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RUMOUR CONTROL

What price the JSF?

Sales hype and disinformation aside, how much will the Joint Strike Fighter actually cost? And can we afford it?

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The New Air Combat Capability project within Defence is the largest single procurement project in our history. It has a budget in the range of \$11-15 billion dollars and plans to acquire 'between 70 and 100 aircraft'. The selected aircraft is the Lockheed-Martin Joint Strike Fighter (JSF). Designed to a low cost (relatively – no combat aircraft is cheap), the JSF will come in three variants for Air Force, Navy and Marines use. It is also yet to fly in its final form, meaning that there is plenty of scope for project variations still left.

One of the consequences of the remaining uncertainty in the JSF program is that there is plenty of scope to argue about the cost, capability and schedule. We are only going to focus on the cost, but even that leaves plenty of room for debate. Amazingly, it is possible to quote costs ranging from US\$45 million through to US\$222 million per aircraft and be right about each of them. Hopefully we can shed some light on why that might be so.

But let's be clear about one thing. When you reach the end of this article, you will still not know how much the JSF is going to cost. That is because no-one does. What we *can* do here is sort out a lot of the confusing and contradictory things that have been written about JSF costs and take our best shot at estimation. Then, for good measure, we'll compare that to the cost of the F-22. Of course, when comparing future aircraft with present ones, it's important to make fair comparisons. For that reason, we have converted all of the figures in this article to constant 2006 dollars.

As a first step, we need to make clear what we mean when we talk about the cost of acquiring the JSF. There is a lot more to getting an aircraft into service than manufacturing the airframe. Figure 1 shows the definitions used by the USAF. Any of the costs in the figure can be turned into an average unit cost (average cost per aircraft) simply by dividing the corresponding total cost over the program lifetime by the number of aircraft produced.

The lowest figure is the recurring flyaway cost, which is the cost incurred every time a new airframe is rolled out the hangar door. This is the figure that will be trotted out by salesmen or by eager proponents of a particular type. In the case of the JSF, that is where the lowest figure of US\$45 million comes from. It is not wrong, and has the virtue (for salesmen) of being seductively small, but it omits a lot of the actual costs for a service that wants to field the aircraft.

