XP-X151-1E

# UTILITY FLIGHT MANUAL

# X-15-1

## ADD-ON ROCKET AIRCRAFT FOR FLIGHT SIMULATOR

**Serial number: AF56-6670**
**(XLR-11 and XLR-99 engines)**

**ENGLISH VERSION 1.0**


**Desktop commanders are responsible for bringing this publication to the attention of all flight simulator enthusiasts and X-15 fans cleared for operation of subject add-on rocket aircraft.**

**Contains full product description and specifications, installation instructions, normal procedures and check list.**

Xtreme Prototypes

www.xtremeprototypes.com

X-15 FOR FLIGHT SIMULATOR SERIES

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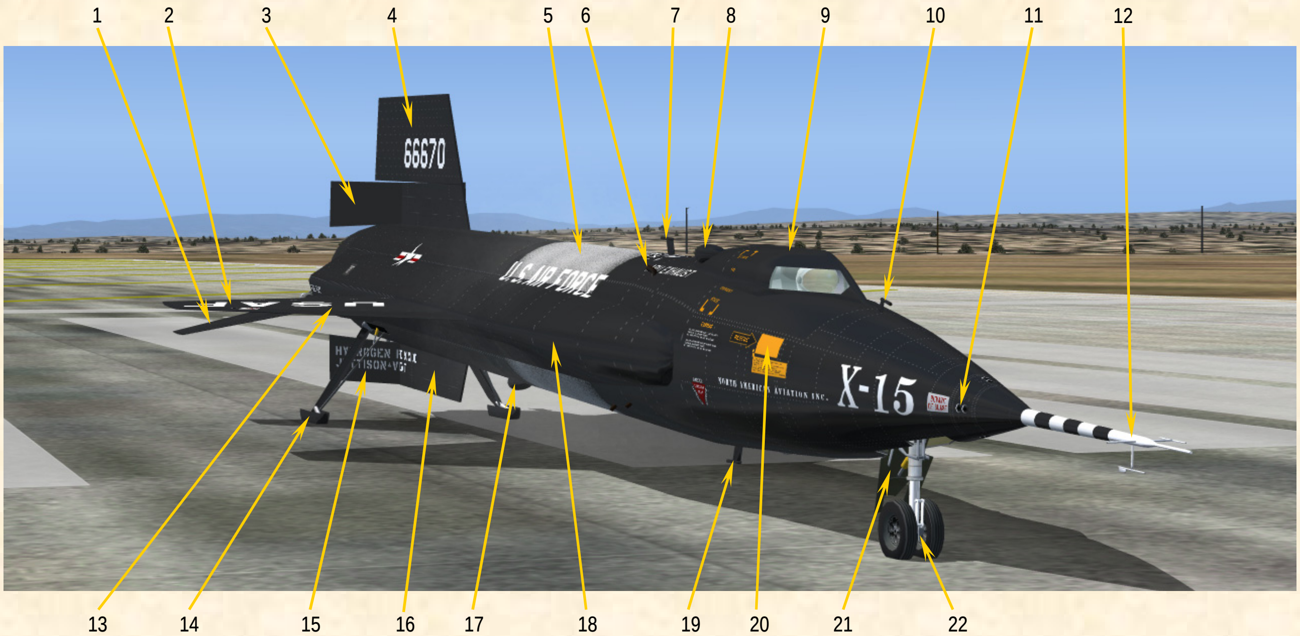
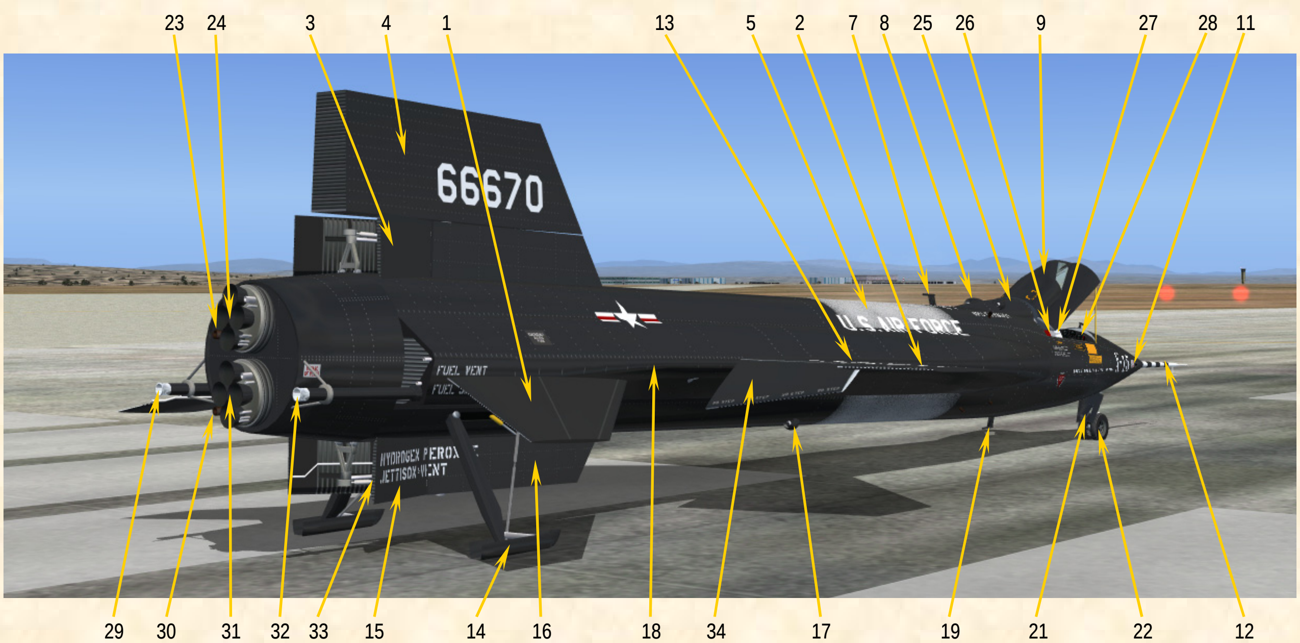



