United States General Accounting Office

GAO

Report to Congressional Committees

March 2002

TACTICAL AIRCRAFT

F-22 Delays Indicate Initial Production Rates Should Be Lower to Reduce Risks

GAO-02-298

Report Documentation Page

Report Date	Report Type	Dates Covered (from... to)
00MAR2002	N/A	-

Title and Subtitle TACTICAL AIRCRAFT: F-22 Delays Indicate Initial Production Rates Should Be Lower to Reduce Risks	**Contract Number**
	Grant Number
	Program Element Number
Author(s)	**Project Number**
	Task Number
	Work Unit Number
Performing Organization Name(s) and Address(es) General Accounting Office, PO Box 37050,Washington, DC 20013	**Performing Organization Report Number** GAO-02-298
Sponsoring/Monitoring Agency Name(s) and Address(es)	**Sponsor/Monitor's Acronym(s)**
	Sponsor/Monitor's Report Number(s)

Distribution/Availability Statement
Approved for public release, distribution unlimited

Supplementary Notes

Abstract
The Air Force is developing the F-22 aircraft to replace its fleet of F-15 aircraft.The F-22 is to be superior to the F-15 by being less detectable, capable of flying at higher speeds for longer distances,and able to provide the pilot with substantially improved awareness of the surrounding situation.The Air Force began the F-22 development program in 1991 and plans to complete it by March 2004.In 1998,following repeated increases in the program s estimated development cost,the National Defense Authorization Act for Fiscal Year 1998 1 limited the cost of F-22 development to $20.443 billion. 2 The act also required us to assess the Air Force s F-22 development program annually and determine whether key cost,schedule,and performance goals are being met. 3 This is our fifth report.In our last report,issued in March 2001, 4 we stated that the Air Force had not met its schedule goals for 2000 and that flight-testing delays coupled with prior years delays made it unlikely that the development program could be completed as scheduled within the $20.443 billion congressional cost limitation.

Subject Terms

Report Classification unclassified	**Classification of this page** unclassified

Classification of Abstract unclassified	**Limitation of Abstract** SAR
Number of Pages 42	

Contents

Tables

Figures

GAO
Accountability * Integrity * Reliability

United States General Accounting Office
Washington, DC 20548

March 5, 2002

Congressional Committees

The Air Force is developing the F-22 aircraft to replace its fleet of F-15 aircraft. The F-22 is to be superior to the F-15 by being less detectable, capable of flying at higher speeds for longer distances, and able to provide the pilot with substantially improved awareness of the surrounding situation. The Air Force began the F-22 development program in 1991 and plans to complete it by March 2004. In 1998, following repeated increases in the program's estimated development cost, the National Defense Authorization Act for Fiscal Year 1998[1] limited the cost of F-22 development to $20.443 billion.[2] The act also required us to assess the Air Force's F-22 development program annually and determine whether key cost, schedule, and performance goals are being met.[3] This is our fifth report. In our last report, issued in March 2001,[4] we stated that the Air Force had not met its schedule goals for 2000 and that flight-testing delays coupled with prior years' delays made it unlikely that the development program could be completed as scheduled within the $20.443 billion congressional cost limitation.

On September 13, 2001, the secretary of defense notified the congressional defense committees that the Department of Defense (DOD) had approved the F-22 program for low-rate initial production and that the cost to complete the program's development phase would be $557 million more than the cost limit. This increased the cost estimate for development to $21 billion. The National Defense Authorization Act for Fiscal Year 2002[5] has since eliminated the cost limitation but still requires us to provide annual assessments.

---

[1]P.L. 105-85, Nov. 18, 1997.

[2]As adjusted under the act's provisions.

[3]The act also requires us to assess whether we had access to sufficient information to make informed judgments on matters covered by our report.

[4]U.S. General Accounting Office, *Tactical Aircraft: F-22 Development and Testing Delays Indicate Need for Limit on Low-Rate Production*, GAO-01-310 (Washington, D.C.: Mar. 15, 2001).

[5]P.L. 107-107, Dec. 28, 2001.

This report addresses (1) the extent to which the development program is meeting its schedule, cost, and performance goals, including whether the program is likely to be completed within the current cost estimate; (2) the status of F-22 modifications; and (3) the Air Force's plans for low-rate initial production of F-22 aircraft and the risks associated with those plans.

Results in Brief

The F-22 program 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. First, while progress was made in testing the aircraft's capabilities, problems and delays continue with the assembly and delivery of development test aircraft and the flight-test program continues to be less efficient than planned. The delays and the less than planned efficiency have prevented the Air Force from completing the flight-testing planned for 2001. In June 2001, the Air Force extended the development test program 8 months and delayed the beginning of operational testing. However, even with the extension, it is unlikely that the development and operational tests programs can be completed as scheduled for several reasons, including the fact that test aircraft are taking longer to assemble and are being delivered late to the flight-test program. DOD's director, operational test and evaluation, and an Air Force independent test review team have characterized the new test plan as very optimistic.[6] Second, delays in the flight-test program make it unlikely that the development program can be completed as planned within the current $21 billion cost goal. Third, based on initial testing, the Air Force projects that the F-22 will meet or exceed its performance goals by the end of development. However, testing to demonstrate performance is not far enough along to enable the Air Force to confirm its projections.

Regarding the status of modifications, the Air Force has implemented and continues to implement process and manufacturing changes to solve problems with the horizontal tail section and cracking in the cockpit canopy that we reported on last year. While the results to date appear

[6]The team is comprised mainly of former Air Force and Office of the Secretary of Defense officials with extensive aircraft testing experience and was formed by the principal deputy assistant secretary of the air force for acquisition.

adequate, the Air Force continues to monitor the results to ensure the corrective actions will be sufficient.

In September 2001, the Air Force submitted to Congress a revised acquisition plan. Because of the recent slip in the projected start of operational testing, the revised plan will increase the number of aircraft committed to low-rate production before the completion of operational testing. In previous reports, we have said that buying production articles before they are adequately tested can be costly, if further testing identifies problems that then require costly modifications. Further, the increase in production commitments could occur without the F-22 program office knowing the extent that the contractor's key manufacturing processes are in control.[7] Program officials state that they no longer track this information. Our prior reviews have found that proceeding into production without manufacturing processes in control can increase both cost and schedule risks.

We are recommending that the Air Force reassess the cost to complete the F-22 development program and report the results to Congress. We are also recommending that DOD limit the low-rate production of F-22 aircraft until operational testing is completed and manufacturing processes are in control. We are further recommending that the Air Force monitor the status of the contractor's key manufacturing processes.

In commenting on our report, DOD said that it continuously tracks the cost to complete the F-22 development phase of the program and that if the budget for that phase of the program were to increase, it would report this increase to Congress. However, it said that a report was unnecessary at this time. As discussed in this report, there are strong indications the F-22 development program is unlikely to be completed within the current cost estimate of $21 billion. We believe that Congress should be notified as soon as possible of projected cost increases in the development program. In response to our second recommendation, DOD said that it does not believe there is sufficient justification to limit the F-22 production rate. We believe this report provides ample justification for limiting low-rate production quantities. DOD agreed that it is important to ensure that manufacturing processes are maturing as production progresses and that these processes are in control. It said that an assessment of key F-22

[7]A manufacturing process is considered to be in control when it can consistently be done in a high-quality manner.

manufacturing processes would be included in an upcoming report on production readiness. We support DOD's plan to conduct the assessment and believe that the F-22 program office should continue to accumulate statistics on the percentage of key manufacturing processes in control as the program proceed towards full-rate production.

