An hourglass-shaped graphic with a globe inside. The top bulb is dark blue, and the bottom bulb is light blue. The globe is centered in the narrow neck of the hourglass. The text is centered within the hourglass.

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Report RL31673

F/A-22 Raptor

Christopher Bolkcom, Foreign Affairs, Defense, and Trade Division

December 19, 2008

Abstract. The F-22A Raptor is a next-generation fighter/attack aircraft that features the latest stealth technology to reduce detection by radar. Using more advanced engines and avionics than the current F-15 Eagle, the F-22A is intended to maintain U.S. Air Force capabilities against more sophisticated enemy aircraft and air defenses in the 21st century. This report examines the Air Force's F-22A Raptor program, including costs and schedule; considers several key issues, and concludes with a synopsis of recent legislative activity on the program.

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F-22A Raptor

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December 19, 2008

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Summary

The F-22A Raptor is a next-generation fighter/attack aircraft that features the latest stealth technology to reduce detection by radar. Using more advanced engines and avionics than the current F-15 Eagle, the F-22A is intended to maintain U.S. Air Force capabilities against more sophisticated enemy aircraft and air defenses in the 21st century. This report examines the Air Force's F-22A Raptor program, including costs and schedule; considers several key issues, and concludes with a synopsis of recent legislative activity on the program.

In 1986, two contractors were selected to build competing prototypes, Lockheed's YF-22 and Northrop's YF-23, which were flight tested in late 1990. In April 1991, the Air Force selected Lockheed's YF-22 design for full-scale development, now termed System Development and Demonstration (SDD). The aircraft is powered by Pratt & Whitney's F119 engine, selected in competition with General Electric's F120 engine. In December 2005, the Air Force announced that the 12 F-22 aircraft with the 27th Fighter Squadron, 1st Fighter Wing, Langley Air Force Base, had reached initial operational capability (IOC).

A 184-aircraft program was estimated by the Department of Defense (DOD) in September 2006 to cost about \$65.2 billion in actual prior-year and projected out-year expenditures. The Administration's FY2007 budget requested \$2.6 billion for the F-22A program, and the authority to enter into a multiyear procurement (MYP) for the final three years of production. Congress granted both these requests. Congress denied the Air Force's request to incrementally fund F-22 procurement.

The F-22A has had strong congressional support, although some have criticized the program on grounds of cost, requirements, and coordination with other tactical aircraft programs. Deletion of procurement funds in the FY2000 defense appropriation bill passed by the House made the future of the program a major issue for House and Senate conferees in 1999.

Under DOD's current plan, FY2009 is the final year of F-22 procurement funding. Sufficient funds have been provided by Congress and disbursed by DOD to keep the F-22 production line open until the next presidential administration is in place. Many, including Air Force leaders, argue that more F-22s are required than are currently planned and urge Congress to provide additional funds. Others, including DOD leaders, argue that the current plan is appropriate and that DOD has other military aviation priorities that would be threatened by continued spending on the Raptor.

The F-22 airframe is produced by Lockheed Martin in Marietta, GA, and Ft. Worth, TX, and by Boeing in Seattle, WA, with engines by Pratt & Whitney in Middletown, CT. This report will be updated.

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Introduction

The F-22A Raptor is intended to be the world's preeminent combat aircraft. Designed as a fighter with some ground-attack capability, the F-22A Raptor uses the latest developments in stealth technology to reduce the probability of detection by enemy radar, as well as thrust-vectoring engines for high maneuverability, and avionics that fuse and display information from on-board and off-board sensors in a single display. The first prototype of this next-generation stealth fighter/attack plane was flown on September 29, 1990, followed by the first flight of a development aircraft seven years later. The F-22 achieved initial operational capability in late 2005, and full operational capability on December 12, 2007.¹ The final F-22 is currently planned to be delivered to the Air Force in 2011. The major contractors are Lockheed Martin in Marietta, GA, and Fort Worth, TX, and Boeing in Seattle, WA, for the airframe, with engines made by Pratt & Whitney in Middletown, CT.²

Background

During the early 1980s, the Air Force began development of a stealth aircraft called the Advanced Tactical Fighter (ATF), then expected to enter service in the 1990s to replace F-15 fighter planes developed in the early 1970s. The ATF was viewed as a necessary response to expected advances in the Soviet Union's development and production of combat aircraft in the 1990s. A naval variant of the ATF that could operate from aircraft carriers (the NATF) was expected to replace the Navy's F-14 fighter; however, funding for the NATF was not requested by the Defense Department after 1990. Meanwhile, development of the Air Force's ATF continued.

In hopes of controlling costs, the Defense Department emphasized competitive prototypes for airframes, engines, and avionics. The Air Force selected two teams of airframe contractors to develop ATF prototypes: Lockheed teamed with Boeing and General Dynamics; and Northrop teamed with McDonnell Douglas. On October 31, 1986, the Air Force awarded each team a \$691-million fixed-price contract to build two prototypes, Lockheed's YF-22 and Northrop's YF-23, powered by new engines—one using Pratt & Whitney's F119 and one using General Electric's F120 power plant. The Air Force announced in 1989 that the full-scale development phase would be delayed to allow more time for development of engines and avionics. Each contractor team reportedly spent over \$1 billion in company funds to develop competing prototypes, two YF-22s and two YF-23s, which were flight-tested and evaluated in late 1990.

On April 23, 1991, the Air Force selected the Lockheed team's YF-22 design for development as the F-22, powered by Pratt & Whitney's new F119 engines. Former Air Force Secretary Donald Rice stated that the choice was based on confidence in the ability of the Lockheed team and Pratt & Whitney to produce the aircraft and its engine at projected costs. He emphasized the importance of the Lockheed team's management and production plans, and added that the YF-22 offered better reliability and maintainability. Neither design was significantly more maneuverable

¹ Michael Sirak. "Air Force F-22 Raptor Stealth Fighter Reaches Full-Operation-Capability Milestone." *Defense Daily*. December 13, 2007.

² The number of companies involved in the F-22A program is large. They are many subcontractors and component suppliers. Estimates vary between 650 companies in 32 U.S. states and 1,150 companies in 46 states and Puerto Rico depending on the range of suppliers included. *World Military & Civil Aircraft Briefing*. Teal Group Inc. Fairfax, VA. *Jane's All the World's Aircraft* (Various years). Jane's Publishing Group, London.

or stealthy than the other. On August 2, 1991, contracts totaling \$11 billion were awarded to Lockheed and Pratt & Whitney for engineering and manufacturing development (EMD) of the F-22, then including 11 development/prototype aircraft.

The quantity of aircraft in the program has been steadily reduced from the initial goal of 750 aircraft. The F-22A's development/production schedule has also been delayed several times. Citing budgetary constraints, reduced threats in Europe, and the F-15's longer service life as reasons for deferring production, then-Secretary of Defense Richard Cheney told Congress in April 1990 that production of the aircraft could be delayed two years instead of beginning in FY1994 as originally planned, with annual production peaking at 48 aircraft in 2001 instead of increasing to 72 by FY1999 as previously planned. These 1990 projections of the F-22's development and production schedules were further revised later, when the development program was extended and the number of prototypes was reduced.

