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F/A-22 Raptor

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Summary

The F/A-22 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/A-22 is intended to maintain U.S. Air Force capabilities against more sophisticated aircraft and missiles in the 21st century. This report examines the Air Force's F/A-22 Raptor program, including costs and schedule; considers several key issues, and concludes with a synopsis of recent legislative activity 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. If produced as now projected, F/A-22s could begin replacing F-15s after 2005.

Through FY2004 Congress provided some \$41 billion for the F/A-22. A 279-aircraft program was estimated by DOD in June 2004 to cost about \$72 billion in actual prior-year and projected out-year expenditures. The Administration's FY2005 budget requested \$4.8 billion for the F/A-22 program in procurement and development funds. Appropriators reduced this request by \$40 million.

The F/A-22 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.

Some question the urgency of procuring of the F/A-22 when production of comparable or better aircraft by other countries appears unlikely. Others argue that the F/A-22 should enter production as early as possible to cope with future threats from more advanced air defenses of potential enemies and to maintain the preeminent U.S. position in aviation technology and production. The airframe will be 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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F/A-22 Raptor

Introduction

Air Force officials regard the F/A-22 program as the service's highest aviation priority. Designed as a fighter with attack capability, the F/A-22 Raptor uses the latest developments in stealth technology to reduce the probability of detection by enemy radar as well as thrust-vectoring engines for more maneuverability and avionics that fuse and display information from on-board and off-board sensors in a single battlefield 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/A-22 could achieve initial operational capability in late 2005, with deliveries expected to continue into the 2010s. 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.¹ Known as the F-22 for several years, the Air Force began calling the aircraft the F/A-22 in 2002 to emphasize the Raptor's attack capabilities.

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 reducing 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

¹ The number of companies involved in the F/A-22 program is vast. 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. [<http://www.globalsecurity.org>]

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. 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 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/A-22's development/production schedule has also been delayed. Citing budgetary constraints, reduced threats in Europe, and the F-15's longer service life as reasons for deferring production, Secretary of Defense 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 F/A-22 program. Based on the FY2005 President's budget submission, the Bush Administration's current plan is to procure at least 276 F/A-22's.

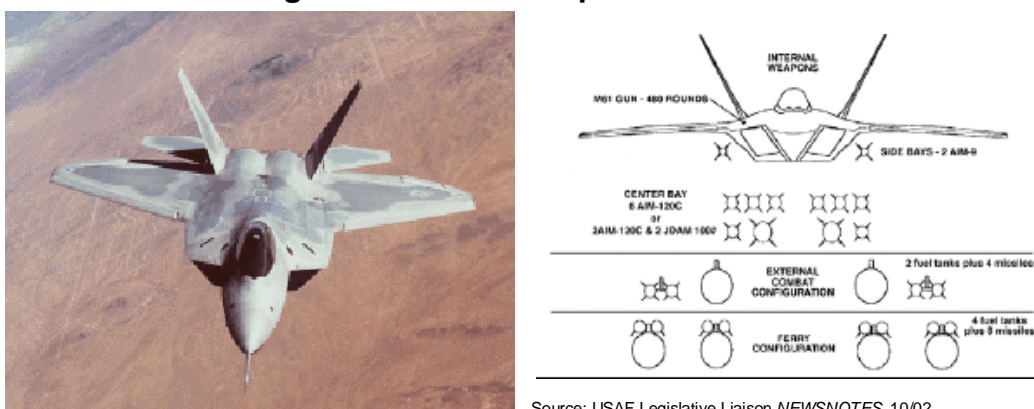
Originally conceived of as an air superiority fighter with minimal air-to-ground attack capability, the Air Force has increasingly emphasized the F/A-22's potential for air-to-ground attack over time. An "A" (for "attack") was added to the F-22 designation in September 2002 to signify the plane's ability to conduct these types of attacks. In 2003, the Air Force began letting contracts to the F/A-22's builders that focused on the improvements to radar and communications required to upgrade the *Raptor's* air-to-ground capabilities.

In April 2003 the F/A-22 entered Initial Operational Test and Evaluation. Following this testing phase a decision will be made on whether the Raptor is ready to enter full rate production. This decision is currently scheduled for March 2005.

System Description

The production version of the F/A-22 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 32,000 lb (without fuel and munitions). Powered by two Pratt & Whitney F-119 turbofan engines with afterburners and thrust-vectoring nozzles, the F/A-22 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/A-22 Weapons Loadout



The F/A-22's armaments 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/A-22'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 low-probability of intercept communications.

Planned Procurement Quantity

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 279 Raptors under current projections.² Any further increases in the cost of

² "Conferees Put Caps on F-22 EMD, Production," *Aerospace Daily*, Oct. 27, 1997, p.139B. Tony Capaccio, "Lockheed Must Cut F-22 Cost For U.S. To Buy More, Zackheim Says," *Bloomberg.com*, Jan. 30, 2003.

the F/A-22 program have to be mitigated by reducing the number of aircraft produced or by relaxing or eliminating the cost cap.

On December 23, 2004, an internal DOD Program Budget Decision (PBD 753) was leaked to the press. PBD 753 recommended ending F/A-22 production in FY2008 and trimming 96 aircraft from the 279 planned purchase. These reductions would preclude approximately \$10.4 billion in spending on the F/A-22. If PBD 753's recommendation is implemented, the Air Force could field a fleet of only 183 Raptors.³

Costs

The Defense Department's Selective Acquisition Report of June 30, 2004, estimated the total program cost of 279 aircraft at \$71.7 billion in current year dollars. This equates to a total program acquisition cost (the total cost of acquiring the aircraft, including R&D and military construction investments) of \$256.9 million for each of the 279 aircraft. Some, including the Air Force, argue that "flyaway" cost is a better representation of the F/A-22's unit cost. Flyaway costs include management, hardware, software, and nonrecurring "start-up" costs. An aircraft's flyaway cost does not reflect the cost of many investments that some argue are required to acquire and fly the aircraft, such as technical data, training and maintenance manuals, contractor services, support equipment, training equipment, factory training, initial spares, or military construction. The F/A-22's flyaway cost is estimated at \$133 million per aircraft.

