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SENATE ARMED SERVICES COMMITTEE

**STATEMENT OF**

**CHRISTOPHER BOLKCOM**  
**SPECIALIST IN NATIONAL DEFENSE**  
**CONGRESSIONAL RESEARCH SERVICE**

**BEFORE THE**

**SENATE ARMED SERVICES COMMITTEE**  
**AIRLAND SUBCOMMITTEE**

**HEARING ON AIR FORCE AND NAVY**  
**TACTICAL AVIATION PROGRAMS IN THE**  
**FY2007 DEFENSE AUTHORIZATION REQUEST**  
**AND THE FUTURE YEARS DEFENSE PLAN**

**MARCH 28, 2006**

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## Complications

A number of factors may complicate DoD's ability to secure congressional approval of its "unorthodox plan" for the F-22A. For example, the F-22A program has experienced noteworthy turbulence between the FY05 and FY07 budget requests. Total program budget, annual budget requests, total inventory, annual procurement rate, and program duration have all changed. These changes may engender closer scrutiny than is customary of the underlying criteria for MYP authority.

Considering the changes to the F-22A program that have occurred, and changes which are being proposed, some may question the Air Force's ability to comply with some provisions of 10 USC 2306b(a), including provision (2) "That the minimum need for the property to be purchased is expected to remain substantially unchanged during the contemplated contract period in terms of production rate, procurement rate, and total quantities." and (3) "That there is a reasonable expectation that throughout the contemplated contract period the head of the agency will request funding for the contract at the level required to avoid contract cancellation."

A further complication may be a problem with sections of the F-22A's titanium "forward boom frame" (a series of load-bearing structures within the aircraft's fuselage, located between the engine and the wing) which was discovered by the manufacturer in December 2005. 10 USC 2306b(a) (4) requires that "There is a stable design for the property to be acquired and that the technical risks associated with such property are not excessive." Air Force officials say that the cause of the problem has been identified, and is not expected to affect any aircraft built after Lot 5. Air Force officials say that "Neither a redesign nor a retrofit are expected at this time."<sup>4</sup> However, Air Force officials also note this issue is still being evaluated, so making conclusive statements on potential ramifications may be premature.<sup>5</sup> Further, 91 aircraft were potentially affected by this problem. Inspecting these aircraft and taking corrective action, if any, may require substantial time and effort that was previously unforeseen.

Even if this potential flaw is easily resolved, some may raise questions about how this problem was made public. The Air Force briefed committee and other congressional staff on the F-22A's proposed funding strategy on February 22, 2006 and March 13, 2006, but did not mention the potential flaw in either briefing. Yet the potential flaw was discovered in December 2005. Were Air Force leaders unaware of this potential problem in February and March? Or, on the other hand, were Air Force leaders aware of this problem when they briefed congressional staff, and chose not to mention it? If so, this may suggest a lack of disclosure and transparency on the Air Force's part. Questions may remain on whether other problems associated with F-22A manufacture may emerge.

Another complication for the Air Force is the proposed incremental funding of F-22A procurement. Section 8008 of the FY2006 Defense Appropriations Act (PL 109-148) states that multiyear procurement must be based on "full funding of units to be procured through the contract." Supporting legislation, such as H.R. 4613 (H.Rept.108-553 of June 18, 2004) make clear that some appropriators find incremental funding to be incompatible with MYP contracts: "the Committee directs these requirements be met before future multiyear production contracts can be entered into: (1) Multiyear contracts must follow full funding policies and not be used as vehicles for incrementally funding procurement..." Some Members of Congress have already expressed concern

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<sup>4</sup>"Bullet Background Paper on F-22A Forward Boom Heat Treatment Issue." March 16, 2006. U.S. Air Force.

<sup>5</sup>Tony Capaccio. "Lockheed F-22A May Have Flaw Forcing Redesign, Rep. Young Says." *Bloomberg News Service*. March 15, 2006.