The Defense Department's 1993 Bottom-Up Review (BUR) resulted in the program's reduction to 442 aircraft—438 production and four pre-production versions (later reduced to two)—which would support four fighter wings in a force structure of 20 wings (13 active; seven Reserve/National Guard). The Defense Department's Quadrennial Defense Review (QDR) released on May 19, 1997, recommended a further reduction of the projected buy from 438 to 339 production aircraft, which would support three fighter wings in a 20-wing force structure of 12 active and 8 Reserve/National Guard wings. The QDR also recommended reducing the maximum production rate from 48 to 36 planes per year as a more affordable rate of production. The 2001 QDR did not make specific recommendations on the numbers of F-22's to be produced. Based on the FY2009 President's budget submission, the Bush Administration hopes to procure 184 F-22As.

Originally conceived of as an air superiority fighter with minimal air-to-ground attack capability, the Air Force has increasingly emphasized the F-22A's potential for air-to-ground attack over time. An "A" (for "attack") was added to the F-22 designation in September 2002—F/A-22—to signify the plane's ability to conduct these types of attacks. In December 2005, the Air Force returned to the F-22 designation, adding an "A" to the end of the designation: F-22A. A letter at the end of a military aircraft's alpha-numeric designation is used to differentiate significant "block upgrades" within an aircraft program, such as new engines, or radar. Some interpret the Air Force's addition of an "A" to the end of F-22 to mean that the Service anticipates there to be an F-22B variant.

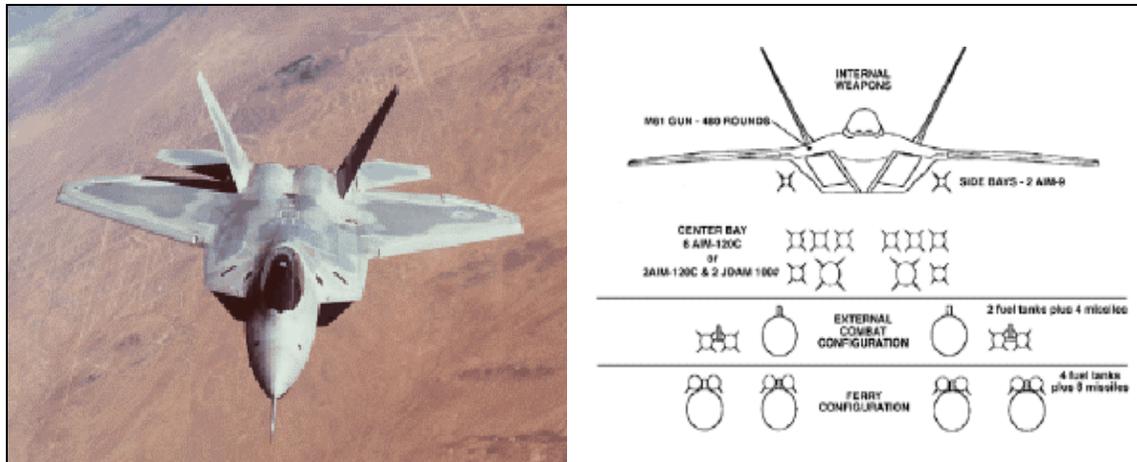
On December 12, 2005, the Air Force's Air Combat Command declared that the first squadron of 12 F-22A Raptors—27th Fighter Squadron of the 1st Fighter Wing, based at Langley Air Force Base (AFB)—had achieved Initial Operational Capability (IOC). On January 21, 2006, the F-22A flew its first operational sorties, taking part in an on-going air superiority mission over the United States. As of August 2008, the F-22A has flown no operational sorties outside of the United States.

System Description

The production version of the F-22A has a wingspan of 44.5 ft, length of 62 ft, and height of 16.5 ft. The aircraft's maximum takeoff weight is estimated to be about 60,000 lb with a projected empty weight of about 40,000 lb (without fuel and munitions). Powered by two Pratt & Whitney F-119 turbofan engines with afterburners and thrust-vectoring nozzles, the F-22A is expected to

have a supersonic level speed of about Mach 1.7 using afterburners and a supersonic cruise speed of about Mach 1.5 without afterburners.

Figure 1. F-22A Weapons Loadout



Source: USAF Legislative Liaison NEWSNOTES, 10/02

The F-22A's armament include a 20-mm M61 gun and various loadings of air-to-air missiles (visual-range AIM-9 Sidewinders and medium-range AIM-120 AMRAAMs) and air-to-surface ordnance (e.g., Joint Direct Attack Munitions, and potentially munitions currently in development such as the Small Diameter Bomb), which can be carried internally or on underwing pylons. The F-22A's reduced radar-cross-section and stealth features of low observability are achieved through the use of radar-absorbing composite materials, the reduction of infrared and radar signatures by shaping and blending of structures, and by exploiting passive sensors, and low-probability of intercept communications.

Costs

Obligated to keep production costs below a \$36.8 billion cap (reduced from the original estimates of \$43.4 billion due to low rates of inflation and subtracting the cost of six aircraft paid for with RDT&E funds), the Air Force can currently afford to build 184 Raptors under current projections.³ Any further increases in the cost of the F-22A program have to be mitigated by further reducing the number of aircraft produced or by relaxing or eliminating the cost cap. Funding of the F-22A began in the early 1980s (as the Advanced Tactical Fighter, or ATF) and procurement funding planned to end in FY2009. Over \$58 billion has been spent on the F-22A through FY2008. Through FY1992 the program received about \$165 million in Navy R&D funds for a naval variant that was not developed.

The Defense Department's Selective Acquisition Report of December 31, 2007, estimated the total program cost to be \$66.9 billion in "then-year" dollars. This equates to a program unit acquisition cost (PUAC) of \$350 million for each aircraft. Some, including the Air Force, argue that average procurement unit cost (APUC) is a better representation of the F-22A's unit cost than

³ "Conferees Put Caps on F-22 EMD, Production," *Aerospace Daily*, October 27, 1997, p.139B. Tony Capaccio, "Lockheed Must Cut F-22 Cost For U.S. To Buy More, Zackheim Says," *Bloomberg.com*, January 30, 2003.

the PUAC. The APUC does not reflect sunk costs like R&D, which can be considerable. The F-22A's average procurement unit cost is estimated at approximately \$191.6 million per aircraft.

Debate continues over whether additional costs would need to be incurred by enhancing the F-22A's attack capabilities, or whether these costs would be covered by the existing budget. See "Enhancing Attack Capabilities" in the "Key Issues" section below, for more discussion.

Budget and Schedule

The 109th Congress granted DOD the authority to purchase 60 F-22As through a three-year procurement of 20 Raptors per year. This MYP will be funded by procurement budgets in FY2007, FY2008, and FY2009. DOD currently has no plans to procure additional F-22s. DOD had hoped to extend F-22 procurement spending through 2010 by incrementally funding the MYP, but Congress objected to this plan.

F-22 critics note that this production profile (20 aircraft per year) will increase program costs \$1.8 billion more than the program's cost estimate under the FY2006 plan, which would procure four fewer aircraft, but at a more efficient rate of production.⁴ F-22 supporters note that the MYP is expected to cost \$225 million less than if the final 60 F-22s were procured through three single-year procurements.

Under the current plan, the final lot of Raptors will be delivered to the Air Force in December 2011, but production line shutdown will begin much sooner. Prior to passage of the FY2009 Defense Authorization Bill, DOD reported that this process will begin in November 2008 (e.g., tool disposal and environmental cleanup), unless a decision is made to procure more Raptors than currently planned.⁵ Congress provided sufficient funds to keep the F-22 production line open until the next administration takes office.