Funding of the F/A-22 began in the early 1980s (as the Advanced Tactical Fighter, or ATF) and is projected to continue into the FY2010s. Some \$36.1 billion, mainly in R&D funding, has been spent on the F/A-22 through FY2003. The Office of the Secretary of Defense (OSD) Comptroller estimates that \$25.2 billion remains to be spent on the program. Through FY1992 the program received about \$165 million in Navy R&D funds for a naval variant that was not developed.

In early 2004 some debate emerged over whether additional costs would need to be incurred by enhancing the F/A-22'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.

FB-22

Lockheed Martin has initiated the study of a radically modified version of the Raptor called the FB-22. This variant would seek to significantly increase the F/A-22'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-

³ PBD 753 can be accessed, with a subscription, at [<http://www.defensenews.com/content/static/dn.pbd753.pdf>].

lb Small Diameter Bombs.⁴ These potential improvements would likely result in some performance tradeoffs, such as reduced acceleration and maneuverability.

Although not officially part of the F/A-22 program and still very much in the conceptual phase, some Air Force leaders have expressed enthusiasm for the idea. 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.⁵ Air Force leaders have also 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. Air Force acquisition chief Marvin Sambur said that the F/A-22's difficulties would have to be solved before the FB-22 could be considered.⁶ Also, the cost of developing the FB-22 are debated. Some argue that by leveraging the F/A-22 cockpit, engines, computer systems, production methods and materials, the FB-22 could be produced relatively cheaply. Others argue that re-designing 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. House Armed Services Committee Chairman 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."⁷

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.⁸

In congressional testimony, Secretary Roche suggested that up to 150 FB-22s could be procured. Full-rate production could be achieved by FY2011, Roche estimates, if development funds were committed in FY2004.⁹ No funds in the F/A-22 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

⁴ 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*, Mar. 4, 2002.

⁵ Ron Laurenzo, "Roche Envisions Close Air Support F-22," *Defense Week*. July 1, 2002.

⁶ Bill Sweetman. "Smarter Bomber," *Popular Science*, June 25, 2002.

⁷ Lorenzo Cortes, "Roche Looking to Next Year for Near-Term Proposals on Strike Concepts," *Defense Daily*, Mar. 17, 2004.

⁸ Lorenzo Cortes, "Lockheed Martin Expects FB-22 To Compete Against UAVs, 'Arsenal Ship' Ideas," *Defense Daily*. March 20, 2004.

⁹ Lorenzo Cortes, "Air Force Issues Clarification on FB-22, FY'11 Delivery Date Possible," *Defense Daily*, Mar. 10, 2003.

concept are still quite notional. How this multi-role aircraft would compete with — or conversely complement — the JSF has not yet been determined. The feasibility of expanding the F/A-22's ground attack capabilities, either in its current configuration or in a redesigned configuration, is currently unclear. In July 2003 it was reported that Air Force officials have discovered that the F/A-22 will likely not be able to carry external fuel tanks without encountering structural problems. The FB-22 could also encounter similar difficulties.¹⁰ The Air Force disputes claims that the F/A-22 can't effectively employ external fuel tanks.

Key Issues

The main issues associated with the F/A-22 center on four overlapping areas. The first issue is whether the Raptor should be built at all. The F/A-22 has been a defense budget issue since 1990 when reassessments of Soviet capabilities called into question the need to replace current fighters with next-generation aircraft. The specifics of this debate have changed over time, but the essence of the debate remains consistent. The second issue is one of quantity. If the Raptor is to be built, how many should be built? The third issue is one of budget and schedule: are they satisfactory? The potential for foreign sales is the fourth issue.

Does the United States Need the F/A-22?

Main Arguments of Those Favoring the F/A-22. Its advocates argue that the F/A-22 will be the first stealthy fighter/attack aircraft that combines supersonic speed without resort to afterburners (requiring additional fuel), maneuverability via thrust-vectoring engines, and fusion of multi-sensor avionics data via computers, and this will enable pilots to destroy enemy aircraft and ground-based air defenses at greater standoff ranges. They argue that the United States must develop a next-generation fighter if we are to maintain a technological lead in the development and production of combat aircraft. Soviet MiG-29s and Su-27s are equal to or better than current U.S. fighters in combat capabilities, according to F/A-22 advocates, and European aerospace industries are likely to produce more advanced aircraft in the years ahead.

Air Force officials say that experiments conducted at Air Force test ranges indicate that the most advanced Russian fighters consistently defeat F-15s in dogfight situations.¹¹ These aircraft could pose serious threats in regional conflicts. Further, recent exercises with the Indian Air Force surprised U.S. Air Force participants. The Indian pilots were much more experienced than U.S. intelligence estimated they would be, and demonstrated advanced tactics and strategy. Other developing world air forces may be more potent than anticipated, argue F/A-22 supporters. When the F/A-22 enters service after 2005, many U.S. Air Force and Navy fighters (developed in the mid-1970s) will be about 30 years old.

¹⁰ Laura Colarusso, "Plans to Extend F-22 Range Frustrated by Structural Limit Problems," *Inside the Air Force*, July 26, 2002.

¹¹ Ron Laurenzo, "Air Force Inflates Russian Fighter Threat, Experts Say," *Defense Week*, July 22, 2002.

