UTILITY FLIGHT MANUAL

X-15A-2

ADD-ON ROCKET AIRCRAFT FOR FLIGHT SIMULATOR

Serial number: AF56-6671
(XLR-99 engine)

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

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X-15 FOR FLIGHT SIMULATOR SERIES

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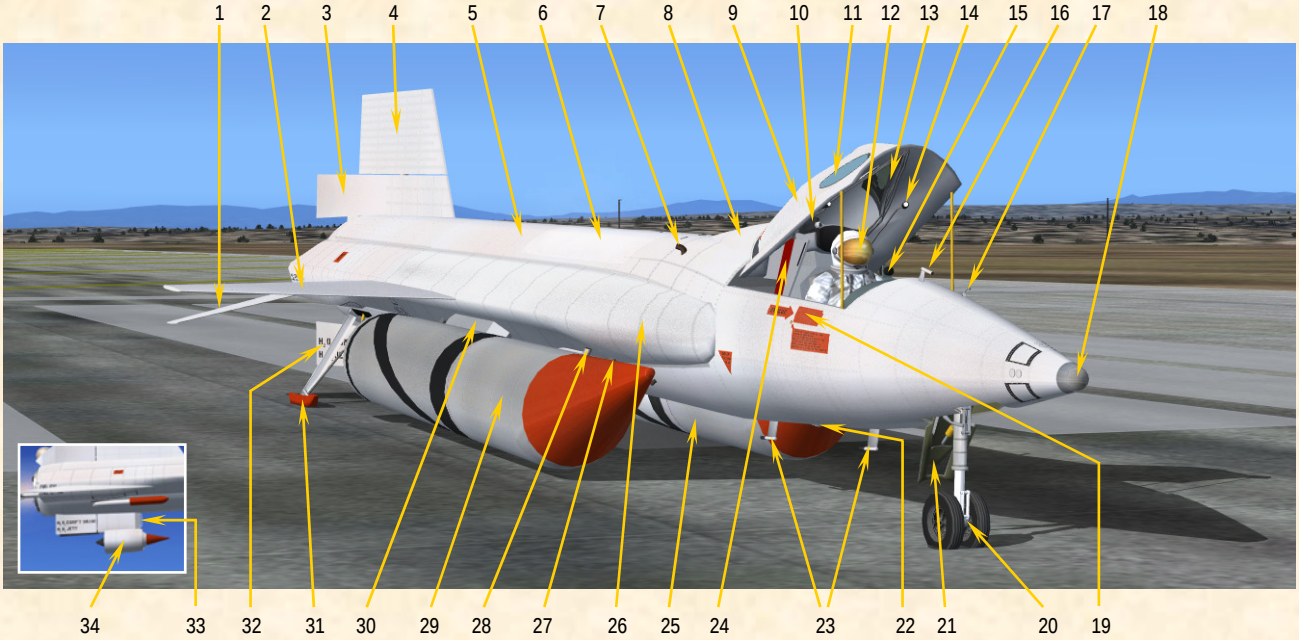

Figure 3-2

1. MOVABLE HORIZONTAL STABILIZER
2. WING (2, LEFT AND RIGHT)
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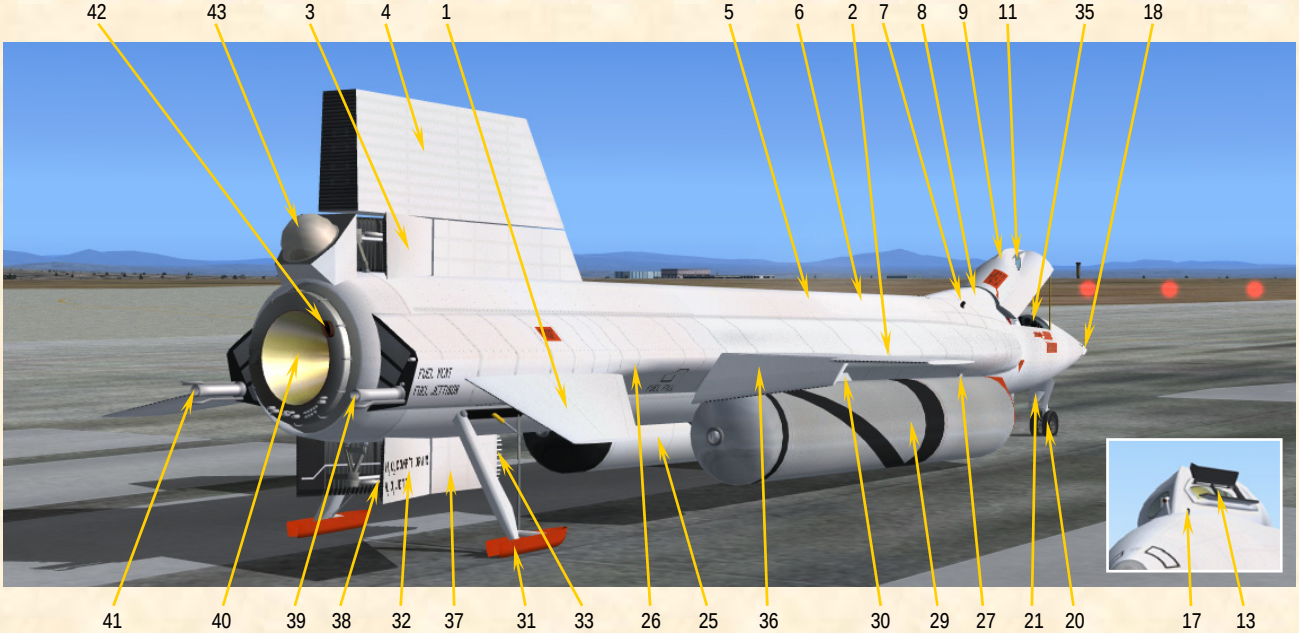
40. XLR-99 ROCKET ENGINE
41. LIQUID OXYGEN JETTISON PORT
42. ENGINE TURBOPUMP EXHAUST
43. SPHERICAL HELIUM TANK