Figure 3-1

1. MOVABLE HORIZONTAL STABILIZER
2. BALLISTIC CONTROL SYSTEM ROCKETS (2, ON BOTH WINGS)
3. UPPER SPEED BRAKE
4. MOVABLE UPPER VERTICAL STABILIZER
5. LIQUID OXYGEN TANK (FROST)
6. APU EXHAUST (2, LEFT AND RIGHT)
7. UPPER UHF ANTENNA
8. TOP BUG-EYE CAMERA PORT (2, ON BOTH SIDES)
9. CANOPY
10. PITOT HEAD
11. BALLISTIC CONTROL SYSTEM ROCKETS (8)
12. NACA VANE-TYPE BOOM NOSE
13. WING (2, LEFT AND RIGHT)
14. REAR LANDING GEAR SKID (2, ON BOTH SIDES)
15. LOWER SPEED BRAKE
16. LOWER FIXED VERTICAL STABILIZER (MOVABLE VENTRAL REMOVED)
17. VENTRAL BUG-EYE CAMERA PORT (2, ON BOTH SIDES)
18. SIDE FAIRING (2, LEFT AND RIGHT)
19. LOWER UHF ANTENNA
20. EXTERNAL CANOPY EMERGENCY JETTISON HANDLE ACCESS DOOR
21. NOSE LANDING GEAR DOOR
22. NOSE LANDING GEAR
23. UPPER XLR-11 ENGINE TURBOPUMP EXHAUST
24. UPPER XLR-11 ROCKET ENGINE
25. EQUIPMENT COMPARTMENT
26. EJECTION SEAT
27. PILOT
28. INSTRUMENT PANEL
29. LIQUID OXYGEN JETTISON PORT
30. LOWER XLR-11 ENGINE TURBOPUMP EXHAUST
31. LOWER XLR-11 ROCKET ENGINE
32. WATER-ALCOHOL JETTISON PORT
33. HYDROGEN PEROXIDE JETTISON PORT
34. FLAP (2, LEFT AND RIGHT)



**WITH CONVENTIONAL FLIGHT REFERENCE SYSTEM AND XLR-11 ENGINES (X-15-1a, b)**

# MAIN PANEL

* Gauges in gray do not perform any specific simulator function.

