

# **A Legacy Decision for Future Generations of Canadians: The Long-term Strategic Considerations for the CF-18 Replacement Project**

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The intent of this paper is to shine a light on the critical aspects of the CF-18 replacement initiative that appear to have been buried in the public debate surrounding this multi-billion dollar project. Beyond the rhetoric are the immutable consequences borne by future generations of Canadians if we choose poorly. The world is becoming increasingly vulnerable to security threats that will likely increase in frequency and scale. Although military force should always be the last resort to resolving such threats, it behooves future generations of Canadians as well as our closest allies that we ensure that our military response remains credible and effective well into the future. As such, my argument as someone who was directly responsible for developing the requirements for new replacement aircraft for the Royal Canadian Air Force (RCAF) and who has no direct interests or obligations with any of the companies seeking to bid on the project is simple; there is only one viable choice, the F-35 Lightning II.

Military procurement projects are complex endeavours that must navigate a complicated bureaucratic path while being subjected to the inevitable conflicting influences of other government departments, industry and a variety of political interests. A project on the scale of the Future Fighter Capability (FFC) with the objective of selecting a suitable replacement for the aging CF-18 Hornet naturally draws significant attention. However, this project has evolved into a political conundrum further exasperated by the media attention that it has attracted regarding initial purchase costs subsequent to the Auditor General's report of April 2012. Although the actuarial cost estimates of this report were insightful, it had the unfortunate effect of marginalizing the operational requirements and the long-term strategic considerations of this key military capability for Canada.

Recent arguments have focused on the domestic role of our fighter force in defending our sovereign airspace and bilateral continental interests through Canada's commitment to the North American Defense (NORAD) agreement. While both are important roles, any analysis of the FFC operational requirements would be woefully incomplete without including Canada's explicit and implicit obligations to international defence and security interests through its relationships with the North Atlantic Treaty Organization (NATO) and the United Nations (UN). Canada's military history is an instructive frame of reference; other than the Northwest Rebellion of 1885 and a few skirmishes with German U-boats in our sovereign waters, every other peacekeeping, peacemaking and combat mission involving Canada's military has been overseas. More specific to the FFC project, the CF-18 has been in no less than four armed conflicts overseas since the end of the Cold War including the first Gulf War, the 1999 Kosovo campaign, Libya, and more recently in the ISIL bombing campaign in Iraq and Syria. The CF-18 has also proven to be a welcomed contribution to allied deterrence missions from the Cold War through to Canada's most recent commitment in Latvia. Notwithstanding the important roles of Canada's army and naval forces, the rapid deployability and multi-role capabilities of the fighter force has made it a preferred option by previous governments in numerous cases of urgent requests for Canada's support in international crisis over the past several decades.

Looking forward, experience reinforces the likelihood that the RCAF can expect to operate the next fighter aircraft for several decades, possibly even beyond 2060. Recognizing that Canada has become increasingly subject to the interdependencies of the global economy, as well as the defence and security implications of threats originating in other parts of the world, it would be wise to invest in military capabilities with the potential to continuously adapt to new and emerging threats. A lot can change over the probable lifetime of this new fighter; a period of time that will see the great-grandchildren of baby boomers grow into adulthood. The potential impact of future economic, defence and security risks will most likely increase in the coming decades as these interdependencies continue to deepen while the nature of the threats continue to evolve in complexity, capability and consequence. Against this backdrop is the terrifying reality of the potential employment of chemical, biological, and nuclear weapons of mass destruction against soft targets and civilians anywhere in the world by rogue nations, terrorists or irrational actors.

As such, a critical factor for the FFC will be its ability to stave off obsolescence in both an effective and affordable fashion. Modern fighter aircraft have figuratively become computers with wings. The last time around, Canada invested in leading edge, fourth generation fly-by-wire technology when it purchased the CF-18 in the early 80's. This was a very wise decision that provided the RCAF with a multi-role fighter that continues to serve Canada's interests with honor and effectiveness to this day. As an extension of this new capability, the RCAF also created a software engineering squadron in Cold Lake, Alberta as the means to provide ongoing improvements to the software in the CF-18's mission computers. While the team of engineers and technicians in this squadron were second to none in their capabilities, the cost of maintaining the unit eventually became unviable over time. The end result was the difficult decision to close the unit and to purchase an entirely new operating system for the CF-18 from the United States Navy (USN) as part of the CF-18 modernization project in the 2001 timeframe. The RCAF was lucky that the USN was still operating their own versions of the F/A-18 Hornet, and as such had an off-the-shelf solution readily available for purchase. However, this also created a go-forward dependence on the USN for all future software upgrades...on their terms and at their price.

