

By Richard Gale

In a bid to cut debts and deficits, Western defence procurement and costly weapons programs have been targeted as an obvious source for cutting what is seen as wasteful spending. So what of the most expensive weapons development programme ever: the Joint Strike Fighter? It has rarely been out of the headlines, whether praised for its intention to develop a genuinely "all-round" and innovative fighter aircraft or criticised for its vastly increased costs and ever extending timescales for delivery. With the recent sea trials for the Short Take Off, Vertical Landing (STOVL) variant, and the highly publicised efforts of the US Congress to find savings within the defence budget and within the program, it is a good time to take a step back and look at the history and important aspects of the JSF's development.

A brief history of the JSF

The first step for the programme came in 1997 with the selection of Lockheed Martin and Boeing for the concept demonstration. (McDonnell-Douglas were eliminated and Northrop Grumman joined Lockheed Martin's development). The mandate given to both suppliers was to develop flying demonstrators for possible production, working on the brief that the US wanted to produce an affordable, tactical aircraft with stealth capability that could replace and cover the capabilities of at least 4 different types of jets in service.

In 2000, that both Boeing's X-32 and Lockheed's X-35 underwent test flights and a year later Boeing's concept performed a series of supersonic flights, achieving Mach 1.05. However, Lockheed Martin's X-35B demonstrator then successfully caught the eye with a test of STOVL, reaching a milestone Boeing's concept did not achieve. It was this development which pushed the verdict in Lockheed's favour and they were subsequently awarded the contract to develop further and produce a family of conventional take-off and landing (CTOL), carrier-capable (CV), and short take-off vertical landing (STOVL) aircraft for use primarily with the U.S. Air Force, Navy, and Marine Corps. International participation in the programme also came in 2001 as the UK also selected the Joint Strike Fighter program to replace its Harriers then serving with the Royal Navy and RAF.

A report in June 2003 delivered to US Congress conveyed an optimistic picture of the timescales involved and the status of the project. They predicted that the programme would begin production around 2005 and first aircraft deliveries would start in 2008. However the first indications of rising costs came when the maximum flyaway cost was revised up to \$38million per aircraft and overall project cost at \$219billion (including research, development and the cost for the US Air Force to buy the F-35's).

It was not until late 2006 that the first Lockheed Martin F-35 rolled out from the factory and made its maiden flight. It then took another 4 years until the carrier variant was tested and the STOVL variant enjoyed a vertical landing. F-35 have yet to be delivered to its various government buyers, and it is unlikely to become operational until 2016 at an (optimistic) earliest.

Engine trouble?

The competition of the engine to be used for the F-35 was also meant to drive manufacturers to develop better, more efficient engines for production. This however has been a significant factor among many for the delays outlined above. GE Aviation and Rolls Royce competed against Pratt and Whitney for the engine contract; the latter of which was then awarded the contract of more than \$4 billion to develop its propulsion system F135, for all 3 variants, (GE and Rolls Royce continued to develop their own engine and were part funded by the US). However, testing of the Pratt and Whitney engine has proved difficult and been onset with problems. The STOVL variant's second stage turbine failed during fatigue testing and was grounded until the fix could be completed. In April 2011 a small number of F135 test and production engines were replaced after a ground test engine was found to be misassembled. Further checks then identified the same problem on other test and production engines. These

delays have caused not only many to question the perceived quality of P&W's F135 engine, but also caused the cancellation from both the Obama administration and then Rolls and GE of their separate engine development due to the budgets constraints and what was seen as wasteful spending.

Programme costs

As with the engine, the overall research, development and production costs of the JSF have been rising. The initial cost for the US Military was projected at \$231 billion to purchase 2866 aircraft. In 2010 it was then confirmed that the procurement had increased between 57% and 89% since Lockheed Martin won the contract and the programme is now budgeted at \$385 billion for the US. As well as the US, at least 8 countries are hoped to spend over \$1 trillion to buy and maintain around 5,000 aircraft.

Britain has already spent at least £1.4 billion since 2002, but in a move to curb costs, has changed the order of the aircraft; selecting the Carrier based F-35C as opposed to the STVOL F-35B. (Downgrading of order numbers of this variant is also a high possibility).

The US Congress has ordered \$450 billion in defence budget cuts, citing the JSF as one of the most high profile potential victims. However, senior US congressmen are seeking to protect the budget of the F35 through the formation of the Congressional Joint Strike Fighter caucus, whose members are some of the top recipients of political money from Lockheed Martin. According to reports however, more likely scenarios are the reduction in number of aircraft purchased, or even scrapping one of the three variants in development.

Trials and testing

In addition to rising costs, delays in the programme have caused the projections for testing and trials to be revised significantly. The project's initial operational capability was projected to be 2010 after its development began in 2001. As noted, it was not until late 2006 that the first F35 began its maiden flight. It took another 4 years until the carrier variant was tested and the STOVL variant enjoyed a vertical landing.

Recently however, testing has increased in intensity and enjoyed relative success. In October 2011 two F35-B's carried out STOVL sea trials on the USS Wasp; completing the JSF's first vertical landing at sea. In November 2011, 79 flight tests were conducted rather than the 64 planned and for the whole of 2011 until November, the flight-test programme was 11% ahead of plan, having conducted 902 actual tests compared with 813 planned. There have however still been issues during these sea trials, including problems with the upper lift fan door actuator having to be redesigned. But other variants such as the F-35C have also recently achieved success, undergoing a successful test launch using the Electro-Magnetic Aircraft Launch System. Data from this will then be used by the UK for the F-35C development capability on the new Prince of Wales Carrier currently in production.

The link between recent successes in testing and the highly public debates in Washington discussing the need to cut US defence budgets should not be ignored. Pressure on Lockheed Martin for the JSF to produce successful steps in development after many years of delays and setbacks are required more than ever if the programme is to survive in its full form. The cancellation of the second engine development was a significant wake-up call to the manufacturers, of the stance US lawmakers were willing to take to the even such an important development such as the JSF.

The JSF has had a chequered history overall, attracting attention from both defence and non-defence analysts. In Part 2 of this analysis, we will look at the future of the JSF and the F-35; the operational capabilities of the aircraft and its 3 variants, its potential for success against the backdrop of aircraft it is replacing and what this all means for the export prospects of the aircraft.

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Data sources include

Congress Report: <a

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>http://www.dtic.mil/cgi-bin/GetTRDoc?Location=U2&doc=GetTRDoc.pdf&AD=ADA472773</p>