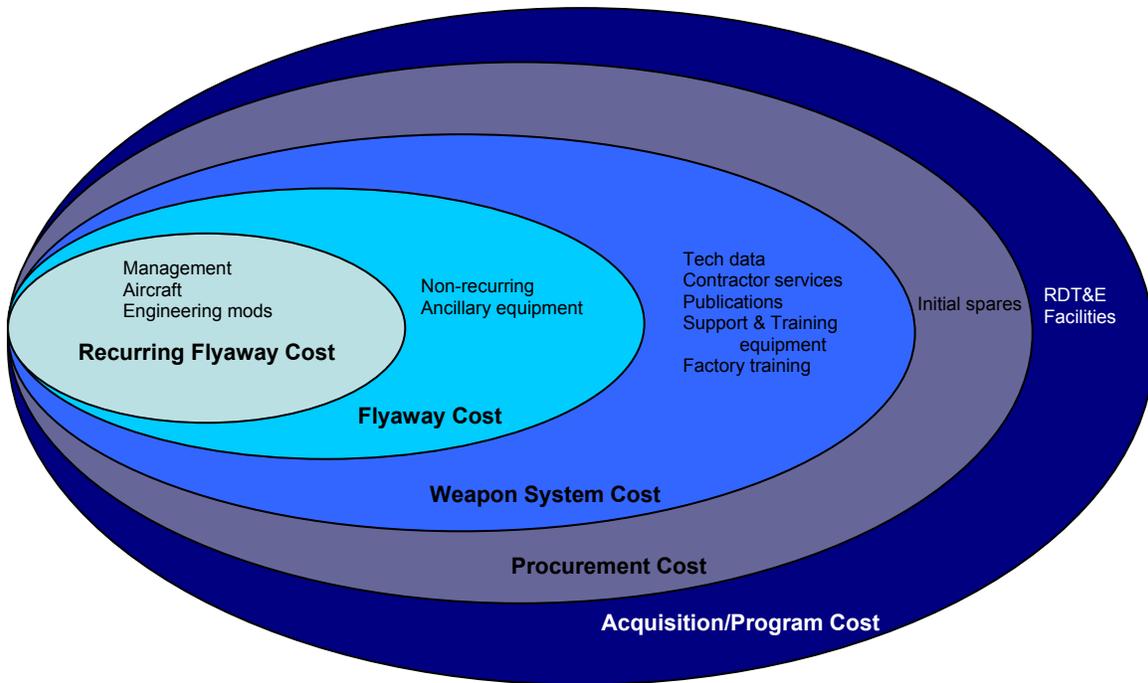


Figure 1. USAF Aircraft cost definitions.

For the country of manufacture, the total cost of acquiring an aircraft must include the cost of all contracted services, associated equipment, facilities and, significantly, the R&D. In USAF parlance, that is the acquisition or program cost. When the US congress makes decisions about aircraft programs, the program cost is what they usually consider. Not unreasonably, the US often seeks to recoup some of the R&D costs by passing these on to foreign customers.

For a second party hoping to buy the aircraft from the manufacturing country, the procurement cost is the minimum they can expect to pay, including as it does all of the documentation, training and support and initial spares. Participation in the JSF program as a member country carries the benefit of a waiver on initial R&D costs, meaning that the procurement cost is a good measure of the actual cost of getting the aircraft into service.

With these definitions in place we can start to make some sensible statements about likely JSF costs. Unlike Australia, the US has a commendably open approach to defence procurement, so there are reliable figures in the public domain. The US DoD publishes quarterly figures for major programs, and data dating back to the 1960s are available on the internet. From those sources we can extract the figures in Table 1.

Table 1. JSF costs in 2006 US\$.

| | |
|-------------------------------|---------|
| | JSF |
| R&D Cost | \$45b |
| Procurement Cost | \$161b |
| Program Cost | \$221b |
| Number of aircraft (for US) | 2,458 |
| Average Unit Procurement Cost | \$65.5m |
| Average Unit Program Cost | \$89.9m |

So far so good. We now know that if the JSF program runs as currently planned, the aircraft will cost, on average, US\$65.5 million apiece to procure – including documentation, training, initial spares etc. There are still a few complications though. Firstly, the JSF is not a single aircraft type and Australia is planning to buy the least expensive conventional take-off and landing (CTOL) version. Secondly, the average cost is over a planned production run of thousands (including foreign sales). The early aircraft will cost more than the later ones and the timing of a buy is important. Finally, the JSF program still has at least six or seven years to go before operational aircraft are available. Past experience with other aircraft programs shows that cost escalations (and delays) are likely.

We can get a handle on the first two factors by looking at how much the USAF is planning to pay for their CTOL aircraft. The 2007 budget papers have figure for the years 2007-2011, during which the USAF will be acquiring low rate initial production (LRIP) aircraft. The figures are shown in Table 2, and include the flyaway and weapon system costs. For our purposes the weapon system cost is more relevant. The procurement cost would be slightly higher.

Table 2. JSF CTOL - USAF budget requests to 2011 (in constant 2006 US dollars).

| | 2007 | 2008 | 2009 | 2010 | 2011 |
|--------------------|--------|--------|--------|--------|--------|
| Number of aircraft | 5 | 8 | 15 | 20 | 31 |
| Flyaway cost | 176.3m | 137.2m | 100.2m | 86.8m | 79.7m |
| System cost | 222.5m | 172.1m | 137.9m | 120.6m | 107.6m |

Note that all of these aircraft are considerably more expensive than the average values quoted above. We also see a dramatic fall-off of costs over time, as well as the highest figure of US\$222 million mentioned earlier. That is due to early costs including production set-up costs and the effect of ‘learning’ – the fact that it gets easier to manufacture items with experience. Figure 2 shows the learning curve for the CTOL aircraft in the first five years. (Note that, common usage aside, a ‘steep learning curve’ is actually a good thing. It means that things are getting cheaper faster.)