Congress on their high priority procurement programs. If approved, this funding strategy may be cited by future DoD leaders as a precedent. Rep. Duncan Hunter, stated that the Air Force is “asking us to approve incremental funding for the F-22A, a precedent in and of itself,” and that he wished to understand “how we’ve arrived at this very unusual, precedent setting funding strategy.”<sup>8</sup>

The Air Force does not have a history of requesting incremental funding. This may be its first such request. At one point, requesting incremental funding in the Navy was also unusual. Today it has become common. For example after the Navy’s LHD-6 program received incremental funding in FY1993 and FY1994, the instances of incremental funding in Navy ship building appeared to accelerate. Since the mid 1990s, the LHD-8, LHA-6, CVN-21 and DDX programs have either been incrementally funded, or incremental funding has been proposed. As a final example of how the Services cite precedent to justify unorthodox requests, in 2001, Navy officials requested the use of advance appropriations for Navy ship procurement, noting that this funding approach had been used by several federal agencies other than DOD.<sup>9</sup>

The primary benefit that Air Force leaders say will result from this unorthodox plan is that by adding a 9<sup>th</sup> production lot to the F-22A program, the assembly line will remain open for a longer period of time. The Air Force says that this will reduce the potential gap between the end of F-22A production and the beginning of F-35 production. DoD believes that, as Air Force Secretary Wynne testified, it is in the nation’s interests to maintain a continuous production of advanced fighter aircraft in case we encounter a “hot engagement.”

This rationale may sound reasonable, but questions persist about how beneficial such continuous production may be, and whether these potential benefits merit the potential risks involved. The need for extending the F-22A production line has already been the subject of congressional scrutiny. At a March 1, 2006 hearing of the House Armed Services Committee, Chairman Duncan Hunter asked:

If there was a need to have a fifth generation fighter production line open, why the decision was made last year to cut the F-22 production line and then this year reverse that decision and extend the production, in both cases producing about the same number of aircraft, only now for a billion dollars more in program cost?<sup>10</sup>

It is unclear what immediate value keeping the F-22A production line open would have in a crisis. If, for example, the United States found itself unexpectedly drawn into major conflict and a larger inventory of *Raptors* were desired, it does not appear likely that the manufacturer could rapidly produce additional aircraft in large numbers. Due to the need to appropriate “long-lead” items, such as titanium, and to procure in advance other aircraft components, it takes between three to four years to build a production lot of F-22As from start to finish.<sup>11</sup> Even if large numbers of aircraft were rapidly produced, pilots for these aircraft, and maintenance personnel would need to be trained and organized. Tools, supplies, and spare parts would likely need to be acquired. How long does DoD envision such an “hot engagement” to last? The most intense and demanding air combat in recent operations has been measured in days and weeks, not in months or years.

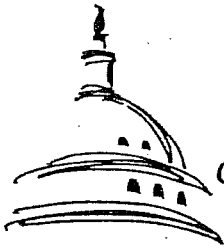
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<sup>8</sup>Rep. Duncan Hunter. *Opening Statement*. OpCit.

<sup>9</sup>CRS Report RL32776. *Navy Ship Procurement: Alternative Funding Approaches*. Ronald O’Rourke.

<sup>10</sup>Rep. Duncan Hunter. *Opening Statement*. OpCit.

<sup>11</sup> Conversation with SAF/LLW. March 14, 2006.



**Congressional  
Research  
Service**

**Memorandum**

June 19, 2006

**TO:**



**FROM:** Christopher Bolkcom (7-2577)  
Specialist in National Defense  
Foreign Affairs, Defense, & Trade Division

**SUBJECT:** F-22 Technical Challenges

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This memo responds to your recent request for a description of "current/on-going technical problems" in the F-22 program, "as well as the technical problems the program has had historically."

