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# F-22 Raptor Aircraft Program

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# F-22 Raptor Aircraft Program

## SUMMARY

The F-22 Raptor is a next-generation fighter/attack aircraft using the latest stealth technology to reduce detection by radar. Equipped with more advanced engines and avionics than the current F-15 Eagle, the F-22 is expected to maintain U.S. Air Force capabilities against more sophisticated aircraft and missiles in the 21st century.

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 "Engineering & Manufacturing Development" (EMD). 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-22s could begin replacing F-15s after 2005.

The Administration's FY2002 budget requested almost $4.8 billion for the F-22 program in procurement and development funds. Through FY2000, Congress provided some $22.8 billion for the F-22. A 341-aircraft program was estimated in June 2000 to cost about $61.9 billion in actual prior-year and projected out-year expenditures.

The F-22 program raises questions about its cost and the need for this aircraft, the capabilities it would have, and the number of these planes needed to meet military requirements. The F-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 beginning production of the F-22 when production of comparable or better aircraft by other countries appears unlikely. Others argue that the F-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 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 West Palm Beach, FL.

## MOST RECENT DEVELOPMENTS

*The Administration's FY2003 budget requested $5.2 billion for the F-22 program in procurement and development funds. In their mark ups of the FY2003 defense authorization bill, both House and Senate authorizing committees met the Administration's request for F-22 funding.*

*On March 6, 2002, the GAO published a report ("F-22 Delays Indicate Initial Production Rates Should be Lower to Reduce Risk" ) recommending that the Air Force cut the number of F-22 Raptors procured during low rate initial production (LRIP) to 13 aircraft per year; which equates to a reduction of 113 aircraft over five years..*

*On August 15, 2001, the Pentagon's Defense Acquisition Board (DAB) approved the F-22 to enter low-rate initial production (LRIP). The DAB also reduced the overall number of F-22s to be produced from 331 to 295 aircraft.*

## BACKGROUND AND ANALYSIS

### Major Developments

Air Force officials regard the F-22 program as the service's highest aviation priority. Designed as a fighter with attack capability, the F-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 integrated avionics for rapid fusion and display of target data. The first prototype of this next-generation stealth fighter/attack plane was first flown on September 7, 1997, followed by test flights by two development aircraft at Edwards Air Force Base, CA, where 184 test-flight hours were completed by November 23, 1998. The first F-22s could be in service after 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 West Palm Beach, FL.

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, and development of a naval variant has not been pursued.

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 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. Secretary of the Air Force Donald B. 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. Emphasizing the importance of the Lockheed team's management and production plans, he stated that the F-22 offered better reliability and maintainability and denied that either prototype was significantly more maneuverable or stealthy. 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 Defense Department's Selected Acquisition Report (SAR) of September 30, 2000, estimated the development and production cost of a 341-aircraft program at $61,940.1 million then-year dollars (actual funding in prior years and projected funding in future years). The quantity of aircraft in the program was reduced from 750 to 648 in 1991, then to 442 in late 1993, and later to 341(339 production and 2 development aircraft) in 1997. The F-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 FY1997 budget projected procurement of 40 aircraft in FY1998-FY2001 (versus the 76 projected in 1994 to be bought in these years), costing $11 billion in development and procurement funds. The FY1999 budget projected procurement of 18 aircraft in FY1998-FY2001 (versus the 40 projected in 1996 to be bought in these years) and 40 in FY2002-FY2003, costing $18.6 billion for development and procurement of 58 aircraft. As projected in 1998, two aircraft, termed "Production Representative Test Vehicles," would be procured in FY1999, followed by 6 (FY2000), 10 (FY2001), 16 (FY2002), and 24 (FY2003). These annual buys were also in the FY2000 budget, which projected 36-plane buys in FY2004 and FY2005. Procurement of six production aircraft in FY2000 as projected in early 1999 was later changed by Congress to procurement of six test aircraft in FY2000.