Background

The F-22 is an air superiority aircraft with advanced features to make it less detectable to adversaries (stealth characteristics) and capable of high speeds for long ranges.[8] It has integrated avionics to greatly improve pilots' awareness of the situation surrounding them. The objectives of the F-22 development program are to (1) design, fabricate, test, and deliver 9 F-22 development test aircraft, 2 non-flying structural test aircraft, 6 production representative test aircraft, and 37 flight-qualified engines; (2) design, fabricate, integrate, and test the avionics suite; and (3) design, develop, and test the support and training systems. The F-22 is being developed under contracts with Lockheed Martin Corporation (for the aircraft) and Pratt & Whitney Corporation (for the engine).

Following a history of increasing cost estimates to complete the development phase of the F-22 program, the National Defense Authorization Act for Fiscal Year 1998 established a cost limitation of $18.688 billion for F-22 development and a limitation of $43.4 billion for production.[9] The act instructed the secretary of the air force to adjust the cost limitation for the amounts of increases or decreases in costs attributable to economic inflation after September 30, 1997, and for compliance with changes in federal, state, and local laws enacted after September 30, 1997. Congressional direction in fiscal year 2000 legislation added six production representative test aircraft to the development program, which helped increase the cost limitation to $20.443 billion.

The National Defense Authorization Act for Fiscal Year 2000 required that before the secretary of the air force awards a contract for F-22 low-rate initial production,[10] the secretary of defense had to certify that the (1) test plan in the program's development phase is adequate for determining the

[8]Air superiority is the degree of air dominance that allows the conduct of operations by land, sea, and air forces without prohibitive interference by the enemy.

[9]P.L. 105-85, Nov. 18, 1997.

[10]P.L. 106-65, Oct. 5, 1999.

operational effectiveness and suitability of the F-22 aircraft and (2) development phase and the production phase for the F-22 program could be executed within the congressionally mandated cost limitations.[11] If the Secretary of Defense was unable to make either of these certifications, he would be required to submit to the congressional defense committees a report that includes (1) the reasons the certifications could not be made, (2) a revised acquisition plan if the decision to proceed with low-rate initial production is made, and (3) revised cost estimates for the remainder of the development phase and the production phase if the decision is made to proceed with low-rate initial production.

On September 13, 2001, the under secretary of defense for acquisition, technology, and logistics notified the congressional defense committees that DOD had approved the F-22 program for low-rate initial production. The under secretary certified that the development test plan is adequate to determine the operational effectiveness and suitability of the F-22 aircraft. The under secretary said DOD could not certify that the F-22 development phase or the production phase could be completed within the existing congressional cost limitations. In his letter, he stated that both the Air Force and the Office of the Secretary of Defense estimates of the cost to complete the development phase exceeded the cost limitation. He indicated that the development phase would cost an additional $557 million. However, instead of requesting an increase in the cost limitation amount, he asked that the development cost limitation be removed. The under secretary also developed a revised acquisition plan and requested that Congress remove the production cost limitation, estimating that the production phase could cost $5.4 billion more than the $37.6 billion production cost limitation.

In December 2001, the National Defense Authorization Act for Fiscal Year 2002 eliminated the development cost limitation.[12] The production cost limitation remains in effect.

[11]The limitation on production cost does not specify a quantity of F-22 aircraft.

[12]P.L. 107-107, Dec. 28, 2001.

F-22 Development Program Continues to Experience Delays and Risks in Meeting Key Schedule Goals

The F-22 program met DOD's test criteria to continue with low-rate initial production, but it did not meet key schedule goals for developmental flight-testing. The Air Force reduced and extended the development flight-test program due to delays in flight-testing. The development flight-test program now overlaps with operational testing. However, the extended flight-test schedule is also experiencing delays. These delays will likely require the Air Force to extend the development flight-test schedule again to complete current testing objectives. DOD's director, operational test and evaluation, and an Air Force chartered independent test review team have characterized the new test plan as very optimistic.

F-22 Program Meets DOD's Test Criteria to Continue with Low-Rate Production

According to the Air Force, the F-22 program had fulfilled all test criteria considered prerequisites for awarding the fiscal year 2002 low-rate production contract. The under secretary of defense for acquisition, technology, and logistics established the criteria. The test criteria included completing specific testing of the avionics for guided missile launch, engine, and radar. DOD required the criteria to be met prior to the planned December 2001 contract award date for 13 low-rate production aircraft. (See appendix I for a listing of the criteria.)

Delays Result in Flight-Test Program Being Reduced and Extended

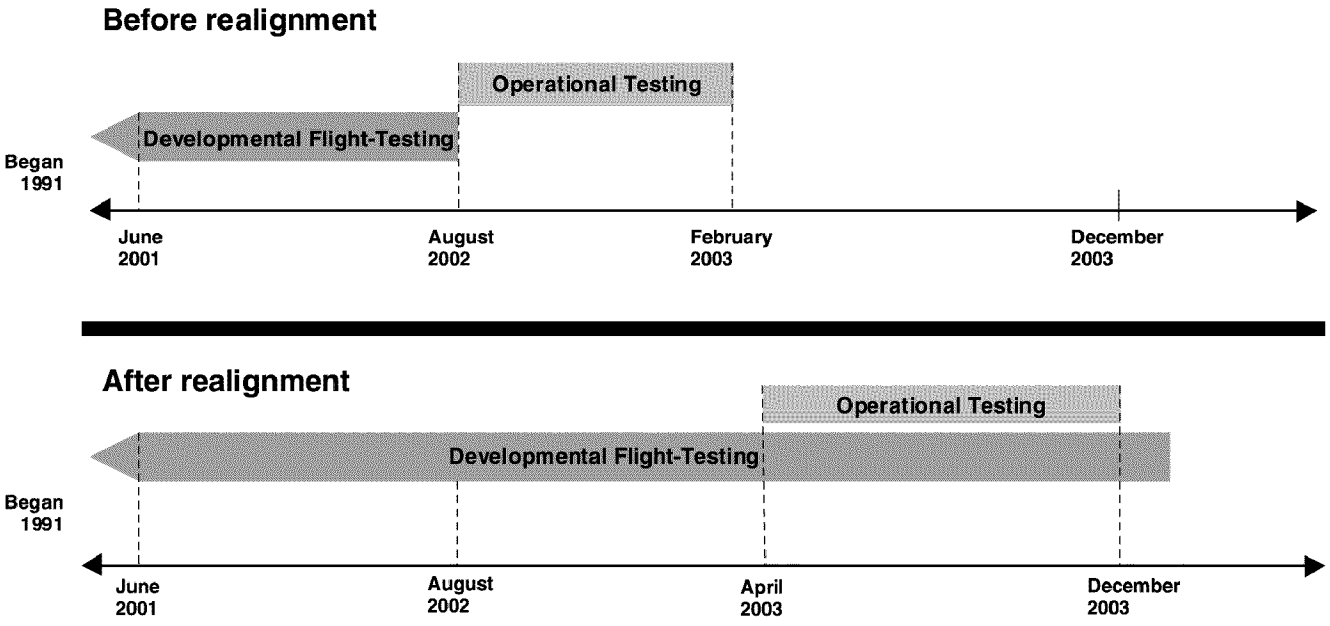
In March 2001, we reported that the F-22 development flight-test program was significantly behind schedule due to (1) problems and delays with the assembly and delivery of development test aircraft, (2) delivered development test aircraft not being ready for testing, and (3) lower than planned efficiency in the flight-test program.[13] We concluded that the Air Force would have to either extend the developmental test program past its planned completion date of August 2002, or start operational testing, scheduled to begin in August 2002, without completing all development flight-tests.

In June 2001, the Air Force realigned the test program. The realignment extended the completion of the development flight-test program, delayed the beginning of operational testing, and reduced the content of the test program. Development flight-testing determined by the Air Force as necessary to begin operational testing was extended 8 months and the beginning of operational testing was delayed 8 months. Some additional development flight-testing is now planned to be concurrent with

[13]See GAO-01-310, Mar. 15, 2001.

operational testing. Figure 1 shows the program schedule before and after the realignment and shows a 9-month overlap between development flight-testing and operational testing that did not exist prior to the realignment.

