] should come **OFF** when any damper switch is set to **DAMPER (UP)**.
4. Control stick steering (CSS) switch [4, fig. 4-14; 17,

fig. 3-4] – **OFF (DOWN)**. Turning this switch to **OFF** deactivates CSS and activates the autopilot.

5. MH-96 “autopilot” function switches (angle-of-attack hold, roll hold, pitch hold) [7, fig. 3-4] – **ON**. Check that the MH-96 system indicator (green) lights [90, fig. 4-3; 85, fig. 4-4; 16, fig. 3-4] are ON.



6. MH-96 “autopilot” function switches (angle-of-attack hold, roll hold, pitch hold) [7, fig. 3-4] – **OFF**.
7. Control stick steering (CSS) switch [6, fig. 4-14; 17, fig. 3-4] – **ON (UP)**. Turning this switch to **ON** deactivates the autopilot and reactivates CSS.
8. Pitch, roll and yaw gain selector switches [8-10, fig. 4-14] – **FIXED GAIN (DOWN)**.
9. Pitch, roll and yaw damper switches [1-3, fig. 4-14] – **OFF (DOWN)**.
10. Reaction controls switch [6, fig. 4-14] – **OFF (DOWN)**.

HOW TO ACTIVATE THE SWITCHES, BUTTONS AND KNOBS IN THE VC

Most **2-position switches** can be alternately turned ON and OFF by a simple left click with the mouse cursor positioned over the actual 3D part. Turning the mouse wheel up will turn the switch to ON, turning the mouse wheel down will turn the switch to OFF.

NOTE: As in the 2D panels, tooltips have been integrated into every clickable parts in the VC. When the mouse cursor becomes a hand and the tooltip is displayed, the 3D part can normally be activated by left clicking with the mouse.

3-position switches can be turned to their UP position from their middle (neutral) position by left clicking with the mouse. Right clicking will move the switch lever down one position at the time (UP, MID, DOWN). Left clicking will move the switch lever up again one position at the time (DOWN, MID, UP). Turning the mouse wheel up will turn the switch lever up, turning the

mouse wheel down will turn the switch lever down.

Push-button switches can be activated with a single left click.

Most **levers** can be dragged with the mouse to the desired position. Simply click on the lever handle with the left mouse button, drag the handle to the desired position, and release the mouse button.

Control sticks cannot be dragged with the mouse but are synchronized with the movements of your joystick or with the keyboard arrow keys (pitch and roll). Clicking on the black handle activates the control stick.

The **rudder pedals** are synchronized with the rotation movement of your joystick or your flight sim pedals.

Most **knobs** can be rotated to the right by left clicking with the mouse and to the left, by right clicking. Turning the mouse wheel up will turn the knob to the right, turning the mouse wheel down will turn the knob to the left. Continuous rotation is possible on some knobs by left or right clicking with the mouse and leaving the mouse button depressed until the knob is set to the desired position.



The radio frequency units can be changed by left or right clicking the **radio channel selector knob**. The radio frequency decimals can be changed by turning the mouse wheel up or down while pointing the radio channel selector knob.

CHANGES TO THE PITCH ANGLE SET CONTROL AND PITCH ERROR POINTER ON THE ATTITUDE INDICATOR

The **pitch error pointer** on the attitude indicator (the short horizontal pointer on the left side of the instrument) and the **pitch angle set control** are now fully functional and work as follows:

Select the pitch angle you want with the pitch angle selector control (the small lever must be clicked to get positive angles). As you maneuver the aircraft to within +5 or -5 degrees of your selected pitch, the pitch error



pointer on the left side of the eight-ball will act as a vernier pitch indicator which you can use for fine-tuning the pitch angle.

Initial pitch-up and precise pitch angle control was an essential part in every X-15 mission. You should first approximate the desired pitch angle with the ball and then focus on the pointer for precise adjustments. The pointer moves in the same direction as the ball so it acts as a magnifying glass for pitch.

For more info: http://x15.xtremeprototypes.com/en/flying_the_X-15.asp

THE SAVED FLIGHTS



You can load one of the twelve new X-15 saved flights included with version 1.1 as a “template” for a new flight. This has the advantage of presetting all X-15 internal systems to OFF and preventing the rocket

plane from moving by itself on the runway at the beginning of a flight because the engine was running in the previous flight, in the last saved flight or in the default flight.

It is also easier to prepare the X-15 for takeoff or simulate an X-15 launch at a high altitude from a "B-52 carrier aircraft" over different dry lakes in the Mojave Desert by loading one of the saved flights.