The F-22 has been a defense budget issue since 1990, when reassessments of Soviet threats and capabilities have called into question the need to replace current fighters with next-generation aircraft. Critics of the program argue that since the Soviet Union is unlikely to continue producing the kinds of aircraft the F-22 stealth fighter/attack plane is designed to combat, it would be more cost-effective to upgrade fighter/attack planes currently in production (e.g., F-15Es and F-16s), which these critics think would be adequate for the most probable threats. Some critics argue that production of the F-22 should at least be delayed, pending the emergence of a credible military threat. Others argue that fewer F-22s would be needed because of the greater combat capability the aircraft is expected to provide. Defense Secretary William Cohen, for example, cited the F-22's superior combat capability as a reason for the QDR's proposed reduction to 339 production aircraft. Some believe that fewer than 339 F-22s will be bought. Rep. 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-22s. In September, 2000 Rep. 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."[1]

Proponents of the F-22 argue that fighters with its stealth (low radar-observability) features and advanced combat capabilities would be needed in conflicts involving sophisticated air defenses in the hands of competent enemies equipped with advanced versions of Russian or European aircraft and missiles; e.g., the Russian Su-35 and the Eurofighter EF-2000 and Russian SA-10 and SA-12 surface-to-air missiles. Its advocates argue that the F-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 also believe the F-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-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.

In December 1993, a General Accounting Office (GAO) report ("Tactical Air: Planned F-15 Replacement Is Premature") recommended that the F-22's initial operational capability (IOC) be delayed until 2010, arguing that current F-15s can defeat expected threats until 2015 or later. GAO also noted a contradiction between development of the F-22 as a highly specialized aircraft to be used by only one service for a single mission and the Defense Department's current emphasis on developing joint-service, multi-mission aircraft. Critics of GAO's position argue that the proliferation of advanced European and Soviet aircraft, surface-to-air missiles, and radar capabilities in the Third World could pose threats that would require the capabilities of the F-22, even if F-15s remain in service longer than earlier expected. They argue that Russian Su-27s and MIG-29 fighters are technologically equal to the F-15 and could defeat an F-15 force in a scenario where these U.S. fighters might be

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

outnumbered. F-22 supporters cite its low radar-observability, superior fuel efficiency at sustained supersonic speed, and greater range and maneuverability than the F-15.

Concerns about the cost of the F-22 were expressed in 1996 during Senate debate on the FY1997 defense budget (*see below in* **Congressional Action**). In late 1996, the Air Force began negotiating with the contractors to control cost overruns in development and production that some thought might reduce the number of aircraft procured. Cost-reduction measures included eliminating two of the four pre-production aircraft between the prototypes and production aircraft.

In 1997, the cost of the F-22 program was a major issue in Senate deliberations and action on the FY1998 defense budget. The Senate Armed Services Committee's Air-Land Subcommittee hearing on April 16, 1997, focused on different estimates of the F-22's cost by Defense Department and Air Force officials, and the FY1998 authorizations bill imposed caps on development cost at $18.7 billion and production cost at $43.4 billion. (In early 2000 these caps were adjusted to $20.4 billion and $37.6 billion, respectively, to reflect inflation and a congressionally mandated change in procurement and development funding for FY2000.) In 1998, the program was again discussed in Senate Armed Services Committee hearings, where Air Force plans to begin production of the aircraft in FY1999 were criticized. Despite such criticism, Congress appropriated $2,346.7 million of the $2,367.5 million requested for the F-22 in the FY1999 defense budget.

In discussions with members of congressional defense committees, it was agreed that at least 183 hours of flight testing would be completed before awarding contracts for procurement of two aircraft termed "production representative test vehicles" and for advance procurement funding of 6 production aircraft to be funded in FY2000. This flight-testing goal and several other requirements for initial production were met by November 23, 1998, clearing the way for contract awards.