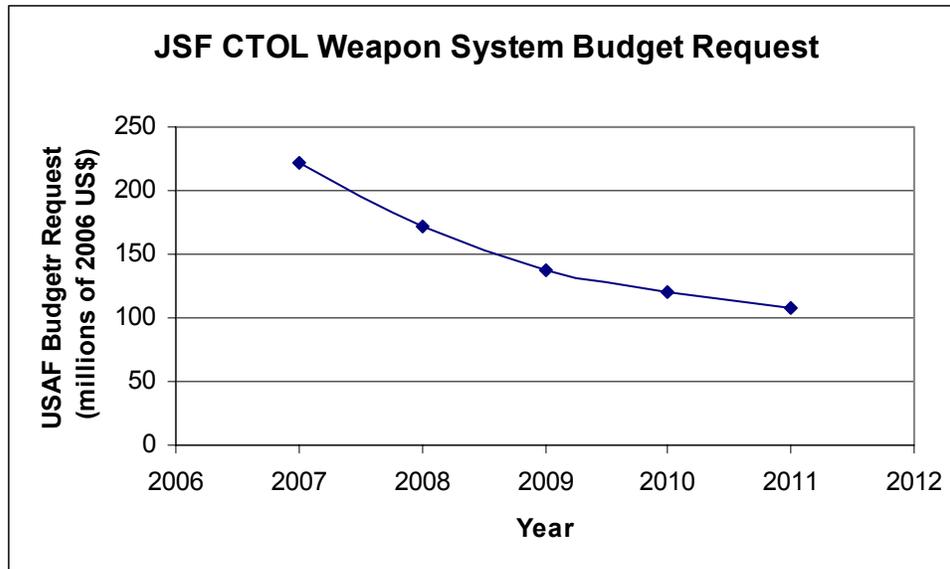


Figure 2. USAF Weapon System budget requests for the JSF CTOL variant.

We can estimate later-year costs by fitting the industry standard learning curve and extrapolating out. If we do that, we find that a CTOL aircraft in 2016 has a weapon system cost of US\$85 million. Given that an initial Australian purchase will hopefully occur before then to allow for replacement of retiring F-111 and F/A-18 aircraft, we conclude that our early aircraft will cost in excess of that figure. Later purchases will be less expensive, with a cost that will be determined by how the learning curve develops in practice.

Of course, all of the above is predicated on the JSF program running according to plan. If it does, it will be almost unique in aircraft programs. We can get an estimate of what is likely by looking at two past programs. The F/A-18 E/F Super Hornet program is generally regarded as very successful, while the F-22 Raptor program has been plagued with cost overruns and resulting cuts to numbers.

Taking historical US DoD data for these two programs, we can see how they have fared over time. The US DoD figures provide the average unit program costs over the fourteen year life of the programs to date. The program cost per aircraft of the F-22 has increased almost three-fold over time, while the Super Hornet, albeit a technologically less advanced aircraft, has experienced cost growth less than 50% above the initial estimates.

So far we have figures for only the first five years of the JSF program. Putting the figures for those years on the same graph as the Raptor and Super Hornet makes for an interesting comparison. Figure 3 shows that, so far, the JSF program has suffered as much cost growth as the Super Hornet has over its lifetime. Supporters of the JSF claim, with some justification, that the program is being very proactive in addressing risks. That may be reflected in these figures. On the other hand the JSF is, like the F-22, a fifth-generation aircraft with the attendant manufacturing difficulties. It also comes in three disparate variants. The future direction of that trend line is not clear.