FB-22

Lockheed Martin initiated the study of a radically modified version of the Raptor called the FB-22. This variant would seek to significantly increase the F-22A's air-to-ground capabilities, primarily through a redesign that would double the aircraft's range, and significantly increase the aircraft's internal payload. Some estimate that the delta-winged FB-22 could carry up to 30 of the developmental 250-lb Small Diameter Bombs.⁶ These potential improvements would likely result in some performance tradeoffs, such as reduced acceleration and maneuverability.

Although not officially part of the F-22A program and still very much in the conceptual phase, some Air Force leaders have expressed enthusiasm for the idea. Former Secretary of the Air Force, James Roche, reportedly favors the FB-22 idea as the potential platform of choice for providing better close air support for tomorrow's ground forces.⁷ Air Force leaders have also

⁴ FY2006 and FY2007 Budget Estimates. Aircraft Procurement Air Force OPR: SAF/FMB. Volume I. U.S. Air Force.

⁵ "F-22." *Selected Acquisition Report (SAR)* Office of the Secretary of Defense (AT&L) December 25, 2007. p. 4.

⁶ Richard Whittle. "F-22 Bomber Studied," *Dallas Morning News*, July 30, 2002. Frank Wolfe, "Sambur: F-22 Must Prove Itself Before FB-22 Becomes Formal Program," *Defense Daily*, March 4, 2002.

⁷ Ron Laurenzo, "Roche Envisions Close Air Support F-22," *Defense Week*. July 1, 2002.

depicted the FB-22 as a “regional bomber” that could serve as a “bridge” between the current bomber force and a follow-on capability.

Other Air Force leaders have reportedly shown less enthusiasm in the FB-22 concept. Former Air Force acquisition chief Marvin Sambur said that the F-22A’s difficulties would have to be solved before the FB-22 could be considered.⁸ Also, the cost of developing the FB-22 are debated. Some argue that by leveraging the F-22A cockpit, engines, computer systems, production methods and materials, the FB-22 could be produced relatively cheaply. Others argue that redesigning an aircraft to perform a mission it was not originally intended to perform is difficult, and usually costly. Some estimate that developing the airframe could cost up to \$1 billion. Also, some question the attractiveness of a medium range bomber with a relatively small payload. Representative Duncan Hunter, for example, is reported to have commented that it was “counterintuitive that our modernization program has, on the average, encompassed acquisition of aircraft with shorter and shorter legs.”⁹

On April 29, 2004, the Air Force issued a request for information (RFI) about resources or technologies available with the potential to substantially improve Air Force long-range strike capabilities. It is expected that Lockheed Martin will offer the FB-22 as one concept that could satisfy this requirement.¹⁰

In congressional testimony, former Air Force Secretary James Roche suggested that up to 150 FB-22s could be procured. Full-rate production could be achieved by FY2011, Roche estimated, if development funds were committed in FY2004.¹¹ No funds in the F-22A program have yet been devoted to the FB-22 nor has money been allocated to the bomber program from other sources. Potential costs and schedule of the FB-22 concept are still quite notional. How this multi-role aircraft would compete with—or conversely complement—the Joint Strike Fighter (JSF) has not yet been determined. The feasibility of expanding the F-22A’s ground attack capabilities, either in its current configuration or in a redesigned configuration, is currently unclear.

Key Issues

The main F-22A issues for the 110th Congress center on quantity, modernization, the potential for foreign sales, and whether the program is vulnerable to potential unforeseen problems.

Quantity

Like some other aviation modernization programs, the F-22A planned production quantity has fluctuated considerably, with the overall trend downward. Originally pegged at 750 aircraft, the

⁸ Bill Sweetman, “Smarter Bomber,” *Popular Science*, June 25, 2002.

⁹ Lorenzo Cortes, “Roche Looking to Next Year for Near-Term Proposals on Strike Concepts,” *Defense Daily*, March 17, 2004.

¹⁰ Lorenzo Cortes, “Lockheed Martin Expects FB-22 To Compete Against UAVs, ‘Arsenal Ship’ Ideas,” *Defense Daily*, March 20, 2004.

¹¹ Lorenzo Cortes, “Air Force Issues Clarification on FB-22, FY’11 Delivery Date Possible,” *Defense Daily*, March 10, 2003.

F-22A program today is to produce 184 Raptors by the end of 2011. Air Force leaders have argued that they require a minimum of 381 Raptors.

This disagreement between the Office of the Secretary of Defense (OSD) and the Air Force appears to have come to a head when, in June 2008, Secretary of Defense Robert Gates asked the Air Force's top civilian and military leaders to resign. In numerous press articles it was reported, and confirmed by former Secretary of the Air Force Michael Wynne, that Air Force leaders' reluctance to accept a fleet of 184 Raptors was the key factor that led to their ouster.¹²

Those nominated to replace Secretary Wynne and former Chief of Staff Gen. Michael Moseley have expressed more moderate positions than their predecessors on the F-22 fleet. Acting Secretary of the Air Force Michael Donley has refused to opine on the required number of Raptors, instead expressing his desire to keep the production line open until the next administration is in place. Chief of Staff Gen. Norton Schwartz testified that he would study the issue closely because he believed that 184 Raptors was insufficient, but that "381 is too high."¹³

The debate over the number of F-22s to be acquired has been driven by perceptions of threat and program cost. There is a strong consensus among defense professionals that dominating the air is a critical advantage for all fielded U.S. forces: ground, air, and sea. There is also little debate over the F-22's capabilities. If it performs as advertised, it should be a superb air dominance aircraft. However, as threats from hostile nations have apparently ebbed, and as counterinsurgency, stability operations, and other low-intensity missions have grown, many question whether DOD needs, and can afford, such a sophisticated aircraft. U.S. air superiority can, and should be, achieved by other, more cost-effective means, they argue.

As the congressionally mandated budget cap (see above) and policy decisions by DOD reduced the number of F-22s to be purchased, the Air Force adopted what it called a "buy-to-budget strategy." In essence, the Air Force recognized that it could afford only 184 F-22s, but hoped to purchase more aircraft in the future if production efficiencies could be achieved. In March 2004, the General Accounting Office issued a report (GAO-04-391) that criticized the buy-to-budget strategy. Instead, the GAO argued, the Air Force should develop a business case for the Raptor—based on capabilities, need, alternatives, and spending constraints—rather than just purchasing the most aircraft that can be afforded.

Air Force leaders have argued that 381 F-22s are required to populate the Service's 10 Air Expeditionary Forces (AEFs). The AEF is the primary organizational unit that the Air Force uses to rotate equipment and personnel among training, maintenance, and operational assignments. If the Air Force does not have enough F-22s to rotate among its 10 AEF's they argue, the Raptor force will have to be allocated on an "as needed" basis. This obviates the principal benefit of the AEF system, which is to provide predictability and stability for airmen.

Others point out that many other assets, such as bombers and ISR aircraft, are too few to be permanently attached to AEFs and are instead assigned on an as-needed basis. Further, they argue, decisions on how many F-22s to be procured should be based on need, not on force-

¹² See, for example: "Wynne speaks out; Tell-all interview covers Iraq withdrawal, nuclear report, procurement and more." *Air Force Times*. July 21, 2008. and John T. Bennett. "Wynne Talks About His Tenure, Termination." *Defense News*. July 14, 2008.