The cost of the program again became an issue in late 1998, when it was reported that cuts in production of Lockheed Martin's C-130J cargo/transport planes would increase the F-22's overhead cost, since both aircraft are produced at the contractor's Marietta, GA, facility. (See CRS Report RL30685, C-17 Cargo Aircraft Program, for references to the C-130J.) In a December 1, 1998, letter to Defense Secretary Cohen, Representative Obey expressed concerns about this matter, asking whether the F-22 contract will be tied to C-120J purchases and whether there is precedent for such linkage between the overhead costs of different programs.[2]

Concerns over the F-22 program's cost were raised again in 2000. On June 15 Air Force officials testified that the program's cost is estimated to be $1 billion above the spending cap placed on the production phase. However, they had identified $21 billion in future cost reductions. However, the DoD office of Operational Test and Evaluation estimated the F-22 program cost had grown $8 billion higher than Air Force projections. Furthermore, in a August 16, 2000 report, the GAO claimed that about one half of the $21 billion in cost reductions identified by the Air Force have yet to be implemented, and that the Air Force

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[2] "Representative Obey Questions C-130J/F-22 Linkage." *Aerospace Daily,* December 7, 1998. p.380.

may not be able to achieve many of these reductions because they depend on actions by either DoD or Congress.[3]

Originally scheduled for December 21, 2000, the Pentagon's Defense Acquisition Board (DAB) approved on August 15, 2001 the F-22 to enter low-rate initial production (LRIP). Lockheed Martin to build 10 Raptors using FY2001 funds, and 13 in FY2002 LRIP will continue through FY2005, when the program is expected to shift to full rate production, of up to 90 aircraft per year. As part of the LRIP decision, DoD officials reduced the overall number of aircraft to be purchased from 333 to 297. The DAB reportedly reduced the number of F-22s to be produced because of uncertainties regarding production costs. The Pentagon's Cost Analysis Improvement Group (CAIG) estimated that the production program would be $9 billion over the $37.6 billion congressional cost cap. The Air Force estimates it is $2 billion over the cap.[4] The DAB chose the CAIG's estimates to determine the total production run.[5]

Completing EMD testing, appeared to be a significant development for the F-22 program. On February 5, 2001, the Air Force announced that it had completed all required tests. However, the next day, a Pentagon a spokesman announced that no meeting would be scheduled on the F-22 LRIP decision until after Secretary of Defense Rumsfeld had a chance to completely review the program.

In a December 20, 2000 letter to then Under Secretary of Defense Jacques Gansler, DoD's director of Operational Test and Evaluation recommended extending the F-22 engineering, manufacturing and development (EMD) phase an additional nine months to conduct additional tests and to reduce "unacceptable risks." General Michael Ryan, Air Force Chief of Staff disputed this recommendation, calling the F-22 "The most extensively tested fighter in history."[6] Yet, in May 2001, it was reported that the F-22 program manager, Brig. Gen. Jay Jabour confirmed that the F-22's operational testing would be delayed up to nine months.[7] On June 6, 2001 Gen. Ryan confirmed Jabour's statement, testifying that F-22's EMD phase would be extended from November 2001 to the spring of 2002.[8]

On February 6, 2001, Deputy Secretary of the Air Force Darleen Druyan announced that the Air Force would remove 14 to 15 F-22s from its low rate initial production purchase to free up $475 million that it would invest in producibility improvements. The Air Force's FY2002 budget requested procurement funds for 13 Raptors, rather than the previously planned 16 low-rate initial production aircraft. The Air Force anticipates buying the removed F-22s in future years. If the Air Force were to extend the F-22 test program, however, it

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[3] "Quarterly Reports Urged on F-22 Production Costs." *Aerospace Daily*. August 16, 2000.

[4] De France, Linda. "F-22 Program Gets Reprieve with Postponement of DAB until Jan. 3." *Aerospace Daily*. December 19, 2000.

[5] Weinberger, Sharon . Program Head: F-22 on course for LRIP, next contract due in October. *Aerospace Daily*. September 24, 2001

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

[7] Lowe, Christian. "F-22 Testing to Slip, Costs to Rise. *Defense Week*. May 21, 2001.

[8] Selinger, Marc. "USAF Considers New Tanker, F-22 Development Phase. *Aerospace Daily*. June 7, 2001.

would likely add cost to the overall program and also make it difficult for the aircraft to enter operational service in late 2005.