Figure 1: F-22 Test Program Schedule Before and After Realignment



Source: Air Force.

Office of the Secretary of Defense officials involved in operational testing were included in the testing realignment process and did not take exception to some development flight-testing being planned concurrent with operational testing. However, according to these officials, there is an increased risk involved in the concurrency, and there is still a high risk of not completing an adequate amount of development flight-testing before operational testing is scheduled to begin. The start of operational testing could be delayed if the required development flight-testing is not completed as scheduled.

During the program realignment, the Air Force established new schedule dates for the remaining major schedule events. Table 1 shows the prior and current schedule dates and the slip in schedule between the prior and current dates.

Table 1: Revised Schedule Dates Associated with the Test Program Realignment

Schedule events	Estimate prior to realignment	Current estimate	Slip in schedule events (months)
Completion of development flight-testing necessary prior to operational testing	August 2002	April 2003	8
Start of operational testing	August 2002	April 2003	8
Completion of operational testing	February 2003	December 2003	10
High-rate production decision	July 2003	March 2004	8

Source: Air Force.

In addition to extending the flight-test program schedule, the Air Force reduced the content of the F-22 development flight-test program. Specifically, the Air Force eliminated and consolidated some test points (specific test objectives conducted during flight-testing) and deferred other test points that it did not have to complete before the start of operational testing. As a result, the combined total flight-test points (airframe and avionics) remaining have been reduced by approximately 4,708 points, or 31 percent.

Extended Test Schedule Likely to Slip

The realigned test schedule established by the Air Force in June 2001 is likely to slip for a number of reasons. First, development test aircraft are taking longer to assemble and, as a result, are being delivered late to the flight-test program. Second, the schedule for completing airframe flight-testing is high risk because (1) the available test aircraft are not achieving the number of test objectives per flight hour specified in the test plan and (2) the completion of the schedule is heavily dependent on one test aircraft in lieu of three as originally planned. Third, the avionics portion of the flight test program is being delayed by the late delivery of test aircraft.

The director, operational test and evaluation, and the Air Force's independent test review team have expressed concerns that the revised test schedule still does not provide enough time for adequate testing and is very optimistic. The director, operational test and evaluation, has reported that extending the portion of development flight-testing necessary to begin operational testing by 8 months, to April 2003, still does not provide enough time to sufficiently complete that testing. The director estimates that the F-22 program will probably not be ready to begin operational testing until at least August 2003, not April 2003 as currently planned.

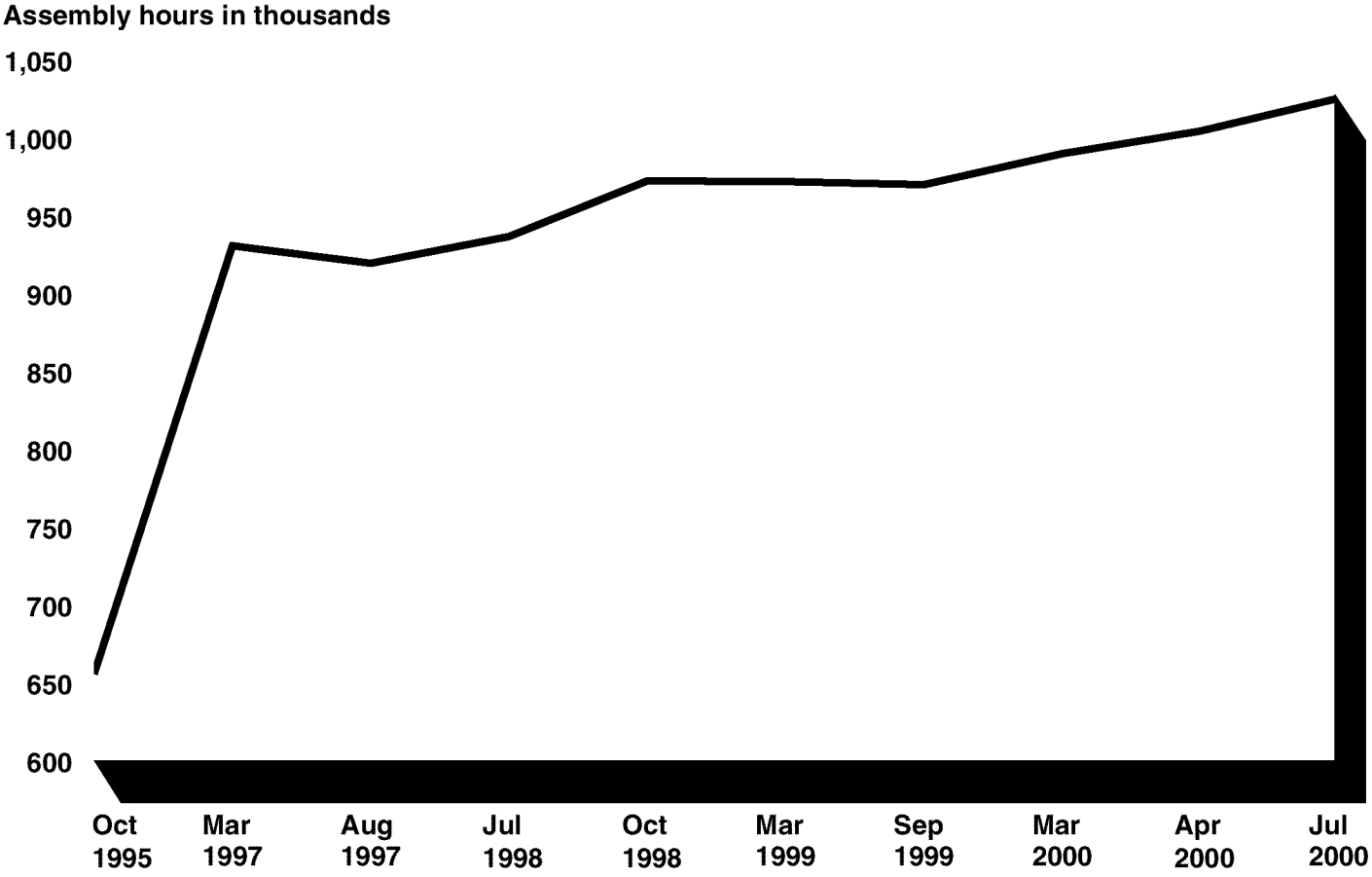
Delays in Aircraft Assembly Delay Flight-Test Program

The contractor is taking considerably more time than originally estimated to assemble development test aircraft. For example, a few months after the critical design review in February 1995,[14] the contractor estimated that it would take 665,111 hours to assemble nine development test aircraft at the Marietta, Georgia, facility.[15] According to the latest data provided to us and as shown in figure 2, that estimate continued to grow through July 2000. As the figure shows, the contractor estimated in July 2000 that it would take 1,025,290 hours, or around 360,000 more hours to assemble the nine development test aircraft.

[14]A review conducted to determine that the detailed design satisfies the performance and engineering requirements of the aircraft.

[15]This figure was an estimate based on actual assembly hours of historical fighter aircraft.

Figure 2: Increase in Estimated Hours to Assemble F-22 Development Test Aircraft at the Marietta, Georgia, Facility (October 1995-July 2000)



Source: Lockheed.

The three aircraft completed during 2001 took more hours to complete than planned. Also, the two aircraft that are still being assembled are requiring more assembly time than planned. Table 2 shows the planned versus actual assembly hours for these five aircraft.