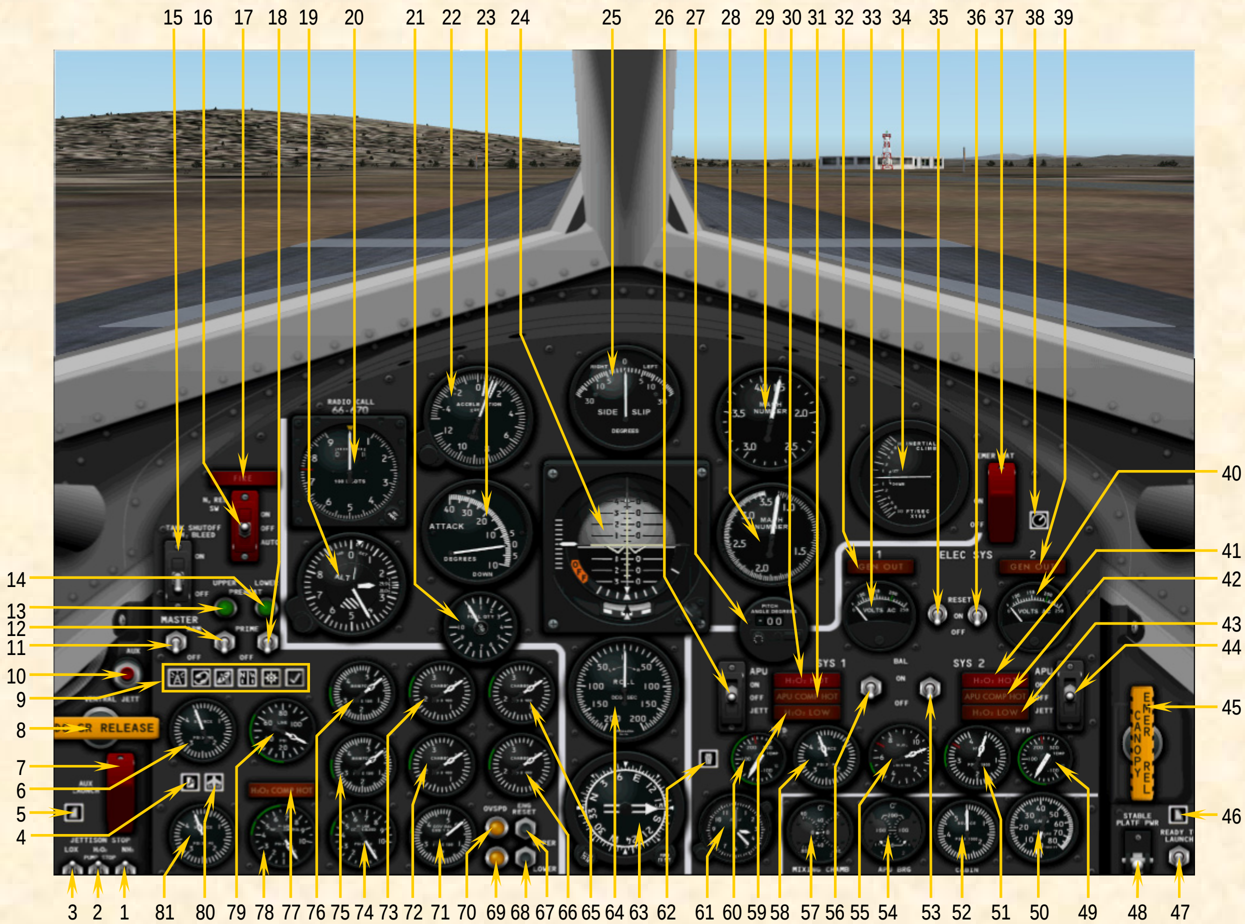



Figure 4-1

1. WATER-ALCOHOL JETTISON STOP SWITCH
2. $H_2O_2$ JETTISON STOP SWITCH
3. LIQUID OXYGEN JETTISON STOP SWITCH
4. DISPLAY/HIDE LEFT WHITE CONSOLE ICON
5. DISPLAY/HIDE LEFT SIDE PANEL ICON
6. HELIUM SOURCE PRESSURE GAUGE
7. AUXILIARY LAUNCH SWITCH*
8. LANDING GEAR HANDLE
9. DISPLAY/HIDE ICONS: RADIO/ADF PANEL, ATC WINDOW, GPS, COMPASS, MAP, KNEEBOARD
10. VENTRAL JETTISON BUTTON
11. ENGINE MASTER SWITCH
12. UPPER ENGINE PRIME SWITCH
13. UPPER ENGINE GAS GENERATOR PREHEAT INDICATOR LIGHT
14. LOWER ENGINE GAS GENERATOR PREHEAT INDICATOR LIGHT
15. TANK SHUTOFF AND $N_2$ BLEED SWITCH
16. NITROGEN RELEASE SELECTOR SWITCH
17. ENGINE COMP'T FIRE-WARNING LIGHT
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19. ALTIMETER
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21. FUEL QUANTITY GAUGE
22. ACCELEROMETER
23. ANGLE-OF-ATTACK INDICATOR
24. ATTITUDE INDICATOR
25. SIDESLIP INDICATOR
26. NO. 1 APU SWITCH
27. PITCH ANGLE SET CONTROL
28. LOW-ALTITUDE MACHMETER
29. HIGH-ALTITUDE MACHMETER
30. NO. 1 APU $H_2O_2$ OVERHEAT WARNING LIGHT
31. NO. 1 APU COMPARTMENT OVERHEAT CAUTION LIGHT
32. NO. 1 GENERATOR-OUT LIGHT
33. NO. 1 GENERATOR AC VOLTMETER
34. VERTICAL VELOCITY INDICATOR
35. NO. 1 GENERATOR SWITCH
36. NO. 2 GENERATOR SWITCH
37. EMERGENCY BATTERY SWITCH
38. DISPLAY/HIDE SERVICE PANEL ICON
39. NO. 2 GENERATOR-OUT LIGHT
40. NO. 2 GENERATOR AC VOLTMETER
41. NO. 2 APU $H_2O_2$ OVERHEAT WARNING LIGHT
42. NO. 2 APU COMPARTMENT OVERHEAT CAUTION LIGHT
43. NO. 2 APU $H_2O_2$-LOW CAUTION LIGHT
44. NO. 2 APU SWITCH
45. CANOPY INTERNAL EMERGENCY JETTISON HANDLE
46. DISPLAY/HIDE RIGHT SIDE PANEL ICON
47. READY-TO-LAUNCH SWITCH
48. STABLE PLATFORM SWITCH
49. NO. 2 HYDRAULIC TEMPERATURE GAUGE
50. CABIN PRESSURE ALTIMETER
51. HYDRAULIC PRESSURE GAUGE
52. CABIN HELIUM SOURCE PRESSURE GAUGE
53. NO. 2 BALLISTIC CONTROL SWITCH
54. APU BEARING TEMPERATURE GAUGE
55. APU HYDROGEN PEROXIDE PRESSURE GAUGE
56. NO. 1 BALLISTIC CONTROL SWITCH
57. MIXING CHAMBER TEMPERATURE GAUGE
58. APU HELIUM PRESSURE GAUGE
59. NO. 1 APU $H_2O_2$-LOW CAUTION LIGHT
60. NO. 1 HYDRAULIC TEMPERATURE GAUGE
61. CLOCK
62. DISPLAY/HIDE CENTER PEDESTAL ICON
63. COURSE INDICATOR (ADF INDICATOR)
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65. UPPER ENGINE THRUST CHAMBER PRESSURE GAUGE
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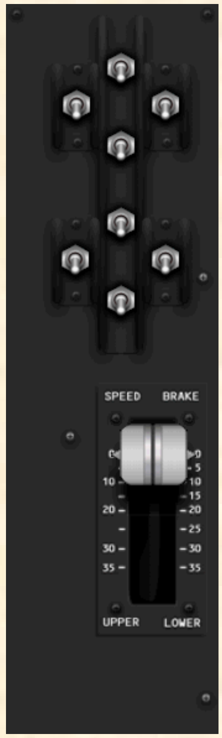
72. LOWER ENGINE THRUST CHAMBER PRESSURE GAUGE
73. UPPER ENGINE THRUST CHAMBER PRESSURE GAUGE
74. NITROGEN LINE CONTROL AND BLEED PRESSURE GAUGE
75. LOWER ENG. MANIFOLD PRESSURE GAUGE
76. UPPER ENG. MANIFOLD PRESSURE GAUGE
77. $H_2O_2$ COMPARTMENT-HOT CAUTION LIGHT
78. NITROGEN LINE TANK AND CONTROL PRESSURE GAUGE
79. LIQUID OXYGEN AND WATER-ALCOHOL LINE PRESSURE GAUGE
80. DISPLAY/HIDE THROTTLE AND SPEED BRAKE PANEL ICON
81. NITROGEN SOURCE PRESSURE GAUGE

**THROTTLE AND SPEED BRAKE PANEL** icon [80, fig. 4-1; 25, fig. 4-2; 24, fig. 4-3] on the main panel to display the throttle and speed brake panel (or select **THROTTLE AND SPEED BRAKE PANEL** from the “Instrument Panel” menu, under the “View” menu of the main Flight Simulator window menu bar).