A March 6, 2002 GAO report criticized the F-22 program, claiming that it "did not meet key schedule goals for 2001, the cost to complete planned development is likely to exceed the $21 billion reported to Congress, and the program is not far enough along in flight-testing to confirm Air Force estimates of the aircraft's performance."[9] The report projected that airframe flight testing four years longer than currently planned. The report noted that the Air Force is conducting F-22 flight tests at a rate that is 30 percent lower than planned. According to Air Force records, first flight of F-22 development aircraft has been delayed a total of 83 months. The GAO's primary recommendation was for DoD to limit the low-rate production (LRIP) of F-22 aircraft to 13 per year, until operational testing is completed and manufacturing processes are under control. GAO wrote that more testing is needed to confirm F-22 performance estimates.

GAO reported that DoD did not concur with the recommendation to limit LRIP aircraft. DoD officials said there was not sufficient justification to limit production rate for the F-22 until operational testing is completed. Also, they argued that limiting the number of aircraft procured during LRIP would make it difficult for sub-suppliers to make improvements leading to full-rate production readiness.[10] In fact, DoD officials claim that cost reduction efforts are already paying dividends, and will allow the Air Force to purchase 23 Raptors in FY2003, an increase of two aircraft over previous proposals.[11] One senior DoD official commented that implementing GAO's LRIP recommendation could "destabilize program cost and schedule."[12] The stability of the F-22 program is not always clear, however. In April 2002, Air Force Secretary James Roche said that due to a variety of problems, the F-22 program had a "50-50 chance" of entering the dedicated initial operational test and evaluation (DIOT&E) phase on schedule.[13]

## Program Details

**Program Acquisition Cost.** The Defense Department's Selective Acquisition Report (SAR) of September 30, 2000, estimated the total program cost of 341 aircraft (339 production and two development aircraft) at $61,940.1 million then-year dollars (actual amounts spent in prior years and estimated expenditures in future years, based on current assumptions about inflation rates and annual production rates in the out-years). As projected in 1997, the F-22's program cost was $70.9 billion then-year dollars for development and production of 440 aircraft.

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[9] General Accounting Office. *Tactical Aircraft: F-22 Delays Indicate Initial Production Rates Should Be Lower to Reduce Risks.*(GAO-02-298). March 6, 2002. P.2.

[10] *IBID.* p. 27.

[11] Hebert, Adam. "Air Force Sees Early Returns From F-22 Cost Savings." *Inside Defense.com.* March 7, 2002.

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

[13] Frank Wolfe. "Roche: 50-50 Chance of F-22 Entry into DIOT&E by April 2003." *Defense Daily.* April 19, 2002. P.1.

**Planned Procurement Quantity.** As currently projected, the Air Force plans to procure 295 production aircraft. When the F-22 design was selected (April 23, 1991), the service projected procurement of 648 aircraft instead of the 750 previously projected. In late 1993, the Air Force announced plans to procure 442 aircraft ( 438 production aircraft and four development aircraft). The 1997 QDR called for further reduction to 339 production aircraft. On July 26, 2000 Secretary of the Air Force Whitten Peters was reported to have said that 339 F-22 Raptors "...is about the right number for 10 AEFs," (Air Expeditionary Forces), the USAF's latest organizational scheme.[14]

**Unit Cost.** $182 million then-year dollars per plane in a 341- aircraft program (2 development and 339 production aircraft as currently projected by the Air Force) estimated in June 2000 to cost $61,940.1 million then-year dollars.

**Funded through FY2000.** Some $22.8 billion (then-year $), mainly in R&D funding, including $2.5 billion in FY2000. Through FY1992, the program received about $165 million in Navy R&D funds for a naval variant that was not developed. Funding of the ATF/F-22 began in the early 1980s and is projected to continue into the FY2010s.

## System Description

The production version of the F-22 will have 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-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. The F-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 future munitions like the small diameter bomb), which can be carried internally or on underwing pylons. The F-22's reduced radar-cross-section and stealth features of low radar-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.