¹³ "Senate Armed Services Committee Holds Hearing on Air Force Nominations." *Congressional Transcripts*. Congressional Quarterly Inc. July 22, 2008.

structure dictates.¹⁴ Proponents of purchasing fewer F-22s cite Secretary of Defense Robert Gates's recent testimony, where he remarked that "the reality is we are fighting two wars, in Iraq and Afghanistan, and the F-22 has not performed a single mission in either theater."¹⁵ If the F-22 is to be an infrequently used aircraft, they argue, organizing it outside the AEF scheme and using it on an "as needed" basis would be appropriate.

On November 2, 2007, an F-15C Eagle broke-apart during a training mission, and the entire F-15 fleet was grounded until the cause could be determined. An investigation discovered that the crash was caused by the failure of a structure (the "longeron") that holds together the F-15 cockpit and fuselage, and that longerons in other F-15s were suspect. The F-15 fleet was grounded a second time on November 28 when a more sensitive test found that the longeron problem was evident in more F-15s than previously believed.¹⁶ Some argue that the longeron problem is emblematic of the kinds of challenges and risks of operating an aging fighter fleet and that the Air Force would be well advised to purchase more than 184 F-22s to hedge against the risk of additional F-15 failures. In hearings on the Air Force's FY2009 budget request, Air Force leaders testified that due to new estimates of the life of the legacy fighter force, the current F-22 and JSF procurement plans would likely leave a gap of up to 800 fighter aircraft would arise by the year 2024.¹⁷

Some question the validity of this projected fighter gap, arguing that it strongly influenced by assumptions on threats and whether the United States will fight alone or as part of a coalition.¹⁸ Even if such a fighter gap does emerge, some argue, that does not necessarily mean that purchasing additional F-22s is the most cost-effective way to address the shortcoming. New F-15s could be purchased, some note, with more advanced radars and other technology than the F-15s currently in the fleet, for a relatively modest \$60 million each.¹⁹

A final point made by F-22 proponents is that the F-35 has not yet entered full-rate production, and that it would be unwise to shut down F-22 production until there is confidence that F-35 is on track. Even if it does not appear now that many stealthy, fifth-generation fighters is mandated by the current threat environment, it is a prudent hedge to keep at least one such production line alive in the event threat projections prove optimistic. Further, once it is shutdown, the F-22 line will be expensive to reopen if needed. The F-22 and F-35 share many of the same vendors and sub-vendors. Therefore, keeping the F-22 line open will help protect the F-35s industrial base, supporters argue.

¹⁴ William Mathews. "Coming up short; Is the Air Force's 'fighter-gap' |truth or spin?" *Armed Forces Journal*. July 2008. p. 26.

¹⁵ Jen DiMascio. "Gates: F-22 Production Increase Could Hurt More Affordable JSF." *Defense Daily*. February 7, 2008.

¹⁶ Michael Sirak. "Moseley: Questions Remain Over F-15C Crash As F-15Es Returning to Flight." *Defense Daily*. November 19, 2007. Gayle Putrich. "F-15s Ordered Out of the Air Again; Could Help USAF Make Case for More F-22s." *Defense News*. December 3, 2007. "USAF Orders F-15s Grounded ... Again." *Air Safety Week*. December 3, 2007.

¹⁷ Lieutenant General Daniel Darnell, Deputy Chief of Staff Air, Space and Information Operations, Plans and Requirements. "Senate Armed Services Subcommittee on Airland Holds Hearing on the Fiscal 2009 Budget for Air Force and Navy Aviation Programs." *Congressional Quarterly*. Congressional Transcripts. April 9, 2008. p.16.

¹⁸ William Mathews. "Coming up short; Is the Air Force's 'Fighter-gap' truth or spin?" *Armed Forces Journal International*. July 2008. p. 26.

¹⁹ Amy Butler. "Passing the Buck; The Pentagon abdicates F-22, C-17 decisions in Fiscal 2009 budget plan." *Aviation Week & Space Technology*. February 11, 2008.

F-35 proponents challenge this logic, however. They note that because of intense budgetary competition, building additional F-22s threatens the F-35 program rather than lending it support. Therefore, they argue, F-22 production should be ended as planned because the F-35 is a more cost-effective aircraft. They point to John Young, DOD's senior acquisition official's remarks that "any decision to buy more F-22s at the expense of JSF is not a good choice for the taxpayer."²⁰ Additionally, F-35 proponents note that it takes three years to build the Raptor. Keeping the F-22 production line open as a hedge against an unexpected crisis does not make sense, they argue, because it is not possible to quickly produce large numbers of F-22s.

Modernization

The Air Force originally conceived of the Raptor as an air superiority fighter with minimal air-to-ground attack capabilities. Today, the Air Force describes the Raptor as a multi-role combat aircraft. It is pursuing upgrades to the aircraft's ground attack and Intelligence, Surveillance and Reconnaissance (ISR) capabilities.

Enhancing the Raptor's attack capabilities includes increasing the weapons payload from two 1,000 lb bombs to eight 250 lb bombs and modifying and improving the aircraft's radar. These changes include adding a ground moving-target indicator, a high-resolution synthetic aperture radar, and a fourth-generation electronically scanned array. Modernizing the Raptor raises two broad issues: are these capabilities needed? Are they worth the cost?

In their report GAO-04-391, the GAO suggests that the need for the F-22A's enhanced attack capabilities is unknown, because a business case for these aircraft have not been made. Also, it does not appear that the Air Force had produced an Operational Requirements Document, (also called a Capabilities Development Document) that describes what air-to-ground attack capabilities are required. It appears that by making the F-22A more of a multi-role combat aircraft, the Air Force is blurring the distinction between the Raptor and the Joint Strike Fighter. The JSF is also a multi-role combat aircraft that is projected to have a superior internal payload (5,700 lbs vs the F-22A's 2,000 lbs) and will also employ an advanced air-to-ground radar. A detailed description of how the F-22A will improve upon the JSF's attack capabilities and how these aircraft might be used in operational scenarios could prove useful.

The GAO reports that enhancing the Raptor's attack capabilities will cost an additional \$11.7 billion over current budget projections.²¹ These capabilities will be added and costs incurred through three spirals from 2007 to 2015. Air Force officials are reported to contest these cost projections, saying that these improvements have already been fully budgeted, and suggesting that the GAO and others are confusing the F-22A with the conceptual FB-22.²² In November 2008 however, senior DOD officials admitted that modernizing the F-22 would cost an estimated \$8 billion that was not accounted for in the program of record.²³

²⁰ John Reed. "Young: Given Current Wars, F-35s are Better Choice Than More F-22As." *Inside the Air Force*. June 6, 2008.

²¹ GAO-04-39, pp.7-8.

²² David Fulghum, "Escalation Clause," *Aviation Week & Space Technology*, March 22, 2004. Gail Kaufman, "Putting the 'A' in F/A-22," *Defense News*, March 8, 2004. Lorenzo Cortes, "GAO Official Says Adding Ground Attack to F/A-22 Costs \$8 Billion," *Defense Daily*, March 26, 2004.

²³ Bettina H. Chavanne. "DOD Acquisition Czar Outlines F-22 Reservations." *Aerospace Daily & Defense Report*. November 21, 2008.