Table 2: Planned Versus Actual Assembly Hours for Development Test Aircraft

Aircraft	Planned assembly hours[a]	Actual assembly hours[a]	Difference
4005[b]	207,345	231,567	+24,222
4006[b]	204,554	232,573	+28,019
4007[b]	202,843	226,533	+23,690
4008[c]	197,171	206,798	+9,627
4009[c]	175,170	187,496	+12,326

[a]Planned and actual hours at the Marietta, Georgia; Ft. Worth, Texas; and Seattle, Washington, facilities.

[b]Completed aircraft.

[c]As of November 2001. These aircraft are not yet completed.

Source: Air Force.

According to Air Force officials the development test aircraft are taking longer to assemble than planned because of necessary design changes and modifications to the aircraft, parts shortages, and problems integrating hardware and software subsystems. For example, an engineering redesign that affected all aircraft was required because of problems with the separation of materials in the aircraft's horizontal tail section. In addition, manufacturing problems associated with some of the avionics components—the communication, navigation, and identification and the electronic warfare systems—resulted in lower than expected software productivity and the late release of engineering drawings. Moreover, the contractor experienced higher levels of scrap and rework, and increased labor hours for inspection of nonconforming parts.

The delays in assembling development test aircraft continue to delay the flight-test program. Table 3 shows the delay in the development test aircraft's first flights.

Table 3: Delays in First Flight Dates of F-22 Development Test Aircraft

Test aircraft	Planned first flight dates	Actual first flight dates	Total delay to first flight dates (months)
4001	May 29, 1997	September 7, 1997	3
4002	July 9, 1998	June 29, 1998	0
4003	June 16, 1999	March 6, 2000	9
4004	August 17, 1999	November 15, 2000	15
4005	January 11, 2000	January 5, 2001	12
4006	May 18, 2000	February 5, 2001	9
4007	September 25, 2000	October 15, 2001	13
4008	February 2, 2001	February 8, 2002	12
4009	June 1, 2001	March 21, 2002[a]	10[a]
Total delay			**83**

[a]Projected as of February 2002.

Source: Air Force.

In early 2001, the Air Force anticipated that the five development test aircraft that remained to be assembled at that time (aircraft 4005-4009) would be available for flight-testing by the end of 2001 and planned to use these aircraft for flight-testing under the flight-test program realignment. However, only aircraft 4005-4007 became available. Although aircraft 4007 took its first flight, other delays prevented it from being fully incorporated into the flight-test program during 2001. Aircraft 4008 was delayed until February 2002 and aircraft 4009 is projected to be delayed until March 2002.

Schedule for Completing Airframe Flight-Testing Is High Risk

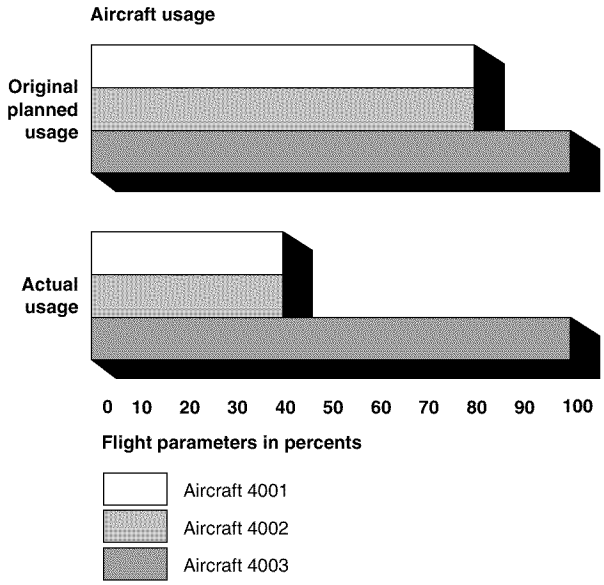
The Air Force's plan to complete developmental airframe flight-testing necessary for the start of operational testing in April 2003 and all airframe flight-testing by February 2004 is high risk because (1) the planned number of test objectives per flight-hour are not being achieved and (2) most of the planned flight-test program is essentially being performed by only one test aircraft rather than the three originally planned. Airframe testing demonstrates the aircraft's flight capabilities.

The Air Force is not accomplishing the planned number of airframe test objectives per flight-hour. Aircraft flight capabilities are demonstrated by performing specific test objectives or flight-test points. A gauge of flight-testing efficiency is the number of flight-test points achieved in each flight-test hour. In our March 2001 report, we noted that the Air Force had planned to accomplish an average of 10.4 test points per flight-test hour through December 2000 but were only accomplishing an average of 6.9 points per hour, or 30 percent less than planned. We found a similar

situation in 2001. Specifically, the Air Force's plan continues to have a test point goal of around 10 points per hour, but is only accomplishing a program average of 7 test points per hour, or 30 percent less than planned.

It is unlikely that the planned flight-test hours will be achieved, much less increased, because flight-test plans were based on the availability of three test aircraft, and only one is available for most of such testing. The original 1997 test program contained a plan for using development test aircraft 4001, 4002, and 4003 for the airframe flight-test program. The plan was for aircraft 4001, 4002, and 4003 to concurrently accomplish approximately 80 percent of the testing required to expand the F-22 flight parameters and then aircraft 4003 would continue to the 100 percent level. However, program officials determined that aircraft 4001 and 4002 would not be capable of accomplishing more than 40 percent of flight parameters and that the structures of all subsequent development test aircraft would need to be strengthened. This structural strengthening began with aircraft 4003. Aircraft 4003 remains the only development test aircraft that is structurally strong enough and adequately equipped with test instrumentation to accomplish the other 60 percent of flight parameters and to complete the planned airframe portion of flight-testing. Therefore, the completion of future airframe test points and flight hours relies heavily on this one aircraft. Figure 3 below compares the planned and actual usage of aircraft 4001, 4002, and 4003.

Figure 3: Planned Verses Actual Usage of Development Test Aircraft 4001, 4002, and 4003



Source: Air Force.

An assessment by the director, operational test and evaluation, indicated that the availability of only one development test aircraft to complete essentially all the remaining airframe flight-testing including structural, performance, propulsion, and flying qualities, creates a significant risk. The director concluded that without augmentation of aircraft 4003 with another aircraft, the completion of the required developmental flight-testing necessary to begin operational testing in April 2003 is high risk. Our computations show that the development flight-testing necessary for the start of operational testing might not be completed until March 2004, or 11 months later than planned. Air Force officials told us they understand that completing the tests as scheduled with only one development test aircraft is high risk.

Based on Air Force F-22 flight-test accomplishment data and current flight plans, we project that airframe flight-testing will have to continue until February 2008 to accomplish all the remaining 8,199 test points with one aircraft. Our computations are based on an average completion rate of 7 test points per flight-test hour at an average of 15.2 flight-test hours per aircraft completed per month. Thus, unless the test plan changes, it will take almost 4 years beyond the February 2004 scheduled completion date to complete all airframe flight-testing. An F-22 program office testing

official agreed with our projection. Officials in the program office also told us that in November 2001 the Air Force reviewed the flight-testing delays, but the conclusions reached during this review are still unofficial.

Avionics Flight-Test Schedule Is at Risk

The original 1997 program and realigned flight-test program planned to use development test aircraft 4004-4009 for avionics flight-testing.[16] However, the late delivery of these aircraft is increasing the risk of not completing the avionics portion of the realigned flight-test program by the planned September 2003 date. Aircraft 4007, 4008, and 4009 will be delivered later than the planned dates under the flight-test program realignment, which could result in additional delays in completing flight-test points. As of January 2002, the three aircraft had been delayed a total of 8 months since the realignment, and aircraft 4008 and 4009 were not scheduled to be delivered until sometime in calendar year 2002.

In addition to late deliveries of aircraft 4007-4009, aircraft 4004-4006 are accomplishing less than one avionics test point per flying hour. Based on F-22 flight-test data provided by the Air Force, we project it would take until August 2004 to complete the remaining 1,271 avionics flight-test points. This would require an extension of about 11 months in avionics flight-testing beyond the September 2003 scheduled end of testing.

