A Case for the F-35 Lightning

by Tim Dunne

F-35 Lightning. Lockheed Martin Corporation

Introduction

The Canadian Government's 16 July 2010 announcement that it was to replace the ageing CF-18 *Hornet* with the Lockheed Martin F-35 *Lightning II* joint strike fighter (JSF) aircraft predictably attracted stern admonishment from Rideau Institute president Steven Staples, and from others who oppose military purchases.

Their objections revolve around their beliefs that Canada does not need a fifth generation (5G) combat aircraft; that there was the arbitrary selection of a single aircraft without a legitimate competitive process; and that the cost is excessive. They suggest that we purchase lesser aircraft, presumably for a lesser cost, if, indeed, they agree with a fighter aircraft acquisition program at all.

Typically, Canada squeezes all possible productivity out of its aircraft (and other military hardware) before they are retired. Witness the continued service of the Second World War DC-3 *Dakota,* acquired in 1943 and flown until 1988, and the *Sea King* maritime helicopter, which will celebrate its 50th year of service on 1 August 2013. Our current CF-18A *Hornet* fighter aircraft, purchased in the 1980s, will be nearly 40 years old when they are ultimately decommissioned and replaced. Rapidly becoming moribund in the air combat world, our *Hornets* would be dangerous vehicles in which to engage in fifth generation warfare. The aircraft is wearing out, and it needs to be replaced within five-to-ten years.

The US JSF program had its origin in the 1980s and 1990s, and was intended to replace several fleets of American tactical aircraft: the McDonnell Douglas AV-8 *Harrier II* 'jump jet' used by the US Marine Corps; the General Dynamics F-16 *Falcon* (both of which were extensively employed by 'friendly' foreign militaries); and the carrier-based Grumman A-6 *Intruder* medium attack fighter, all of which were approaching the end of their useful service lives.The end of the Cold War, however, reduced flying hours on these particular fleets, and therefore, the relative urgency for fleet replacements.

The JSF is the single largest fighter aircraft program in history, with expenditures expected to exceed US$383 billion in producing up to 5000 aircraft. The requirements for the JSF were stringent and complex. There were to be three variants; a conventional take-off and landing model, a carrier-based model, and a short take-off and vertical landing model. All variants had to share common components, generate increased lethality over their predecessors, be survivable during the rigorous demands of combat, be supportable in increasingly challenging operational environments, and, be affordable.

Ultimately, three corporate bidding teams 'threw their hats into the ring,' consisting of Lockheed Martin, Boeing, and McDonnell Douglas.

The Competitive Process

Canada joined the JSF program in 1997, when DND signed onto the Concept Definition Phase with an initial investment of US $10 million. As part of this phase, Canada, as a partner nation, was consulted in the US-led competitive process, during which the three bidding teams developed their submissions.

McDonnell Douglas designs were rejected in 1996. Over the next five years, Boeing and Lockheed Martin developed and constructed their prototypes, the X-32 and the X-35 respectively, which were extensively flight tested and evaluated until 2001, when the F-35 was ultimately selected as the joint strike fighter. As a partner nation, Canada had been consulted during the extensive and rigorous US-led process.

In addition to Canada and the United States, the multi-national effort to build and sustain an affordable, multi-role, 5G stealth fighter aircraft includes partner-level participation by Australia, Denmark, Italy, Netherlands, Norway, Turkey, and the United Kingdom (UK), as well as peripheral/potential participation by other nations. All partner nations were given the opportunity to participate in the evaluation and selection process, and all, except the UK, deferred to the US, since the Americans were acquiring the 'lion's share' of the aircraft. Canada assigned DND personnel to the International JSF Project Office to keep the Canadian government informed about program developments, which gave Canada full access to the results of the JSF competition

A Canadian Competition?

In a comprehensive article in *Frontline Defence* magazine (Issue 3, 2011), Lieutenant-General (ret'd) Ken Pennie noted that if a decision was made to conduct a purely Canadian competition, the competing aircraft would likely be:

- the Lockheed Martin F-35 *Lightning II* (US)
- the Boeing F-18F/A *Super Hornet* (US);
- the Saab *Gripen* (Sweden);
- the Dassault *Rafale* (France); and
- the British Aerospace *Eurofighter*.