Proponents also believe the F/A-22 is needed as a hedge against a revived Russian threat as well as unpredictable third-world dangers in the years ahead, and they see the program as necessary to maintain U.S. industrial capabilities for development and production of advanced aircraft. With some 30 major subcontractors and some 4,500 suppliers in 48 states, the F/A-22 program is expected to generate up to 28,000 jobs at peak production, with indirect employment adding up to 112,000 jobs, according to contractor estimates in 1999.

Proponents further assert that current operational fighters cannot be modified further to provide the stealth and other combat capabilities needed to cope with the air defenses many Third World countries may possess in the 2000s, when economic conditions in the former Soviet bloc may stimulate the proliferation of sophisticated military technology, particularly in surface-to-air missiles. Ukraine's recent sale of air defense radars to Iraq is one example of this threat, proponents say. Over time, these advanced air defenses are likely to become a bigger impediment to U.S. air operations than advanced enemy fighters. Along with the stealthy B-2, the F/A-22 will be part of the Air Force's Global Strike Task Force, which is designed to destroy particularly threatening systems such as the Russian SA-10 and SA-12 surface-to-air missiles. The F/A-22 and B-2 are the only systems capable of eliminating these "anti-access" threats and create an environment in which the rest of the U.S. air forces can operate safely. In sum, proponents view the F/A-22 as the cornerstone of future U.S. air dominance and its combination of advanced technologies as a key catalyst and component of a true Air Force transformation.

Main Arguments of Those Against the F/A-22. Critics argue that the F/A-22 is not a prudent use of scarce defense dollars. Recent conflicts in Iraq, Kosovo, and Afghanistan have shown that today's U.S. military aircraft strongly dominate the competition. The F/A-22 was designed principally to defeat the Russian air force, and production of a new generation of fighter planes cannot be justified in light of the collapse of this threat critics contend. Instead, they argue, the United States should concentrate on programs to upgrade and modernize existing U.S. fighter and attack aircraft while improving their air-intercept missiles and avionics to counter future advances in the aircraft of potential enemies. Also, improvements to surveillance and reconnaissance aircraft such as AWACS and the E-2C Hawkeye, along with the fielding of advanced data links such as Link-16, will greatly improve the combat capability of today's fighter aircraft.

While the proliferation of advanced Russian SAMs is cause for concern, F/A-22 opponents argue that the pace and scope of this proliferation is actually much slower and narrower than once projected. Russian arms exports have not competed well with Western arms exporters generally, they argue, and the sale of the more advanced and more expensive SAMs has been infrequent. Only Russia and China field these most threatening systems today, critics argue, and few countries have the kind of defense budgets that would support such expenditures. Development of the F/A-22 might be continued as a hedge against long-term threats, its critics assert, but there are too many uncertainties about the need for this aircraft to warrant major funding commitments to the program over the near term, which may jeopardize funding of other critical weapon systems, such as tactical and strategic missile defenses.

Critics argue that our limited defense funds could be more prudently invested developing unmanned aerial vehicles (UAVs) and unmanned combat vehicles (UCAVs) more aggressively as well as fielding better electronic warfare capabilities to counter the air defenses of likely enemies. F/A-22 detractors point out that the U.S. Navy and Marine Corps will also have to operate in the same future threat environment as the Air Force. Yet, unlike the Air Force, these services believe that the much more modestly priced Joint Strike Fighter, along with robust electronic warfare assets will be adequate to defeat double digit SAMs. Finally, F/A-22 opponents argue that pursuing this aircraft may actually impede a military transformation by locking the Air Force too long into traditional manned aircraft. Instead, the Air Force would be better off more aggressively pursuing more revolutionary warfighting technologies such as UCAVs, airborne lasers, or space-based weapons, they argue.¹²

Production Quantity

Like some other aviation modernization programs (e.g., the RAH-66 Comanche helicopter), the F/A-22 planned production quantity has fluctuated considerably, with the overall trend downward. Originally pegged at 750 aircraft, the F/A-22 program today is to produce as few as 276 Raptors.¹³ The debate regarding F/A-22 quantity implicitly incorporates many of the arguments described above, and tends to explicitly focus on the issues of capability and cost.

Some have argued that because it will be much more capable than the F-15, the F/A-22 does not have to replace that aircraft on a one-for-one basis. In 1997, then-Defense Secretary William Cohen, for example, cited the F-22's superior combat capability as a reason for that year's Quadrennial Defense Review's (QDR) proposed reduction to 341 Raptors. Then Secretary of the Air Force Whitten Peters endorsed this number in 2000, saying that 341 F/A-22 Raptors "...is about the right number for 10 AEFs."¹⁴ AEF's (Air Expeditionary Forces) are the core units of Air Force's organizational scheme.

One argument for the number of F/A-22's to be produced is what the Air Force calls its "buy-to-budget strategy." The Air Force wants more Raptors than are currently budgeted. As savings and efficiencies are realized in the program, however, the Air Force hopes to increase the number of aircraft that can be purchased under this budget. In March 2004, the General Accounting Office issued a report (GAO-04-391) which 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.

¹² For more information about UCAVs, see CRS Report RL31014, *Unmanned Combat Air Vehicles: Issues and Outlook*, by Robert E. Chapman II.

¹³ This number may decrease further, potentially down to 224 aircraft, under the \$36.8 cost congressional cost cap.

¹⁴ Frank Wolfe, "Peters: 339 F-22s 'About The Right Number' for 10 AEFs," *Defense Daily*, July 26, 2000, p. 8.