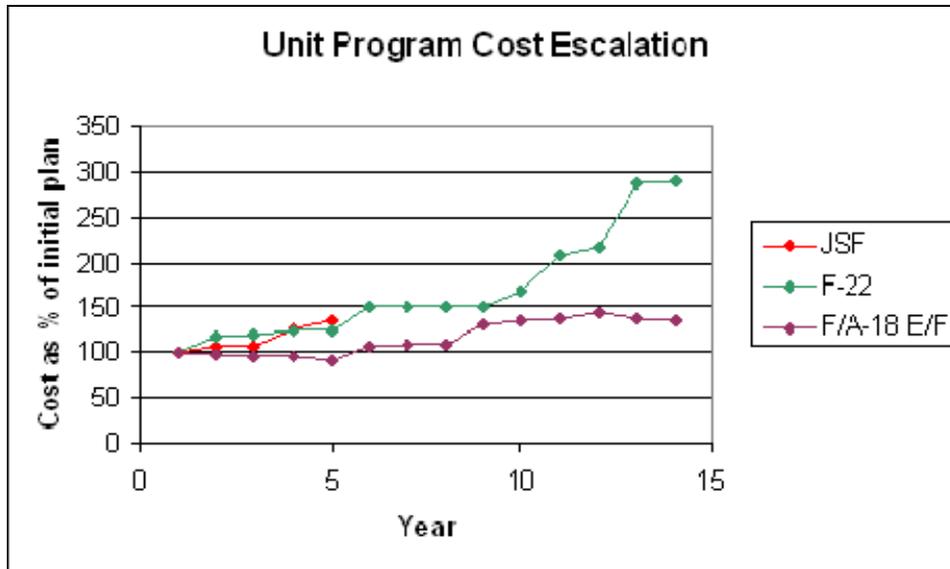


Figure 3. The JSF compared to the F-22 and Super Hornet.

To see what a worst-case cost might look like, we can calculate the cost of the JSF if it undergoes the same escalation as the F-22. When we do that, we get the figures in Table 3. From that we conclude that the CTOL variant will, at worst, cost in the region of US\$100 million per aircraft. (One final caveat: these figures assume that numbers are not cut. However, the JSF program is large enough that the sensitivity to numbers produced – provided they don't fall too far - is not very strong.)

Table 3. JSF costs if escalation is the same as the F-22 program.

| | 'Worst case' JSF costs |
|-------------------------------|---------------------------|
| R&D Cost | \$51b |
| Procurement Cost | \$259b |
| Program Cost | \$310b |
| Average Unit Procurement Cost | \$105.6m |
| Average Unit Program Cost | \$126.3m |

For comparison, the USAF budget papers provide a relatively robust figure for the cost of the F-22. The F-22 program is now mature, and the last 60 aircraft to be produced are budgeted with a weapon system price tag of between US\$158 million and US\$168 million each. But even here things are not that simple. A revised multi-year procurement scheme which has the potential to lower the price is wending its way through the US congress. On the other hand, there is still R&D work to be done, especially on air to ground capability, and that has the potential to add to the final cost. The best we can do is to conclude that the *minimum* price Australia could pay for the F-22 would be a procurement cost of around US\$160 million per aircraft. If any R&D costs were factored

in, the price could be significantly higher. For example, a 20% contribution towards R&D costs would push the price in excess of US\$180 million. Any decision to buy the F-22 would require serious negotiations to keep the price down. It might be moot though - at these sorts of prices, we couldn't afford a fleet of even 50-60 within the current budget.

So where have we got to? As promised, we still don't know how much the JSF will cost Australia (or anyone else for that matter). What we do know is that the JSF CTOL average procurement cost will almost certainly be in the range of US\$65-100 million per aircraft. We also know that the earlier we buy, the more expensive the aircraft will be, and that the first batches acquired can be quite a bit higher than the average cost. This is a 'Catch 22'. Keeping the legacy F-111 and F/A-18 aircraft in service is complex and expensive, but so is an early JSF replacement. That may be one of the reasons the Defence Minister has asked for a re-evaluation of other options. There will also be associated project overheads that are Australia-unique. Such factors, and their associated costs, are not public information. Similarly, we don't know yet how the support arrangements will work or what they will cost.

Since we can't put an exact figure on the cost of the JSF, it is hard to be definitive about its affordability for Australia. What we can say is that the low end of the cost range the full buy of 100 aircraft *looks* affordable. US\$65 million each leaves some A\$4 billion extra in the project budget for overheads (which admittedly we also don't know). At the upper end, 100 aircraft at US\$100 million each pretty much eats up the whole budget, making other costs impossible to fit in. The number of aircraft would have to be reduced or the budget increased. 70 may still be affordable, depending on what the overheads are. Like many aspects of the JSF program, we will have to wait for time to reveal all.

Andrew Davies is the Director of the Operations and Capability program at the Australian Strategic Policy Institute. The views expressed here are his own.

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