The X-15 saved flights can be loaded from the **Free Flight** page in FSX (click on the **Load...** button) or the upper window of the **Select a Flight** page in FS2004.

NOTE: The FSX saved flights are installed in your "...My documents\Flight Simulator X Files" folder and not in your "Microsoft Flight Simulator X\Flights" folder, like in FS2004.

There are two categories of X-15 flights: the **"takeoff flights"** and the **"high-altitude launch" flights**. Each category contains many flights that are based on actual X-15 historical missions.

After a "high-altitude launch" flight is loaded and the aircraft is launched at around FL400 and 0.8 Mach, **click the automatic ignition sequence start button (the "magic" red icon in the cockpit)** and fly the X-15 to the edge of space! Follow the indicated heading, complete your ballistic trajectory, shut off the engine and glide your way back to Rogers Dry Lake, near Edwards Air Force base (KEDW).

IMPORTANT NOTE: Do not use CTRL+E to start the X-15 engine. Use the automatic ignition sequence start red button (icon) instead. The red button initiates all X-15 internal custom systems, including her three-propellant rocket fuel management system.

By default, the automatic ignition sequence **turns on** the unlimited fuel option switch on the X-15 service panel. If you prefer a more realistic X-15 flight with a limited engine burn time (about 90 seconds with the XLR-99 engine), **turn off** the unlimited fuel option switch on the service panel before the automatic ignition sequence turns on the engine master switch on the main panel. Once the engine master switch is turned on, the unlimited fuel option switch on the service panel cannot be changed. Refer to sections IV and V in the basic (v1.0) flight manual for more details about this switch.

Unlike the real-world X-15 that was designed to be launched at a high altitude from a B-52 carrier air-

plane, the X-15 for Flight Simulator can also take off from an airport runway like any other Flight Simulator aircraft! Taking off from the ground is rather fun and is something the real-world X-15 pilots could not do!

After a "takeoff" flight is loaded, you can either **click the automatic ignition sequence start button (the "magic" red icon in the cockpit)** or proceed with the standard procedures described in section V of the flight manual to start the engine and take off from the runway. The flight model enables the airplane to accelerate up to approximately Mach 4.65, reach the altitude of about 354,200 feet (100,000 feet in FS2004), complete its ballistic trajectory, decelerate, jettison its remaining propellants and glide its way back to Rogers Dry Lake.

THE "TAKEOFF" FLIGHTS



There are eight "takeoff" flights included with version 1.1. Four flights enable the X-15 to take off from the ground at Edwards Air Force base (KEDW) and four flights enable takeoffs from airfields located near a dry lake in the Mojave Desert that was used for high-altitude launches during the actual X-15 program:

Flight No. 2-12-23

X-15-2A VC Ready for Takeoff at Edwards AFB

X-15-2 (XLR-99 engine, boom nose) preparing for takeoff from runway 4 at Edwards Air Force Base (KEDW).
December 6, 1960, 15:29.

Flight No. 2-11-22

X-15-2A VC Ready for Takeoff at Rosamond Airfield

X-15-2 (XLR-99 engine, boom nose) preparing for takeoff from runway 7 at Rosamond airfield (near Rosamond Dry Lake), California (L00). *November 22, 1960, 13:25.*

Flight No. 2-18-34

X-15-2B VC Ready for Takeoff at Edwards AFB

X-15-2 (XLR-99 engine, ball nose) preparing for takeoff from runway 4 at Edwards Air Force Base (KEDW).
September 12, 1961, 14:40.

Flight No. 2-13-26

X-15-2B VC Ready for Takeoff at Baker Airfield

X-15-2 (XLR-99 engine, ball nose) preparing for takeoff from runway 15 at Baker airfield (near Silver Lake), California (002). *March 7, 1961, 10:28.*

Flight No. 3-3-7

X-15-3A VC Ready for Takeoff at Edwards AFB

X-15-3 (XLR-99 engine, MH-96 FCS) preparing for takeoff from runway 4 at Edwards Air Force Base (KEDW).
April 5, 1962, 10:15.