Due to the intersection of a perceived reduction in threat, growing costs, and high expectations for the F/A-22's combat capability, some have argued that a "silver bullet" force of Raptors is appropriate, numbering between 100 and 200 aircraft. The Defense Planning Guidance (DPG) has directed the Air Force to study the pros and cons of trimming the overall F/A-22 purchase to 180 aircraft. Representative John Murtha, ranking Democratic member of the House Defense Appropriations Subcommittee, has reportedly stated that, depending on the threat and budget constraints, "the Air Force will be lucky" to get 140 F/A-22s. Subsequently, Representative Murtha reinforced his position, saying that he didn't think the current threat justified more than 150 Raptors, and that "I don't think we'll have the money to build any more."¹⁵ As mentioned earlier in this paper, Presidential Budget Decision 753, if enacted, could cut the Raptor purchase to as few as 179 aircraft, not far off Representative Murtha's prediction.

Others, both in Congress and in DOD, argue for an increase in the number of Raptors. The most senior Air Force leaders, Secretary James Roche and Chief of Staff General John Jumper, have advocated a buy of up to 800 F/A-22 and FB-22s. They say that larger numbers of these aircraft would improve the Air Force's ability to attack the kinds of time critical targets associated with terrorists and weapons of mass destruction delivery systems.¹⁶

In a white paper for the Congressional Electronic Warfare Working Group, Representative Jim Gibbons supported the purchase of 750 Raptors. Representative Gibbons argued that procuring 750 F/A-22s would reduce the cost per aircraft significantly and would more appropriately outfit the Air Force's 10 AEFs than 341 Raptors. Additionally, he wrote, 750 Raptors would allow the Air Force to reallocate its most advanced F-16s to the Guard and Reserves.¹⁷ Representative Randy "Duke" Cunningham is also reportedly in favor of procuring 750 F/A-22s, both to improve U.S. capabilities relative to advanced Russian fighters and to reduce the cost per aircraft procured.¹⁸

Budget and Schedule

Observers and policy makers have consistently raised concerns over the F/A-22 program's cost and schedule. Recently, for example:

¹⁵ "Rep. Lewis: F-22, JSF Numbers to be Set in Two to Three Years," *Aerospace Daily*, Oct. 8, 1999:43,46. Frank Wolfe, "Murtha: Pentagon Can Afford only 150 F-22s," *Defense Daily*, Sept. 22, 2000, p.2.

¹⁶ Nick Cook, "USAF Launches 'Big Sell' Bid for 800 F-22s," *Jane's Defence Weekly*, July 31, 2002.

¹⁷ Rep. Jim Gibbons, "F-22X: The Key to Negating Anti-Access Threats," Electronic Warfare Working Group, Issue Brief #3, Mar. 13, 2001.

¹⁸ Sharon Weinberger, "DAB approves F-22 Raptor for LRIP, but lowers planned production number," *Aerospace Daily*, Aug. 16, 2001, p.1. Marc Selinger, "DoD Needs to Keep Close Eye on JSF Development Lawmaker Says," *Aerospace Daily*, Feb. 19, 2002, p.6.

- On November 14, 2002, officials acknowledged that the program was four months behind schedule and that the operational testing phase would begin in August 2003 rather than the previously planned April 2003 start date.¹⁹ On December 6, 2002, Air Force officials announced that the EMD phase of the Raptor program had experienced a potential cost overrun of between \$700 million and \$1 billion.²⁰
- In March 2003 the F/A-22 budget and schedule again came under fire. The GAO estimated that the Air Force budget had not accounted for up to \$1.3 billion in estimated costs.²¹ The Air Force and Lockheed Martin disputed GAO's claim that the most recent F/A-22 cost estimate did not include these costs, which the GAO said were primarily due to program delays, less than anticipated savings from the JSF program, and switching avionics subcontractors. In November 2003 it was reported that avionics reliability had improved to an average failure rate of once every 21 hours and that the DOD was confident that this rate could be maintained.²² Regardless, some in Congress expressed deep concern over the Raptor's budget and schedule.²³
- On April 4, 2003, DOD released its Select Acquisition Report for December 31, 2002, and revealed that F/A-22 program costs had increased by \$2 billion due to increases in engine and airframe recurring costs, additional risk, and reduced production cost savings. To address these increased costs, DOD reduced the planned F/A-22 purchase by 63 aircraft (from 341 to 278), and restructured the program by moving \$763 million from the F/A-22 procurement account through FY2006 to the R&D account to pay for cost overruns there.²⁴
- On March 22, 2004, the Defense Acquisition Board approved the Air Force's plan for the F/A-22 to enter IOT&E in April 2004. This

¹⁹ Laura Colarusso, "Air Force Discloses Raptor Entry to DIOT&E Will Slip Four Months," *Inside the Air Force*, Nov. 15, 2002, p.1. There has been no official public report on the December 5 meeting.

²⁰ Ron Laurenzo, "Air Force Challenges Lockheed Martin Over F/A-22," *Defense Week*, Dec. 9, 2002.

²¹ General Accounting Office, *DoD Needs to Better Inform Congress about Implications of Continuing F/A-22 Cost Growth*, GAO-03-280, Feb. 2003.

²² Tony Capaccio, "Lockheed Appears to be Fixing F/A-22 Avionics Flaws, Wynne Says," *Bloomberg.com*, July 31, 2003.

²³ Ron Laurenzo, "Congressman Slams Air Force over F/A-22," *Defense Week*, Mar. 24, 2003.

²⁴ *Selected Acquisition Report (SAR) Summary Tables*, as of Date Dec. 31, 2003, DOD (OUSD (AT&L) AR&A/AM, Apr. 4, 2003, pp .6-7. Amy Butler, "DoD Restructures F/A-22 Program, Slices 49 Airframes from Buy," Jan. 6, 2003.

approval followed, however, months of debate over whether the aircraft was ready to enter operational test. Senior Air Force officials commented that they thought the F/A-22 might not be ready,²⁵ and the Director of Operational Test and Evaluation reported that problems in the F/A-22 program posed high risks to its test schedule.²⁶

In November 2004 the F/A-22 program received good news. Acting DOD acquisition chief Michael Wynne approved the criteria required for the F/A-22 to full rate production.²⁷

The F/A-22's production quantity is directly tied to its budget and schedule. Because of the production cost cap, the Air Force is pursuing a "buy to budget" strategy: it will purchase as many F/A-22's as the \$36.8 billion budget allows. Under current law, if F/A-22 costs go up, no funds can be added to the budget, so increased costs must be offset by fewer aircraft buys. Thus, any turbulence in the F/A-22's schedule that raises cost, threatens the final F/A-22 production quantity; unless the current congressionally mandated cost cap is relaxed or eliminated.