This roster, General Pennie believes, would quickly be pared down to three: the F-35, the F-18F/A, and the *Eurofighter*, which, in turn, would be quickly further reduced to the F-35. The *Eurofighter* is the least capable and the most expensive, and the F/A-18, the *Gripen*, and the *Rafale* do not meet Canada's mandatory minimum requirements, leaving the F-35 as the only logical choice for Canada's air force.

Theoretically, there could be a further two fifth generation competitors: China's Chengdu J-20, and Russia's Sukhoi PAK-FA. However, these aircraft should not be considered serious contenders. If either nation should disagree politically with Canada over issues, such as Chinese relations with Taiwan or India, or should Russia mount an aggressive challenge to our Arctic policies and activities, they could easily choke off access to vital spare parts. They would also know exactly what countermeasures to use, or to advise our adversaries to use, against our air force in operational deployments.

Furthermore, there would be several attendant consequences associated with a purely Canadian competition.

- Canada would lose its place in the F-35 queue, adding years to the CF-18 replacement program.
- While there would be no financial penalty incurred *per se*, Canada would effectively withdraw from the memorandum of understanding with the US Government, thereby losing its $160 million investment. If Canada were to pursue the only other avenue of acquiring the F-35, i.e., through the US Department of Defense (DoD) Foreign Military Sales (FMS) program, the cost would increase by $850 to $900 million.
- Canadian industrial involvement in the JSF project could be eliminated, thereby ending the high-value work which Canadian companies would contribute to the entire fleet of F-35s, for the life of the program, scheduled to extend to 2051. Of note, the proceeds of Canadian industrial involvement could ultimately exceed Canada's purchase price for the planned fleet of 65 aircraft.

Reuters RTR2Q115 by Sergei Karpukhin

Two Sukhoi T-50 PAK-FA Fifth Generation fighters at a recent display.

- The industrial regional benefits negotiated for just 65 aircraft could pale when compared to the potential industrial program offered by the entire JSF program of 3000 to 5000 aircraft. In addition to Canada's industrial involvement, Canadian membership in the nine-nation partnership to acquire this aircraft will result in royalties expected to be as much as $130 million being paid into the Government of Canada's Consolidated Revenue Fund from sales to non-partnership nations.

- Canadian industry would lose its privileged position in competing for contracts to manufacture components, or to develop software for the entire fleet of JSFs, which already amount to $350 million, and are expected to significantly increase in the coming years.

Cost

The fine art of explaining funding of major equipment programs to the public in a clear and easily understood manner continues to elude DND. Cost estimates are clouded by terms such as *budget year*, *then-year*, *infrastructure costs*, as well as a continuously confusing litany of cost factors and life cycle management statistics. The purchase of the F-35 is further confused by the efforts to compare the cost figures of the U.S. Government Accountability Office (GAO) with those of the Department of National Defence. However, simply stated, this is an effort, (and I apologize for the tired metaphor), to 'compare apples and oranges.'

Canada joined the program's System Development and Demonstration Phase in 2002 with an investment of US $100 million, as well as an additional $50 million contributed through federal Canadian technology investment programs. This phase extends until 2015.

In 2003, the Americans invited the current partners to participate in the Production, Sustainment and Follow-on Development phase, culminating with Canada signing the *JSF Production, Sustainment and Follow-on Development Memorandum of Understanding* in December 2006. Canadian participation in this phase will cost approximately US $551 million over the course of the 2007-2051 timeframe to cover Canada's portion of production, sustainment, and follow-on development costs, including common tooling and sustainment. The US is funding most of the research and development (R&D).

Four types of costs are associated with the JSF acquisition of the F-35: recurring flyaway cost; procurement cost; acquisition cost; and total ownership cost. While each is an important element in the project, they continue to confuse those who are concerned with respect to the cost of an aircraft purchase to replace the venerable CF-18 *Hornet*.

Canada undertook an extensive assessment of the options, including a detailed cost comparison based upon data provided to Canada on a government-to-government basis. This information verified that the F-35 was the only aircraft that could meet the CF's operational requirements at an affordable price. In short, the JSF program was developed to provide the most effective fighter aircraft for the most affordable price possible.

David Perry is a defence analyst with the Conference of Defence Associations Institute. His excellent paper, *Canada's Joint Strike Fighter Purchase: Parsing the Numbers* (in *CDA Institute, On Track*, Summer 2011), details the cost of the F-35:

The basic unit of analysis is the recurring flyaway costs … [which] include program management, hardware, airframe, vehicle and mission systems, propulsion and engineering change orders. Procurement costs are frequently expressed per aircraft as average procurement unit costs (APUC). The acquisition costs of the JSF include procurement costs, plus research, development, test and evaluation and cost of facility construction. Finally, total ownership costs include all the preceding costs, plus operations and support, improvements and modifications. DND's announced program states that the *unit recurring flyaway cost* (URF) is $70 to $75 million.