**Please describe the current/on-going technical problems**

The Air Force has reported five technical problems currently being experienced in the F-22 program:

- **Structures Retrofit Program.** SRP is a planned improvement effort required to manage weapon system service life and ensure the aircraft meets the design service life of 8,000 flight hours. As service life deficiencies were identified during Engineering, Manufacturing and Development (EMD) structural testing, (mid fuselage, engine bay, aft boom, forward boom, wing leading edge) corrections were incorporated into the production line. The SRP retrofits those aircraft delivered prior to the incorporation of all corrective actions into the production process (aircraft 4010-4083). Work will begin as early as January 2007 and is scheduled to conclude in 2010.
- **Forward Boom Heat Treat Issue.** In December 2005, the Air Force was notified that some titanium forward boom frames were not properly heat-treated. This improper heat treatment created the potential for forward boom frames with anomalous material properties (e.g. extensive cracking) in aircraft 4017-4107. Immediate studies indicated this is not a safety of flight issue, but the cost of inspections and steps potentially required to address this anomaly are currently unknown.
- **Canopy Actuator.** On 10 Apr 06, an F-22A ground-aborted because the canopy would not open. This problem was caused by screws backing out of the internal locking mechanism in the canopy actuator. An inspection for potentially faulty actuators identified 42 potentially faulty actuators (35 installed on F-22As and 7 spares). A 30-

day repetitive mechanical inspection has been implemented to ensure proper operation of the actuators and potentially faulty actuators will be replaced through retrofit expected to be complete by February 2007.

- **Air Recharge System.** The Air Recharge System (ARS) experienced three problems: leakage, auto-ignition failures, and an ARS rupture during flight. The ARS replenishes the Stored Energy System after engine start. Fixes to these problems have been initiated.
- **Nose Landing Gear.** On 11 May 06, an F-22A (aircraft 4020) experienced an uncommanded nose landing gear retraction and the nose of the aircraft fell to the ground, landing on the main weapons bay doors. A similar incident occurred on 18 Mar 2003 to aircraft 4008. The technical solution preventing uncommanded nose gear retractions has been incorporated into the production process and is being fielded throughout the fleet. The findings of Safety Investigation Board are pending.

In addition to those problems reported, at least one production issue may also warrant concern. The F-22 aircraft exiting the Lockheed Martin final assembly plant have experienced an increase in gross takeoff weight of 800 lbs from the beginning of production to the present.<sup>1</sup> Increased weight reduces aircraft performance.

It may be useful to note that the technical problems identified above are those that are currently known, and reported. As mentioned in testimony before the Senate Armed Services Committee on March 28 2006, the titanium problem that the Air Force discovered in December 2005 was not reported to Congress until March 2006. Based on this experience, it may be that additional technical problems exist in the F-22A program of which Congress has not yet been informed. Further, the Government Accountability Office (GAO) and others have expressed concern that the Air Force's plan to integrate a new, multi-mode, air-to-ground- capable AESA (Agile, Electronically Steered Array) radar into the F-22 could present unforeseen and significant technical challenges. The Air Force does not share the GAO's concern, and argues that modernizing the F-22 radar is no more challenging than, for example, retrofitting existing F/A-18/E/F Super Hornets with new AESA radars.

### Technical problems experienced historically

According to the GAO, increased labor rates coupled with technical problems associated with avionics, airframe, and engines have caused 70% of the F-22 cost growth.<sup>2</sup>

- **Avionics:** overcoming avionics software instability was a key challenge that led to an extension of the EMD phase (engineering, manufacturing and development)
- **Airframe:** Lockheed Martin experienced a number of technical challenges with the F-22 airframe, including buffeting of the vertical tail fin, a separation of materials in horizontal tail fin, and "bumps on external shape due to repackaging internal systems"

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<sup>1</sup> *F-22 Multiyear Procurement Business Case Analysis*. Institute for Defense Analyses. May 2006. P.7.

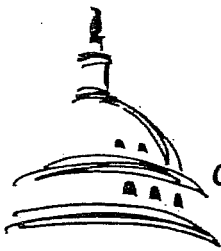
<sup>2</sup> GAO-03-645T p.18.