5. Undock and reposition the panel if necessary.

6. Speed brake handles [9, fig. 4-9] – **CLOSED (forward).**

7. Click the **DISPLAY/HIDE LEFT WHITE CONSOLE** icon [4, fig. 4-1; 24, fig 4-2; 23, fig. 4-3] on the main panel to display the left white console panel (or select **LEFT WHITE CONSOLE** from the “Instrument Panel” menu, under the “View” menu of the main Flight Simulator window menu bar).


8. Undock and reposition the panel if necessary.

9. Wing flap switch [1, fig. 4-10] – **UP.**

10. Jettison trim switch [2, fig. 4-10] – **OFF (center).**

11. Vent, pressurize, and jettison control lever [3, fig. 4-10] – **VENT.**

*<u>In the real world</u>: The vent valve on the water-alcohol or ammonia tank will be manually closed before flight to prevent losing water-alcohol or ammonia during captive flight (when the X-15 is attached to the NB-52 carrier). When the vent, pressurize, or jettison control lever is placed in the PRESSURIZE or JETTISON position and then back to VENT, the water-alcohol or ammonia vent valve will then be open.*

12. Engine thrust selector switches (eight) [1-8, fig. 4-9] – **OFF (aft)** (XLR-11 engines only).

13. Throttle [10, fig. 4-9] – **OFF** (XLR-99 engine only).

14. Click the **DISPLAY/ HIDE LEFT SIDE PANEL** icon [5, fig. 4-1, 4-2; 7, fig. 4-3 ] at the far left of the main panel to display the left side panel (or select **LEFT SIDE PANEL** from the “Instrument Panel” menu, under the “View” menu of the main Flight Simulator window menu bar).


15. Undock and reposition the panel if necessary.

16. Jettison stop switches [4-6, fig. 4-5] – **STOP.** Check that all three switches (LOX, $H_2O_2$, and WALC or $NH_3$) are in the **STOP** position.

17. Auxiliary launch switch [3, fig. 4-5] – **OFF (guard down).**

18. Ventral jettison button [2, fig. 4-5] – **Check (normal).**

19. Landing gear handle [1, fig. 4-5] – **IN.**

<u>Main instrument panel (XLR-11 engines)</u>:

1. Fire-warning (red) light [17, fig. 4-1] – **Check OFF.**

2. $N_2$ release switch [16, fig. 4-1] – **OFF.**

*X-15-1 for Flight Simulator after servicing.*

## CAPTIVE TAXI AND FLIGHT

1. Radio function selector switch [3, fig. 4-8] – Turn right to **MIDDLE position (Main, T/R; Aux., ADF).**


**NOTE:** The radio function selector switch [3, fig. 4-8] must stay in this (middle) position or be turned further right for the simulator's GPS to be turned on. Turning this switch to OFF (in the left position) turns off the aircraft's avionics and the GPS. See page 5-25-26.

## TAXI (CARRIER AIRPLANE)

*<u>In the real world</u>: The following procedures were done during taxi and before takeoff of the carrier airplane.*


1. SAS function switches and (amber) lights [1-4, 5-6, 31-32, fig. 4-11; 1-4, 5-6, 15-16, fig. 4-13] – **Check.** Move SAS function switches to **ENGAGE** or **LO GAIN** and check lights (should come **OFF**). Return function switches to **STDBY** after each function trips.


2. Radar beacon switch [22, fig. 4-11; 13, fig. 4-12] – **ON.**

## BEFORE TAKEOFF (CARRIER AIRPLAINE)

*<u>In the real world</u>: The following procedures were done before takeoff of the carrier airplane.*

1. Ram-air lever [28, fig. 4-11; 15, fig. 4-12] – **CLOSED.**

2. $N_2$ or helium release switch [16, fig. 4-1; 10, fig. 4-2; 17, fig. 4-3] – **AUTO.**

3. Jettison stop switches [1-3, fig. 4-1, 4-2, 4-3; 4-6, fig. 4-5] – **STOP.**

<u>XLR-11 engines</u>:

*<u>In the real world</u>: The X-15 pilot would check and report on the following instruments.*

1. Cabin source pressure gauge [52, fig. 4-1] – **Check (2800 to 3900 psi).**

2. Helium source pressure gauge [6, fig. 4-1] – **Check (3300 to 3800 psi).**

3. $N_2$ source pressure gauge [81, fig. 4-1] – **Check (No. 1, 3200 to 3900 psi; No. 2, 2900 to 3900 psi).**

<u>XLR-99 engine</u>:

*<u>In the real world</u>: The X-15 pilot would check and report the following instruments.*

1. Propellant source pressure gauge [12, fig. 4-2; 13, fig. 4-3] – **Check (3300 to 3800 psi).**

2. Propellant tank pressure gauge [6, fig. 4-2; 81, fig. 4-3] – **Check (pointer "L", 0 to 5 psi; "A", 0 to 10 psi).**

3. Propellant pump inlet pressure gauge [8, fig. 4-2; 74,

eration, driving rapidly to indicate the actual angle of attack and sideslip of the airplane.

Propellant jettison tests:

Propellant jettison tests will be conducted concurrently on all three systems (liquid oxygen, water-alcohol or ammonia and hydrogen peroxide).

1. Instrument readings – **Check for proper reading before pressurization.**

2. Vent, pressurize, and jettison control lever [3, fig. 4-10] – **JETTISON.**


3. Jettison stop switches [4-6, fig. 4-5] – **JETT** for about 3 seconds then **STOP.** In the spot plane exterior view, check for vapor emitting from the jettison ports, at the back of the X-15 aircraft.


