The
NATIONAL STRATEGY FORUM REVIEW
An Online National Security Journal Published by the National Strategy Forum

Fighter Gaps

By William A. Price

January 27, 2011

> *The F-22A Raptor is the only U.S. fighter aircraft design in existence or planned which has the capability to penetrate and survive the advanced air defence weapons now proliferating globally. Unless the U.S. deploys a minimum of 500-600 of these aircraft, it will lose the ability to access hostile airspace with acceptable losses in aircraft and aircrew.*
>
> —Peter Goon, *Air Power Australia*[1]

Introduction: The Comfortable Margin

Secretary of Defense Robert Gates laid out a comfortable air defense scenario in a July 16, 2009 speech to the Economic Club of Chicago:[2]

> [B]by 2020, the United States is projected to have nearly 2,500 manned combat aircraft of all kinds. Of those, nearly 1,100 will be the most advanced fifth generation F-35s and F-22s. China, by contrast, is projected to have no fifth generation aircraft by 2020. And by 2025, the gap only widens...

Mr. Gates went back to China in January 2011. U.S. and international news sources reported test flights during his trip for a "J-20" fighter, whose external appearance, at least, resembled the U.S. F-22 Raptor.[3] The Chinese economy was reported to have passed Japan's as the second largest in the world as of 2010.[4] It may be number one, larger even than the United States.[5] Old fighter program data and old relative power projections for 2015-2025 may need revision.

---

1 http://www.ausairpower.net/APA-NOTAM-160209-1.html

2 http://www.defense.gov/speeches/speech.aspx?speechid=1369

3 See, e.g., http://www.ft.com/cms/s/0/e7767bd6-1d5f-11e0-a163-00144feab49a.html#axzz1B4bLmLh2

4 http://www.bloomberg.com/news/2010-08-16/china-economy-passes-japan-s-in-second-quarter-capping-three-decade-rise.html

5 http://www.iie.com/realtime/?p=1935

F-22 Program Cancellation

The F-22 program was cancelled based on a the 2010 Quadrennial Defense Review.[6] The same relative strength assumptions present in the Secretary's speech were included in the review: "U.S. air forces will become more survivable as large numbers of fifth-generation fighters join the force."[7] The review did note that "As part of its long-term, comprehensive military modernization, China is developing and fielding large numbers of advanced medium-range ballistic and cruise missiles, new attack submarines equipped with advanced weapons, increasingly capable long-range air defense systems, electronic warfare and computer network attack capabilities, advanced fighter aircraft, and counter-space systems."[8] The review also commented that "U.S. air forces in future conflicts will encounter integrated air defenses of far greater sophistication and lethality than those fielded by adversaries of the 1990s. Proliferation of modern surface-to-air missile systems by Russia and others will pose growing challenges for U.S. military operations worldwide."[9]

Some of the performance assumptions that led to the F-22 cancellation may not have been correct. The aircraft operate in the rain, their maintenance schedules are not impossible, and their other teething troubles their production appear to have been worked out – just in time for the end of the program.[10]

New Foreign Weapons Programs

Current joint fighter development plans assume that the cancellation of more than half of scheduled F-22 air superiority fighter production will not matter much, since the Warsaw Pact is gone, and no potential enemy will have air assets which may be clearly superior to the F-35. This comfortable assumption has been challenged in recent years, with China's probable deployment of more than 600 multirole air superiority fighters in the next few years. Russia, similarly, has increased planned deployments of SU-34 "2Fullback" strike aircraft and there are apparently plans for the acquisition of 300 or so Sukhoi Pak FA air superiority fighters. These are not now comparable to U.S. airframes. By 2020, they may be.

Development of the Russian FA series, with billions of dollars worth of cash support from India, means the F-22 could have a "fifth generation" fighter challenge. Such fighters may or may not be beyond the capability of our F-35. At worst, they could reverse our current qualitative advantage. We have usually been able to count on beating multiple opponents with one of our naval F-14 or Air Force F-15 fighters. If the FA and the Chinese J-X are as good as they could

---

6 "Rebalancing the Force." Quadrennial Defense Review, Feb. 10, 2010: Executive Summary, p. xi

7 Id., at p. 39

8 Id., at p. 31-32.

9 Id., at p. 31-32.

10 For original reasons to cancel, see http://www.washingtonmonthly.com/archives/individual/2009_07/019076.php; but see also a refutation, http://www.afa.org/edop/2009/edop_7-13-09.asp

be, this assumption could be reversed, with our F-35's having to deal with fully stealthed and high range missile equipped opponents designed for air superiority.