Air Force officials also told us they understand that completing avionics flight-testing as scheduled will be a program challenge, but they still expect to meet the planned completion date and consider the completion of airframe flight-testing an even higher risk. These officials also explained that once test aircraft 4007, 4008, and 4009 are fully incorporated into the flight-test program, the test program will have six test aircraft designated for avionics flight-testing instead of just the three current aircraft and the program will be able to accomplish the projected 70 avionics flight-test hours per month. However, our projection assumes that aircraft 4007, 4008, and 4009 will be incorporated into the flight-test program as scheduled and still shows that avionics flight-testing could be delayed if the program accomplishes only 54 avionics flight-test hours per month, which is the projected accomplishment rate based on the historical average for the program.

[16]Flight-testing of the aircraft electronics.

F-22 Development Costs Likely to Increase

The F-22 development program is not likely to be completed within the current cost estimate of $21 billion. Costs will likely increase further because (1) delays in the flight-test program may require an extension of the development program, and (2) Lockheed's development costs continue to increase. In addition to development costs, the estimated cost of post-development activities continues to increase.

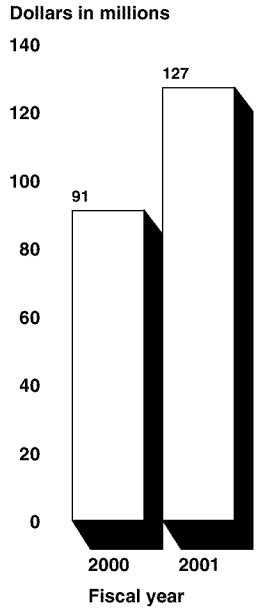
Flight-Test Delays Would Increase Costs

The delays that increase the number of months to complete development will result in increased costs for the F-22 program. As noted earlier in this report, it is unlikely that the Air Force will be able to complete the development program as scheduled. Continued delays in the assembly and delivery of development test aircraft and a flight-test program that is less efficient than planned will likely result in delays in the completion of development flight-testing and the beginning of operational testing after April 2003. If this happens, the development program will cost more than currently estimated. For example, the recent test program realignment that extended the majority of development testing and the start of operational testing 8 months resulted in a cost increase of $557 million.

Increases in Lockheed's Cost Will Likely Increase Development Costs

Lockheed's development costs continue to increase and, because of the cost reimbursement type contract Lockheed has with DOD, those costs are liabilities to the government. Over the last two fiscal years, Lockheed's costs have exceeded budgets by a total of $218 million. Figure 4 shows the costs over budgets for fiscal years 2000 and 2001.

Figure 4: Lockheed Costs Over Budgets during Fiscal Years 2000 and 2001



Source: Lockheed.

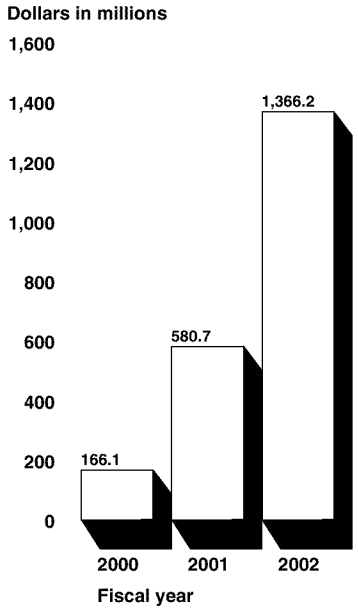
At the beginning of fiscal year 2001, F-22 program officials told us that Lockheed's costs for the fiscal year should be closer to their budget than that experienced in 2000 because the development program was closer to completion and there was more certainty concerning the cost of the remaining development activities. However, Lockheed's costs over budget in fiscal year 2001 exceeded the fiscal year 2000 amount. If cost increases continue in fiscal year 2002 and these are not offset by cost savings initiatives, the development program will cost more than currently estimated.

Planned Post-Development Funding Continues to Increase

The Air Force has defined another phase of the program separate from development and production that will require additional funds. The Air Force budget includes additional planned funding of almost $1.4 billion through fiscal year 2007 for activities the Air Force has defined as post-development, or separate from the activities associated with the $21 billion development estimate. These activities include avionics software upgrades, partial funding for a ground collision avoidance system, an improved short-range missile, instrumentation for testing, and a classified project. Air Force officials told us they consider these funds and the activities associated with these funds outside the scope of the F-22

development and production programs. We are reporting on these planned activities and potential costs because they have increased significantly since fiscal year 2000. Figure 5 shows that planned funding has increased each year from fiscal year 2000 to fiscal year 2002.

Figure 5: Total Post-Development Funding As Planned Each Year in Fiscal Years 2000, 2001, and 2002



Source: Air Force.

More Testing Needed to Confirm F-22 Performance Estimates

In November 2001, the Air Force estimated that by the time the development program ends, the program will have met and, in some instances, exceeded the major F-22 performance goals. However, the Air Force's estimates are based on limited flight-test data, computer models, ground tests, and analyses. Flight-test progress has been slower than expected, thus delaying the confirmation that the F-22 will deliver the required performance. Moreover, the F-22's performance may be affected by other factors such as increasing aircraft weight, maintenance needs, and a potential problem with the aircraft's vertical tail.

Significant Testing Remains to Confirm Performance Estimates

Even though F-22 development began in 1991 and flight-testing began in 1997, a significant amount of testing remains before the planned completion of development flight-testing in February 2004. F-22 performance goals are described in 10 key performance parameters, about

which the Air Force reports regularly to the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics. Through November 2001, the Air Force reported that ground and flight-test experience, engineering analyses, and computer models indicate F-22 performance will meet or exceed all required parameters. However, most ground and flight-tests will have to be completed before the estimates are confirmed. A recent review by the Air Force Operational Test and Evaluation Center concluded there was insufficient testing completed to assess 9 of the 10 key performance parameters.

Appendix II shows the goal for each parameter and the estimated performance the Air Force believes is consistent with models, ground tests, analyses, and flight-tests for each parameter as of November 2001. The appendix also shows the Air Force's latest estimates of expected performance for each parameter by the end of the development program.

While avionics testing with development test aircraft has been limited,[17] the program has been able to accomplish airborne avionics testing in a flying avionics laboratory, a commercial aircraft reconfigured as flying laboratory. This has helped provide information to testers and has helped to identify many problems with the hardware and software. However, while avionics testing in a flying laboratory is effective testing, it is not the equivalent of avionics testing in an actual F-22 test aircraft for two main reasons. First, because the flying laboratory is a large Boeing 757 passenger aircraft and not a more agile F-22, the Air Force cannot test the F-22's avionics performance in a dynamic flight environment where the aircraft is maneuvering at speeds and angles more characteristic of a smaller, fighter aircraft. A DOD testing official advised us that avionics performance can change when operated under the more demanding conditions of a fighter aircraft. Second, the flying laboratory does not contain the full complement of avionics sensors that are planned to be on an F-22, and in some cases, the position of sensors on the laboratory are not representative of how they are to be positioned on an F-22.

[17]Only 288 of about 1,324 planned avionics flight-test points, or 22 percent, have been accomplished.

Performance May Be Affected by Additional Factors

The F-22's performance may be affected by (1) increased aircraft weight, (2) maintenance needs that exceed established objectives, and (3) a potential problem with the aircraft's vertical tails. Aircraft weight, which impacts several of the key performance parameters such as supercruise,[18] maneuverability, acceleration, and combat radius has increased since 1995. During 2001, the aircraft's weight increased 285 pounds because the airframe had to be strengthened with additional materials. Even though the aircraft weight continues to increase, the Air Force continues to estimate that by the end of the development program, the F-22 will meet or exceed its supercruise, maneuverability, acceleration, and combat radius key parameters.