MAIN PANEL

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

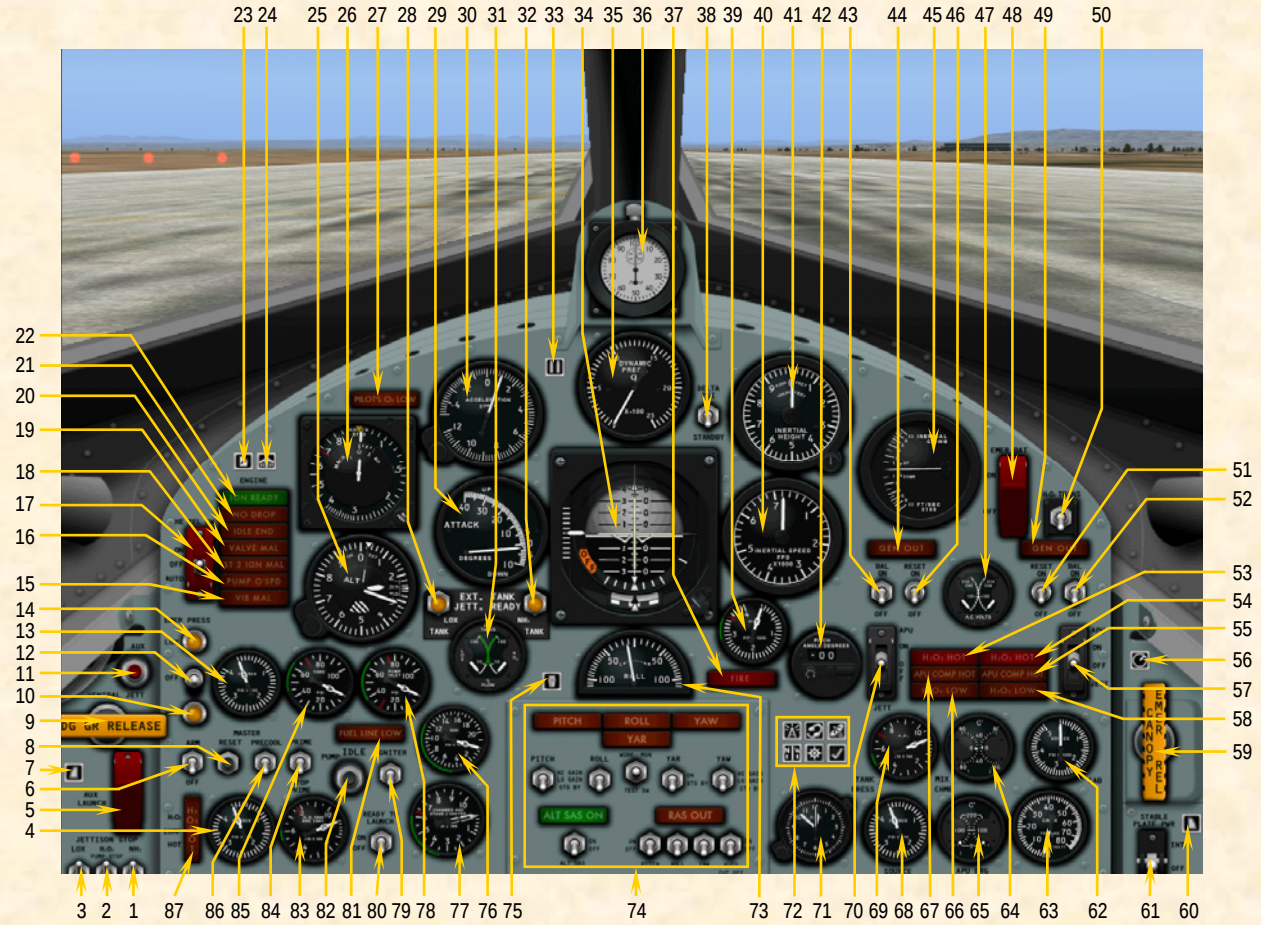


Figure 4-1

1. AMMONIA JETTISON STOP SWITCH
2. H_2O_2 JETTISON STOP SWITCH
3. LIQUID OXYGEN JETTISON STOP SWITCH
4. H_2O_2 SOURCE PRESSURE GAUGE (INT./EXT.)
5. AUXILIARY LAUNCH SWITCH*
6. ENGINE MASTER SWITCH
7. DISPLAY/HIDE LEFT SIDE PANEL ICON
8. ENGINE RESET BUTTON
9. LANDING GEAR HANDLE
10. AMMONIA TANK PRESSURE-LOW CAUTION LIGHT
11. VENTRAL (OR RAMJET) JETTISON BUTTON
12. PROPELLANT EMERGENCY PRESS SWITCH
13. PROPELLANT SOURCE PRESSURE GAUGE (INT./EXT.)
14. LIQUID OXYGEN PRESSURE-LOW CAUTION LIGHT
15. ENGINE VIB MALFUNCTION CAUTION LIGHT
16. TURBOPUMP OVERSPEED CAUTION LIGHT
17. HELIUM RELEASE SELECTOR SWITCH
18. STAGE 2 IGNITION MALFUNCTION CAUTION LIGHT
19. VALVE MALFUNCTION CAUTION LIGHT
20. IDLE-END CAUTION LIGHT
21. NO-DROP OR 23-SECOND CAUTION LIGHT
22. IGNITION-READY LIGHT
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26. AIRSPEED/MACH INDICATOR
27. PILOT'S OXYGEN-LOW CAUTION LIGHT
28. LEFT (LIQUID OXYGEN) EXTERNAL TANK JETTISON-READY INDICATOR LIGHT
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30. ACCELEROMETER
31. EXTERNAL TANKS FUEL FLOW INDICATOR
32. RIGHT (AMMONIA) EXTERNAL TANK JETTISON-READY INDICATOR LIGHT
33. DISPLAY/HIDE EXTERNAL DROP TANKS CONTROL PANEL ICON
34. ATTITUDE INDICATOR
35. DYNAMIC PRESSURE INDICATOR
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37. FIRE-WARNING LIGHT
38. SIDESLIP SELECTOR SWITCH
39. HYDRAULIC PRESSURE GAUGE
40. INERTIAL SPEED (VELOCITY) INDICATOR