U.S. Air Superiority Fighter Reductions

Our 2010 defense budget, and future force plans include the retirement of 112 F-15's and 134 F-16s, along with restriction of the F-22 program to 187 units. The Air National Guard had five F-15 squadrons in 2009, four down from nine in 1999, and reductions may continue. A Congressional Research Service report suggested there could be a Navy and Marine Corps shortfall of 243 fighter aircraft by 2018. Heritage Foundation articles have suggested that the 500 or so fighters we will retain that are designed primarily for air superiority may not be enough to deter possible opponents.

These trends do not mean we have an immediate lack of air superiority. They do indicate there could be a problem by the second half of this decade. [11]

How Good Is the F-35?

Estimates of F-35 air to air combat capabilities range from very low to cautiously optimistic. Lockheed Martin has said this joint strike fighter's "combination of stealth, multisensor situational awareness, advanced pilot-machine interface and basic aeromechanical performance make it a credible fighter aircraft." [12] *Aviation Week* cited the F-35A, which is the version the Air Force would deploy for conventional takeoffs and landings, as Lockheed's "ideal" air combat configuration. After citing maneuvering characteristics similar to an FA-18 or an F-16, with two A-120 AAMRAM missiles in the internal weapons bay. They concluded that this kind of performance would:

> ...leave the F-35 short of the kind of air-to-air capabilities provided by other combat aircraft, such as the Russian Su-30MKI or the European Typhoon ... the F-35 may have notable weaknesses for pure air-to-air combat. For one, it is not designed to conduct engagements in a high-speed, high-altitude, sustained turning environment. Its high-speed cornering capability should help it to dodge an adversary's beyond-visual-range missiles...[13]

Carlo Kopp, an Australian analyst, has not been optimistic. His analysis states that "The JSF program is almost unique historically in the extent to which its intended survivability and lethality are mismatched against the operational environment in which the aircraft is intended to be used." [14]

---

11 For this and the prior three paragraphs, see http://www.heritage.org/research/reports/2009/07/fixing-the-fighter-gap-facing-the-us-navy-air-force-and-air-national-guard, and http://www.heritage.org/research/reports/2009/07/the-growing-air-power-fighter-gap-implications-for-us-national-security

12 http://www.military.com/features/0,15240,186349,00.html

13 Id.

14 http://www.ausairpower.net/jsf.html, accessed 1/14/2011

Ariel Cohen, of the Heritage Foundation, is less pessimistic. His analysis does not show current Russian fifth generation fighter development as particularly impressive. On the F-35, he says that:

> While these measures make the Lockheed Martin F-35 Lightning Joint Strike Fighter seem inferior, they are actually fully consistent with its projected mission: F-35s are designed to operate in tandem with Lockheed Martin/Boeing F-22 Raptors, which would clear the way for F-35s in real combat.[15]

The Missile Engagement

According to *Aviation Week*, "Some pilots argue that in a dogfight, the air-to-air missile has more to do with the engagement's outcome than does the aircraft." [16] Lockheed executives have said that ranges greater than 18 nautical miles will represent 62% of all aerial combat. Another 31% of engagements would fall into the 8-18 nautical miles transition range, and just 7% of fighting would be close-in combat where the airframe is stressed the most.[17]

The trouble with this assumption is that beyond visual range (BVR) engagements present some significant problems for existing U.S. air combat missiles, radar and other sensor systems, and airframes. On the sensor end, the big problem is identification of friends and enemies. You don't want to shoot down your allies and friends. This can happen even if you visually inspect the target before firing.[18] We do have a widely deployed set of radar guided "fire and forget" missiles in the various generations of the AIM 120, and they do work some of the time.[19] Their history, and their use against current and future generations of Russian and Chinese aircraft, presents problems.