In addition to weight increases, the F-22's performance may also be affected by maintenance needs that exceed established objectives. The Air Force has estimated that the F-22 should at this point in development be able to complete 1.55 flying hours between maintenance actions. The Air Force also estimates the F-22 will be able to complete 1.95 flying hours between maintenance actions by the end of development and 3 flying hours between maintenance actions when the F-22 reaches maturity in 2008.[19] (The figure of 3 flying hours between maintenance actions is a key performance parameter.) However, the development test aircraft have been completing only .60 flying hours between maintenance actions, which means significantly more maintenance actions than are currently expected at this point in development and significantly more than are expected at system maturity.

Further, extensive maintenance has been associated with compounds that are used to fill gaps or seams on the aircraft's surface to help maintain the aircraft's low observable or stealthy nature.[20] As a result, when maintenance actions related to low observable features are included, the flying hours between maintenance figure decreases to only .44 flying hours between maintenance actions. In March 2001, we reported that program officials had earlier determined that the compound planned for this use on the F-22 was not meeting expectations; under certain conditions, it would swell or crack after application. Since then, a new compound has been

[18]Supercruise is the aircraft's ability to travel at high speeds for long ranges.

[19]System maturity is defined as 100,000 flying hours.

[20]Because the presence of any seams around maintenance access panels can potentially allow the aircraft to more easily be detected by enemy radar, a compound is applied to these seams in an effort to eliminate them and make the aircraft's surface smooth.

formulated and is being tested, but the cracking problem continues under certain conditions. This issue is a concern because in early 2002 the test program is about to enter a phase where the Air Force expects aircraft 4007, 4008, and 4009 to maintain 100 percent of their planned low observable configuration throughout their use in the test program. Moreover, the maintenance of low observable features has historically been more difficult and time consuming than expected.

The Air Force is also investigating a problem with the aircraft's vertical tails that could impact performance. The problem involves a "buffet," or excess movement back and forth, of the aircraft's two vertical tails when the aircraft is operating at certain speeds and angles. Additional test instrumentation has been added to development test aircraft 4003 to better define the problem and determine the possible final solutions.

Status of Aircraft Modifications

Air Force and Lockheed officials said they have implemented and are continuing to implement needed changes to solve problems discovered with separation between some of the materials within the horizontal tail and cracking around the cockpit canopy holes. These are problems we reported on last year. The Air Force continues to monitor these problems closely to ensure the corrective actions will be sufficient.

The current problem they are working on with the horizontal tail section involves separations between some of the materials and the shaft that allows the horizontal tail to pivot. Because the separations reduce the strength of the tails, the Air Force restricted the flight-testing of aircraft 4002 and 4003, the two development test aircraft that had this problem. To remove the test restriction, Lockheed repaired the horizontal tails of these two aircraft. The Air Force and Lockheed officials believe that improvements to the aircraft's manufacturing process will solve this problem, and experience to date appears to confirm their position. According to Air Force officials, these improvements are to be used in the manufacture of the horizontal tail for aircraft 4012, scheduled for delivery in June 2002.

The problem with the cockpit canopy involves cracks emanating from the mounting holes in the clear section of the canopy. In our March 2001 report, we stated that the contractor and the supplier had identified over 100 potential causes for the cracks and were developing plans to address each cause. Manufacturing changes have been made to reduce exposure of the canopy to harmful solvents and excess stress placed on the clear section of the canopy during assembly into its frame. Additional changes

are also being evaluated. According to Air Force officials, while the potential for cracking still exists, it is being continually reduced as manufacturing improvements are made.

Risks in the F-22 Proposed Acquisition Plan

The F-22 revised acquisition plan, submitted to Congress in September 2001, has risks. First, the plan increases the total number of aircraft committed to production before the completion of operational testing. We have previously reported that buying production articles before they are adequately tested can be costly when testing identifies problems requiring costly modifications to achieve satisfactory performance. Second, the increase in production commitments could increase cost and schedule risks if the contractor's key manufacturing processes are not in control. The F-22 program office no longer tracks the percentage of the contractor's key manufacturing processes that are in control. Third, the plan would increase annual production quantities even though tests of the F-22's structural integrity are not complete.

Increasing Production Prior to Completion of Operational Testing Increases Risks

In September 2001, DOD informed Congress that the F-22 production program would exceed the congressional cost limit by $5.4 billion and the Air Force would purchase a minimum of 303 aircraft, a reduction of 36 aircraft.[21] The Air Force proposed an acquisition plan that extends initial low-rate production two additional years and begins high-rate production in fiscal year 2006 rather than 2004. The proposed plan is designed to provide funds for cost reduction initiatives by funding fewer aircraft in the early production years of the proposed plan. Table 5 shows the planned aircraft purchases under the prior and the proposed acquisition plans and the quantity reductions through 2005.

[21]The Air Force still intends to try to procure these 36 aircraft if cost savings are realized through ongoing cost savings projects.

Table 4: Planned Aircraft Quantity Reductions

	Fiscal year					
Program plan	**2001**	**2002**	**2003**	**2004**	**2005**	**Total**
Prior acquisition plan	10	13	24	36[a]	36[a]	**119**
Proposed acquisition plan	10	13	23	27	32	**105**
Reduction	0	0	1	9	4	**14**

[a]High-rate production

Source: Office of the Secretary of Defense.

The fiscal year 2002 Defense Appropriations Act provided funds to increase initial low-rate production to 13 F-22 aircraft.[22] The act also provided advance procurement funds for F-22s in fiscal year 2003. The Air Force proposes to continue low-rate initial production through 2005 and begin high-rate production of 40 aircraft in fiscal year 2006.

In several reports over the last 7 years, we concluded that DOD should minimize commitments to F-22 production until completion of operational testing. In our March 2001 report, we concluded that limiting production to no more than 10 aircraft a year (the fiscal year 2001 quantity) was a prudent way to mitigate risks until the Air Force completes operational testing.

The Air Force's current plan would reduce the annual buy of low-rate production aircraft, but it would increase the total commitment of production aircraft before the projected completion of operational testing in December 2003. Specifically, the Air Force had planned to buy 47 aircraft at about $9.8 billion prior to the completion of operational testing in February 2003. However, under the current acquisition plan, it plans to buy 71 aircraft at about $14.9 billion prior to the completion of operational testing, now scheduled for December 2003. Moreover, should the schedule for operational testing slip further, as indicated earlier in this report, the Air Force's commitment to a greater number of aircraft before the end of operational testing could increase significantly. Buying production articles before they can be adequately tested can result in buying systems that require significant, and sometimes costly, modifications to achieve satisfactory performance; accepting less capable systems than planned; and deploying substandard systems to combat forces. Conversely, lower

[22]P.L. 107-117, Jan.10, 2002.

production rates could increase average procurement cost over the life of the program.

Key Manufacturing Processes Need to Be in Control to Reduce Production Risks

Our reviews of world class organizations during the last four years found that these organizations minimize risk when they manufacture products by relying on existing manufacturing processes and controlling key manufacturing processes before production begins.[23] In fact, most of the firms we visited during these reviews told us that all of their key manufacturing processes are in control before production begins. In November 2000, when the F-22 program office ceased collecting information on the percentage of key processes in control, the contractor had only 44 percent of its manufacturing processes in control. Less than a year later, in September 2001, a contract for 10 aircraft was awarded to begin F-22 production.

During our current review, F-22 program officials told us that neither they nor the prime contractors track the status of manufacturing processes in control because of the cost involved in tracking these processes. They rely on the subcontractors to manage their own manufacturing processes. Hence, the program office may be committing to increased production quantities without knowing the percentage of key manufacturing processes that are in control. Continuing to increase the F-22 aircraft production quantities in low-rate production before 100 percent of the key manufacturing processes are in control increases the risk that manufacturing and assembly problems evident with the development test aircraft will carry over to the production program. The cost involved in correcting manufacturing and assembly problems would most likely exceed the cost of tracking manufacturing processes.