**NOTE:** The liquid oxygen and water-alcohol or ammonia jettison ports are the long tubes protruding at the back of the airplane's side fairings (each side of the engine compartment). The hydrogen peroxide jettison port is located inside the lower speed brake compartment (right side). Because of some limitations of the FS2004 platform, the $H_2O_2$ jettison effect cannot be observed in the X-15-1 equipped with the XLR-11 engines. For the same reason, there is no special effect associated with the APU $H_2O_2$ jettison.


*The three propellants (liquid oxygen, ammonia and hydrogen peroxide) are being dumped overboard through the jettison ports at the back of the X-15-1 for Flight Simulator.*

Propellant tank pressurization:


1. Vent, pressurize, and jettison control lever [3, fig. 4-10] – **PRESSURIZE.**

When the vent, pressurize, and jettison control lever is moved to **PRESSURIZE**, water-alcohol (or ammonia) and liquid oxygen tanks are pressurized and the propellants will be supplied to the engine turbopump(s). The hydrogen peroxide tank is also pressurized and $H_2O_2$ will be supplied to the turbopump(s) cut-off valve(s).

*In the real world: The X-15 pilot would check and report the following instruments. If instruments are not within limits, the pilot would check with ground control for an alternate mission.*

XLR-11 engines:

1. Water-alcohol and liquid oxygen line pressure gauge [79, fig. 4-1] – **Check ("L" pointer, 45 to 65 psi; "A" pointer, 43 to 70 psi).**

2. $N_2$ line, tank and control pressure gauge [78, fig. 4-1] – **Check ("C" pointer, 475 to 575 psi; "T" pointer, 425 to 475 psi).**

3. Engine preheat (green) lights [13-14, fig. 4-1] – **Check ON (after a short delay).**


XLR-99 engine:

1. Propellant tank pressure gauge [6, fig. 4-2; 81, fig. 4-3] – **Check ("L" pointer, 45 to 65 psi; "A" pointer, 45 to 65 psi).**

2. $H_2O_2$ tank and engine control line pressure gauge [86, fig. 4-2; 79, fig. 4-3] – **Check ("C" pointer, 575 to 615 psi; "T" pointer, 425 to 475 psi).**

XLR-11 engines:

1. Engine preheat (green) lights [13-14, fig. 4-1] – **Check ON.**

**NOTE:** The engine preheat (green) lights can only be ON after the vent, pressurize, and jettison control lever [3, fig. 4-10] is moved to PRESSURIZE.


2. Tank shutoff and $N_2$ bleed switch [15, fig. 4-1] – **ON.**

When the tank shutoff and $N_2$ bleed switch is on, the main shutoff valves for water-alcohol and liquid oxygen will open. This switch also opens the nitrogen to the engine for control and bleed.

**NOTE:** The tank shutoff and $N_2$ bleed switch can only be turned ON when both the engine preheat (green) lights [13-14, fig. 4-1] are ON (after the vent, pressurize, and jettison control lever [3, fig. 4-10] is moved to PRESSURIZE).

3. Chamber pressure gauge [65-66, 72-73, fig. 4-1] – **Check for bleed (4 to 8 psi).**

4. $N_2$ line control and bleed pressure gauge [74, fig. 4-1] – **Check (400 to 475 psi).**

5. Fuel quantity gauge [21, fig. 4-1] – **Check 100%.**

6. DC voltmeter selector switch [20, fig. 4-11] – **STRAIN GAGE.**


7. Check strain gauge (battery) power supply **(24 volts)** on DC voltmeter [19, fig. 4-11].

8. DC voltmeter selector switch [20, fig. 4-11] – **BUS.**

9. SAS function switches [5, 31-32, fig. 4-11; 5, 15-16, fig. 4-13] – **ENGAGE.** Check that the yaw, pitch, and roll caution (amber) lights are out.

10. Flight controls – **Check.**

*In the real world: The X-15 pilot would move all flight controls through allowable travel and would receive verbal acknowledgment from the launch operator (in the carrier airplane) and the chase pilots that all control surfaces are operating properly.*

11. Water-alcohol and liquid oxygen line pressure gauge [79, fig. 4-1] – **Check (both pointers, 43 to 70 psi).**

12. $N_2$ tank and control line pressure gauge [78, fig. 4-1] – **Check (tank pressure, 400 to 475 psi; control line pressure, 500 to 650 psi).**

13. Governor balance line pressure gauge [71, fig. 4-1] – **Check (both pointers, 350 to 360 psi).**

14. Chamber pressure gauge [65-66, 72-73, fig. 4-1] – **Check for bleed (4 to 8 psi). ABORT THE MISSION if there is no indication of bleed.**

15. Engine master switch [11, fig. 4-1] – **ARM.**

16. Engine reset buttons [67-68, fig. 4-1] – **Push once.**

17. Prime switches [12, 18, fig. 4-1] – **PRIME.** Check for vapor emitting from the prime drains on each XLR-11 engine.

*In the real world: 60 to 70 seconds are required to prime the engines. A continuous flow overboard of liquid oxygen and water-alcohol will be observed at the back of the aircraft by the launch operator.*


*XLR-11 engine prime (X-15-1).*

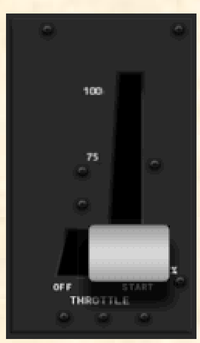
When future versions of Flight Simulator have provisions for rocket engines, this problem will be corrected.