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42. PITCH ANGLE SET CONTROL
43. NO. 1 BALLISTIC CONTROL SWITCH
44. NO.1 GENERATOR-OUT LIGHT
45. VERTICAL VELOCITY INDICATOR
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48. EMERGENCY BATTERY SWITCH
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52. NO. 2 BALLISTIC CONTROL SWITCH
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54. NO. 2 APU H_2O_2 COMPARTMENT OVERHEAT WARNING LIGHT
55. NO. 2 APU COMPARTMENT CAUTION LIGHT
56. DISPLAY/HIDE SERVICE PANEL ICON
57. NO.2 APU SWITCH
58. NO. 2 APU H_2O_2-LOW CAUTION LIGHT
59. CANOPY INT. EMERGENCY JETTISON HANDLE
60. DISPLAY/HIDE RIGHT PANEL ICON
61. STABLE PLATFORM SWITCH
62. CABIN HELIUM SOURCE PRESSURE GAUGE
63. CABIN PRESSURE ALTIMETER
64. MIXING CHAMBER TEMPERATURE GAUGE
65. APU BEARING TEMPERATURE GAUGE
66. NO.1 APU H_2O_2-LOW CAUTION LIGHT
67. NO. 1 APU COMPARTMENT OVERHEAT CAUTION LIGHT
68. APU SOURCE PRESSURE GAUGE
69. APU H_2O_2 TANK PRESSURE GAUGE
70. NO. 1 APU SWITCH
71. CLOCK
72. DISPLAY/HIDE ICONS: RADIO PANEL, ATC WINDOW, GPS, COMPASS, MAP, KNEEBOARD
73. RATE-OF-ROLL INDICATOR
74. SAS/RAS PANEL (SEE FIGURE 4-10)
75. DISPLAY/HIDE CENTRAL PEDESTAL ICON
76. PROPELLANT MANIFOLD PRESSURE GAUGE
77. CHAMBER AND STAGE 2 IGNITER PRESSURE GAUGE
78. PROPELLANT PUMP INLET PRESSURE GAUGE
79. IGNITER IDLE SWITCH
80. READY-TO-LAUNCH SWITCH
81. FUEL LINE-LOW CAUTION LIGHT
82. TURBOPUMP IDLE BUTTON
83. H_2O_2 TANK AND ENGINE CONTROL LINE PRESSURE GAUGE
84. ENGINE PRIME SWITCH
85. PROPELLANT TANK PRESSURE GAUGE
86. ENGINE PRECOOL SWITCH
87. H_2O_2 COMPARTMENT-HOT CAUTION LIGHT