Need to Complete Fatigue Testing to Reduce Risks

The F-22 test plan requires two major tests (static and fatigue) of the structural integrity of the F-22's airframe. These tests are important to reduce the risk of structural problems emerging during the production of aircraft or during aircraft operations. Static testing is undertaken to ensure

[23]U.S. General Accounting Office, *Best Practices: Successful Application to Weapon Acquisitions Requires Changes in DOD's Environment*, GAO/NSIAD-98-56 (Washington, D.C.: Feb. 24, 1998).

the aircraft will withstand stresses that are expected to be encountered throughout the aircraft's flight regime. The aircraft structure is tested to determine if it can withstand stresses up to 150 percent of its design limits. After a 14-month delay, static testing was essentially completed in December 2000.

In 1997, the Air Force estimated that fatigue testing, which measures the aircraft's durability over its expected life, would be completed in December 1999. After several subsequent delays, fatigue testing was started on December 21, 2000, and is expected to be completed by April 2002, more than 2 years later than planned. Delays in the completion of fatigue testing affect when structural changes can be identified and incorporated into F-22 production. DOD's director, operational test and evaluation, has expressed concern over the delays in the completion of fatigue testing for these reasons.

Conclusions

In June 2001, the Air Force extended the F-22 development test program. This schedule may have to be extended further because problems and delays continue with the assembly and delivery of flight-test aircraft, the flight-test program continues to be less efficient than planned, and there are limited development test aircraft to accomplish required test objectives. If the schedule slips again, the cost of the development program will increase beyond the $21 billion reported to Congress in September 2001.

The current acquisition plan would increase the total number of aircraft committed to production before the completion of operational testing compared with the previous plan. The number of aircraft committed to production could be even higher than that in the current plan if the test schedule slips again. Buying production aircraft before they are adequately tested can result in problems, such as the need for costly modifications to achieve satisfactory performance.

The F-22 program office does not know the percentage of the contractor's key manufacturing processes that are in control because they no longer collect these statistics. As of November 2000, the contractor had only 44 percent of its key manufacturing processes in control. Increasing F-22 production quantities before key manufacturing processes are in control increases the risk that manufacturing and assembly problems with development test aircraft will transition to the production program.

Recommendations for Executive Action

Because of Congress's past and continuing interest in the cost of the F-22 program, it is important that it be kept apprised of the current cost to complete the F-22 development program. Therefore, we recommend that the Secretary of the Air Force reassess the cost to complete the F-22 development program and, as a supplement to the fiscal year 2003 budget request, provide information on any funds that would be necessary above the $21 billion previously reported to Congress.

To help minimize the risks of producing large quantities of aircraft that may require costly modifications, we recommend that the Secretary of Defense limit aircraft production to no more than 13 aircraft a year until operational testing is completed and key manufacturing processes are in control.

To help ensure that manufacturing and assembly problems with the development test aircraft do not carry over to the production program, we recommend that the Secretary of the Air Force direct the F-22 program office to monitor the status of key manufacturing processes by accumulating statistics on the percentage of key manufacturing processes in control as the program continues to proceed toward high-rate production.

Agency Comments and Our Evaluation

In written comments on a draft of this report, DOD partially concurred with our first recommendation. In responding, DOD said that it continuously tracks the cost to complete the engineering and manufacturing development phase of the F-22 program and reports the results to the Under Secretary of Defense for Acquisition, Technology, and Logistics at quarterly reviews. DOD also said that if the budget for that phase of the program were to increase, it would report this increase to Congress. DOD did not believe that it was necessary to provide Congress with a supplement to the fiscal year 2003 budget request.

We support DOD's tracking of the F-22's development costs and its intent to report cost increases to Congress. As discussed in this report, there are strong indications the F-22 development program is unlikely to be completed within the current cost estimate of $21 billion because delays in the flight-test program may require an extension of the development program and delays result in increased costs. Moreover, Lockheed's development costs continue to increase and, because of the cost reimbursement type contract Lockheed has with DOD, these costs are liabilities to the government. We believe that Congress should be notified

as soon as possible of projected cost increases in the development program.

DOD did not concur with our second recommendation. It stated it does not believe there is sufficient justification to limit the production rate for the F-22 until operational testing is completed. DOD said that while flight-testing has progressed at a slower than predicted rate, the F-22 continues to make progress in development. DOD believes this progress confirms the F-22's potential to meet air superiority mission needs. DOD also said that limiting the number of aircraft acquired during low-rate production would make it difficult for the contractor to persuade its suppliers to make improvements leading to full-rate production readiness.

We believe that there is sufficient justification to limit F-22 low-rate production until operational testing is completed because the Air Force's estimates of performance are based on limited flight-test data, computer models, ground tests, and analyses. Our previous work has shown that buying production articles before they can be adequately tested can result in buying systems that require significant and sometimes costly modifications to achieve satisfactory performance, accepting less capable systems than planned, and deploying substandard systems to combat forces. Deferring a substantial increase in production rates would reduce the amount of production funds committed until the operational effectiveness and suitability of the F-22 has been successfully demonstrated during operational testing. Although DOD said that lower production rates may cause the contractor to have difficulty persuading its suppliers to make improvements in their manufacturing process needed for full-rate production readiness, we believe this possibility would be an acceptable risk to the alternative of producing larger quantities of aircraft before the operational effectiveness and suitability of the F-22 has been demonstrated.

In regard to the third recommendation, DOD partially concurred. It agreed that it is important to ensure that manufacturing processes are maturing as production progresses and that these processes are in control. DOD further said that an assessment of the status of key F-22 manufacturing processes would be included in an upcoming report assessing production readiness. This report is scheduled for completion prior to the lot 3 low-rate production contract award planned for December 2002. We support DOD's plan to conduct an assessment of the status of key F-22 manufacturing processes prior to the next planned low-rate production contract and believe that the F-22 program office should continue to

accumulate statistics on the percentage of key manufacturing processes in control as the program continues to proceed towards full-rate production.

DOD's comments are reproduced in appendix III. DOD also provided updated information and suggested additional technical changes, which we incorporated in the report where appropriate.

Scope and Methodology

To determine whether the program is expected to meet schedule goals, we reviewed program and avionics schedules and discussed potential changes to these schedules with F-22 program officials. We also compared current schedules with those developed in 1997 as a result of a study by a cost estimating team. We tracked progress in the flight-test program and evaluated schedule variances in the contractors' performance management system and compared planned milestone accomplishment dates with actual dates. We tracked technical problems in manufacturing and assembling the development test aircraft.

To determine whether the program is likely to meet the cost goal, we examined (1) the extent to which the development program is likely to be completed within the current cost estimate, (2) the Air Force's plans to fund the program for fiscal year 2002, and (3) the program funding plan compared to the current cost estimate. We compared the estimated cost at completion of the prime contracts with planned amounts, evaluated cost variances identified in the contractors' cost reporting systems, and reviewed the status of initiatives designed to avoid cost growth.

To determine whether the development program is likely to meet performance goals, we analyzed information on the key performance parameters and those sub-parameters that are measured. We compared performance goals established by the under secretary of defense for acquisition, technology, and logistics with the Air Force's current estimates of performance in November 2001 and at completion of development.

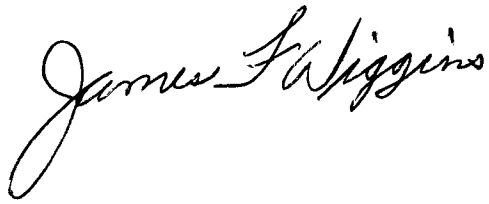
To identify the status of F-22 modifications, we collected updated information on the status of existing aircraft structural problems that have required aircraft modifications.