Generally at issue is whether the F/A-22 can be produced on schedule (2005 IOC), and at a cost that would not require any further reduction in final production quantity. In May 2004 Air Force acquisition chief Marvin Sambur told defense reporters that the F/A-22's IOC could slip "a couple of months" beyond the program goal of December 2005.²⁸ Air Force Chief of Staff subsequently disagreed with Sambur, saying the December 2005 goal was still attainable. Opponents of the program say that the schedule has consistently failed to meet objectives, and that program costs have risen despite a reduction in aircraft. F/A-22 proponents argue that the Air Force is developing the world's most advanced tactical fighter, and that some perturbation in cost and schedule can be expected and is acceptable. Specific issues of concern may include:

- **Unexpected Technical Problems:** Leaders of both the Air Force and the Raptor's manufacturer Lockheed Martin Corp. have expressed confidence that the F/A-22's development problems have been solved, that the aircraft's design is sound, and that modernization should go smoothly. Air Force Acquisition Chief Marvin Sambur, for example, reported that the F/A-22's longstanding problems with

²⁵ See Marc Selinger, "Roche: F/A-22's Readiness for Key Testing Phase is 'Iffy,'" *Aerospace Daily*, Mar. 18, 2004. Elizabeth Rees, "F/A-22 DAB Review Brings No Opposition to Plans for April IOT&E Start," *Inside the Air Force*, Mar. 26, 2004.

²⁶ Hampton Stephens, "DOT&E Report: Raptor Testing Problems Pose High Schedule Risk," *Inside the Air Force*, Jan. 23, 2004.

²⁷ Marc Selinger, "F/A-22 Inches Closer to Full-Rate Production," *Aerospace Daily & Defense Report*, Nov. 11, 2004.

²⁸ Elizabeth Rees, "Sambur: F/A-22 IOC Date May Slip a Few Months, Move into 2006," *Inside the Air Force*, May 7, 2004.

avionics software stability had been remedied²⁹ Yet some fear that unexpected technical problems could still surface in this complicated program, and at this late stage of development, cause expensive delays. 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.³⁰ Further, during flight testing on September 28, 2004, an F/A-22 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.³¹ Finally, on December 20, 2004, a Raptor crashed and was destroyed at Nellis AFB. This mishap is being investigated, and it is not yet clear if it was caused by a technical problem.

- Variance in budget estimates: The Air Force, the Office of the Secretary of Defense (OSD), and the GAO have frequently differed in their estimates of the F/A-22 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.³² 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.³³ In July 2004 appropriations conferees called for a new and independent cost estimate of the F/A-22 program (see below).

²⁹ Marc Selinger, “F/A-22’s software stability ‘no longer an issue,’ USAF says,” *Aerospace Daily & Defense Report*, May 3, 2004.

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

³¹ David Fulghum, “Questions Abound After F/A-22 Crash,” *Aviation Week & Space Technology*, Jan. 3, 2005.

³² 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.

³³ “Quarterly Reports Urged on F-22 Production Costs,” *Aerospace Daily*, Aug. 16, 2000.

- **Adequacy of Testing:** Some fear that as program officials attempt to keep the F/A-22 program on schedule and on budget, they may not follow as robust a testing regime as desirable. For example, after Chief of Staff of the Air Force General Mike Ryan testified that F/A-22's EMD phase would be extended from November 2001 to the spring of 2002, DOD's director of Operational Test and Evaluation recommended extending the F/A-22 engineering, manufacturing and development (EMD) phase an additional nine months to conduct additional tests and to reduce "unacceptable risks." General Ryan disputed this recommendation, calling the F/A-22 "the most extensively tested fighter in history."³⁴ In July 2003 it was announced that the Air Force was splitting the test program into two phases to prevent a shortage of test aircraft from slowing down the timetable.³⁵ Policy makers may ask whether this change was simply a clever innovation or an erosion of the F/A-22's test program caused by budget and schedule pressures.
- **Production Tempo:** The testing issue is directly tied to production tempo. Some recommend that the Air Force slow the speed of F/A-22 production until more testing can be completed to verify the Raptor's performance estimates. Also, some fear that if too many aircraft are produced prior to completion of testing, that a large number of these aircraft will have to be retrofitted with improvements that are identified after they are manufactured. The GAO has recommended that DOD reduce production rates until more development risks are ameliorated.³⁶ The Air Force disputes that the current plan will result in costly retro fits. One senior DOD official reportedly commented that implementing GAO's LRIP recommendation could "destabilize program cost and schedule."³⁷
- **Production Cost Cap:** A final issue is the efficacy, impact and future of the congressionally mandated production cost cap. Concerned with rising costs, and seeking to impose fiscal responsibility and accountability on the F/A-22 program, congressional overseers imposed a cap on the Raptor's production. One result of the cap is that the number of aircraft that can be procured as costs rise has decreased, which the Air Force has labeled its "buy to budget strategy." Some observers have criticized this strategy. GAO chief David Walker testified against the "buy to budget" approach, saying that instead of just settling for however many aircraft they can

³⁴ Anne Marie Squeo, "Lockheed's Next-Generation F-22 Faces More Development Hurdles," *Wall Street Journal*, Jan. 5, 2001, p.4

³⁵ Robert Wall, "Tweaks to the F/A-22," *Aviation Week & Space Technology*, July 28, 2003.