3. Data switch [18, fig. 4-8] – **ON.**

4. Calibrate instrumentation button [2, fig. 4-8] – **Push once** (button green light should come **ON** for 3 seconds, then **OFF**, indicating instrumentation calibration).

5. Ready-to-Launch switch [80, fig. 4-1] – **Test ON.** Ready-to-Launch (green) indicator light on service panel [10, fig. 4-2] should come **ON**. **Turn OFF** Ready-to-Launch switch. Ready-to-Launch (green) indicator light on service panel should come **OFF.**

6. Indicator, caution and warning lights – **Check.** Place the indicator, caution, and warning light test switch [7, fig. 4-4] at **TEST** (up position). All indicator, caution, and warning lights (except the fire warning light) will come **ON**. This is only a test of the bulbs. Return the switch to **NORMAL** (down position).

Make sure the canopy is closed at this time.

X-15A-2 for Flight Simulator after servicing.

CAPTIVE TAXI AND FLIGHT

1. Radio function selector switch [3, fig. 4-5] – Turn right to **MIDDLE position (Main, T/R; Aux., ADF).**

NOTE: The radio function selector switch [3, fig. 4-5] 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 5-23).

TAXI (CARRIER AIRPLANE)

In the real world: The following procedures were done during taxi and before takeoff of the carrier airplane.

1. SAS function switches and (amber) lights [74, fig. 4-1; 1-4, 5-6, 15-16, fig. 4-10] – **Check.** Move SAS function switches to **LO GAIN** and check lights (should come **OFF**). Return function switches to **STD BY** after each function trips.

2. Radar beacon switch [13, fig. 4-8] – **ON.**

BEFORE TAKEOFF (CARRIER AIRPLAINE)

In the real world: The following procedures were done before takeoff of the carrier airplane.

1. Ram-air lever [15, fig. 4-8] – **CLOSED.**

2. Helium release switch [17, fig. 4-1] – **AUTO.**

3. Jettison stop switches [1-3, fig. 4-1] – **STOP.**

In the real world: The X-15 pilot would check and report

In the real world: During the cruise-climb to launch altitude, the pilot of the NB-52 carrier would start the time-to-go sequence and confirm with the launch operator that the liquid oxygen top-off is satisfactory. The following procedures would be performed at an altitude of between 35,000 to 45,000 feet.

1. Ram-air lever [15, fig. 4-8] – **CLOSED.**

PRELAUNCH

BEFORE COUNTDOWN

Before countdown, complete final cockpit check as follows:

1. Ram-air lever [15, fig. 4-8] – **Check CLOSED.**

2. Ventral arming switch [3, fig. 4-4] – **Check ARM.**

APUs:

When the APUs are operating, steam should be observed coming out of the APU exhaust pipes.

1. APU switch No. 1 [70, fig. 4-1] – **ON.** As APU No. 1 comes up to speed, hydraulic pressure will increase and then stabilize at 3000 to 3500 psi.

2. No. 1 generator switch [46, fig. 4-1] – Move No. 1 generator switch momentarily to **RESET**, then to **ON.**

3. No. 1 generator out (amber) light [44, fig. 4-1] – Check **OFF.**

4. APU switch No. 2 [57, fig. 4-1] – **ON.** As APU No. 2 comes up to speed, hydraulic pressure will increase and then stabilize at 3000 to 3500 psi.