Flight No. 3-4-8

X-15-3A VC Ready for Takeoff at Coaldale Airfield

X-15-3 (XLR-99 engine, MH-96 FCS) preparing for takeoff from runway 12 at Coaldale airfield (near Mud Lake), Nevada (2Q6). *April 20, 1962, 11:26.*

Flight No. 3-20-31

X-15-3B VC Ready for Takeoff at Edwards AFB

X-15-3 (XLR-99 engine, MH-96 FCS, wing-tip pods) preparing for takeoff from runway 4 at Edwards Air Force Base (KEDW). *July 9, 1963, 12:12.*

Flight No. 3-22-36

X-15-3B VC Ready for Takeoff at Austin Airfield

X-15-3 (XLR-99 engine, MH-96 FCS, wing-tip pods) preparing for takeoff from runway 18 at Austin airfield (near Smith Ranch Lake), Nevada (9U3). *August 22, 1963, 10:05.*

THE “HIGH-ALTITUDE LAUNCH” FLIGHTS



There are four “high-altitude launch” flights included with version 1.1. These flights enable the X-15 to be launched at a high altitude over a dry lake in the Mojave Desert that was used for high-altitude launches during the actual X-15 program:

Flight No. 2-11-22

X-15-2A VC High-altitude Launch over Rosamond Dry Lake

X-15-2 (XLR-99 engine, boom nose) ready for launch over Rosamond Dry Lake, California (FL350, 0.8 Mach, LAT N34° 54.88', LONG W118° 12.72', HEADING 078).
November 22, 1960, 13:25.

Flight No. 2-13-26

X-15-2B VC High-altitude Launch over Silver Lake

X-15-2 (XLR-99 engine, ball nose) ready for launch over Silver Lake, California (FL380, 0.8 Mach, LAT N35° 12.46', LONG W116° 4.25', HEADING 245). *March 7, 1961, 10:28.*

Flight No. 3-4-8

X-15-3A VC High-altitude Launch over Mud Lake

X-15-3 (XLR-99 engine, MH-96 FCS) ready for launch over Mud Lake, Nevada (FL400, 0.8 Mach, LAT N37° 56.19', LONG W117° 0.71', HEADING 178). *April 20, 1962, 11:26.*

Flight No. 3-22-36

X-15-3B VC High-altitude Launch over Smith Ranch Lake

X-15-3 (XLR-99 engine, MH-96 FCS, wing-tip pods) ready for launch over Smith Ranch Lake, Nevada (FL400, 0.8 Mach, LAT N39° 16.67', LONG W117° 31.27', HEADING 170). *August 22, 1963, 10:05.*

NEW X-15 CUSTOM SOUND SETS

The X-15-2 and X-15-3 now have their own custom sound sets for both FSX and FS2004. In addition to the basic FS2004 sound set (“air conditioning”, igniter idle, rocket engine, flaps and gear, etc.), extra sound effects (APUs, turbopump, engine precool/prime and fuel jettison effects) are included in the FSX version. These sounds are part of the FSX special visual effects linked to the above aircraft features.



The XLR-99 rocket engine, which according to X-15 pilot Milt Thompson “...had a very distinct banshee-type sound that was instantly recognizable... from the rumbling of the ignition sequence through the main chamber light off to the peculiar hog calling like noise of the shut-down”¹, will produce a great deal of noise and vibrations during normal operation. For this reason, you might want to adjust the **engine volume level** in the **Sound Settings page** in Flight Simulator.

To reduce the volume, try a setting of between 30% to

50%. If you like more rumble, noise and vibrations, try anything from 60% to 85%. A setting of about **60%** seems acceptable for most computer sound systems and will produce the level of noise one would expect from a 60,000-pound rocket engine! A little experimentation might be necessary in order to find the optimal settings in FSX and FS2004, depending on your own sound system configuration and personal preferences.

1: Thompson, Milton O.; “At the Edge of Space: The X-15 Flight Program”; Smithsonian Books (1992).

KNOWN ISSUES

Screen becomes white with the “Light bloom” display option selected in FSX — If the “Light bloom” option is selected in the FSX display settings, the X-15 add-on aircraft may not appear in the aircraft preview window and during flight with the screen becoming all white. To avoid this problem, unselect the “Light bloom” option in the FSX display settings page. This might also improve your frame rate. This is a model-related issue and cannot be corrected in version 1.1. We are currently working on this issue to avoid this problem in future versions of the software.

Note to Windows® Vista™ with DirectX® 10 users: DirectX® 10 Preview option box in FSX display settings must be unchecked for proper aircraft display. The current version of the software does not support certain DirectX® 10 features.

The engine is running at the beginning of a new flight and before the aircraft has been serviced — At this time, the X-15 has not yet been serviced and the engine should be shut down. If the engine has been ignited by the simulator and has (have) not been shut down automatically by the X-15 integrated systems, simultaneously press the **CTRL+SHIFT+F1** keys on your keyboard to shut down the engine. To avoid this problem, you can load one of the new X-15 saved flights included with version 1.1 as a “template” for your flight. This has the advantage of presetting all X-15 internal systems to OFF and preventing the engine from being ignited at the beginning of a flight because the engine was running in the previous flight, in the last saved flight or in the default flight.