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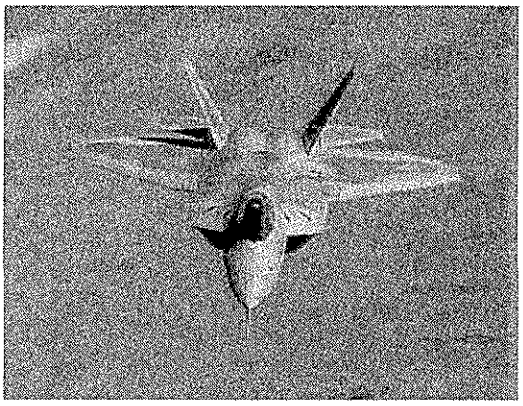
[14] Wolfe, Frank. Peters. "339 F-22s 'About The Right Number' for 10 AEFs." *Defense Daily*. July 26, 2000: 8.

**Figure 1. F-22 Prototype**



# Key Issues

## Does the United States need to develop new tactical fighter aircraft at this time?

**Main arguments of those favoring development of a new fighter.** 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 roughly comparable to current U.S. fighters in combat capabilities, and European aerospace industries are likely to produce more advanced aircraft in the years ahead. These aircraft could pose serious threats in regional conflicts in the next century, when we would also face serious threats from more advanced air defenses. When the F-22 enters service after 2005, many U.S. Air Force and Navy fighters (developed in the mid-1970s) will be about 30 years old. Moreover, they may be outnumbered by comparable or better foreign aircraft, given recent procurement trends and projected force reductions. Currently operational fighters cannot be further modified 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 arms reductions in the West and economic conditions in the former Soviet bloc may result in a proliferation of sophisticated military technology, particularly in surface-to-air missiles and air defenses. The F-15 will be unable to provide that measure of air superiority required in the post-2005 world.

**Main arguments of those favoring improvement of present systems.** 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 and air defense capabilities of potential enemies. Production of a new generation of fighter planes cannot be justified in light of the collapse of the Soviet Union and recent Persian Gulf experience in which current U.S. aircraft operated effectively. These factors raise serious doubts about the military threats the F-22 is designed to oppose. Development of the F-22 might be continued as a hedge against long-term threats, 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. Our limited defense funds could be more prudently invested in improving fighter aircraft now in production, while developing more lethal munitions of greater range and accuracy, as well as better electronic warfare capabilities to counter the air defenses of likely enemies.

## Congressional Action

The ATF/F-22 program has had strong support in Congress, which has generally authorized funding for the program as requested, although in some years Congress has appropriated less than the amounts requested and authorized, usually reflecting opposition to the program in the House.

The Administration's FY1997 defense budget, submitted March 4, 1996, requested $2,003 million in Air Force development funds for the F-22 program (plus $4.4 million in military construction funds). The House authorized funding as requested for the F-22 in its FY1997 defense authorizations bill (H.R. 3230, passed May 15, 1996) as did the Senate in its authorizations bill (S. 1745, passed July 10, 1996). The Senate Armed Services Committee expressed concern over the cost of the program, however. Noting that the last independent cost estimate was in 1991 when Lockheed's YF-22 design was selected for full-scale development, the Committee called for an updated estimate by DOD's Cost Analysis Improvement Group (CAIG) to be submitted to Congress by March 30, 1997, with eight percent of the program's FY1997 funding (about $160 million) to be withheld until receipt of this cost estimate (Sec. 218 of S. 1745). A floor amendment to Sec. 218 by Senator Grassley specified the use of a July 1991 CAIG estimate as the baseline for cost comparisons and called for a description and cost assessment of changes since July 1991 in the program schedule, aircraft quantities, and projected production rates. (See *Congressional Record*, June 27, 1996: S7158-S7159.) Section 219 of S. 1745 called for additional reports to Congress on major events and upcoming decisions affecting the development and production of the F-22. These Senate provisions were included in the conference report (H.Rept. 104-724), which was passed by the House on August 1, 1996, by the Senate on September 10, and signed into law (P.L. 104-201) on September 23, 1996, by the President.

