NF-104 Version 1.11

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Based on several F-104 X-Plane models by various authors, including me.

Thanks to:
Burncycle, for the idea and initial push-start (a LONG time ago!)
Urwumpe, for help with HUD coding
Hendo and Daver and erv, for the CVE-Lite code on which this is based.
Christophe Chabot, for the RealExhaust texture. And the XCOR Aerospace team, for original rocket engine and photo. http://www.xcor.com

And, above all, many thanks go to Martin Schweiger, for actually developing the simulator I used to daydream about in astrodynamics classes!

http://www.orbitersim.com

Unpacking:

Use Winzip to put each subfolder in its matching Orbiter folder.

This archive includes cvelmessage.dll, located in the /Modules folder. All CVEL vessels require this file; obviously, this will over-write any other one. It should not matter.

Dependencies:

This add-on requires no others to run.

For maximum enjoyment, however, an Edwards AFB add-on is recommended. Either Slat's LC39-EAFB 2006.3 or the Project X-15 Edwards AFB are supported in the included scenarios.

In order to bail out from the NF-104, you'll need the MOOSE add-on contained within my Dyna-Soar v1.3 add-on.

Introduction:

Welcome to the NF-104 add-on! The NF-104 was a modified F-104A Starfighter, used by the short-lived Aerospace Pilots Research School to train future USAF astronauts.

The NF-104 adds an AR-2 H2O2/Kerosene rocket engine in the tail, and small H2O2 RCS jets at the tips. By performing a zoom climb maneuver, the pilots at the ARPS could pop briefly out of the sensible atmosphere, practice using the RCS jets to maneuver the aircraft, then practice a re-entry and landing. Possibly a dead-stick landing, if the jet engine failed to restart.

Of the three NF-104's built, one crashed, severely injuring pilot (and ARPS commandant) Col. Chuck Yeager. This mishap was featured in the movie “The Right Stuff”

NF-104 Operation:

Launch the NF-104 from the base of your choice. If you have no Edwards add-on fly it from KSC instead.

Takeoff at full power. Rotate at 135 m/s or so, retract the gear (G) and flaps (F). Don't exceed more than 12 degrees nose-up while on the runway to prevent dragging the tailpipe.

Pull the power out of afterburner. Afterburner is modeled in the NF-104 as occuring at 0.8 throttle deflection, so bring the throttle back below this range. You'll know it because the noise will decrease, the thrust will drop significantly on the HUD readout, and you'll stop accelerating so much.

Cruise out about 150 km or so at moderate altitude. Then turn back towards the base. You'll want to try this caper over the base in case you can't relight your jet engine.

Push the throttle back to max and accelerate to Mach 2.0, climbing gently as you go.

Once at Mach 2.0, pre-rotate gently to about 20 degrees nose-high, still maintaining Mach 2.0.

Passing 12 km up, pull up (at about a 14-degree constant AOA; 3.5 G's on the G-meter) until your flight path is 70 degrees up. Passing 45 degrees, light the rocket engine. The rocket engine is controlled with the hover throttle. It is not throttleable, so it is either off or on. Tap the keypad 0 key to ignite the rocket, and tap the keypad . key to shut it down.

In reality, the NF-104 pilot needed to manage the jet engine very carefully to prevent overtemperature conditions at the turbine. This process is considerably simplified for Orbiter; just

leave the throttle at max.

Hold the 70 degrees flightpath through burnout of both jet and rocket.

Once the jet engine flames out (a bit above 24 km), it also stops rotating due to insufficient air flow through it. There is a deployable Ram Air Turbine (RAT) back-up, but above the atmosphere, it won't rotate either! This causes the loss of all AC-powered electrical equipment. More importantly to us, it also causes the loss of all hydraulics! Flight controls are frozen in neutral, and the pitch trim is frozen in its last position. Your zoom climb MUST be accurate and smooth, because once the hydraulics stop, you're along for the ride.

Once above 30 km or so, activate your RCS with the CTL-/ key. Gently maneuver. Then, quickly, get the nose back down in preparation for re-entry!

Hold no more than 20 degrees AOA during re-entry. Exceeding about 30 would stall the tail and crash the aircraft.

The jet will start windmilling, restoring hydraulics and flight controls quite suddenly at around 24 km altitude. Finish your pullout, then glide back to the base, or restart the jet as appropriate. Kill the RCS (CTL-/ again) if you haven't already.

On final, deploy the gear AND FLAPS. Final airspeed is 150 m/s; touchdown at 135. Remember the 12-degree nose-up limit on landing.

Failing to deploy the flaps on final means a no-flap approach, with considerably higher speeds. Try 190 m/s for final, touching down at 160. Roundout will be much more difficult if you intend to keep the nose below 12 degrees nose-high on landing.

There are three separate propellant resources in the NF-104; a jet-fuel tank for the jet, H2O2/kerosene tanks for the rocket engine, and a reserve of H2O2 for the attitude-jet system. The “default” propellant tank (the one displayed on the HUD) is normally the jet-fuel tank. The rocket tank is displayed instead whenever the rocket engine is firing.

NF-104 Keys:

G – Lower/raise the landing gear
B – Toggles the speedbrake
F – Toggles the flaps
Keypad **0** – Ignite rocket engine
Keypad **.** – Shut down rocket engine
CONTROL-**/** – RCS Jets toggle on/off
CONTROL-**E** – Eject (ONLY if Dyna-Soar v1.3 is installed; will CTD otherwise)

Note that wheel brakes have been moved to the Orbiter-standard , and . keys; press both simultaneously to stop, or either for differential braking. Rudder actuation on the ground will provide additional steering by the nosewheel.

Version 1.1 added significant information in the HUD:

In the upper right is a countdown timer to thrust cutoff, which operates when the rocket is thrusting.

Indicated airspeed is shown on the left side, with a suffix KEAS, for Knots Equivalent Air Speed.

Aircraft total G-loading is shown just below KEAS.

On the right is a radar altimeter, reading feet, active below 2500' altitude.

Above this is the pressure altimeter. Once above 60,000', the pressure altimeter becomes increasingly unreliable; it is replaced with an inertial altitude (suffix “I”).

Bibliography:

Web:
NF-104.com, by one of the pilots: http://www.nf104.com

Version history:

v1.11
  Re-compile for Orbiter 2010

v1.1
  Added HUD code from Urwumpe: KEAS, altitude
  Wheel brakes now actuated by Orbiter-standard , and . Keys
  Added G-meter

v1.0
  First release