XLR-99 engine:



*XLR-99 engine start on the X-15-1 for Flight Simulator. The XLR-99 engine produced nearly 60,000 pounds of thrust at high altitude.*

After release from the “carrier airplane” or when ready to take off from the runway, proceed as follows:




On the throttle and speed brake panel:

1. Throttle [10, fig. 4-9] – **START (click and then move inboard to 50%).** Throttle must be moved to 50% by the time the idle-end (amber) caution light [21, fig. 4-2; 20, fig. 4-3] comes on.

Note that combustion in the main thrust chamber of the XLR-99 engine on the X-15 for Flight Simulator will occur almost instantaneously when the throttle lever is moved from OFF to START 50%.


2. Chamber and stage 2 igniter pressure gauge [76, fig. 4-2; 28, fig 4-3] – **Check (large pointer, 335 to 600 psi within 2 seconds, depending on throttle position; small pointer 350 to 630 psi, depending on throttle position).**

3. Propellant manifold pressure gauge [84, fig. 4-2; 72, fig. 4-3] – **Check ("L" pointer, 455 to 980 psi; "A" pointer, 510 to 1155 psi).**

4. Propellant (helium) source pressure gauge [12, fig. 4-2; 13, fig. 4-3] – **Check (3300 to 3900 psi).**

5. $H_2O_2$ source and purge pressure gauge [4, fig. 4-2, 4-3] – **Check (both pointers, 3300 to 3900 psi).**

6. Propellant tank pressure gauge [6, fig. 4-2; 81, fig. 4-3] – **Check ("L" pointer, 45 to 65 psi; "A" pointer, 45 to 65 psi).**

7. $H_2O_2$ tank and engine control line pressure gauge [86, fig. 4-2; 79, fig. 4-3] – **Check (both pointers, 575 to 615 psi).**

## NORMAL INDICATIONS DURING START

When the thrust chamber or chambers are fired, the following indications will be evident:

- ❑ Turbine whine;
- ❑ Turbine exhaust steam will be seen at the back of the aircraft;
- ❑ Liquid oxygen and fuel will automatically stop bleeding overboard (as observed during prime);
- ❑ Fuel and liquid oxygen manifold pressure will rise to rated values;

- Igniters will be operating;
- Pressure of the chamber(s) being fired will rise to a point where the igniters cease firing and chamber pressure will be shown on the indicator gauge;
- Airplane propellants will be consumed at a very high rate, as can be observed on the volume gauges [1-3, fig. 4-4] on the X-15 for Flight Simulator service panel;
- Chamber pressure will reach rated values;
- Thrust chamber(s) will emit a great deal of noise;
- Flames and exhaust gases (smoke, steam) will be seen at the back of the airplane.


*X-15-1 during start.*

## ENGINE THRUST CONTROL

XLR-11 engines:

Thrust control is achieved by operating the thrust selector (control) switches [1-8, fig. 4-9] for individual chamber firing. Thrust chambers may be fired at approximately 2-second intervals. This will increase or decrease thrust in increments of 1500 pounds (per chamber).

**NOTE:** While there was no throttle installed in the real-world X-15 equipped with the XLR-11 engines, **throttle control is enabled on the X-15-1 for Flight Simulator.** Moving the (joystick) throttle forward will increase engine thrust to its maximum rated value. To simulate the true XLR-11 engine operation, simply leave the throttle in its maximum forward position and fire or shut off the individual rocket chambers to increase or decrease thrust. The throttle can be used concurrently, if desired. Remember that the No. 1 and No. 3 chambers and the No. 2 and No. 4 chambers on each XLR-11 engine are linked together.

XLR-99 engine:


Engine thrust is controlled by movement of the throttle between 50% and 100% thrust. Engine response to throttle movement is very rapid, 50% to 100% in approximately 1.5 seconds.

Remember that combustion in the main thrust chamber of the XLR-99 engine on the X-15 for Flight Simulator will occur almost instantaneously when the throttle lever [10, fig. 4-9] is moved from OFF to START 50%.

## NORMAL OPERATING CONDITIONS

The following conditions accompany normal rocket engine operation (see appendix 2 for more details):

XLR-11 engines:

1. Water-alcohol and liquid oxygen manifold pressure [75-76, fig. 4-1] – **300 to 335 psi (both, on both engines).**

2. Thrust chamber pressure [65-66, 72-73, fig. 4-1] – **220 to 250 psi (each, 8).**

3. Liquid oxygen and water-alcohol line pressure [79, fig. 4-1] – **45 to 58 psi (both).**

4. Helium source pressure [6, fig. 4-1] – **3200-3800 psi.**

5. Nitrogen source pressure [81, fig. 4-1] – **3200-3800 psi.**

6. Engine control pressure [78, fig. 4-1] – **415 to 440 psi.**

7. Nitrogen line control and bleed pressure [74, fig. 4-1] – **400 to 475 psi.**

8. Governor balance line pressure [71, fig. 4-1] – **415 to 440 psi.**

9. APU $H_2O_2$ tank pressure gauge [58, fig. 4-1] – **550**

## LANDING

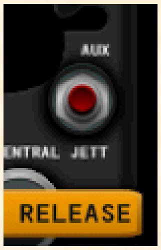
To provide ground clearance for the landing gear, the lower ventral (rudder) must be jettisoned before landing.

**NOTE:** Under normal flight conditions, the ventral rudder should not be jettisoned except during landing approach.

When the altimeter [19, fig. 4-1; 26, fig 4-2; 25, fig. 4-3] indicates 5000 feet, proceed as follows:

1. Ventral arming switch [3, fig. 4-6, 4-7] – **Check ARM.**

2. Ventral jettison button [2, fig. 4-5] – **Push (once).**



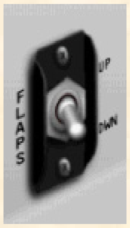


*In the real world: The ventral should be jettisoned at an altitude of about 5000 feet and at a minimum of 1500 feet above the ground.*


*The ventral rudder is jettisoned before landing to make room for the rear landing skids. In the real world, a parachute will prevent the rudder from being damaged upon landing on the ground. The rudder would be recovered and reused.*

Pushing the ventral jettison button actually fires explosive bolts to release the ventral. Note that the ventral is also jettisoned automatically when the landing gear and skids are deployed.