The House Appropriations Committee recommended $1,982 million ($20.5 million less than the $2 billion requested and authorized by the House and Senate and appropriated by the Senate), which was appropriated in the House version of the FY1997 defense appropriations bill (H.R. 3610, passed June 13, 1996). The committee report described this minor reduction as being "... without prejudice, noting that historically the Air Force has only awarded 84 percent of the funds budgeted for award fees for the F-22 in a given fiscal year." The Senate Appropriations Committee recommended funding as requested and authorized for FY1997. House and Senate conferees agreed in the FY1997 omnibus appropriations bill (H.R. 3610, P.L. 104-208, September 30, 1996) to appropriate $1,987 million of the $2,003 million requested and authorized for the F-22.

The Administration's FY1998 defense budget requested $2,152.1 million for the F-22 program ($2,071.2 million 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 ($2,152.1 million 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 $1,858.2 million 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-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-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 authorizations bill included in Sec. 217 the Senate's restrictions on the aircraft's EMD costs (capped at $18.7 billion) and productions costs (capped at $43.4 billion), with these caps in FY1997 dollars that would be adjusted annually to account for inflation.

The Administration's FY1999 defense budget requested $2,367.5 million for the F-22 program ($1,582.2 million 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, the General Accounting Office (GAO) recommended delaying award of the F-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-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-22 funds as requested in H.R. 3616, passed on May 21, 1998. The Senate also authorized F-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-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-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-22 ($14 million less that 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 FY2000 budget requested $3,074.3 million for the F-22 program — $1,852.1 million in procurement and $1,222.2 million in R&D funding for 6 low-rate initial production (LRIP) aircraft. The F-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 are 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-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-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-22 program as requested. The committee directed the Secretary of the Air Force to certify by February 1, 2000, that F-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-22 program only the $1,222.2 million requested in R&D funding. The $1,852.1 million requested for procurement of 6 "low-rate initial production" (LRIP) F-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-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-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-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, $277.1 million 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. Rep. 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-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 FY2001 budget, submitted on February 7, 2000, requested $3,957.9 million for the F-22 program – $2,546.1 million for procurement of ten low-rate initial production (LRIP) aircraft and $1,411.8 million 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-22 funding, the defense oversight committees expressed marked concern over the aircraft's testing program. House appropriators noted that the F-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-22 until: 1) first flight of an F-22 aircraft incorporating block 3.0 software, 2) certification by the Secretary of Defense that all Defense Acquisition Board exit criterial 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-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-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 recommended a provision that would increase the F-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-22 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-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.

The FY2001 Defense Authorization Conference Report (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-22's EMD cost cap by 1.5% to ensure adequate testing.

In a March 2001 letter to Defense Secretary Donald Rumsfeld, 59 lawmakers recommended that DoD commence F-22 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-22 is ready to move into low-rate initial production. [15]

On March 29, 2001 it was reported that Congress approved the Pentagon's request to reprogram $674.5 million in procurement funds from the projected purchase of the first 10 F-22 aircraft to sustain the EMD program. This reprogramming was requested because the Defense Acquisition Board decision on whether the F-22 program was ready for LRIP was postponed indefinitely, and FY2001 funds had run out. Congress had previously provided $353 million in "bridge funding" in the Departments of Labor, Health and Human Services, and Education Conference Report to finance work on the F-22 from December 31, 2000, to

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

March 30, 2001. The Air Force says these funds will be used to preclude a work stoppage, which they say would have resulted in increased costs and a serious erosion of the supplier base.

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-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 also cut $2.6 million from the program. This adjustment included reductions in tooling (-$100 million) and ancillary equipment (-$14 million). This 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-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-22's Advanced Procurement (Current Year) account to FY2002 procurement. Conferees also transferred $16 million from the F-22 Operational Systems Development account to the EMD account.

The Administration's FY2003 defense budget request included $5.2 billion for the F-22. $4.6 billion was requested to procure 23 aircraft, $530 million was for FY04 advanced procurement (current year) and $11 million was for modifications. Both the House and Senate authorizing committees matched the Administration's FY2003 request.[16]

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[16] "Senate Armed Services Committee Completes Markup of National Defense Authorization Bill for Fiscal Year 2003." Press Release. United States Senate, Committee on Armed Services. May 10, 2002. P.5. "House Armed Services Committee Reports Fiscal Year 2003 Defense Authorization Legislation." Press Release. United States House of Representatives, Committee on Armed Services. May 1, 2002. P.14.