Perry insightfully notes that DND's URF cannot be meaningfully compared to the GAO's $133 million estimate. The GAO's figure is an *average procurement unit cost* (APUC), and this includes spare parts, logistics, and other cost figures, *and is an average cost for all three variants of the aircraft*. However, Canada is purchasing the conventional take-off and landing (CTOL) version – the cheapest of the three variants. Canada's Department of National Defence (DND) accounts for other costs separately.

These seemingly contradictory figures even have Ottawa's Parliamentary Budget Office (PBO) questioning DND's estimates. PBO estimates the total acquisition costs for the 65 fighters to be $9.7 billion, and $1.7 billion for logistic set-up, plus 30 years of operating and support costs ($14 billion), plus $3.9 billion in overhaul and upgrade costs.

This is an astounding and confusing series of figures to be included in the procurement package, but the 'bottom line' is that whichever aircraft Canada purchases will have follow-on costs associated with training, storage, operations, maintenance, and armament purchases for the fighter. Whatever we buy will require retooled and redesigned facilities at the two fighter bases. We can expect that these costs will probably increase from those associated with the CF-18 fleet.

For a more realistic figure, one should look at the acquisition costs of the aircraft as it will exist in the Canadian context, which DND stipulates will be approximately $75 million per airplane, or $4.55 to $4.88 billion in sum. The remaining funds in the budget envelope will, as DND's Assistant Deputy Minister for Materiel Dan Ross wrote in a 15 June letter to the *Ottawa Citizen*, be used for "...weapons, supporting infrastructure, initial spares and training simulators." Associate Defence Minister Julian Fantino and Dan Ross reconfirmed these estimates on 14 June 2011 in their joint remarks to the Parliamentary Standing Committee on Government Operations and Estimates.

The GAO estimates the APUC to be $133 million, *which is the average unit cost of for all three variants over the entire production line, including the very expensive aircraft at the earliest production period.* By way of comparison, and using this measurement yardstick, Boeing's F-18E/F *Super Hornet* would cost about $5 to $10 million more per aircraft than the F-35.

Canada's acquisition of the aircraft is expected to begin in 2016, when the production line has been in operation for several years, and when the unit cost will be at its lowest. Production lines are most expensive as they begin construction of aircraft and decrease quite dramatically once the assembly line has been fully established. DND says it will be able to adjust the purchase date to coincide with the start of the multi-year production, if desired, to take advantage of the reduced price point.

When all these factors are considered, David Perry notes: "... [that] DND's cost estimates for the F-35 (CTOL) appear very similar to the GAO's when expressed in comparable terms, although the PBO's estimates are significantly higher."

With nine nations and their collective industrial capabilities engaged in the aircraft's development, the JSF program is a new model of international partnership in aircraft production. The multinational approach to F-35 production is intended to cut costs by reducing redundant

research and development, by providing access to the technology and replacement parts in partner nations, and by generating economies of scale. Component commonality across the three variants reduces the requirement for unique spare parts and simplifies the logistics footprint on the assembly line, specifically embodied in shared wing platforms, in common systems that enhance maintenance, in field support, and in service interoperability.

Industry Canada has signed agreements with member companies of the Lockheed Martin team, and this participation has already provided Canadian aerospace industry with long-term, high technology industrial opportunities for its advanced composite manufacturing, mission systems, and high speed machining, to mention just a few of these opportunities. To date, Canada has invested just over $200 million in the JSF. Since 2002, the Canadian government's participation in this program has led to more than $350 million in contracts for more than 64 Canadian companies, laboratories, and universities.

Now that Canada has committed to purchasing the F-35, Canadian industrial opportunities could exceed $12 billion for the production of the aircraft. Sustainment and follow-on opportunities for Canadian industry are emerging, and they will be available over the 40-year life of the program. Industrial participation agreements provide stipulate that all 19 Canadian companies which are manufacturing items for the F-35 will also repair and overhaul those components for the entire global fleet.

Too much aircraft for Canada?