To extend the flaps, turn the wing flap switch [1, fig. 4-10] on the left white console to **DWN** or use the **"F8"** key on your keyboard (or the appropriate button on your joystick).





To lower the landing gear, click the landing gear handle [1, fig. 4-5] on the left side panel or use the **"G"** key on your keyboard.

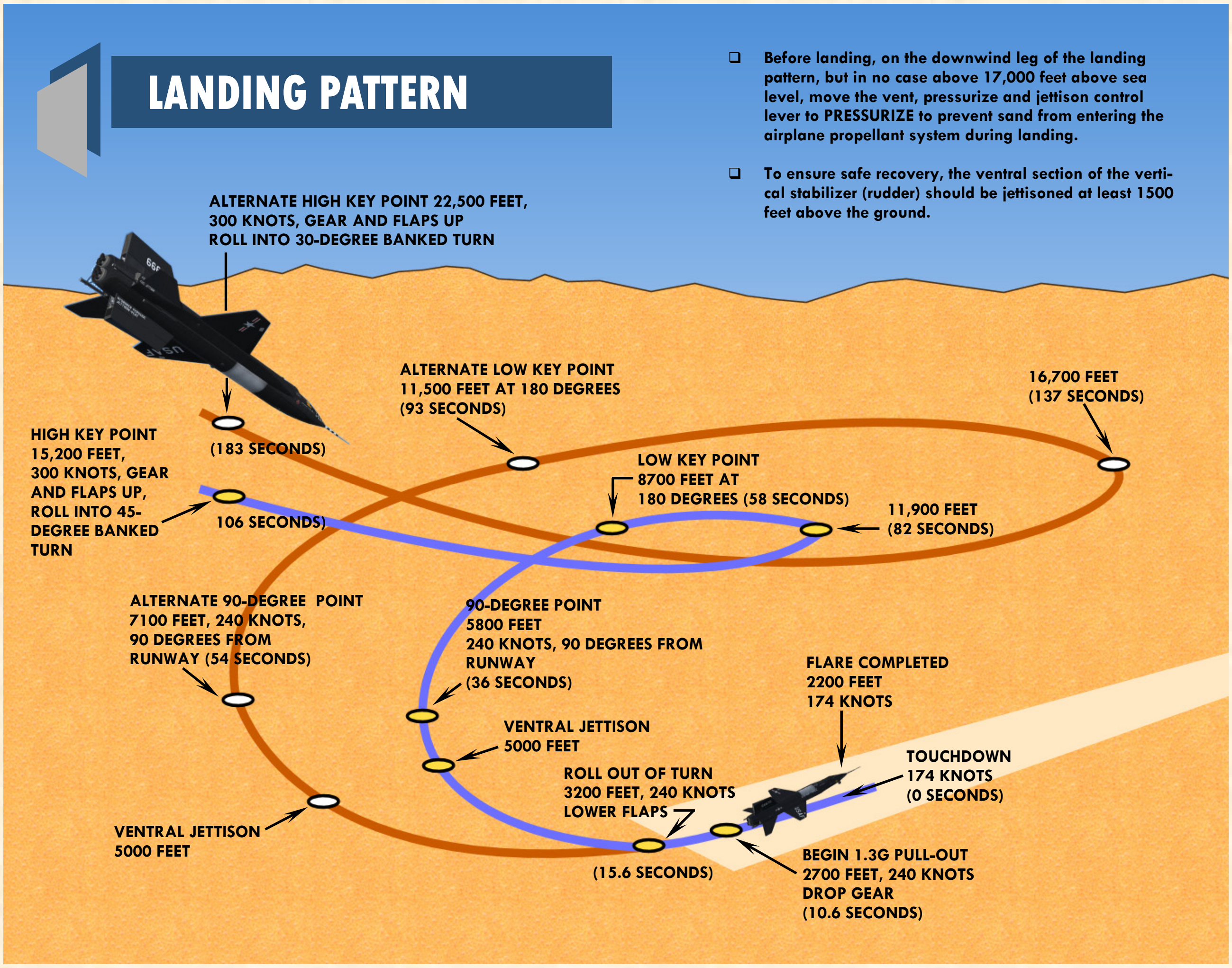

LANDING PATTERN
❑ Before landing, on the downwind leg of the landing pattern, but in no case above 17,000 feet above sea level, move the vent, pressurize and jettison control lever to PRESSURIZE to prevent sand from entering the airplane propellant system during landing.
❑ To ensure safe recovery, the ventral section of the vertical stabilizer (rudder) should be jettisoned at least 1500 feet above the ground.
ALTERNATE HIGH KEY POINT 22,500 FEET, 300 KNOTS, GEAR AND FLAPS UP ROLL INTO 30-DEGREE BANKED TURN
(183 SECONDS)
HIGH KEY POINT 15,200 FEET, 300 KNOTS, GEAR AND FLAPS UP, ROLL INTO 45-DEGREE BANKED TURN
106 SECONDS)
ALTERNATE LOW KEY POINT 11,500 FEET AT 180 DEGREES (93 SECONDS)
16,700 FEET (137 SECONDS)
LOW KEY POINT 8700 FEET AT 180 DEGREES (58 SECONDS)
11,900 FEET (82 SECONDS)
ALTERNATE 90-DEGREE POINT 7100 FEET, 240 KNOTS, 90 DEGREES FROM RUNWAY (54 SECONDS)
90-DEGREE POINT 5800 FEET 240 KNOTS, 90 DEGREES FROM RUNWAY (36 SECONDS)
FLARE COMPLETED 2200 FEET 174 KNOTS
VENTRAL JETTISON 5000 FEET
TOUCHDOWN 174 KNOTS (0 SECONDS)
ROLL OUT OF TURN 3200 FEET, 240 KNOTS LOWER FLAPS
VENTRAL JETTISON 5000 FEET
(15.6 SECONDS)
BEGIN 1.3G PULL-OUT 2700 FEET, 240 KNOTS DROP GEAR (10.6 SECONDS)