5. No. 2 generator switch [51, fig. 4-1] – Move No. 2 generator switch momentarily to **RESET**, then to **ON.**

6. No. 2 generator out (amber) light [49, fig. 4-1] – **Check OFF.**

7. Stable platform power switch [61, fig. 4-1; 9, fig. 4-4] – **INT (up position).**

8. Service panel external power switch [25, fig. 4-2] – **OFF.**

9. Service panel external power (yellow) light [26, fig. 4-2] – **Check OFF.**

10. Generator (AC) voltmeter [47, fig. 4-1] – **Check (both pointers, 200 volts, internal).**

11. Hydraulic pressure gauge [39, fig 4-1] – **Check (both pointers, 3000 to 3500 psi).**

12. DC voltmeter selector switch [12, fig. 4-8] – Check **BUS.**

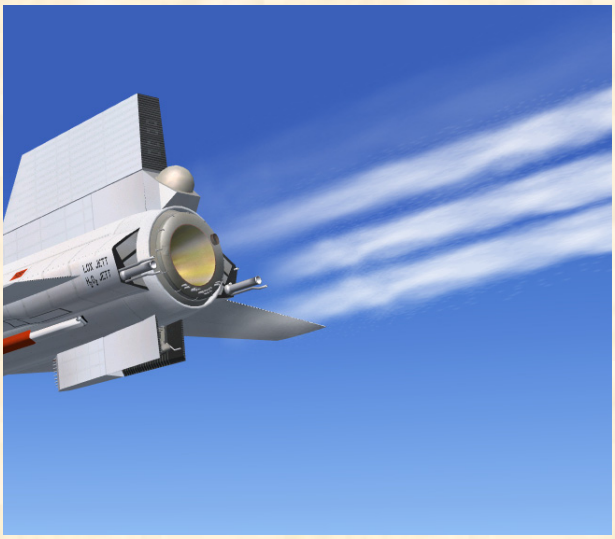
13. DC voltmeter [11, fig. 4-8] – **Check (28 volts).**

2. Vent, pressurize, and jettison control lever [5, fig. 4-7] – **JETTISON.**

3. Jettison stop switches [4-6, fig. 4-3] – **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.

4. External tanks fuel flow indicator [31, fig. 4-1] – **Check (both pointers, about 80% during jettison test).**

NOTE: The liquid oxygen and 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, 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-15A-2.

Propellant tank pressurization:

1. Vent, pressurize, and jettison control lever [5, fig. 4-7] – **PRESSURIZE.**

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

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.

1. Propellant tank pressure gauge [85, fig. 4-1] – **Check ("L" pointer, 45 to 65 psi; "A" pointer, 45 to 65 psi).**

2. External tanks fuel flow indicator [31, fig. 4-1] – **Check (both pointers, about 50% after initial pressurization). Fuel flow will gradually increase to about 80% during the jettison check and up to 100% during engine operation.**

3. H_2O_2 tank and engine control line pressure gauge [83, fig. 4-1] – **Check ("C" pointer, 575 to 615 psi; "T" pointer, 425 to 475 psi).**

4. DC voltmeter selector switch [12, fig. 4-8] – **STRAIN GAGE.**

5. Check strain gauge (battery) power supply **(24 volts)** on DC voltmeter [11, fig. 4-8].

6. DC voltmeter selector switch [12, fig. 4-8] – **BUS.**

7. SAS function switches [6, 15-16, fig. 4-10] – **LO GAIN.** Check that the pitch, roll, and yaw caution (amber) lights are **OUT**.

8. Flight controls – **Check.**

In the real world: The X-15 pilot would move all flight

(forward) position. **Then pull the throttle back to its minimum position.**

20. Telemeter and radar switches [16, 13, fig. 4-8] – **Recheck.**

21. Telemeter commutator motor switch [17, fig. 4-8] – **Check ON.**

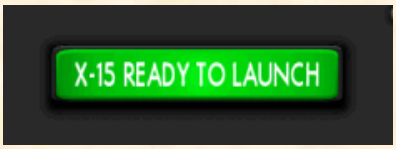
22. Communications – **Check.**

In the real world: Check communication with ground station, carrier pilot, and chase pilots.

23. Ready-to-Launch switch [80, fig. 4-1] – **ON.**

In the real world: Verbally check with carrier pilot and launch operator that the Ready-to-Launch light is on.

24. Ready-to-Launch (green) light on Service Panel [10, fig. 4-2] – **Check ON.**



Operation of igniter idle is limited to 30 seconds. When 7 seconds remain of the normal igniter idle phase, the no-drop or 23-second (amber) caution light [21, fig. 4-1] will come **ON.** With the no-drop or 23-second (amber) caution light on, the pilot must terminate the igniter idle phase – by moving the engine prime switch to **STOP PRIME** – or continue on to the launch phase.

In the real world: The igniter idle phase must be terminated immediately if the idle-end (amber) caution light [20, fig. 4-1] comes on, as damage to the engine chamber will occur because of insufficient cooling.