The end of the Cold War sowed expectations for a more peaceful world with a greater level of international development and cooperation that could not, as it materialized, be reaped. Since then, Canada has experienced several geostrategic shocks where Canadian air power was deployed: During the *Persian Gulf War* (1990-1991), CF-18 aircraft provided air cover for multinational maritime operations in the region. Over Kosovoin 1999, our *Hornets* participated in UN-sanctioned NATO operations to protect ethnic-Albanian Kosovars as part of Operation *Allied Force.* And over Libya, in a mission still in progress at the time of writing, six CF-18 aircraft have been deployed as part of NATO's Operation *Mobile*.

Without exception, each of these operations came as a surprise to Canadians, requiring fighter aircraft to deploy quickly. Future operations can be expected to happen in a similar manner, with little or no notice. But as military technology develops and becomes less expensive, older and less sophisticated aircraft will be flying into increasingly perilous situations.

Many of the arguments against the F-35 are seriously misinformed. There is a need to replace Canada's CF-18 aircraft and upgrade our air combat capabilities to meet emerging threats and challenges that we cannot foresee at this point in time.

Many people disregard new and emerging security concerns emanating from sovereignty challenges, terrorism, illegal migration, and climate change, as well as the global threats facing Canada in years to come. Canada cannot rely upon its allies for domestic security, and we must be prepared to participate in collective defence to honour our international commitments and

treaty obligations, and to participate in pacification efforts whenever and wherever the Canadian Government decides to deploy our forces.

F-35 15 Jul 11. Lockheed Martin Corporation

Several of these security challenges may be developing in the Canadian north. Some 'analysts' scoff at the suggestion that the F-35 can contribute to Arctic sovereignty. However, this contingency may not be so far-fetched when it is taken into consideration in tandem with: the five-nation competition for ownership of the Arctic, and the resources believed to sit beneath a rapidly-diminishing ice cap. Canada's contested ownership of the Northwest Passage, Russia's Tu-32 *Bear* aircraft flights approaching Canadian airspace, and Russia's planting of her national flag on the ocean floor at the North Pole all give credence to sovereignty concerns for the region. Several nations contest Canada's claim that the Northwest Passage lies within the Canadian Arctic archipelago, and if they are successful in having the Passage *internationalized*, the airspace above it also becomes *internationalized*, creating yet another strategic challenge for Canada.

Canada is one of seven nations that share the Arctic, and four are competing with us for increased ownership. While all competitors have agreed to pursue their claims amicably and cooperatively, Russian actions do not match their words. In March 2009, Russia announced it intended to create a special operations unit exclusively for military operations in the Arctic. While Canada has established a military Arctic Training Centre at Resolute Bay, we are still lagging behind our allies and our rivals. In March, 2010, Russian president Dmitry Medvedev announced his intention to ensure Russian access to mineral resources in the Arctic and acknowledged that competition over these resources could spark future conflicts between Arctic states.

F-35(3). Lockheed Martin Corporation

Conclusion

The F-35 purchase is the first to incorporate extensive partner nation engagement in a major acquisition program. Unit production costs drop because of the economies of scale, the logistics footprint is reduced, industrial engagement is spread among all participating nations for the life of the project, and complete interoperability is assured among the participating nations, something that previously proved to be an elusive ideal.

To purchase a lesser aircraft, one that does not possess the same stealth qualities, electronic interoperability, armament, and capabilities as the F-35, would jeopardize mission success for our air force, and would reduce the potential for pilot survivability. A *Super Hornet* or a *Eurofighter* might be good enough for today's strategic demands, but we would be effectively using yesterday's technology to meet challenges in the coming decades that have yet to be even fully hypothesized.

When Canada sends its sons and daughters into harm's way, they must have the best equipment that is available. The world of the 21st Century has already proven to be unkind and unpredictable, and we cannot know what threats and dangers the future will hold. However, whatever happens, we have learned from hard experience that it will be a 'come as you are party,' and we, as a nation, must anticipate this eventuality.

Our political decision makers should also be mindful that those who oppose this purchase will never have to fly a combat aircraft into harm's way. They will not have to defend their claims whenever Canada faces domestic or international adversity. They will not be held accountable if the Canadian Forces fails to meet its mission objectives because an inferior aircraft with

inadequate capabilities to achieve the mission aims and provide pilot survivability was purchased. In aerial combat, there are no points for second place.

F-35 cockpit (DND Photo IS2011-0006-02[1])

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