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31 December 2015

Senate Foreign Affairs, Defence and Trade References Committee Members,

**RE: PLANNED ACQUISITION OF THE F-35 LIGHTNING**

I write in relation to the planned acquisition of the F-35 Lightning II (Joint Strike Fighter) and a letter from Senator Alex Gallacher, dated 18 December 2015, inviting me to comment on the same.

The F-35 is said to be the smartest and most complex fighter jet on the planet, designed to conduct lethal strikes on air and ground targets without being detected by radar, but its development has been beset by delays and cost overruns, concerning which you no doubt hold extensive documentation. In my professional opinion, these delays and cost overruns make it far from obvious that this aircraft is necessary for the defence of Australia in an age of distance warfare and remote attacks.

Advocates of the F-35 originally stated that investment in the aircraft was necessary to keep Australia at the top of the regional air combat pecking order and ensure that our forces remain fully integrated with key US strike aircraft for the foreseeable future. However, recent reports and leaks from pilots within the test program suggest that the aircraft will not ensure that Australia has air superiority over the likes of China, India and Russia, all whom have or are testing what will arguably be more robust – albeit less stealthy – fighter jets.

With this in mind, and the fact that Australia already has air superiority over its more immediate regional neighbours, the question for the committee ought to be whether Australia needs the capability to fight with the US against a major power in such an integrated but traditional fashion, especially when it comes at such great expense. My suggestion is that it does not. Indeed, it is not even obvious that we need a human in the loop (that is, a pilot in the cockpit). While it is true that despite heavy international investment in unmanned aircraft systems, the associated technologies and software

algorithms have not yet progressed to a point such that any remotely or autonomously operated fighter jet can manoeuvre and react to fast-changing dynamics in a combat environment anywhere near as effectively as an aircraft such as the F-22 Raptor, it is not at all obvious whether the margin of improvement offered by an aircraft like the F-35 (over a General Atomics MQ-9 Reaper or a purpose built combat drone, for example) represents a good return on investment or the sort of 'value for money' that the Australian people expect in times of relative austerity.

I therefore urge the committee to consider whether we have the right balance between piloted, optionally piloted, remotely piloted and even automatically piloted (autonomous) systems planned for the future ADF force structure. None of this is to suggest that Australia's part in the F-35 program be abandoned in its entirety or substantial part, even if this could be achieved without massive contract penalties and losses in terms of sunk costs. It may be that a reduced number of optionally manned F-35 jets, with the prospect of updates and revisions aimed at furthering autonomous operation, represents an opportunity for Australia to turn an otherwise unsound investment into a capability enhancer. Lockheed Martin has not yet officially confirmed the development of a pilotless or optionally piloted version of the F-35, but it is my understanding that they have had plans for an unmanned variant for some time now, with F-35 programmers having long ago confirmed to me that the fly-by-wire functionality was designed-in as inherent feature for later exploitation in the design of an unmanned model. I would suggest that if the Committee is not aware of such options, they be thoroughly investigated with Lockheed with a view toward exploring potential technical problems such as the lag time between commands and their execution, and the impact that removing the human from the F-35 design would have on flight characteristics. If, on the other hand, future unmanned operation has already been factored into the cost-benefit analysis by Defence decision makers and its investment partners, I would suggest that this logic be made clear to the public, especially given that it is not the only aircraft manufacturer converting its fighters for unmanned operation: Boeing has already successfully converted several F-16 fighter jets into drones and these are less amenable to automated operation due to their age.

Either way, it needs to be recognised that without a human in the cockpit, the aircraft would be more capable in that it would be able to perform riskier missions in support of international security. Without the need for an ejector seat and other life support systems, the F-35 would also be able to significantly increase its weapon or sensor payload, and/or fly higher for an extended duration. Of course, the government also needs to consider the higher level moral, political and strategic costs of employing such novel technologies. A host of questions go largely unanswered in this regard: are pilotless systems capable of discriminating between a fisherman displaying his catch and an angry Somali pirate holding a rocket propelled grenade, or between an Iraqi child playing in the street with a toy gun and a child soldier wielding an AK-47 assault rifle? Do unmanned systems operators benefit from improved situational awareness or is it more like trying to conduct a sword fight in a telephone booth while looking through a toilet paper tube? Will there be psychological consequences for the operators of these systems if they see events unfold in real time only to go home for dinner with their families without time to process them?