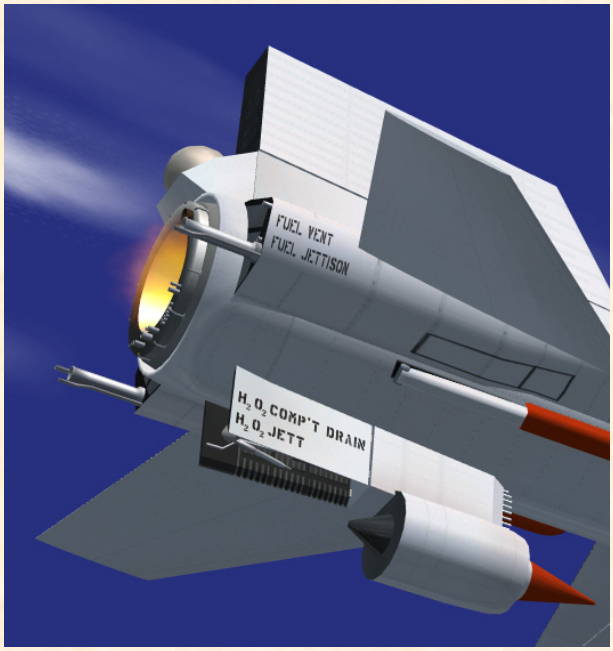
25. Igniter idle switch [79, fig. 4-1] – **IGNITER.**

When the igniter idle switch is placed to **IGNITER**, the ignition-ready light [22, fig. 4-1] goes out for 2 seconds while the engine is purged with helium and the igniter spark plugs are energized. When this phase is completed, the ignition-ready light comes on again.

26. Chamber and stage 2 igniter pressure gauge [77, fig. 4-1] – **Check (small pointer, 150 psi in about 5 seconds, when stage 2 is ignited).** Flames should be observed inside the rocket engine bell (nozzle) as stage 1 and stage 2 are ignited.

The main chamber and stage 2 igniter pressure will increase during engine operation and will vary according to the movement of the throttle.

Ready to launch! *In the real world: Countdown by carrier pilot.*

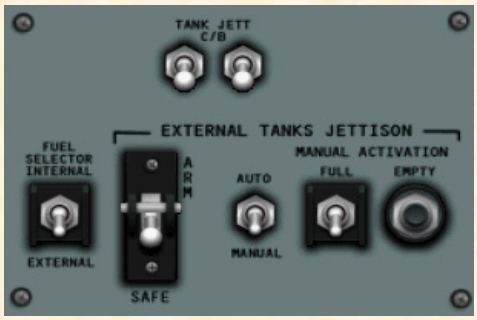


Igniter idle phase.

BALLISTIC CONTROL AND REACTION AUGMENTATION SYSTEM OPERATION

Since some missions will involve flight at altitudes where control surfaces are ineffective and where ballistic control system operation will be required to maintain airplane attitude, the ballistic control system should be

When the fuel selector switch [7, fig. 4-9] on the external tanks control panel [fig. 4-9] is set to **EXTERNAL** (propellant system pressurized), a transfer system is activated and the propellant is transferred from the external



tanks to the internal tanks. At the end of a preset time period, an *intervalometer* times out, deactivating the transfer system, and the two external tanks jettison-ready indicator lights in the cockpit [28, 32, fig. 4-1] come **ON**, indicating that the tanks are ready to be released. The propellant feed system automatically shifts to the internal tank feed.

When the fuel selector switch [7, fig. 4-9] on the external tanks control panel [Fig. 4-9] is set to **INTERNAL** (propellant system pressurized), the transfer system is deactivated and propellant feed is from internal tanks only, regardless of propellant remaining in the external tanks.

The external tanks jettison safe-arm switch [6, fig. 4-9] controls arming of the external tank release circuit.

When the external tanks jettison auto-manual switch [5, fig. 4-9] is set to **AUTO** (fuel selector switch at **EXTERNAL** and external tanks jettison safe-arm switch to **ARM**), the automatic mode of external tank release system is activated. When the *intervalometer* (see above) times out, **the external tanks are automatically released.**

Placing the switch to **MANUAL** activates the manual mode of the external tank release system. To release the tanks, the pilot must press the external tanks jettison empty button [3, fig. 4-9]. If the tanks are full, the pilot must actuate the external tanks jettison full switch [4, fig. 4-9]. Either full or empty jettison switches will release the tanks if the system is armed.