While the original mission computers on the CF-18 have been characterized as the equivalent of a Commodore 64, with less than a few thousand lines of code, today's fighters are far more complex with the F-35 possessing upwards of 6 million lines of code thereby providing for unprecedented operational plasticity over its lifetime. The key takeaway from this is that such computerized sophistication is both a blessing and a curse: a blessing in that it provides the basis for continuous software updates to enable adaptation to emerging threats and evolving technologies; but a curse in the associated expense in the development, testing and implementation of such improvements. As anyone who owns a smart phone would readily understand, such devices necessitate continuous software updates and eventual replacement in a surprisingly short span of time; an eventuality predicted by *Moore's Law*. While the decision to replace a smart phone after only a few years may be economically justifiable (although very frustrating), it is not an option for the RCAF who will be stuck with the FFC for decades. Instead it faces the undesirable dilemma of either a gradual decline into obsolescence, or the expense of ongoing software and hardware upgrades. The question then becomes focused on what option best mitigates such obsolescence with the least cost and consequence to our national interests.

Interoperability with our military allies in NORAD, NATO and the UN is vital to successful coalition operations, including with their respective army and naval forces. Interoperability

is achieved through joint training, common operating procedures, and equipment compatibility. In future theatres of military operations, info sharing (including communications) over secure networks will become an increasingly critical component of mission success. If Canada's follow-on fighter became too costly to upgrade, or worse, reached the physical limits of implementing such computer upgrades, then the subsequent degradation of capabilities would erode its interoperability with our allies. Furthermore, a descent into obsolescence would risk compromising the effectiveness of coalition missions as well as the lives and safety of the allied personnel involved.

In addition to the initial purchase price for the FFC, we must also consider the associated long-term operating costs, including spare parts and maintenance. As with anyone who owns a vintage car or pick-up, they readily understand the challenge and expense of finding spare parts when the production line for their vehicle no longer exists. As the remaining parts supply diminishes the replacement costs inevitably rise. Unfortunately, the RCAF has already been plagued with such circumstances in the recent past with the CC-115 Buffalo search and rescue aircraft as well as the more familiar case of the CH-124 Sea King helicopter fleet. In addition to the rising costs for parts, which in the case of the Buffalo have sometimes necessitated desperate searches on e-Bay, the mission is also negatively impacted by longer delays in repairs thereby reducing the fleet serviceability rates. For the Sea King, by the time the RCAF was finally authorized in 2003 to proceed with the Maritime Helicopter replacement project, over 30 man-hours of maintenance were required for every single hour the Sea Kings flew.

As mentioned, large military projects are subjected to conflicting influences, which sometimes leads to the military being compelled to relax their operational requirements. While such adjustments may permit more bidders for a project and cheaper solutions, the unintended consequences can be far greater than imagined. A poignant reminder is a pre-World War I political decision to supply Canadian soldiers with the Ross rifle. Despite being aware of the rifle's documented tendency to jam in field conditions, and against the military's preference for the British-made Lee Enfield rifle, the government chose the Canadian-made Ross rifle based on other factors. Tragically, many soldiers were fatally disadvantaged during the first two years of the Great War, hindered by frequent gun jams while under enemy fire. Out of desperation, some resorted to prying Lee Enfields from the corpses of fallen British soldiers in order to survive. Despite the evidence from the front, the government pugnaciously stood by its original decision. Thankfully, the British leadership intervened enabling Canadian soldiers to use the Lee Enfield until war's end.

In my view, the best and only viable choice for Canada is the F-35 Lightning. This conclusion did not come readily when I first took over the position of Director Air Requirements (DAR) for the RCAF. In fact, I was originally quite skeptical of the F-35, including the concerns about a single engine. However, in due course it became clear that the single engine is a non-issue, and that the F-35 is far and beyond the best choice. The overwhelming strength of the F-35 option can be found in the consortium of participating nations, which includes three of our four key intelligence sharing partners, seven long-time NATO allies and three branches of the US military. Through such a consortium the costs of future software and hardware upgrades will be significantly reduced through collaboration amongst the participating countries. Similarly, the effectiveness of the development and testing of such upgrades will be reinforced by shared intelligence and combat experience. The F-35 is a new fighter that will continue to be produced for many years to come, along with a global supply chain of parts commensurate with the scale of forecast production that

is envisioned to be upwards of 3,000 aircraft. As such, the F-35 option offers an affordable and effective long-term strategy to mitigate obsolescence over its planned service life.

