JSF – Thunderchief II?

by Dr Carlo Kopp

The new Joint Strike Fighter (JSF) program is often compared to the early nineteen sixties Tactical Fighter eXperimental (TFX/F-111) program, reflecting their common multi-service structures.

In concept and sizing, however, the JSF is very much closer to another early 1960s tactical fighter, the Republic F-105 Thunderchief.

The F-105 was the workhorse of the Vietnam air war, especially the 1964-1968 Rolling Thunder bombing campaign. Affectionately known as the 'Lead Sled', 'Super Hog', 'Ultra Hog', 'Iron Butterfly' and famously 'Thud', the F-105 first flew in 1955, and was designed by Republic's legendary Alexander Kartvelli to be a highly survivable strike oriented tactical fighter, with a secondary air-to-air capability, primarily for self defence. The aircraft was to have significantly better combat radius than previous USAF jet fighters, and in line with the penetration paradigm of the day, very high speed.

The resulting F-105 series was a fighter which is remarkably close to the current JSF in most important cardinal parameters.

Both the F-105 and JSF are large single seat, single engine strike fighters, using the most powerful engine of the era (J75 vs F135/F136), with empty weights in the 12 tonne (27,000lb) class, and wing spans almost identical at 10.6m (35ft). Both carry internal weapon bays, and multiple external hardpoints for drop tanks and weapons. Both were intended to achieve combat radii in the 400nm (740km) class. Neither have by the standards of their respective periods high thrust/weight ratios or energy manoeuvre capability, favoured for air superiority fighters and interceptors.

Both the F-105 and JSF were crafted around the dominant penetration paradigm of their respective periods. The F-105 was built to use speed to penetrate defences, and like the F-111 was designed to penetrate and egress at very low altitudes, using terrain masking and clutter to defeat opposing radar systems. The JSF is being built to penetrate at medium to lower altitudes using X-band stealth to defeat engagement radars and radar guided SAM seekers. While they differ in the substance of their penetration technique, they share the common feature of using the best technique of their respective eras.

The avionics in both aircraft represent the latest technology of their respective periods. The F-105's ASG-19 Thunderstick I/II system was tightly integrated with the NASARR multimode radar, as is the JSF's ICP package and APG-81 radar. Both radars are designs biased toward air-ground modes, but with respectable air-intercept capabilities for their periods.

The definitive F-105D, of which only 610 were built by 1964 due to higher than hoped for costs, could carry up to 1135kg (2500lb) in its internal bomb bay, and external stores on two 1360kg (3000lb) inboard pylons, two 1360kg (3000lb) outboard pylons and a 2045kg (4500lb) centreline pylon, for a total of 5450kg (12,000lb). The JSF carries a 1135kg (2500lb) guided bomb in either fuselage bay, up to 5,000 lb on a pair of inboard pylons, and 1175kg (2500lb) on a pair of outboard main pylons, with a 450kg (1000lb) centreline pylon.

The F-105D fleet was thrown into the meatgrinder of the North Vietnamese air defence system, then the most formidable in existence as the SovBloc pushed its latest SAMs, radars and MiG-21 Fishbeds into the theatre. Between 1965 and 1970 no less than 334 fell to enemy defences – 312 to SAM/AAA – not a bad figure in terms of sorties flown and the density of defences in theatre. Despite the bad press attached to the F-105, it was a rugged high performance aircraft capable of taking a lot of punishment.

The typical configuration for strike sorties was a payload of six to eight 750lb M117 dumb bombs (2045kg to 2725kg/

4500lb to 6000lb), with two external 1700 litre (450 USG) tanks. For shorter ranging close air support/battlefield air interdiction tasks, up to 12 M117 or 4085kg (9000lb) were carried. These payloads are very similar to the nominal internal/external payloads of the JSF. Typical fuel for an F-105D using internal tanks, a bomb bay tank and two 1700 litre (450 USG) tanks was 7265kg (16,000lb) – very close to the internal fuel of a JSF.

Early F-105 sorties were flown in a 'self escort' configuration, armed with an internal 20mm gun and an external AIM-9B missile, paired with an EWSP pod, on outboard pylons. The NVAF quickly learned that early engagement of the F-105 strike packages forced them to jettison bombs to achieve viable performance to defend themselves or evade attack, and very early the F-105s were supported by F-4C Phantom CAPs to keep the MiGs clear of the strike packages. A later tactic saw F-4C/D Phantoms interspersed with F-105s to effect defacto 'escort' support. Most sources claim 22 F-105s lost to MiGs for 27.5 MiGs shot down by the F-105s, or an exchange rate of 1.25:1 in close air combat.