If the improved attack capabilities were to cost an additional \$11.7 billion and if these efforts were covered by the current production cost cap on the F-22A, it could mean that the Air Force could not afford all the aircraft it hopes to build. Roughly speaking, the Air Force might have to reduce its purchase by approximately 62 aircraft (\$11.7 billion / \$187 million per aircraft). Air Force officials say that upgrading the Raptor's air-to-ground capabilities is a modernization program and therefore not covered by the production cost cap.²⁴

Air Force officials have also emphasized the F-22's potential to execute many of the ISR missions that UAVs have performed in support of counter insurgency and low-intensity conflicts.²⁵ Although the F-22 may have effective on-board sensors and the ability to receive additional information from other ISR platforms, it has limited ability to transmit targeting information to other platforms or command and control (C²) assets. This restricted communications capability was a purposeful design choice intended to make the F-22 more elusive to enemy defenses. Air Force officials now wish to reprogram \$85 million to accelerate an upgrade to the F-22 that would enable this aircraft to more effectively share information with other aircraft.²⁶

Some fear that adding new capabilities at this relatively late stage in the F-22A program could increase costs by complicating the program and stretching out its development. Resolving instability problems with the F-22A's advanced avionics has been one of the biggest cost drivers in the development program. Adding a new feature such as an air-to-ground radar, or new communications capabilities, some argue, could jeopardize the progress that has been made in the avionics software. Other concerns focus on the F-22's signature quality: its stealth. If controlling radar and radio emissions was a key component of making the F-22 elusive to enemy defenses, might these modifications reduce the F-22's stealth? If so, are the benefits of these modifications worth the risks?

Finally, modernization and acquisition may be in competition for scarce funding. DOD's top acquisition official, for example, reportedly argued that modernizing the currently fielded F-22s should be considered before acquiring any additional Raptors beyond the current program.²⁷

Foreign Sales

Generally speaking, arguments for foreign military sales tend to focus on advancing U.S. industry, supporting allied countries, and promoting interoperability with those countries. Arguments against arms sales tend to focus on the negative aspects of military technology proliferation and the potential for causing regional instability. The federal government approves arms sales on a case-by case basis.²⁸

²⁴ E-mail from USAF LLW to CRS. February 16, 2005.

²⁵ See, for example, Michael Bruno. "Air Force ISR Chief Foresees Downplaying 'F' in F-22, F-35." *Aerospace Daily & Defense Report*. June 22, 2007.

²⁶ Marcus Weisgerber. "Air Force Loots to Shuffle \$85 Million to Accelerate F-22A Mods." *Inside the Air Force*. August 8, 2008.

²⁷ James Asker. "Endgame Maneuvering." *Aviation Week & Space Technology*. March 17, 2008.

²⁸ For more information on arms sales, see CRS Report RS20757, *Defense Trade Security Initiative: Background and Status*, by Daniel H. Else and Leland Cogliani.

DOD officials have suggested that they favor foreign sales of the F-22A.²⁹ However, Congress has expressed opposition to exporting the Raptor. In FY2001 appropriation conferees wrote “None of the funds made available in this act may be used to approve or licence the sale of the F-22 advanced tactical fighter to any foreign government.”³⁰ This provision was debated in the 109th Congress, with appropriations conferees re-affirming their opposition to F-22 exports.³¹

Japan is most frequently mentioned as a potential F-22 importer. Australia has also, reportedly expressed interest in the Raptor.³² At one point the Israeli Air Force had hoped to purchase up to 50 F-22As. In November 2003, however, Israeli representatives announced that after years of analysis and discussions with Lockheed Martin and DOD, they had concluded that Israel could not afford the Raptor.³³

If F-22A sales were to occur in the future, it would likely be to one of the U.S.’s closest allies and the perceived economic and politico-military benefits would have to clearly outweigh concerns about technology proliferation. The debate over foreign sales may become more prominent if the planned number of Raptors to be procured is reduced.

Potential Complications

At this stage of the F-22 program, the emergence of unforeseen problems could be particularly troublesome. An oft-delayed schedule and dwindling budget leave little time or resources to address problems if they emerge. Examples of potential problems to be guarded against include technical problems and budget shortfalls.

Leaders of both the Air Force and the Raptor’s manufacturer Lockheed Martin Corp. have expressed confidence that the F-22A’s development problems have been solved, that the aircraft’s design is sound, and that modernization should go smoothly. Former Air Force Acquisition Chief Marvin Sambur, for example, reported that the F-22A’s longstanding problems with avionics software stability had been remedied³⁴ Yet some fear that unexpected technical problems could still surface in this complicated program, and at this late stage of development, cause expensive delays. For example:

- In April 2004 it was reported that Air Force testers had encountered unexpected overheating in key Raptor components. Software modifications were required to ameliorate the problem, but a long term solution was not immediately apparent.³⁵

²⁹ Frank Wolfe, “Aldridge JSF Letter Hints at Administration Favor Toward F-22 Foreign Sales,” *Defense Daily*, October 5, 2001.

³⁰ *Making Appropriations for the Department of Defense for the Fiscal Year Ending September 30, 2001, and for Other Purposes*, Conference Report, H.Rept. 106-754 (H.R. 4576), July 17, 2000, sec. 8087, p. 38. And *Making Appropriations for the Department of Defense for the Fiscal Year Ending September 30, 2005, and for Other Purposes*, Conference Report H.Rept. 108-662 (H.R. 4613), July 20, 2004, Sec. 8074, p. 38.

³¹ Sec. 8058, p. 31. Report 109-676 (H.R. 5631).

³² Neil Baumgardner, “Lockheed, Boeing BAE, Dassault, Saab Respond to Australian Fighter Survey,” *Defense Daily International*, February 1, 2002.

³³ Barbara Opall-Rome, “Israel Says ‘No Thanks’ to F/A-22,” *Defense News*, November 24, 2003.

³⁴ Marc Selinger, “F/A-22’s software stability ‘no longer an issue,’ USAF says,” *Aerospace Daily & Defense Report*, May 3, 2004.

³⁵ Amy Klamper, “Pentagon’s Stealth Fighter Plagued by Rising Temperatures,” *National Journal’s Congress Daily*, April 30, 2004.

- During flight testing on September 28, 2004, an F-22A experienced more “G” forces than designed. The aircraft was grounded, and it was subsequently reported that the problem was caused by flight control software problems.³⁶
- On December 20, 2004, a Raptor crashed and was destroyed at Nellis AFB.
- In December 2005 it was discovered that 91 F-22s suffered a “heat treatment anomaly” in a titanium fuselage structure. This figure was later revised to 101 aircraft.
- In May 2006 it was reported that the F-22 program would require \$100 million to carry out a structural retrofit program for 41 of the existing aircraft, but Air Force officials state that no remedial action is required. However, these faulty titanium forgings will require increased inspections during the Raptor’s 8,000 hour lifetimes to avoid catastrophic failures.³⁷

The Air Force, the Office of the Secretary of Defense (OSD), and the GAO have frequently differed in their estimates of the F-22A budget. Over the course of the program, the Air Force estimates have tended to be lower, the GAO’s higher, and OSD’s in between.³⁸ Which estimates are more accurate? Why do they differ? One difference between the estimates is that the Air Force tends to emphasize future savings that it hopes to reap. For example, In June 2000 Air Force officials testified that the program’s cost was estimated to be \$1 billion above the spending cap placed on the production phase. However, they had identified \$21 billion in future cost reductions they hoped to reap. Should future savings be included in budget estimates? In a subsequent report, the GAO cast doubt on the Air Force’s cost saving claims. The GAO wrote that about one half of the cost reductions identified had not been implemented, and that the Air Force may not be able to achieve many of these reductions because they depend on uncertain actions by either DOD or Congress.³⁹ In July 2004 appropriations conferees called for a new and independent cost estimate of the F-22A program.⁴⁰

Congressional Action

The F-22A program has had strong support in Congress. Funding for the program generally has been authorized as requested, although sometimes with reservations in recent years. In some years, Congress has appropriated less than the amounts requested and authorized, usually reflecting opposition to the program in the House. The most acute F-22A controversies in Congress have focused on F-22A procurement spending. Congress has imposed a spending cap on the F-22A program to help control costs, and the level and scope of this cap has been debated.