Carlo Kopp provided fairly high hit percentages in his 2009 study of AIM combat data, but noted that all these kills were against opponents that lacked sophisticated electronic warfare capabilities:

> Performance of the AIM-120A/B/C models in combat to date has not been spectacular. Test range trials have resulted in stated kill probabilities of 85 percent out of 214 launches for the AIM-120C variant. Combat statistics for all three variants are less stellar, amounting to, according to U.S. sources, ten kills

---

15 http://www.upi.com/Business_News/Security-Industry/2009/01/14/Russia-trails-US-in-pursuit-of-a-fifth-generation-jet/UPI-35761231951126/

16 http://www.military.com/features/0,15240,186349,00.html

17 Id.

18 See, e.g., R. GORDON, MICHAEL (15 April 1994). "U.S. JETS OVER IRAQ ATTACK OWN HELICOPTERS IN ERROR; ALL 26 ON BOARD ARE KILLED". New York Times. http://www.nytimes.com/1994/04/15/world/us-jets-over-iraq-attack-own-helicopters-in-error-all-26-on-board-are-killed.html.

19"F-16.net: AIM-120 AMRAAM Advanced Medium Range Air-to-Air Missile". F-16.net. http://www.f-16.net/f-16_armament_article3.html; http://www.deagel.com/Air-to-Air-Missiles/AIM-120C-AMRAAM_a001164003.aspx ; http://www.dtic.mil/dticasd/sbir/sbir041/srch/af276.pdf

> (including a friendly fire incident against a UH-60) of which six were genuine BVR shots, for the expenditure of just over a dozen AIM-120 rounds.[20]

Ten out of twelve kills, or even twelve out of twelve, may not be enough. Russia, China, and other opponents have air to air missiles with similar beyond visual range characteristics to those of the AIM-120.[21] More importantly, they may carry more missiles per fighter than we do. The *Aviation Week* estimate of two AIM-120's stored inside the anti-stealth coating of the F-35 may be low – some sites estimate as many as six may be available – but even this number is low, compared to current Chinese naval aviation assets. Their Russian "Flankers" (SU-27) may carry as many as 12 air to air missiles.[22] This type of aircraft was apparently involved in several head on confrontations with U.S. and South Korean fighters during December 2010 naval exercises.[23]

If such confrontations did lead to war with the U.S., our stealthed fighters would not necessarily win, even if all their missiles hit. A 2008 RAND corporation study reviewed wargames results, and found that the U.S. F-22's and F-35's ran out of missiles and had to exit the confrontation area quickly, eliminating their abilities to control contested airspace until reloaded.[24] This is a standard tactic to avoid being hit by hostile missiles, but still has implications for the maintenance of air superiority. Russian data, confirmed by Australian studies, indicate that the best predictor of kills is the number of missiles available for repeat salvos, not the probability of hits for any single air to air missile.[25] All of our fighters have this problem, but the F-22 is at least capable of Sidewinder range maneuvering for additional chances to win.

Historical Examples

Superior fighters have destroyed less capable machines in large numbers during 20th century wars. The Japanese Zero could usually beat our P-40, even when these were used with Flying Tiger tactics. It succumbed to Navy fighters with better climb rates, sealed gas tanks, and armor around the pilots. The P-51 Mustang controlled both German and Japanese air spaces. The F-86 Sabre easily beat the Russian MiG-15 in Korea. The U.S. F-4 Phantom dominated the Russian MIG-21 in Vietnam. Israel's Air Force, with U.S. and French planes, destroyed Syrian and Egyptian opponents equipped with Russian export fighter models in 1967 and 1973. RAF Harriers used tighter turns and Sidewinder missiles to beat off Argentine attacks in the Falklands war. Coalition forces watched Iraq's air force fly away and intern itself in the first Gulf war, instead of confronting U.S. and allied fighter models. This type of difference is likely to repeat itself. Without fighter superiority, we cannot maintain air superiority.

---

20 Kopp, "The Russian Philosophy of Beyond Visual Range Air Combat Technical Report APA-TR-2008-0301, August, 2009. http://www.ausairpower.net/APA-Rus-BVR-AAM.html

21 See generally Fredricksson, "Missile Non Comparison Table," http://www.x-plane.org/home/urf/aviation/text/missiles/aam.html

22http://www.comhaha.com/blog/581472-pla-su-27-fighter-has-a-large-number-of-live-head-on-confrontation-between-the-us-and-japan/

23http://www.comhaha.com/blog/581472-pla-su-27-fighter-has-a-large-number-of-live-head-on-confrontation-between-the-us-and-japan/

24 Stillion, John, et. al., RAND Pacific View Air Briefing, 2008 PowerPoint slides

25 http://www.ausairpower.net/APA-Rus-BVR-AAM.html, op. cit. n. 19; Jim Campisi: "Lomac and BVR: Beyond Visual Range Combat," pdf 2003, simHQ.com.