³⁶ General Accounting Office, *DoD Should Reconsider Decision to Increase F/A-22 Production Rates While Development Risks Continue*, GA0-03-431, Mar. 2003.

³⁷ Daniel Dupont, "Test Snags Prompt GAO to Call for Initial F-22 Buy Rate Reduction," *Inside the Air Force*, Mar. 8, 2002.

afford, DOD must instead articulate a clear and compelling business case for the F/A-22. Specifically, Walker said this plan should include estimates of “how many do we need, for what purpose, at what cost, and with what ripple effect on budgets and other programs.”³⁸ On March 3, 2005, GAO officials again testified that F/A-22 original business case was weak.³⁹ Air Force officials say that they are developing a new business case as part of the 2005 Quadrennial Defense Review, want the cost cap raised or eliminated.⁴⁰

Enhancing Attack Capabilities

The Air Force originally conceived of the Raptor as an air superiority fighter with minimal air-to-ground attack capabilities. Today, the Air Force bills the Raptor as a multi-role combat aircraft and is pursuing upgrades to the aircraft’s air-to-ground 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 including adding a ground moving-target indicator, a high-resolution synthetic aperture radar, and a fourth-generation electronically scanned array. Enhancing the Raptor’s attack capabilities raises two broad issues: are these capabilities needed? And are these capabilities worth the cost?

Are These Capabilities Needed? In their report GAO-04-391, the GAO suggests that the need for the F/A-22’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/A-22 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/A-22’s 2,000 lbs) and will also employ an advanced air-to-ground radar. A detailed description of how the F/A-22 will improve upon the JSF’s attack capabilities and how these aircraft might be used in operational scenarios could prove useful.

³⁸ Statement of David M. Walker, Comptroller of the United States. Testimony Before the Subcommittee on National Security, Emerging Threats, and International Relations, Government Reform Committee, House of Representatives, Apr. 11, 2003.

³⁹ Statement of Michael Sullivan and Allen Li, Directors, Acquisition and Sourcing Management Issues. General Accountability Office. “Status of the F/A-22 and JSF Acquisition Programs And Implications for Tactical Aircraft Modernization.” *Testimony Before the Subcommittee on Tactical Air and Land Forces, Committee on Armed Services*. March 3, 2005.

⁴⁰ Email from USAF LLW to CRS February 16, 2005.

Are These Capabilities Worth the Cost? The GAO (GAO-04-39, pp.7-8) reports that enhancing the Raptor's attack capabilities will cost an additional \$11.7 billion over current budget projections. 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/A-22 with the conceptual FB-22.⁴¹ 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/A-22, it could mean that the Air Force could not afford the 279 aircraft it plans to build. Roughly speaking, the Air Force might have to reduce its purchase by approximately 45 aircraft (\$11.7 billion / \$257 million per aircraft). The GAO estimates that only 218 Raptors would be affordable under the current "buy-to-budget" strategy. 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.⁴²

Some fear that adding new capabilities at this relatively late stage in the F/A-22 program could increase costs by complicating the program and stretching out its development. Resolving instability problems with the F/A-22'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, some argue, could jeopardize the progress that has been made in the avionics software.

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.⁴³

DOD officials have suggested that they favor foreign sales of the F/A-22.⁴⁴ However, Congress has expressed opposition to exporting the Raptor. In 2001 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."⁴⁵ While it may be difficult to envision many countries with defense

⁴¹ David Fulghum, "Escalation Clause," *Aviation Week & Space Technology*, Mar. 22, 2004. Gail Kaufman, "Putting the 'A' in F/A-22," *Defense News*, Mar. 8, 2004. Lorenzo Cortes, "GAO Official Says Adding Ground Attack to F/A-22 costs \$8 Billion," *Defense Daily*, Mar. 26, 2004.

⁴² Email from USAF LLW to CRS February 16, 2005.

⁴³ For more information on arms sales, see CRS Report RS20757 and CRS Report RL32084.

⁴⁴ Frank Wolfe, "Aldridge JSF Letter Hints at Administration Favor Toward F-22 Foreign Sales," *Defense Daily*, Oct. 5, 2001.

⁴⁵ *Making Appropriations for the Department of Defense for the Fiscal Year Ending Sept. 30, 2001, and for Other Purposes*, Conference Report, H.Rept. 106-754 (H.R. 4576), July (continued...)

budgets adequate to accommodate such an advanced and, some argue, expensive aircraft, Australia has reportedly expressed interest in the Raptor.⁴⁶ At one point the Israeli Air Force had hoped to purchase up to 50 F/A-22s. 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.⁴⁷

If F/A-22 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.

Congressional Action

The F/A-22 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/A-22 controversies in Congress have focused on F/A-22 procurement spending. Congress has imposed a spending cap on the F/A-22 program to help control costs, and the level and scope of this cap has been debated. Also, FY2000 procurement funding for the F/A-22 was eliminated by House appropriators and later reinstated by conferees.

The Administration's **FY2006** defense budget request included \$3.89 billion for the F/A-22. 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 25.⁴⁸

The Administration's **FY2005** defense budget request included \$4.8 billion for the F/A-22. 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.⁴⁹ FY2005

⁴⁵ (...continued)

17, 2000, sec. 8087, p.38.

⁴⁶ Neil Baumgardner, "Lockheed, Boeing BAE, Dassault, Saab Respond to Australian Fighter Survey," *Defense Daily International*, Feb. 1, 2002.

⁴⁷ Barbara Opall-Rome, "Israel Says 'No Thanks' to F/A-22," *Defense News*, Nov. 24, 2003.