³⁶ David Fulghum, “Questions Abound After F/A-22 Crash,” *Aviation Week & Space Technology*, January 3, 2005.

³⁷ In April 2008, it was reported that Boeing was suing the titanium forgings supplier for \$12 million.

³⁸ For example, in September 2001, the DOD office of Operational Test and Evaluation estimated the F/A-22 program cost had grown \$8 billion higher than Air Force projections. The Pentagon’s Cost Analysis Improvement Group (CAIG) similarly estimated that the F/A-22 production program would be \$9 billion over the \$37.6 billion congressional cost cap.

³⁹ “Quarterly Reports Urged on F-22 Production Costs,” *Aerospace Daily*, August 16, 2000.

⁴⁰ *Making Appropriations for the Department of Defense for the Fiscal Year Ending September 30, 2005, and for Other Purposes*. Conference Report H.Rept. 108-662 (H.R. 4613), July 20, 2004. p. 215. This cost estimate was conducted by the Institute for Defense Analyses (IDA) and delivered by DOD to the four congressional defense committees on March 17, 2006. It has not been publically disseminated.

Also, FY2000 procurement funding for the F-22A was eliminated by House appropriators and later reinstated by conferees.

The **FY2009** defense budget request included \$3.6 billion to procure what is currently planned to be the final lot of 20 F-22 aircraft, \$327 million in modernization funds, and \$700 million in research and development.

Authorization conferees (S. 3001) cut \$147 million from the F-22 FY2009 procurement request and provided \$523 million for either advance procurement of long lead items for an additional lot of fighters, or to pay for production line shut down. In Sec. 134, conferees noted that the provision would prohibit “obligating more than \$140 million of those funds until the next President of the United States: (1) decides whether continuing F-22 production or terminating production would be in the best interests of the Nation; and (2) submits a certification of that decision before March 1, 2009, to the congressional defense committees.” Conferees matched the Air Force’s F-22 R&D request.

In a November 19, 2008 hearing, the House Armed Services Air Land Subcommittee chastised Under Secretary of Defense for Acquisition John Young for not obligating FY2009 funds to purchase long-lead items for an additional lot of F-22s that the next administration might decide to purchase. Mr. Young testified that DOD was complying with provisions in the FY2009 Defense Authorization Bill, but some lawmakers disagreed strenuously, and advised Mr. Young to immediately disburse sufficient funds for the advance procurement of long-lead items for 20 F-22s. Subsequent to the hearing, DOD disbursed sufficient funds for long-lead items for four Raptors.⁴¹

Appropriations conferees (H.R. 2638) cut \$147 million from the Air Force’s F-22 procurement request, and provided \$523 million in F-22 advance procurement (current year) for 20 additional aircraft. Appropriators also cut \$38 million from the F-22 R&D account.

The Bush Administration’s **FY2008** defense budget requested \$4.6 billion in total funding: \$3.1 billion to procure 20 aircraft; \$426 million in advance procurement; \$281.9 million for modifications; and \$743.5 million in R&D. In their report H.Rept. 110-177 (H.R. 1585), congressional authorizers matched all F-22 funding requests. Congressional appropriators (Report 110-434, H.R. 3222) approved DOD’s request for procurement and advanced procurement, but they trimmed the modernization and R&D requests by \$25 million and \$132 million respectively due to program growth. Despite these reductions, congressional appropriators expressed their support of the F-22. On page 218 of their report, appropriators wrote

The conferees believe the Air Force should consider extending the current F-22A multiyear procurement contract. The conferees note that \$526,000,000 is available within the F-22A fiscal year 2009 budget for line shutdown and that these funds could be redirected towards advance procurement items to support procurement of an additional 20 aircraft.

The Administration’s **FY2007** defense budget request included \$2.1 billion for the F-22A. These funds would pay for Economic Order Quantity (EOQ) items, sub-assemblies, and material items required for Lot 7, to be procured beginning in FY2008. Under the proposed DOD plan, no

⁴¹ “House Armed Services Subcommittee on Air and Land Forces Holds Hearing on the F-22 Fighter Jet Program.” Congressional Transcripts. *CQ Magazine*. November 19, 2008. and Caitlin Harrington. “Pentagon limits F-22 buys over budget concerns.” *Jane’s Defense Weekly*. November 21, 2008.

complete aircraft would be produced in FY2007 with FY2007 procurement funds. All four defense oversight committees objected strongly to incremental funding, and revised the F-22 funding plan accordingly.

In their report H.Rept. 109-452 (H.R. 5122), House authorizers rejected the Air Force's proposal to incrementally fund F-22 procurement, and added \$1.4 billion to the FY2007 request. Authorizers granted the Air Force authority to enter into a multiyear procurement (MYP) contract. In their report S.Rept. 109-254 (S. 2766) Senate authorizers denied the Air Force requests to incrementally fund the F-22, and therefore added \$1.6 billion to the Air Force's request for FY2007 F-22 procurement. They also denied the Air Force request to enter into a multiyear procurement contract, and cut \$200 million from advanced procurement (current year). On June 22, 2006, the full Senate agreed (70-28) to amendment 4261, introduced by Senator Saxby Chambliss, which reversed the Senate Armed Services Committee's recommendation on MYP. This position prevailed in conference, along with the House's recommended funding. Appropriations conferees (Report 109-676, H.R. 5631) approved MYP authority and added \$210 million to the F-22 procurement request to fully fund 20 aircraft in FY2007.

The Administration's **FY2006** defense budget request included \$3.89 billion for the F-22A. This total includes \$3.1 billion to procure 24 aircraft, \$576.9 million in advance procurement (current year), \$54 million in procurement funds to modify existing Raptors, and \$76.2 million in R&D. R&D funds will be used to procure a non-operational test aircraft, bringing the total number of aircraft procured in FY2006 to 25.⁴² In their reports H.Rept. 109-359 (H.R. 2863) and H.Rept. 109-360 (H.R. 1815) appropriations and authorization conferees matched all funding requests for the F-22.

The Administration's **FY2005** defense budget request included \$4.8 billion for the F-22A. This figure includes \$3.6 billion to procure 24 aircraft, \$523 million in advanced procurement (current year), \$70 million in procurement funds for modifications to in-service aircraft, and \$350 million in R&D.⁴³ In their reports 108-622 (H.R. 4613) and 108-767 (H.R. 4200) appropriations and authorizations conferees cut \$30 million from the F-22 procurement request, and \$10 million from the R&D request.