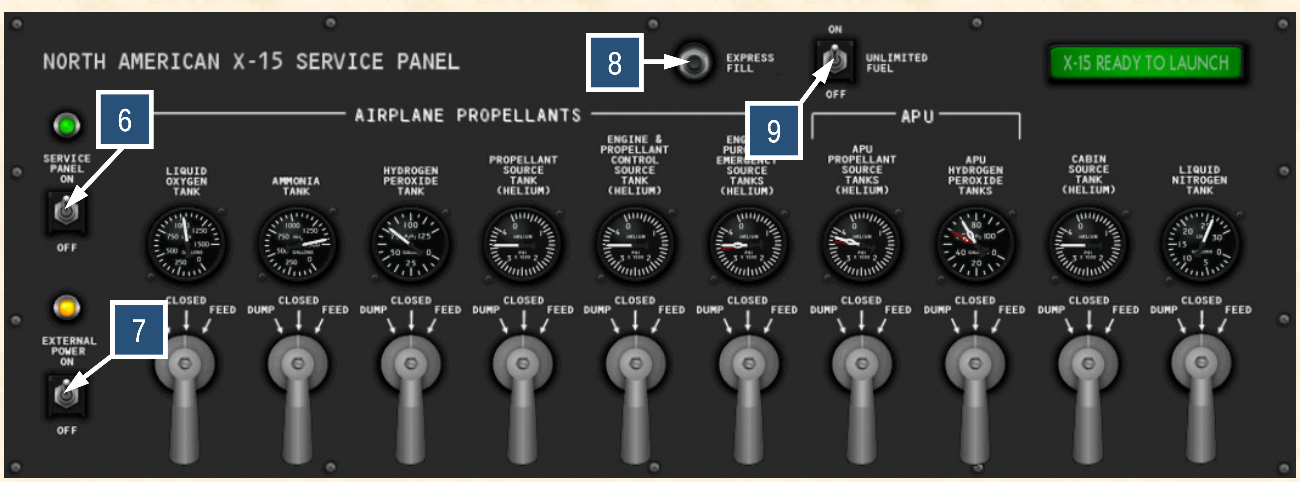
Figure 5-2

XLR-99 ENGINE
(LIGHT BLUE-GRAY PANEL, X-15-1d)

# QUICK-START PROCEDURES

## A


## B



# Appendix 2: INSTRUMENT READINGS

## INSTRUMENT READINGS AFTER SERVICING


The following conditions should be observed after servicing the X-15:

Service panel:

1. Liquid oxygen tank volume gauge [1, fig. 4-4] – **1017 gallons.**
2. Water-alcohol (or ammonia) tank volume gauge [2, fig. 4-4] – **1445 gallons.**
3. Turbopump hydrogen peroxide ($H_2O_2$) tank volume gauge [3, fig. 4-4] – **78 gallons.**
4. Propellant source (helium) tank pressure gauge [4, fig. 4-4] – **3200-3800 psi.**
5. Engine and propellant control source tank (nitrogen or helium) pressure gauge [5, fig. 4-4] – **3200-3800 psi.**
6. Engine purge and emergency (nitrogen or helium) tanks pressure gauge [7, fig. 4-4] – **3200-3800 psi, both pointers.**
7. APU source (helium) tanks pressure gauge [9, fig. 4-4] – **3200-3800 psi, both pointers.**
8. APU $H_2O_2$ tanks volume gauge [10, fig. 4-4] – **60-75 gallons, both pointers.**
9. Cabin helium tank pressure gauge [12, fig. 4-4] – **3200-3800 psi.**
10. Liquid $N_2$ tank volume gauge [13, fig. 4-4] – **25-30 gallons.**

Main panel (XLR-11 engines):

1. Helium source pressure gauge [6, fig. 4-1] – **3200-3800 psi.**
2. Nitrogen source pressure gauge [81, fig. 4-1] – **3200-3800 psi, both pointers.**
3. APU source pressure gauge [58, fig. 4-1] – **3200-3800 psi, both pointers.**
4. Cabin helium source pressure gauge [52, fig. 4-1] – **1000 to 3400 psi.**
5. AC voltmeters [33, 40, fig. 4-1] – **200 volts (external power).**
6. Nitrogen line tank and control pressure gauge [78, fig. 4-1] – **"T" pointer, 0 psi; "C" pointer, 400 to 475 psi.**

Main panel (XLR-99 engine):

1. Propellant source pressure gauge [12, fig. 4-2; 13, fig. 4-3] – **3200-3800 psi.**
2. $H_2O_2$ source and purge pressure gauge [4, fig. 4-2, 4-3] – **3200-3800 psi, both pointers.**
3. APU source pressure gauge [67, fig. 4-2; 65, fig. 4-3] – **3200-3800 psi, both pointers.**
4. Cabin helium source pressure gauge [61, fig. 4-2; 59, fig. 4-3] – **1000 to 3400 psi.**
5. AC voltmeters [43, 50, fig. 4-2; 45, fig. 4-3] – **200 volts (external power).**
6. $H_2O_2$ tank and engine control pressure gauge [86, fig. 4-2; 79, fig. 4-3] – **"T" pointer, 0 psi; "C" pointer, 575-600 psi.**



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