To this document I attach a number of articles that may aid the Committee in conducting and progressing its inquiry. I also refer you to my book, *Military Robots: Mapping the Moral Landscape* (Ashgate 2015), which is held in the parliamentary library and contains a detailed chapter (no. 3) on the operational case for unmanned systems over the manned equivalent. Note that, at the Committee's request, I am available to expand upon any of the above points and provide further comment.

Sincerely,

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Attachments:

Annex A: Lockheed Developing Unmanned F-35 Jet (The Associated Press 2006)  
Annex B: What if there had never been a Joint Strike Fighter? (The Atlantic Council 2015)  
Annex C: Boeing to convert F-16s into unmanned fighters? (Defense IQ Press 2012)  
Annex D: An Unmanned Joint Strike Fighter? (United States Naval Institute News 2012)

## ANNEX A

Aug. 15, 2006, 4:58PM

### **Lockheed Developing Unmanned F-35 Jet**

By REBECCA CHRISTIE Dow Jones Newswires

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WASHINGTON — Lockheed Martin Corp. has designed ways to convert its new F-35 Joint Strike Fighter into a combat drone as part of a broad push into robot technologies, company officials said Tuesday.

Lockheed hopes to become as famous for its drones as Northrop Grumman Corp. and privately held General Atomics Aeronautical Systems Inc., the companies behind the well-known Global Hawk and Predator unmanned aerial vehicles. At a Washington press briefing, Lockheed executives regaled reporters with the company's range of related research.

"We're in the business and we probably have been less aggressive than we should have been," said Richard O'Lear, vice president for unmanned aerial systems.

In recent years, Lockheed has devoted 30 percent to 40 percent of its aeronautics investment to unmanned systems, said Frank Mauro, Lockheed vice president for advanced systems development. He said the company now is making up for its previous single-minded focus on the F-35 program, a \$276 billion initiative to replace thousands of aging fighters around the world.

The sensors developed for the Joint Strike Fighter have a range of potential drone applications, he said. Also, the company's Skunk Works unit has been working over the past two years to design an F-35 that doesn't need a pilot.

This work isn't part of Lockheed's fighter development contract, Mauro said, but the company now has a blueprint in case the Pentagon comes calling.

Lockheed expects an unmanned F-35 would cost roughly the same as a standard plane with a pilot, he said.

**The company has envisioned that two piloted fighters could be accompanied by four unmanned fighters without the full suite of**

***high-tech sensors.***

*"Those are basically external bomb carriers," Mauro said.*

<http://www.chron.com/disp/story.mpl/ap/fn/4119143.html>

## ANNEX B

JULY 24, 2015

# What if there had never been a Joint Strike Fighter? (Part 1)

The US Navy could have spent mad money on drones.

BY JAMES HASIK



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This month, the US Marine Corps declared that its first squadron of F-35Bs had reached “initial operating capability”. That’s 21 years after the program first began as the Joint Advanced Strike Technology (JAST) program, 18 years after the first Joint Strike Fighter (JSF) design contracts were awarded, and yet 13 years after Lockheed Martin won the development contract for the F-35 Lightning II, way back in October 2001. It’s notable that a war started the month prior to that award. Perhaps it’s intriguing to ask what might have happened if that contract had never been signed—if, perhaps, the Pentagon had gone all-in supporting the fighting in Afghanistan (and later Iraq), and found some other solution for backfilling its aging fighter fleets.

Other defense ministries have pursued other ideas, but with comparable programmatic. The Typhoon was similarly in development for 20 years before its entry into service in 2003. This morning, the *Business Standard* of India reported that Eurofighter GmbH has managed to [reduce the unit production cost of its jets by 20 percent](#) over the past five years, even while reducing the production rate (HT: [DID](#)). That would constitute a considerable discount on [the £87 million \(\\$135 million\)](#) that the British National Audit Office recently estimated that the average aircraft has cost throughout the program.