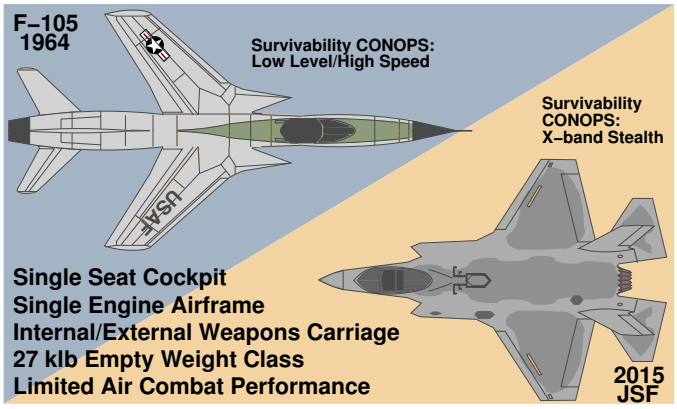
The F-105 experience presents an interesting case study of 'self escorting' strike fighter operations, and the utility of a strike optimised tactical fighter in air combat. Two factors make this experience important. The F-105D/F and MiG-21 Fishbed had defacto parity in radar/missile performance with the MiG doing better in turn/climb performance, and the extended duration of the campaign made for a large number of statistically valuable repeat engagements.

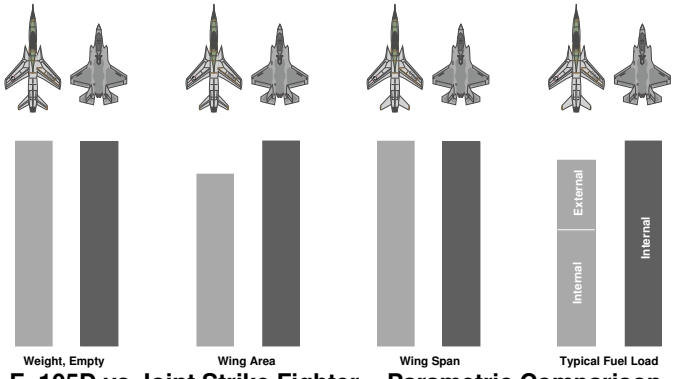
This is especially relevant for Australia which intends to fly 'self escorted' F/A-18As and later JSFs into a Sukhoi Su-30 rich regional environment. For the non-stealthy F/A-18A the reality is that an inbound Sukhoi will force an F/A-18A to jettison stores to achieve viable air combat performance to even survive the engagement – unlike an F-105D evading a MiG-21PF, the F/A-18 family does not have a speed/endurance advantage to play against the Sukhoi. For the JSF, which has roughly parity in radar performance against better Su-30 variants, and parity in energy performance against older Su-27SK configurations, it puts all of the survivability eggs into the stealth basket.

There is another interesting parallel in the F-105/F-4 experience, which is that the F-4 had a significant advantage in radar/missile range and energy performance. This parallels the superior stealth, radar, missile kinematic and energy performance advantages held by the F/A-22A, intended to escort the JSF in US Air Force service.

While the JSF and F-105 are separated by almost half a century in technology, they occupy almost identical niches in size and intended role optimisations. The F-105 was clearly an outstanding success in its primary role of strike/interdiction and close support, but was much less successful in air combat. The lesson in this for future JSF users is a simple one – the JSF is likely to be highly effective in its primary battlefield interdiction/close air support role but less likely to be successful in air combat, as its basic aerodynamic performance is close to parity with the most likely adversary types – advanced Su-30 variants. The decisive factor for the JSF in this game will be its limited stealth performance against the full spectrum of opposing radar systems, especially long range lower band surveillance radars used to guide Sukhoi intercepts.

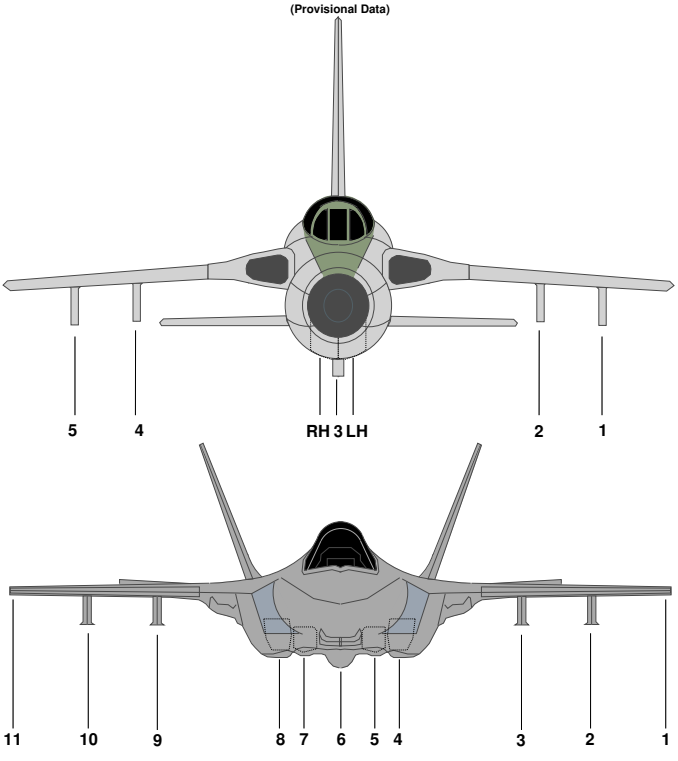
The JSF is no more an F/A-22A, than the F-105D was an F-4C. ✈





F–105D vs Joint Strike Fighter – Parametric Comparison

(Provisional Data)



The F-105 was optimised for battlefield strike and interdiction work, like the JSF, and could carry internal and external stores like the JSF. This Thud is flying a close air support profile with 12 750lb bombs. (US Air Force)