The Administration's **FY2004** defense budget request included \$5.1 billion for the F-22A: \$4.2 billion in procurement (\$3.7 billion to procure 22 aircraft in FY2004 and \$498 million in advance procurement) and \$936 million for research and development.

In their report (H.Rept. 108-106, H.R. 1588) House authorizers reduced the Raptor's procurement funding request by \$161 million, providing \$4 billion to procure 22 aircraft in FY2004. Authorizers noted that the Air Force reduced airframe, engine, and avionics costs in FY2003 by increasing efficiency and negotiating lower vendor costs. The Committee expects those reduced costs to be achieved in FY2004, which suggests that the Air Force requires less money (\$161 million) to produce the same number of aircraft. Expressing their frustration with the Air Force's ability to improve the F-22A's avionics software reliability, the Committee recommended a

⁴² David Bond, "USAF Sees Need for Additional Test F/A-22," *Aviation Week & Space Technology*, February 14, 2005.

⁴³ The Air Force also requested \$35 million pertinent to the F/A-22 in FY2005 for a classified program and for aircraft support equipment.

provision (Sec. 134) limiting the obligation of \$136 million (the cost of one Raptor) until DOD could certify to Congress that the four F-22As being operationally tested could operate an average of at least 20 hours without an avionics software crash. House authorizers matched the Administration's request for F-22A R&D funding.

In their report (S.Rept. 108-46, S. 1050) Senate authorizers cut two aircraft and \$217 million from the Air Force's F-22A procurement request. Like the House, Senate authorizers expressed their concern with the F-22A program's avionics software reliability. They also noted the "continuing inability of this program to meet production schedules," and concluded that it would "not be prudent to authorize the ramp-up of procurement of F-22As to 22 aircraft in fiscal year 2004." (p.100) Like the House, Senate authorizers matched the Administration's request for F-22A R&D funding.

Authorization conferees (H.R. 1588, H.Rept. 108-354) followed the House recommendation, and reduced the Administration's FY2004 procurement request (22 aircraft) by \$161 million. Conferees matched the Air Force's request for advance procurement (\$498 million) and research and development (\$936 million). Following the House, conferees also limited the obligation of \$136 million in FY2004 funds until DOD certified that the F-22A avionics software was stable. Conferees reduced the yardstick from 20 hours between avionics software failures to five hours between failures.

House appropriators (H.R. 2658, H.Rept. 108-187) followed House authorizers by cutting \$161 million from the F-22A procurement request. Senate appropriators (S. 1382, S.Rept. 108-87) also cut \$161 million from the F-22A procurement request due to manufacturing efficiencies, but added \$5 million for "producibility," providing \$3.57 billion for FY2004 procurement. Appropriations conferees provided \$3.67 billion for F-22A procurement in FY2004, cutting \$80 million from the request due to cost savings.

The Administration's **FY2003** defense budget request included \$5.2 billion for the F-22A. A sum of \$4.6 billion was requested to procure 23 aircraft: \$530 million was for FY2004 advanced procurement (current year) and \$11 million was for modifications. The House (H.Rept. 107-436, H.R. 4546), the Senate (S.Rept. 107-151, S. 2514), and the authorizing conferees (H.Rept. 107-772, H.R. 4546) all matched the Administration's FY2003 request.⁴⁴

House appropriators (H.Rept. 107-532, H.R. 5010) provided \$4.1 billion to procure 23 F-22A's in FY2003.⁴⁵ However, the House Appropriations Committee also expressed concern over the slippage in F-22A developmental testing and the potential overlap between developmental testing and operational testing. Fearing that this potential overlap could result in costly retrofits, the appropriations report bars the Air Force from ordering more than 16 F-22As until DOD certifies that the proposed production rate is the lowest risk and lowest cost solution.⁴⁶ In their report

⁴⁴ "Senate Armed Services Committee Completes Markup of National Defense Authorization Bill for Fiscal Year 2003," Press Release, Senate Committee on Armed Services, May 10, 2002, p. 5. "House Armed Services Committee Reports Fiscal Year 2003 Defense Authorization Legislation," Press Release, House Committee on Armed Services, May 1, 2002, p. 14.

⁴⁵ Press Release, "House Passes FY03 Defense Appropriations Bill," House Committee on Appropriations, June 28, 2002.

⁴⁶ Paul Mann, "House Acts to Allay Future F-22 Cost Woes," *Aviation Week & Space Technology*, July 1, 2002. Marc Selinger, "House Panel Slashes Funds for BAT Submunition, Seeks F-22 Assurances," *Aerospace Daily*, June 26, 2002. Laura Colarusso, "House Appropriators Want Review of F-22 Program Risk, Test Delays," *Inside the Air Force*, June 28, 2002.

S.Rept. 107-213 (H.R. 5010), Senate appropriators matched the Administration's request for 23 aircraft in FY2003, but, citing delays in the aircraft's operational testing, cut \$28.5 million from procurement funding. Senate appropriators also matched the request for \$11.2 million in procurement for in-service modifications.

In H.Rept. 107-732 (H.R. 5010) Appropriations Conferees followed the Senate by cutting \$28.5 million from FY2003 procurement due to cost growth, but otherwise supported the Air Force's procurement request: \$4.06 billion for procurement, \$530.6 million in advanced procurement (current year), and \$11.2 million for modification of in-service aircraft. Conferees also included House language requiring that DOD certify that the proposed production rate is the lowest risk and lowest cost solution (p.206). Conferees matched the Administration's request for RDT&E funding: \$627 million for EMD, and \$181.2 for operational systems development.

Both the House and Senate Armed Services Committees supported the Administration's **FY2002** request for \$865.4 million in R&D, \$2.7 billion for 13 low-rate initial production aircraft, and \$379.2 million for advance procurement of 24 aircraft in FY2003. Both authorization committees also matched the Air Force's request for \$865 million in RDT&E funds. In their report on S. 1438 (H.Rept. 107-333) authorization conferees adopted a Senate provision to remove the \$20.4 billion legislative cost cap on F-22A Engineering, Manufacturing and Development.

House appropriators also supported the Administration's FY2002 request for 13 aircraft, but citing delays in anticipated production, the House Appropriations Committee cut \$2.6 million from the program. This adjustment included reductions in tooling (-\$100 million) and ancillary equipment (-\$14 million). However, the reduction was offset by an increase of \$111.4 million to redesign obsolete parts. House appropriators increased the Air Force's \$865 million R&D request by \$16 million. In their report on H.R. 3338 (S.Rept. 107-109), Senate appropriators matched the Air Force's procurement request for current and advance year procurement to build 13 F-22A Raptors and the Air Force's request for RDT&E funding.

In their report on H.R. 3338 (H.Rept. 107-350), appropriations conferees matched the Air Force's request for both procurement and R&D funding. Conferees transferred \$111 million from the F-22A's Advanced Procurement (Current Year) account to FY2002 procurement. Conferees also transferred \$16 million from the F-22A Operational Systems Development account to the EMD account.