Given that the F-18 E/F Super Hornet has been seen as a viable choice for the FFC, it merits some discussion. While it is an impressive fighter with tremendous capabilities, it has already been in service with the United States Navy (USN) for nearly two decades, having been introduced in 1999. It is only in service with one other country in the world, the Royal Australian Air Force, who have a total of 24 with an additional 12 F-18G Growlers on order. In both cases they plan to replace their Super Hornets in conjunction with the phased entry into service of their new F-35s. As such, if Canada purchased the Super Hornet, we would likely be the only country in the world flying it beyond the 2030 timeframe. Inevitably, the long term costs of supporting the software, replacing worn out parts, and attempting to upgrade the aircraft against obsolescence will far outweigh any potential savings at the time of initial purchase given that we'll be on our own.

Furthermore, unlike the joint conversion training that is provided to the F-35 consortium partners in the United States, the RCAF would train in isolation on the Super Hornet, other than during infrequent joint exercises. The joint F-35 conversion training is unto itself extremely valuable in that it would further enhance Canada's interoperability with our primary military allies. As with future equipment improvements, such joint training will positively contribute, on an ongoing basis, to the development of the most effective tactics required to survive and defeat enemy threats. Finally, while the Super Hornet does offer a two-engine option, this will also double the requirements for spare parts and maintenance. Conversely, the simple truth is that jet engine technology has continued to improve in performance and reliability since we first purchased the CF-18. The reason I came to see the single engine as a non-issue for the F-35 was based in large part on the degree of diagnostics integrated into its engine, providing unparalleled real-time assessment, warning and automated response. These innovative measures provide excellent performance while largely mitigating the risk of catastrophic engine failure.

Another operational aspect of the F-35 that does not appear to be fully appreciated is its advanced capabilities in the realm of intelligence gathering, processing and sharing through its onboard sensors and computers. This capability alone has led to a paradigm shift in traditional fighter tactics, thereby allowing a pair of jets to patrol and monitor threats over a vastly greater geographical area. For Canada's sovereignty and our marine environments it will be significant in addressing polluting vessels in the north as well as fishing violators in Canada's territorial waters. Operating in conjunction with air-to-air refueling aircraft, long range patrol aircraft and/or navy and coast guard ships, the F-35 will provide a tremendous boost to Canada's abilities to detect, monitor and inhibit such violations in all three of Canada's ocean approaches. Equipped with a tail hook (like the CF-18) the F-35 will be able to safely operate from Canada's forward operating bases in Iqaluit and Inuvik as we have been doing for years with the CF-18. Our arctic operational capabilities will be further enhanced through joint training with the USAF, Norway and Denmark, who will also be operating the F-35 above the Arctic Circle.

While some commentators in the media are of the opinion that the Super Hornet would better meet Canada's requirements than the F-35, in part because it is a proven platform, it should not be forgotten that Boeing lost the initial competition for the Joint Strike Fighter program in 2001 with its X-32 prototype; an aircraft designed and built after the Super Hornet was developed. Furthermore, Boeing has recently signaled that it is moving away

from the fighter jet line of business in favour of commercial airliners, which implies that future research and development towards improving the Super Hornet's capabilities will soon end. Conversely, not only is the Lockheed Martin F-35 going to be around for many years to come, it's worth noting that this was the same company that developed the F-22 Raptor, the most advanced air superiority fighter aircraft ever produced. In other words, the F-35's fifth-generation technological pedigree stems from the many valuable breakthroughs that came from the development of the F-22 program.

The operational testing and development of the F-35 has been world class. While it's normal that such sophisticated projects must overcome countless technological challenges, it has come a long way since Canada first became involved in the project in 1997, with upwards of 180 F-35s now flying regularly. Furthermore, the United States Marine Corps and the USAF have both declared the F-35s to have achieved Initial Operating Capability, with the USN on track to achieve the same milestone within a year or two. As such, the United States has no reservations about deploying their F-35 squadrons on operations abroad, including in combat. While some commentators view the ongoing testing and development of the F-35 as a sign of flaws in the program, it is in fact a demonstration of a commitment to continuous improvement that is essential to avoid obsolescence. Throughout the lifespan of the CF-18 it underwent recurring upgrades that necessitated robust testing and development to ensure safe and effective outcomes. Finally, in terms of our economy, jobs and global competitiveness, remaining a partner in the F-35 program has tremendous advantages as many Canadian companies have already experienced to date. Not only will the exclusive spin-off opportunities for our aviation industry and manufacturing sector continue for the many decades the F-35 is in service, the return on investment to the Canadian economy from these contractual arrangements have been estimated to equal or surpass the cost of the FFC project.

In conclusion, the intent of this paper was to establish the basis for a broader understanding of longer-term costs, the consequences of obsolescence, and the link with Canada's strategic defence, security and economic interests. Having been intimately involved with the project when I was DAR, and having witnessed the alarming metastasizing of security threats that have evolved since then, I remain firmly of the view that there is only one viable option for Canada; the F-35 Lightning II.

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