Zaretto
Skilled software development

Grumman F-14B Tomcat model for flightgear

Download F-14B Flightgear model

The F-14B always had a beautiful good 3D model and 3D cockpit thanks to Enrique Laslo and Alexis Bory; however I felt that the aerodynamics and flight model were not as good and so in August 2014 undertook to fix this using JSBSim. This is my first flightgear model; although I've been working with flight simulators for many years professionally.

Once I'd fixed the flight model there were a few changes that just had to be made; I felt that the lack of hydraulics and electrics detracted from the realism and provided a challenge to implement these using JSBSim rather than in Nasal. Using JSBSim for none FDM modelling works well.

The JSBSim aerodynamics model uses all of the data in the AFWAL-TR-80-3141 report and is accurate for low speed clean configurations. I have modelled the high speed and flaps etc. based on other reports so these may not match the aircraft precisely.

Because of the more realistic model the aeroplane is harder to fly than those with simpler aerodynamic models (e.g. High-G turns you need to watch the AOA to ensure that you don't stall the wings or the ailerons/stabilators)

I've also redone most of the sound effects to make it what I consider more realistic and improved the cockpit to add missing gauges.

FDM changes

Realistic JSBSim aerodynamic model with high speed and full wing sweep modelling based on real F-14A data. There are 63 distinct detailed aerodynamic coefficients)

Key points

- High alpha handling – including dutch roll and control reversal as described in the pilot's manual
- Accurate stalls, spins, and other departures (including flat spin)
- Wing sweep (20-68) has aerodynamic effect
- Gear effects on aero (pitch, lift, drag)
- Flaps (pitch, lift, drag)
- Wing sweep (including manual sweep). Sweep interlocks are correctly modelled so when deploying flaps aux flaps can only be used below 22deg of sweep; otherwise up to 50degrees the main flaps can be deployed. At wing sweep of more than 55 degrees no flaps are available.
- CADC Maneuvering flaps / slats (again modelled on best available aero data)
- Differential spoilers accurately modelled - so at high alpha or high wing sweep roll rate is reduced (spoilers only effective up to around 10degress AOA; and less than 55deg wing sweep)
- Electrics system model (Mainly for JSBsim)
- Hydraulics systems (Mainly for JSBsim)
- F110 engine performance remodelled (data from NASA-TM-104326) which is more accurate than the previously used values
- Contrails from the wings at high alpha subject to atmospheric conditions.
- AFCS tuning; the altitude hold is implemented in the CADC model; the normal autopilot is used for heading and throttles.
- Added smoke generator (ground services dialog)

Acurately modelled based on:

- AFWAL-TR-80-3141 Investigation of High-Angle-of-Attack Maneuver-limiting factors
- Pilot's manual (NATOPS) F14-AAD-1
- NASA TN D-6909 DYNAMIC STABILITY DERIVATIVES AT ANGLES OF ATTACK FROM -5deg TO 90deg FOR A VARIABLE-SWEEP FIGHTER CONFIGURATION

WITH TWIN VERTICAL TAILS

Sound

- Engine noises made from 5 components (intake, N1 whine, N2 whine, efflux, Augmentation); intake and efflux as based on EPR rather than thrust as this gives more realistic results
- JFS
- Landing gear touchdown and skidding
- Bump / rattle noises based on what's happening with the gear strut compression.
- Flap & Gear extended wind noise
- High alpha vortex noise
- Flap & Gear extension reworked to something that is more hydraulic sounding. Not sure if this is right but it sounds less like a Cessna
- Canopy open / close
- Wind noise
- Gear wind noise
- Flaps and airbrake wind noise
- Ground bumps and ratlles
- Scrape / fuselage contact

Systems

- Auto wing sweep now in FDM for improved fidelity. Wing sweep follows F14-AAD-1 so generally fully swept by M 0.9
- SAS (roll, pitch, yaw in FDM)
- Engine quickstart from menu
- Predefined fuel loads added to external loads panel together with showing the CG%.
- Can do in cockpit engine start

Aircraft model:

- Added NASA 834 livery.
- Wingtip contrails at high alpha
- Engine contrails reworked slightly

Cockpit additions

- Master warn panel with working indications for engs, fuel, hydraulics, electrics.
- Engine control panel (crank, ramps, rudder trim switch)
- Elevator / Rudder and spoiler gauges now connected to surfaces.
- Oil pressure gauges
- Connected elevator & rudder position gauges to surfaces
- Fuel cut off on glareshield works (need this for engine start)
- In cockpit engine start & shutdown possible.
- Anti-Skid / spoiler brake switch connected
- EGT display correct for F110
- Hydraulic pressure gauge
- Hyds transfer panel
- Master generator control panel (you can turn off the generators and emergency generator and will have no electrics)
- ARA 63 panel
- Master test panel

Fuel

- Moved fuel tanks so that the CG% is roughly correct and generally within the range of the pilot's manual.
- Added shortcut buttons for pre-defined fuel loads.

Notes:

The hydraulics and electrics require either engine systems or external power. So if you lose engines at low speed (insufficient airflow to keep the turbines spinning) then you will also lose electrics and hydraulics and thus flight controls

An engine start can be performed by pulling the cut off values (yellow stripy each side of the glare panel) and selecting crank (with or without external air). Once the engine N2 reaches above 18% the hyrdaulics will have sufficient pressure to power the backup electrical generator and the cockpit should light up.

As all of the simulation models are in JSBSim (rather than Nasal) it runs much faster and gives a much more fluid and realistic response.

The brakes control binding for joysticks will function as either ground or airbrakes appropriately.