- **Engine:** F119 engine fuel consumption has been unsatisfactory, and problems were experienced with the engine's core combustor, which did not demonstrate desired temperature levels. Another disappointment was manufacturing problems with fuel-air heat exchangers which reduced effectiveness.
- **Cockpit Canopy:** The F-22 has experienced on-going challenges with the cockpit canopy, including cracking and reliability.
- **Maintenance and Support Requirements:** The F-22 does not meet the Air Force Airlift Key Performance Parameter (KPP) of 8 C-141 equivalents to move a F-22 squadron. 8.8 C-141 equivalents are required. Further, mean time between maintenance is 3 to 5 times the Air Force requirement of ~2 flight hours between maintenance.

Although it is difficult to draw a direct correlation between technical problems and aircraft accidents (also known as mishaps), the F-22 mishap rate may be noteworthy, and may reflect on the technical challenges experienced. The F-22 program experienced three Class A mishaps (>\$1 million in damage) in 14 months.<sup>3</sup>

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<sup>3</sup> Bruce Rolfson. "Raptors Return To Flight Following Dec. 20 Crash; Mishap Was 3rd Crash in 14 Months." *Defense News*. January 10, 2005.



Congressional  
Research  
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**Memorandum**

June 19, 2006

TO:



FROM:

Christopher Bolkcom, (7-2577)  
Specialist in National Defense  
Foreign Affairs, Defense, & Trade Division

SUBJECT: F-22 Program Cost Estimates

This memo responds to your recent request for information on F-22A program cost estimates. Your questions are listed below in **bold text**, with responses directly below.

**Please describe the history of the F-22 to include when the program was initiated (i.e. when money was first allocated for it);**

- F-22 Concept Development began in September 1983 based on \$23 million provided by Congress for Advanced Tactical Fighter (ATF) (PE 0603230F)
- F-22 Demonstration/Validation began in October 1986 with award of \$691million contracts to Lockheed and Northrop to build two prototypes (YF-22 and YF-23 respectively)

**How many aircraft we planned to buy and for what total dollar amount;**

- 648 aircraft were estimated in first Selected Acquisition Report (SAR) on December 31, 1991 for cost of \$57.5 billion in base year dollars (FY90).
- Prior to this, Air Force leaders had expressed interest in purchasing 750 aircraft, but no funds were allocated.

**The number of cost overruns the program has had and the total dollar amount associated with those overruns;**

- DoD has reported 10 cost over-runs in the F-22 program. (DoD is required to report cost overruns in the SAR when the cost estimate is 15% higher than past SAR.)
- The first year in which the F-22 appeared in DoD's Selected Acquisition Reports

(December 31, 1991) the Air Force estimated it would cost \$57.5 billion in FY90 dollars to purchase 648 aircraft. In the most recent SAR, DoD estimates the F-22 program's 185 aircraft to cost \$65.4 billion in FY05 dollars. Adjusting for inflation, the program unit acquisition cost (PUAC) estimate in 1991 was \$114 million per aircraft (\$05) and in 2006 the estimate was \$354 million per aircraft (\$05). In real terms, this represents a per-aircraft price increase of over 200%.

Year	# Aircraft	\$ Base Year	PUAC (\$05)
1991	648	57.5 Billion (90)	114 million <sup>1</sup>
2006	185	65.4 Billion (05)	354 million

#### The number of program delays;

- The F-22 program has experienced >15 years of cycle-time in program delays. Some examples of delayed milestones include:
  - Initial Operational Capability (IOC) delayed 9 years and 9 months (March 96 to December 05)
  - Initial Operational Test and Evaluation (IOT&E) delayed 5 years, 3 months
  - Full Rate Production delayed 5 years, 3 months
  - Low Rate Initial Production (LRIP) delayed 4 years 9 months
  - 1<sup>st</sup> delivery of operational aircraft delayed 4 years, 7 months
  - 1<sup>st</sup> flight delayed 2 years
  - Completion of Critical Design Review delayed 1 year 4 months