Restoring Air Combat Capabilities: Budget Realities and Possible Force Planning Options

The F-35 program is in trouble. Defense Secretary Gates has cancelled all but minimum production line maintenance for the B variant, intended for the U.S. Marines, based on excessive vehicle weight for necessary missile loads.[26] Cancellations through 2015 total 122 aircraft. More may follow, if budget stresses continue.[27] These are likely, since the program was significantly over budget and behind schedule in 2010.[28] Per plane costs, even with full projection, were estimated at $112 million by a GAO analyst in spring 2010.[29] The cost per jet is projected to be above $200 million this year and next year.[30]

The affordability of the F-35 was based on a rule of thumb. Manufacturing costs are estimated to go down 12% every time production doubles. Unfortunately for this estimate, F-35 orders have been going down ever since the original contract was let in 2001. Budget cuts for the program can become a "self-perpetuating death spiral," according to one Dutch analyst.[31]

If air to air capabilities are a problem, Congress and the Air Force can always consider alternative force mixes. Non-stealthy F-16s are still in production, with international orders available to keep the aircraft in operation through 2030.[32] Multiple upgrades programs for that aircraft are underway for air forces like Saudi Arabia and Israel, permitting current standards for non-stealthed strike fighters to be met.[33] Where stealth isn't necessary, F-16s could be a much cheaper force option.[34]

F-22 production restart may also still be possible at a reasonable price. The Air Force was studying options for preserving production tooling in the Spring of 2010.[35] With production costs of about $143 million per aircraft in the final runs, the air superiority fighter would appear to be comparable in budget effects to the F-35, without that aircraft's survivability and deterrence problems for the 2015-2025 air combat environment.[36]

Humpty Dumpty may not be able to be put back together again, but the F-22 decision could be reversed. Until we have true unmanned fighters (not the current set of capabilities for the X-45 series of unmanned combat air vehicles, or the Dassault nEUROn, the other most advanced

---

26http://www.aviationweek.com/aw/community/persona/index.jsp?newspaperUserId=152392&plckUserId=152392

27http://www.businessweek.com/news/2010-01-06/lockheed-f-35-purchases-delayed-in-pentagon-s-fiscal-2011-plan.html

28 http://www.washingtonpost.com/wp-dyn/content/article/2010/03/11/AR2010031102462.html

29 Id.

30 http://www.star-telegram.com/2010/09/14/2468593/proposed-2011-budget-would-cut.html,

31 http://www.flightglobal.com/blogs/the-dewline/2011/01/is-this-what-a-death-spiral-lo.html

32 http://www.defencetalk.com/forums/air-force-aviation/f-16-future-production-8685-2/

33 http://www.airforce-technology.com/projects/f16/

34 http://www.flightglobal.com/blogs/the-dewline/2008/11/pierre-spreys-ideal-us-airpowe.html

35 http://www.flightglobal.com/articles/2010/03/05/339070/usaf-considers-options-to-preserve-f-22-production-tooling.html

36 Source: http://www.defensereview.com/f-22-raptor-program-cancellation-defensereview-weighs-in/

UCAV now flying),[37] the F-22 Raptor is about all we have that can assure Japan, South Korea, and Taiwan we won't have to abandon them if a China-North Korea or Taiwan Straits confrontation turns ugly.

William Price is a corporate attorney (www.growthlaw.com) and has served as the Chair of the Corporation, Securities, and Business Law Section Council for the Illinois State Bar Association. He has taught venture capital and new technology team building at the Illinois Institute of Technology. Mr. Price's prior publications can be found in The National Interest and on StrategyPage.

37 http://www.fas.org/programs/ssp/man/uswpns/air/attack/x-45_ucav.html, accessed 1/15/2011; and see sources on the nEUROn cited at http://en.wikipedia.org/wiki/Dassault_nEUROn