IMPORTANT NOTE: Use the external tanks jettison full switch to release full tanks for successful tank separation. **Do not use the external tanks jettison empty button to release a full tank, as serious damage to the tanks and airplane will result.**

To arm the external tank release system and select the manual mode, proceed as follows:

1. Make sure the external tanks option switch on the service panel [12, fig. 4-2] is set to **INSTALLED**.

2. Fuel selector switch [7, fig. 4-9] – **EXTERNAL.**

3. External tanks jettison safe-arm switch [6, fig. 4-9] – **ARM.**

4. External tanks jettison auto-manual switch [5, fig. 4-9] – **MANUAL.**

IMPORTANT NOTE: The maximum Mach number to be reached by the X-15A-2 aircraft with the external tanks attached is 2.6. **The tanks must be released before reaching that speed (see appendix 3).**

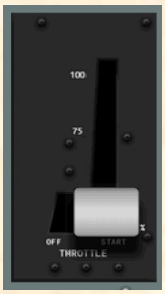
X-15A-2 quickly accelerating to high Mach numbers after her external propellant tanks have been released.

Once the external tanks are released, the X-15A-2 will quickly accelerate to higher Mach numbers until the pilot

ENGINE START

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 [1, fig. 4-6] – **START (click and then move inboard to 50%).** Throttle must be moved to 50% by the time the idle-end (amber) caution light [20, fig. 4-1] 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 [77, fig. 4-1] – **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 [76, fig. 4-1] – **Check ("L" pointer, 455 to 980 psi; "A" pointer, 510 to 1155 psi).**

4. Propellant (helium) source pressure gauge [13, fig. 4-1] – **Check (both internal and external tanks, 3300 to 3900 psi).**

5. H_2O_2 source (helium) pressure gauge [4, fig. 4-1] – **Check (both internal and external tanks, 3300 to 3900 psi).**

6. Propellant tank pressure gauge [85, fig. 4-1] – **Check ("L" pointer, 45 to 65 psi; "A" pointer, 45 to 65 psi).**

7. H_2O_2 tank and engine control line pressure gauge [83, fig. 4-1] – **Check (both pointers, 575 to 615 psi).**

8. External tanks fuel flow indicator on the main instrument panel [31, fig. 4-1] – **50% to 100%.**

XLR-99 engine start on the X-15A-2 for Flight Simulator. The XLR-99 engine produced nearly 60,000 pounds of thrust at high altitude.

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 ammonia will automatically stop bleeding overboard (as observed during prime);
- ❑ Liquid oxygen and ammonia manifold pressure will rise to rated values;
- ❑ Igniters will be operating;
- ❑ Chamber pressure 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. 4-2] on the X-15A-2 for Flight Simulator service panel;
- ❑ Chamber pressure will reach rated values;
- ❑ Thrust chamber will emit a great deal of noise;
- ❑ Flames and exhaust gases (smoke, steam) will be seen at the back of the airplane.

move control lever to **VENT.**

NOTE: The liquid oxygen and 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, there is no special effect associated with the APU H_2O_2 jettison.

BEFORE LANDING

1. Check all controls and instruments for landing.

See figure 5-2 on page 5-29 for the recommended landing pattern and procedures.

In the real world: Before landing and in no case above 17,000 feet, move the vent, pressurize, and jettison control lever [5, fig. 4-7] to PRESSURIZE, to prevent sand and dust from entering the airplane propellant system.

When the altitude is under 17,000 feet, proceed as follows:

1. Vent, pressurize, and jettison control lever [5, fig. 4-7] – **PRESSURIZE.**

To open the eyelid that protected the left canopy window during the high-speed flight, use the Concorde nose simulator command: **SHIFT-Y.**

LANDING

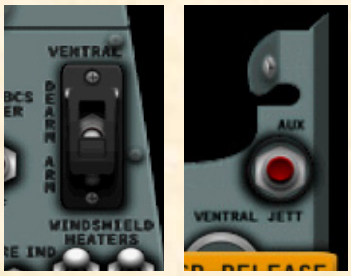
To provide ground clearance for the landing gear, the dummy ramjet (or the lower ventral rudder on the normal configuration) must be jettisoned before landing.

NOTE: Under normal flight conditions, the dummy ramjet (or ventral rudder) should not be jettisoned except during landing approach.

When the altimeter [25, fig. 4-1] indicates 5000 feet, proceed as follows:

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

2. Ventral jettison button [2, fig. 4-3] – **Push (once).**



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

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

The dummy ramjet is jettisoned from the X-15A-2 before landing to make room for the rear landing skids. In the real world, a parachute will prevent the ramjet from being damaged upon landing on the ground. The ramjet will be recovered and reused.

To extend the flaps, turn the wing flap switch [1, fig. 4-7] 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 [9, fig. 4-1; 1, fig. 4-3] on the left side panel or use the **"G"** key on your keyboard.