Unwanted special effects at the beginning of a new flight and before the aircraft has been serviced — No special visual effects (associated with the aircraft lights and smoke system) such as engine flames, APU exhaust steam or frost on the fuselage should be

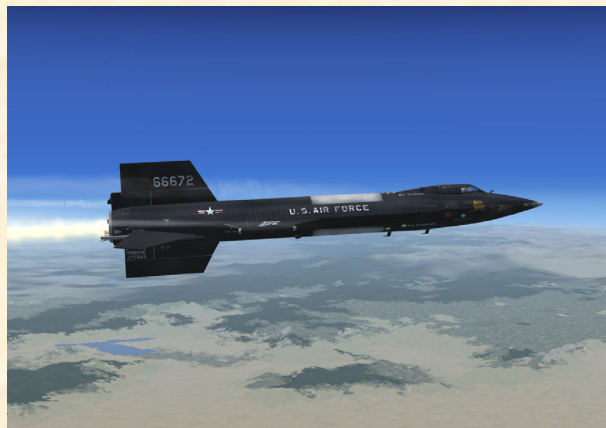
observed around the exterior model of the aircraft at the beginning of a new flight. If such effects are visible, simply press the “L” key (All Lights On/Off command) on your keyboard as necessary, until the effects disappear. These effects appear because some of the aircraft lights were turned on during a previous flight. To avoid this problem, you can load one of the new X-15 saved flights included with version 1.1 as a “template” for your flight. This has the advantage of presetting all X-15 internal systems to OFF and preventing unwanted special visual effects from appearing around the aircraft at the beginning of a flight.

The X-15 moves on the runway at the beginning of a new flight and before the aircraft has been serviced — By default, FSX and FS2004 load previously saved (or default) flights with the engine of the aircraft running. In the case of the X-15, it takes a split second for Flight Simulator to “realize” that the aircraft has not been serviced with the necessary propellants and to shut down the engine. Because of the tremendous power of the rocket engine, the initial split second of thrust is enough to move the aircraft along the runway. The aircraft should come to a halt on its own or the brakes can be applied. Again, to avoid this problem, you can load one of the X-15 saved flights included with version 1.1 as a “template” for your flight. This has the advantage of presetting all X-15 internal systems to OFF and preventing the rocket plane from moving by itself on the runway at the beginning of a flight because the engine was running in the previous flight, in the last saved flight or in the default flight.

The X-15 aircraft has no virtual cockpit — Previous version (v1.0) of the X-15 software is still present on your computer and the wrong aircraft was loaded. Make sure the selected X-15 aircraft is v1.1 (“VC” extension to the name). **Remember:** the installation program does not erase nor replace the previous version (v1.0) of the software, if installed on your computer. The new version is installed in different aircraft folders. You may choose to delete or keep the previous version before installing version 1.1.

Some X-15 aircraft variations are not available in FSX, only two aircraft seem to be installed — Make sure the “Show all variations” option is selected in the “Select aircraft” page in FSX.

Other issues solved — Speed and altitude issues under Microsoft® Flight Simulator X Acceleration Pack reported with earlier versions of the Xtreme Prototypes X-15 for Flight Simulator Series have been corrected and are no longer issues.



FREQUENTLY ASKED QUESTIONS AND TECHNICAL SUPPORT

We invite you to visit our FAQ section on our website to find answers to most questions you might have and solutions to most issues you may encounter while flying the X-15-2 and X-15-3 in Flight Simulator.

www.xtremeprototypes.com

If you need additional technical support, please visit our customer service section. **We try to answer most queries within one business day.**

Our products are designed to evolve with time, according to the feedback we receive from our users or from anyone interested in our products or in flight simulation or aviation in general. Please let us know your comments, ideas and suggestions.

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Portions of the manuals have been inspired or adapted from the original real-world X-15 utility flight manuals published during the 1950s and 1960s by the U.S. Air Force and North American Aviation.

Xtreme Prototypes is not affiliated with NASA, North American Aviation (Boeing), the U.S. Air Force, or any other company, entity or government organization related to the X-15 research program. This product is neither sponsored nor endorsed by NASA.



This game software has been rated "E" by the Entertainment Software Rating Board. ESRB logo (TM) Entertainment Software Rating Board. Software platform logo (TM and ©) IEMA 2007.



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