Extrapolating a little from the Selected Acquisition Report of December 2014, the US Defense Department alone has so far spent or appropriated [just under \\$100 billion on its F-35s](#). Over half of that has been for development and construction; only about \$45 billion has gone into low-rate initial production of the first 300 or so aircraft. The production cost of a Lightning is thus not wickedly worse than that of a Typhoon, though Dassault’s Rafale is probably a bit less. Boeing’s Super Hornets and Saab’s Gripens cost much less—perhaps only half as much, depending on the basis of the estimate.

What else might the Pentagon done with that \$100 billion? (Apart, of course, from the Treasury not borrowing it in the first place!) Forgoing new development, the whole sum would have bought about 740 Typhoons, or 1300 Super Hornets—and those aircraft would be in service already. As the F-35 is only now just available, the wars in Afghanistan and Iraq would have

gone no worse. The Navy would have no carrier deck shortfall. No one would be anguishing over the decaying state of the fighter force. Chinese Intelligence would have had no new stealth fighter plans to steal. So the dreaded Chengdu J-20, like the much-ballyhooed Sukhoi PAK-FA, would still be just a prototype. And this would all be well-and-good, for now.

For by the threat estimates on their briefing slides, a grim mood would have already set in amongst the air admirals and generals. Enemy aircraft aren't the stressing threat yet; it's enemy missiles. Those "fourth-generation" fighters (as Lockheed's marketing literature calls them) are expected to suffer high loss rates against Almaz-Antei's S-300 and S-400 anti-aircraft batteries, now in service from Russia to China to Syria, and maybe soon in Iran. Squadrons of Super Hornets could attempt to fly through them, much like B-17s weathering flak over Schweinfurt. The other frightening missiles are China's legions of the anti-ship variety, on aircraft, ships, and trucks. China's latest aircraft, too, aren't to be trifled with. As I heard a retired air admiral put it recently, "[with squadrons of J-20s coming eastbound, a supercarrier in the China Seas might need all 44 of those F-18s just to defend itself.](#)" Either way, such a "[grinding strategy of attrition,](#)" as Max Boot pointed out back in 2003, no longer fits in what Russell Weigley once termed "[the American War of War](#)".

Against this threat, but without the F-35C, the US Navy might have gone long. (I'll cover other buyers next week.) Speaking at the Citadel in 1999, Texas governor George Bush argued that "our relative peace"—seemingly now lost—was going to allow a fundamental restructuring of the US armed forces, in which Pentagon buyers could "[skip a generation of technology](#)". Just which generation remains a fair question. Citing that speech in 2001, Ivan Eland of the Cato Institute [argued](#) for skipping the F-18 and the presumably "fifth-generation" F-22 in favor of the newer F-35. In Naval Institute *Proceedings* that year, I [argued](#) for skipping the F-22 for the F-18 and the F-35. Without an F-35, the airplane Secretary Mabus calls "[almost certainly... the last manned strike fighter,](#)" the Navy might have gone straight for that "sixth-generation" of the unmanned. The Navy might have put mad money on really long-range drones, to restore the striking range that the fleet lost with the retirement of the A-6 Intruder in 1997.

There's reason to think that this would have produced some impressive robotic aircraft. In 1994, when the JSF was getting underway as the JAST, General Atomics was under contract with DARPA to [demonstrate the MQ-1 Predator](#). The next year, it was flying reconnaissance over Bosnia. In 1999, NATO lost thirty drones over Yugoslavia—a loss that would have been alarming had the aircraft been manned. In 2001, the Predators were firing missiles over Afghanistan. By 2007, turboprop [MQ-9 Reapers](#) were taking their place. The next year, the [138th Attack Squadron](#) of the New York Air Guard became the first unit to trade in its fighters for drones. Sometime around then, Lockheed Martin brought out its [RQ-170 Sentinel](#), the 'Beast of Kandahar', to scout over Pakistan for ObL. Sometime around then, Northrop

Grumman worked up its presumably larger and longer-range [RQ-180](#). In 2014, that company showed that its [X-47Bs](#) could take off from carriers, refuel in the air, and then land on those carriers.

Think about how much more could have been accomplished with just a part of that hundred billion dollars. In the meantime, the Marines have declared IOC with that JSF.