X-15A-2 approaching the landing site.

AFTER LANDING

After landing, as soon as the airplane stops, proceed as follows:

1. Canopy – Open (**SHIFT-E** on your keyboard).

2. Ram-air lever [15, fig. 4-8] – **CLOSED.**

3. Wing flap switch [1, fig. 4-7] – **UP.**

4. SAS/RAS function switches [5-6, 15-16, 8-11, fig. 4-10] – **STD BY or OFF.**

5. Ventral arming switch [3, fig. 4-4] – **DE-ARM.**

6. APU switches [57, 70, fig. 4-1] – **OFF.**

7. Speed brake levers [2, fig. 4-6] – **Full aft position.**

*In the real world: **WARNING** – Before operating the speed brakes, be sure the fuselage rear section around the speed brakes is clear, because the brakes operate rapidly and forcefully and could injure any personnel near the brakes.*

8. Center control stick (joystick) – **Full forward.**

9. Rudder pedals – **Actuate.** *Deplete hydraulic pressure by actuating rudder pedals.*

BEFORE LEAVING AIRPLANE

In the real world: Before leaving the airplane, complete the required airplane form.

Verify the following cockpit control positions:

Left console and side panel:

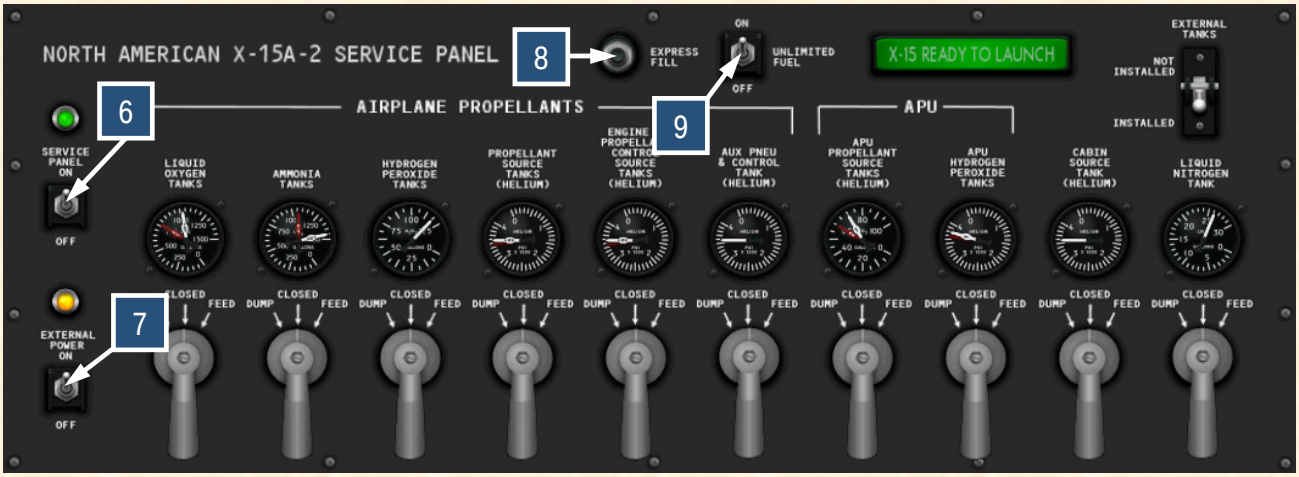
1. Radio control function switch [3, fig. 4-5] – **OFF.**

2. Wing flap switch [1, fig. 4-7] – **UP.**

A


1
2
3
4
5
EMER CANOPY REL
EXT. TANK JETT. READY
PITCH
ROLL
YAW
ALT SAS ON
RAS OUT

B


NORTH AMERICAN X-15A-2 SERVICE PANEL
6
7
8
9
EXPRESS FILL
UNLIMITED FUEL
X-15 READY TO LAUNCH
EXTERNAL TANKS
NOT INSTALLED
INSTALLED
AIRPLANE PROPELLANTS
APU
SERVICE PANEL ON
EXTERNAL POWER ON
OFF
LIQUID OXYGEN TANKS
AMMONIA TANKS
HYDROGEN PEROXIDE TANKS
PROPELLANT SOURCE TANKS (HELIUM)
ENGINE PROPELLANT CONTROL SOURCE TANKS (HELIUM)
AUX PNEU & CONTROL TANK (HELIUM)
APU PROPELLANT SOURCE TANKS (HELIUM)
APU HYDROGEN PEROXIDE TANKS
CABIN SOURCE TANK (HELIUM)
LIQUID NITROGEN TANK
CLOSED
FEED
DUMP

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