⁴⁸ David Bond, "USAF Sees Need for Additional Test F/A-22," *Aviation Week & Space Technology*, Feb. 14, 2005.

⁴⁹ The Air Force also requested \$35 million pertinent to the F/A-22 in FY2005 for a classified program and for aircraft support equipment.

congressional action on the F/A-22 is summarized in the table below. Additionally, Appropriations conferees followed Senate appropriators in calling for an independent F/A-22 program cost estimate. This cost estimate is due to the defense oversight committees no later than August 15, 2005.⁵⁰

Table 1. F/A-22 FY2005 Budget

(\$ millions)

	Procurement		RDT&E
	\$	#	
Request	4,227.1	24	564.5
Authorization, House	4,227.1	24	564.5
Authorization, Senate	3,947.1 -280	-2	564.5
Authorization Conference	4,197.1 -30	24	554.5 -10
Appropriation, House	4,197.1 -30	24	554.5 -10
Appropriation, Senate	4,197.1 -30	24	564.5
Appropriation Conference	4,197.1 -30	24	554.5 -10

Sources: Procurement Programs (P-1), *Department of Defense Budget for FY2005*, Feb. 2004. RDT&E Programs (R-1), *Department of Defense Budget for FY2005*, Feb. 2004. Committee reports 108-491, 108-260, 108-767, 108-553, 108-284, 108-622.

The Administration's **FY2004** defense budget request included \$5.1 billion for the F/A-22: \$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/A-22's avionics software reliability, the Committee recommended a provision (Sec. 134) limiting the obligation of \$136 million (the cost of one Raptor) until DOD could certify to Congress that the four

⁵⁰ H.R. 4613 (108-622) pp.215-216.

F/A-22s 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/A-22 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/A-22 procurement request. Like the House, Senate authorizers expressed their concern with the F/A-22 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/A-22s to 22 aircraft in fiscal year 2004." (p.100) Like the House, Senate authorizers matched the Administration's request for F/A-22 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/A-22 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/A-22 procurement request. Senate appropriators (S. 1382, S.Rept. 108-87) also cut \$161 million from the F/A-22 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/A-22 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/A-22. 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.⁵¹

House appropriators (H.Rept. 107-532, H.R. 5010) provided \$4.1 billion to procure 23 F/A-22's in FY2003.⁵² However, the House Appropriations Committee also expressed concern over the slippage in F/A-22 developmental testing and the potential overlap between developmental testing and operational testing. Fearing that

⁵¹ "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.

⁵² Press Release, "House Passes FY03 Defense Appropriations Bill," House Committee on Appropriations, June 28, 2002.

this potential overlap could result in costly retrofits, the appropriations report bars the Air Force from ordering more than 16 F/A-22s until DOD certifies that the proposed production rate is the lowest risk and lowest cost solution.⁵³ In their report 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/A-22 Engineering, Manufacturing and Development.

House appropriators also supported the Administration's FY2002 request for 13 aircraft, but citing delays in anticipated production, the HAC 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/A-22 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/A-22's Advanced Procurement (Current Year) account to FY2002 procurement. Conferees also transferred \$16 million from the F/A-22 Operational Systems Development account to the EMD account.

In a letter to Defense Secretary Donald Rumsfeld, 59 Representatives recommended that DOD commence F/A-22 low rate initial production without delay.

⁵³ 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.

Expressing their fear that further delay would jeopardize the program, the bi-partisan group of Representatives said that the F/A-22 is ready to move into low-rate initial production.⁵⁴

Congress also approved the Pentagon's request to reprogram \$674.5 million in procurement funds from the projected purchase of the first 10 F/A-22 aircraft to sustain the EMD program. Reprogramming was requested because the Defense Acquisition Board decision on whether the F/A-22 program was ready for LRIP was postponed indefinitely and FY2001 funds ran out. Congress had previously provided \$353 million in "bridge funding" to finance work on the F/A-22 from December 31, 2000, to March 30, 2001. The Air Force said that 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/A-22 program: \$2.5 billion for procurement of ten low-rate initial production (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/A-22 funding, the defense oversight committees expressed marked concern over the aircraft's testing program. House appropriators noted that the F/A-22 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/A-22 until: (1) first flight of an F/A-22 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/A-22 program cost increases by further reductions in the test program. Therefore, the House Appropriations Committee proposed replacing existing, individual statutory budget caps on F/A-22 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/A-22 EMD cost cap by one percent.

The FY2001 defense appropriations conference report (H.Rept. 106-754) fully funded the Administration's request for F/A-22 RDT&E and procurement funding.

⁵⁴ Frank Wolfe, "Further Delay Will 'Effectively Kill F-22,' 59 Lawmakers Say," *Defense Daily*, Mar. 5, 2001.

(\$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/A-22 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/A-22’s EMD cost cap by 1.5% to ensure adequate testing.

The Administration’s **FY2000** budget requested \$3.0 billion for the F/A-22 program: \$1.8 billion in procurement and \$1.2 billion in R&D funding for 6 low-rate initial production (LRIP) aircraft. The F/A-22’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/A-22, 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/A-22 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/A-22 program as requested. The committee directed the Secretary of the Air Force to certify by February 1, 2000, that F/A-22 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/A-22 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/A-22s 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/A-22'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/A-22 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/A-22 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/A-22 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.)

The Administration's **FY1999** defense budget requested \$2.3 billion for the F-22 program: \$1.5 billion in R&D and \$785.3 million in procurement funds, with projected procurement of 58 aircraft in FY1998-FY2003 costing \$18.6 billion in development and procurement funding. In a Senate Armed Services Committee hearing on March 25, 1998, GAO recommended delaying award of the F/A-22's first production contract until October 1999 since only 4% of the development flight test program would be completed by December 1998 when the Air Force planned to contract for the first two production aircraft. Air Force officials stated that the flight tests were generating more data than expected and argued that delaying the contract as recommended by GAO would delay delivery of the aircraft, cause the program to exceed the cost caps imposed in 1997, and weaken subcontractor commitment to the program. In response to concerns about inadequate flight testing prior to the first production contract, the Air Force decided in April 1998 that the two aircraft procured in December 1998 would be designated “production representative test vehicles” instead of production aircraft, although they would be bought with procurement funds and could later be used as production planes.