*James Hasik is a senior fellow at the Brent Scowcroft Center on International Security.*

<http://www.atlanticcouncil.org/blogs/defense-industrialist/what-if-there-had-never-been-a-jsf-part-1>



## ANNEX C

# Boeing to convert F-16s into unmanned fighters?

Contributor: [Defence IQ Press](#)

Posted: 09/04/2012 12:00:00 AM EDT



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Tags: [fighter](#)

As unmanned aerial vehicles (UAVs) become a staple of military arsenals, Boeing is looking to latch onto this growing market segment by converting F-16 fighters into pilotless machines, according to [Defense News](#).

The United States is seeking to upgrade around 300 jets over the next few years and Boeing sees the the conversion of F-16s, which were originally made by General Dynamics, as one option for this programme.

The news could signal an increasingly dogmatic focus on UAVs as not just a complimentary source of air power for fighter fleets, but as a direct replacement for all platforms. It could be that the [F-35](#) Joint Strike Fighter, being designed by Lockheed Martin, will be the last manned fighter ever built as costs of the jets spiral and as governments seek to de-risk the warzone for troops.

*What do you think? Will UAVs "take over the skies"? Will the F-35 be the last manned fighter in production? Email [haveyoursay@defenceiq.com](mailto:haveyoursay@defenceiq.com) to comment or to submit articles on the subject.*

## ANNEX D

# An Unmanned Joint Strike Fighter?

By: [Kurt Albaugh](#)

July 12, 2012 10:22 PM • Updated: February 5, 2013 1:49 PM

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*F-35 Simulator*

*[Northrop Grumman Photo]*

CRYSTAL CITY, VIRGINIA — Three nautical miles from an amphibious assault ship, I toggled a small button labeled “STOVL,” or short take-off and vertical landing. The abbreviation “REDY” flashed in green and I could see thrust vector angles change on my heads-up display in my F-35B Lightning II Joint Strike Fighter. I adjusted what my instructor called the cruise control and set my airspeed to 80 kts. All of a sudden, my flight controls changed as the “REDY” turned solid. I had transitioned to vertical flight.

With minimal coaching, after two minutes I had landed safely on the flight deck of a U.S. Navy ship. Though I briefly felt pride after my landing, I quickly realized that a computer had done all of the hard flying for me.

Computers and cockpits are nothing new, but with the proliferation of unmanned aerial vehicles and the degree to which computers control piloted aircraft today, policy makers and military leaders are asking when pilots can be removed completely from combat aircraft.

The F-35 Lightning II Joint Strike Fighter has over 9 million lines of computer code controlling its flight surfaces, engine and weapon systems. That's nine times the programming in its brainy cousin, the F-22 Raptor. If the F-22 is smart, the F-35 is a wunderkind.

Lockheed Martin would not confirm that it may be developing an unmanned — or optionally manned — version of the F-35. “Our Skunk Works are constantly looking at all kinds of things,” said, Bob Rubino, Lockheed’s director of Washington operations for the JSF program.

Part of the debate over military aircraft acquisitions is whether the military should cut spending on manned aircraft in favor of innovating unmanned combat aircraft. Based on what Lockheed Martin demonstrated Wednesday, manned and unmanned combat aircraft may be much less of one-or-the-other proposition.

An optionally manned F-35 would hold many advantages. With a pilot in its seat, the aircraft can concentrate on the task of flying while the pilot gathers intelligence or operates the aircraft’s extensive command and control suite. Without a human in the cockpit, the aircraft can assume riskier mission profiles. For example, the F-35 can mount external pylons that increase its weapons payload from 5,200 pounds to 18,000 pounds. This increased lethality comes at a cost — decreased stealth. Such dangerous mission profiles are the bread and butter of unmanned aircraft.

Pursuing an unmanned (or remotely piloted) F-35 makes sense from an innovation perspective. With a proven design and as the first aircraft that is “software defined,” the F-35 could act as a bridge to test remotely operated combat aircraft. The lessons gained from writing the software to take humans out of the F-35 could be applied to subsequent unmanned combat aircraft.

The discussion of the future of naval aviation often presents a false dichotomy: either we continue to pursue traditional manned aircraft or we invest to speed production of new systems like the Unmanned Carrier Launched Airborne Surveillance and Strike System (UCLASS). There is a third way: one that leverages current investments to develop future capabilities.

<http://news.usni.org/2012/07/12/unmanned-joint-strike-fighter>