In a letter to Defense Secretary Donald Rumsfeld, 59 Representatives recommended that DOD commence F-22A low rate initial production without delay. Expressing their fear that further delay would jeopardize the program, the bi-partisan group of Representatives said that the F-22A is ready to move into low-rate initial production.⁴⁷

Congress also approved the Pentagon's request to reprogram \$674.5 million in procurement funds from the projected purchase of the first 10 F-22A aircraft to sustain the EMD program. Reprogramming was requested because the Defense Acquisition Board decision on whether the F-22A program was ready for low-rate initial production (LRIP) was postponed indefinitely and FY2001 funds ran out. Congress had previously provided \$353 million in "bridge funding" to finance work on the F-22A from December 31, 2000, to March 30, 2001. The Air Force said that

⁴⁷ Frank Wolfe, "Further Delay Will 'Effectively Kill F-22,' 59 Lawmakers Say," *Defense Daily*, March 5, 2001.

these funds were needed to preclude a work stoppage, which they say would have resulted in increased costs and a serious erosion of the supplier base.

The Administration's **FY2001** budget requested \$3.9 billion for the F-22A program: \$2.5 billion for procurement of ten LRIP aircraft and \$1.5 billion in R&D funding. In their reports issued in May and June 2000, the congressional defense oversight committees recommended authorization and appropriation of funds equal to the Administration's request for both procurement and R&D.

While they approved the Administration's request for F-22A funding, the defense oversight committees expressed marked concern over the aircraft's testing program. House appropriators noted that the F-22A flight test program continues to fall short of Air Force projections. For instance, the program lost nine flight test months between November 1999 and March 2000. The committee was particularly concerned about slips in fatigue and static testing, both of which are more than a year behind schedule. To emphasize the extent of their concerns, the House Appropriations Committee re-stated the criteria established in P.L. 106-79 which prohibits award of a low rate production contract for the F-22A until: (1) first flight of an F-22A aircraft incorporating block 3.0 software, (2) certification by the Secretary of Defense that all Defense Acquisition Board exit criteria for award of low rate production has been met, and (3) submission of a report by the director of operational test and evaluation assessing the adequacy of the testing to date.

House appropriators were also concerned that the Air Force may try to contain F-22A program cost increases by further reductions in the test program. Therefore, the House Appropriations Committee proposed replacing existing, individual statutory budget caps on F-22A development and production with a single, overall cap for the entire program. The Senate Armed Services Committee also expressed concern that the Air Force might reduce testing to accommodate growing program costs. To ensure adequate testing is accomplished, Senate authorizers included a provision that would increase the F-22A EMD cost cap by 1%.

The FY2001 defense appropriations conference report (H.Rept. 106-754) fully funded the Administration's request for F-22A RDT&E and procurement funding. (\$2.5 billion in FY2001 and Advance Year Procurement, and \$1.4 billion in FY2001 RDT&E). Reflecting congressional concern over growing costs, the conferees stipulated that "The total amount expended by the Department of Defense for the F-22A aircraft program (over all fiscal years of the life of the program) for engineering and manufacturing development and for production may not exceed \$58,028,200,000." (Sec. 8125) Conferees also retained the House appropriations report language regarding flight testing, Secretary of Defense certification of meeting DAB goals, and requiring the director of operational test and evaluation to submit a report assessing the adequacy of avionics, stealth and weapons delivery testing.

Authorization conferees (H.Rept. 106-945, H.R. 4205) recommended funding to match the Administration's request for both procurement and RDT&E funding. Consistent with the Senate Armed Services Committee recommendation specifically and with concerns expressed by other defense oversight committees generally, conferees recommended an increase of the F-22A's EMD cost cap by 1.5% to ensure adequate testing.

The Administration's **FY2000** budget requested \$3.0 billion for the F-22A program: \$1.8 billion in procurement and \$1.2 billion in R&D funding for 6 low-rate initial production (LRIP) aircraft. The F-22A's increasing development cost was a major issue in congressional hearings and deliberations on the FY2000 defense budget (March 3, 10, and 17, 1999). GAO and CBO

analysts noted that the program's costs were higher than projected earlier, with the Administration request for FY2000 including \$312 million to cover "procurement cost growth."

The Senate version of the FY2000 defense authorization bill (S. 1059) as reported by the Senate Armed Services Committee (S.Rept. 106-50) and passed by the Senate on May 27, 1999, funded the program as requested. Section 131 of S. 1059 required "the Secretary of Defense to certify, before commencing low rate initial production of the F-22A, that the test program is adequate to determine its operational effectiveness and suitability, and that the development and production programs are executable within the cost caps [imposed in the FY1998 defense authorization act, P.L. 105-85]." The Senate version of the FY2000 defense appropriation bill (S. 1122) as reported by the Senate Appropriations Committee (S.Rept. 106-53) and passed by the Senate on June 8, 1999, also included funding for the F-22A program as requested.

The House version of the FY2000 defense authorization bill (H.R. 1401) as reported by the House Armed Services Committee (H.Rept. 106-162) and passed by the House on July 10, 1999, also funded the F-22A program as requested. The committee directed the Secretary of the Air Force to certify by February 1, 2000, that F-22A development and production aircraft "can remain within the cost limits and that testing of the aircraft will be performed in accordance with test plans that were in place when the cost limits were established [1997]," adding that "If the Secretary is unable to make such certification, he shall inform the committees of the reasons therefor and present a revised plan, including new cost estimates, for the acquisition of this aircraft." This language was included by House and Senate conferees in the conference report on FY2000 defense authorizations, which was agreed to on August 5, 1999 (H.Rept. 106-301, Sec. 131).

On July 22, 1999, the House passed its version of the FY2000 defense appropriation bill (H.R. 2561), which provided for the F-22A program only the \$1.2 billion requested in R&D funding. The \$1,852.1 million requested for procurement of 6 "low-rate initial production" (LRIP) F-22As would instead be used to buy other aircraft (8 F-15s, 5 F-16s, 8 KC-130Js, and 2 E-8s) as well as for pilot retention and various readiness programs. After citing the F-22A's technical problems and cost growth, the House Appropriations Committee report noted that "current threat projections for 2010 indicate that the United States will have a 5 to 1 numerical advantage of advanced fighters against our most challenging adversaries without the F-22." (H.Rept. 106-244: 17-21). Calling for a "production pause," the report denied funding for procurement of 6 LRIP F-22s in FY2000. Supporters of the F-22A argued that denying procurement funds in FY2000 could delay delivery of the plane by two years and add \$6.5 billion to the cost of the program. (See House debate in *Congressional Record*, July 22, 1999: H6250-H6254, H6258-H6262, H6267-H6279.)

The amount of F-22A procurement funding in FY2000 was the most contentious issue before the conferees, who reached an agreement in late September whereby some \$2.5 billion of the \$3 billion requested and authorized for the program would be appropriated (\$1,923 million for R&D and testing and evaluation of the aircraft, \$2.7 billion in advance procurement funds for 6 test aircraft, and \$300 million as a reserve fund for contract termination liability), with production to be delayed from 2000 to 2001. Representative Jerry Lewis, Chairman of the House Defense Appropriations Subcommittee, stated on October 6, 1999, that the "agreement precludes initiation of production in 2001 until the critical Block 3.0 software is successfully flown in an F-22 aircraft." He added that "we hope the national attention to the debate over the future of the F-22A program will lead to a heightened awareness in Congress and the Defense Department to the need for intense scrutiny and prioritization of all national defense programs, no matter how much we

have already spent on research and development or how vital they seemed when the process began.” (See H.Rept. 106-371: Sec. 8146, Sec. 8147.)

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