In May 1998 the House National Security Committee and the Senate Armed Services Committee recommended authorization of FY1999 funding for the F/A-22 as requested, with Sec. 133 of the Senate authorizations bill (S. 2057) requiring certifications by DOD of “sufficient testing prior to committing to production.” The House authorized F/A-22 funds as requested in H.R. 3616, passed on May 21, 1998. The Senate also authorized F/A-22 funds as requested when it passed S. 2057 on June 25, 1998, after an amendment by Senators Dale Bumpers and Russell Feingold to prevent the release of advance procurement funds for the F/A-22 before completion of 601 hours of flight tests was defeated 73 to 19. (See *Congressional Record*, June 25, 1998: S7106-S7110, S7151.) The House version of the FY1999 defense appropriations bill (H.R. 4103), passed on June 24, 1998, provided \$70 million less than the \$2,367.5 million requested for the F/A-22 program. The Senate version (S. 2132), passed on June 24, 1998, funded the program as requested and authorized by the House and Senate. The conferees on the FY1999 defense authorizations bill (H.R. 3616/S. 2057) approved \$2,353.5 million for the F/A-22 (\$14 million less than requested). The conferees on the FY1999 defense appropriations bill (H.R. 4103) agreed in H.Rept. 105-746, passed by the House on September 28 and the Senate on September 29, 1998, to provide \$2,346.7 million for the program (\$20.8 million less than requested).

The Administration’s **FY1998** defense budget included \$2.1 billion for the F-22 program (\$2.0 billion in R&D and \$80.9 million in advanced procurement funds), while projecting procurement of 70 aircraft in FY1999-FY2003 at a cost of \$18.2 billion in development and procurement funds. The previous year’s budget had projected procurement of 40 F-22s in FY1998-FY2001 at a cost of \$11.1 billion. In 1997, the cost of the F-22 program and the need for as many aircraft as projected became matters of more serious concern in Congress. The Defense Department’s QDR, released in May 1997, called for procurement to be reduced from 438 to 339 production aircraft.

On June 25, 1997, the House authorized FY1998 funding as requested for the F-22 (\$2.1 billion in R&D and advance procurement funds), while the Senate on July 11, 1997, authorized only \$1,651.2 million in R&D funding — a reduction of \$420 million in R&D funds and no advance procurement funds. The Senate version of the FY1998 defense authorization bill (S. 936) included language (Sec. 212) limiting the F-22’s development cost to \$18.7 billion and production cost to \$43.4 billion and requiring annual GAO reports on the cost and status of the program, via amendments by Senators Coats and Bumpers. (See *Congressional Record*, July 11, 1997: S7244.)

The Senate Armed Services Committee stated that “Considering the disparities in the statements of official witnesses on the cost estimates for F-22 production and the lack of explanation of the program’s \$2.2 billion overrun in EMD, failure to provide reports on the substance of the program [as requested by Congress in 1996] does little to foster confidence in the program’s management or cost estimates. ...There is currently a lack of confidence due to recently disclosed overruns and estimates of large overruns yet to come in the production. ... Increased development costs tend to imply increased procurement costs throughout a program.” The committee denied advance procurement funds on grounds that “... the F-22 program has \$81.3 million from FY1997 advance procurement funds that could be used to

protect the schedule for the FY1999 production, thus ensuring that there is no break in the early production of the F-22.” (S.Rept. 105-29: 100, 102.)

On July 15, 1997, the Senate appropriated \$1.8 billion in R&D funds but also without advance procurement funds. The Senate Appropriations Committee was less critical of the F-22, noting that the Senate version of the FY1998 defense appropriation bill (S. 1005) recommended deletion of advance procurement funds “to ensure the program stays focused on completion of the EMD program.” The Committee reduced the F-22's EMD funds only by the \$213 million budgeted for termination liability in FY1998, stating it “does not expect the F-22 program to be terminated in FY1998” and expects this reduction to have “no impact on the F-22 EMD program.” (S.Rept. 105-45: 115.)

The House version of the FY1998 defense appropriations bill (H.R. 2266, passed July 29, 1997) funded the F-22 program essentially as requested, with \$6 million of the \$80.9 million requested for advance procurement provided as R&D funding. An amendment by Representative Nadler to reduce funding by \$420 million was defeated by voice vote; an amendment by Representative Obey forbidding the sale of F-22s to foreign governments (Sec. 8104) was agreed to by voice vote. (See *Congressional Record*, July 29, 1997: H5953-H5956, H5966-H5968.) The House version of H.R. 2266 in regard to the F/A-22 program was accepted by the conferees. The conference report on FY1998 defense appropriations (H.R. 2266, passed by Congress September 25, 1997, and enacted as P.L. 105-56 October 8, 1997) provided F/A-22 funding at the total level requested — \$2,152.1 million (\$2,077.2 million in R&D and \$74.9 million in advance procurement funding).

This funding was authorized in the conference report (H.Rept. 105-340) on the FY1998 defense authorizations bill (H.R. 1119), which was approved by the House on October 28 and by the Senate on November 6, 1997. The authorization bill included in Sec. 217 the Senate's restrictions on the aircraft's EMD costs (capped at \$18.7 billion) and productions costs (originally capped at \$43.4 billion, but adjusted to \$36.8 billion for inflation), with these caps in FY1997 dollars that would be adjusted annually to account for inflation.