#### The number of Nunn-McCurdy violations;

- Two (2). In the September 30, 2001 SAR, DoD reported that the F-22 program exceeded both the Nunn-McCurdy thresholds for cost growth for both Procurement Unit Acquisition Cost and Average Unit Acquisition Cost.
- Owing to flexibility in program cost rebaselining, the F-22 program has generally succeeded in avoiding Nunn-McCurdy violation despite noteworthy cost growth.
- GAO has noted the effect of rebaselining on cost reporting in *Defense Acquisitions: Information for Congress on Performance of Major Programs Can Be More Complete, Timely, and Accessible* (GAO-05-182), as an example:

DOD reported in the 2003 Selected Acquisition Report (SAR), the most recent available, that the F/A-22 Raptor program's unit cost decreased by 0.33 percent in the previous 4 months— since the latest rebaselining. DOD did not report that the program's unit cost had cumulatively increased by 72 percent in the last 143 months.

#### The total cost of the program to date;

- The most recent DoD cost estimate for the F-22A program is \$62,600.0 million (\$TY). Of that total amount, \$50,224.7 million (\$TY) has been appropriated through FY06, leaving an estimated program balance of \$12,375.3 million (\$TY).

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<sup>1</sup> A DoD deflator of .78 was used to adjust for inflation between 1990 and 2005.



**Based on the number of Nunn-McCurdy breaches, program delays, cost overruns, etc., are the estimates of both cost of the contract and anticipated cost avoidance through use of an Multiyear Procurement (MYP) realistic as described by the Air Force and IDA?**

- There do not appear to be any obvious methodological flaws in IDA's analysis of F-22 MYP cost savings, which is roughly half of the Air Force estimate (\$225 million in savings vs. \$400 - \$500 million.). However, there may be reasons for some to question the feasibility of achieving IDA's estimated \$225 million MYP savings. For example,
  - There has been consistent and noteworthy disagreement between the Air Force and the Office of the Secretary of Defense (OSD) on F-22 cost estimating. Congress requested an independent cost estimate, which DoD hired IDA to execute.
  - IDA's estimate of F-22 costs is different from OSD's and the Air Force's estimates.
  - In the December 31, 2004 Selected Acquisition Report (SAR) DoD reported that a two-year MYP (for production lots seven and eight) the Air Force anticipated pursuing would have saved \$458.9 million over annual procurement. This level of estimated savings for a two-year MYP is approximately twice the figure IDA estimates the Air Force may save through a three-year MYP. Such disparity in estimates may suggest to some observers poor assumptions, tools, or methodologies for MYP cost savings estimates.
  - The basis of some Air Force cost estimates is unclear. For example, the Air Force plans to acquire two additional F-22 aircraft with the anticipated \$225 million in MYP savings. According to DoD's latest estimate, the F-22's Average Procurement Unit Cost is \$185.4 million in FY2005 dollars. By this figure, two F-22s would cost \$370.8 million.
  - GAO has consistently argued that the F-22 program should have conducted more thorough testing before entering production. For example, GAO has argued that "The F-22 entered production without ensuring production processes were in control."<sup>2</sup> If true, this less-than-mature production process could be responsible for the F-22's current technical problems, which add to program cost, and may reduce projected MYP savings.

**The issue of termination liability (or lack there of) is a great concern to us and we would like you to address this as well.**

- The Congressional Budget Office (CBO) may be the authoritative agency on this issue. On May 28, 2006, Donald Marron, Acting Director of the CBO testified before the Air Land Subcommittee of the Senate Armed Services Committee:

The Air Force would commit to the purchase of 20 aircraft per year for three years, with the right to cancel the remainder of the order at the end of each year. But it is not requesting appropriations sufficient to cover the potential cancellation liability. Under

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<sup>2</sup> As reported in "F/A-22 Raptor - GAO Assessment." *Aerospace Daily & Defense Report* May 2, 2005, page 21.

that proposal for multiyear procurement, the Air Force would have to seek additional appropriations in the future even if a decision was made to cancel the contract.