To assess the Air Force's plans for low-rate initial production and the risks associated with those plans, we determined the amount of overlap between the development program and the production plans, particularly in reference to the completion of initial operational testing and evaluation.

In making these determinations, assessments, and identifications, we required access to current information about test results, performance estimates, schedule achievements and revisions, costs being incurred, aircraft modifications, and the program's plans for continued development and initial production. The Air Force and contractors gave us access to sufficient information to make informed judgments on the matters covered in this report.

In performing our work, we obtained information or interviewed officials from the Office of the Secretary of Defense, Washington D.C.; the F-22 System Program Office, Wright-Patterson Air Force Base, Ohio; the Defense Contract Management Command, Marietta, Georgia; Lockheed Martin Aeronautical Systems, Marietta, Georgia; and the F-22 Combined Test Force, Edwards Air Force Base, California. We performed our work from July 2001 through February 2002 in accordance with generally accepted government auditing standards.

We are sending copies of this report to the secretary of defense; the secretary of the air force; and the director, Office of Management and Budget. Copies will also be made available to others on request. Please contact me at (202) 512-4841 or Robert Pelletier at (202) 512-4032 if you or your staff have any questions concerning this report. Major contributors to this report are listed in appendix IV.



James F. Wiggins
Director
Acquisition and Sourcing Management

List of Congressional Committees

The Honorable Carl Levin
Chairman
The Honorable John W. Warner
Ranking Minority Member
Committee on Armed Services
United States Senate

The Honorable Daniel K. Inouye
Chairman
The Honorable Ted Stevens
Ranking Minority Member
Subcommittee on Defense
Committee on Appropriations
United States Senate

The Honorable Bob Stump
Chairman
The Honorable Ike Skelton
Ranking Minority Member
Committee on Armed Services
House of Representatives

The Honorable Jerry Lewis
Chairman
The Honorable John P. Murtha
Ranking Minority Member
Subcommittee on Defense
Committee on Appropriations
House of Representatives

Appendix I: Calendar Year 2001 Test Criteria Required to Continue with Low-Rate Initial Production

Criteria	Completion date
Establish the flight envelope for Block 2 aircraft structures	May 2001
Conduct sufficient engine initial service release testing to determine engine hot section life	June 2001
Complete F-22 radar detection range measurement	April 2001
Complete first segment of radar cross-section stability over time testing	June 2001
Complete F-22 first Block 3.0 avionics AIM-120 missile guided launch	September 2001
Conduct full scale airframe fatigue testing sufficient to define life limits and initial airframe inspection requirements	September 2001

Appendix II: Estimates of Performance for Key Parameters

Key performance parameter	Goal (acquisition program baseline)	Air Force assessment of estimated performance through November 2001	Estimated performance at completion of development
Supercruise	100 percent	114 percent	115 percent
Acceleration (< 100% is favorable)[a]	100 percent	89 percent	87 percent
Maneuverability	100 percent	101 percent	102 percent
Airlift support (C-141 equivalents)	8	6.6	6.6
Sortie generation rate	100 percent	100 percent	100 percent
Radar cross section (front sector only)	100 percent	Favorable (data classified)	Favorable (data classified)
Average flight-test hours between maintenance	3.0	0.44	1.95 (at end of development) 3.0 (by system maturity in year 2008)
Payload (missiles)	four medium-range, two short-range	six medium-range, two short-range	six medium-range, two short-range
Combat radius	100 percent	112 percent	115 percent
Radar detection range	100 percent	105 percent	105 percent

[a]The acceleration parameter is a measure of the time it takes the aircraft to increase speed to a certain level. If the aircraft is able to increase speed to a certain level in less time than expected, this is considered favorable. Therefore, a measure of less than 100 percent is favorable.

Appendix III: Comments from the Department of Defense

OFFICE OF THE UNDER SECRETARY OF DEFENSE
3000 DEFENSE PENTAGON
WASHINGTON, DC 20301-3000

ACQUISITION,
TECHNOLOGY
AND LOGISTICS

21 FEB 2002

Mr. James Wiggins
Director, Acquisition and Sourcing Management
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Wiggins:

This is the Department of Defense (DoD) response to the GAO Draft Report, GAO-02-298, "TACTICAL AIRCRAFT: F-22 Delays Indicate Initial Production Rates Should Be Lower to Reduce Risks," Dated January 17, 2002 (GAO Code 120084). The Department appreciates the opportunity to comment on the draft report.

Delays in the delivery of development aircraft during the past two years, and delays in flight-testing have contributed to cost and schedule pressures on the program. However, the remedies proposed by the GAO could increase cost and schedule risks.

The GAO's report makes three recommendations. The Department partially concurs with Recommendation 1, agreeing that we need to continually assess the cost to complete the engineering and manufacturing development program. The Department does not concur with Recommendation 2, which is to limit to 13 the number of aircraft in future production lots until operational testing is completed. The Department believes that the GAO's proposed remedy will destabilize program cost and schedule. The Department partially concurs with Recommendation 3, agreeing that we need to track the maturity of the manufacturing processes to ensure that the quality and timing of production deliveries meet our objectives. Comments regarding recommendations are enclosed.

The Department has provided more detailed comments on the report under separate cover.

Sincerely,

Spiros G. Pallas
Acting Director
Strategic and Tactical Systems

Enclosure

GAO DRAFT REPORT DATED JANUARY 17, 2002
(GAO-02-298/GAO Code 120084)

"TACTICAL AIRCRAFT: F-22 Delays Indicate Initial Production Rates Should Be Lower to Reduce Risks"

DEPARTMENT OF DEFENSE COMMENTS TO THE RECOMMENDATIONS

****

RECOMMENDATION 1: The GAO recommended that the Secretary of the Air Force reassess the cost to complete the F-22 development program and, as a supplement to the fiscal year 2003 budget request, provide information on any funds that would be necessary above the $21 billion previously reported to Congress. (Draft Report/p. 26)

DOD RESPONSE: **Partially Concur.** The Department continuously tracks the cost to complete the engineering and manufacturing development (EMD) program, and reports the results to the USD(AT&L) at each quarterly review. If the budget for EMD were to increase, the Department would report the increase to Congress. We do not believe that it is necessary to provide a supplement to the FY 2003 budget.

RECOMMENDATION 2: The GAO recommended that the Secretary of Defense limit aircraft production to no more than 13 aircraft a year until operational testing is completed and key manufacturing processes are in control. (Draft Report/p. 26)

DOD RESPONSE: **Non-concur.** We do not believe that there is a sufficient justification to limit the production rate for the F-22 until operational testing is completed. While flight-test has progressed at a slower than predicted rate, the F-22 continues to make progress in Development Test and Evaluation, which is confirming that the F-22 has the potential to meet air superiority mission needs. During LRIP, production process controls mature to such an extent that the program may move away from developmental fabrication methods. Limiting the number of aircraft to be acquired during LRIP also makes it more difficult for the contractor to persuade its suppliers to make improvements leading to full-rate production readiness.

RECOMMENDATION 3: The GAO recommended that the Secretary of the Air Force direct the F-22 program office to monitor the status of key manufacturing processes by accumulating statistics on the percentage of key manufacturing processes in control as the program continues to proceed toward high-rate production. (Draft Report/p. 26)

DOD RESPONSE: **Partially Concur.** It is important that we ensure that manufacturing processes are maturing as production progresses, and that these processes are "in control." The update to the Production Readiness Review, incorporated as an exit criterion for the Lot 3 award in CY02, will include an assessment of the status of the key manufacturing processes. The Department also monitors those processes through other metrics-for example, scrap rework and repair data. The CY02 exit criteria speak directly to the GAO's recommendation.

Appendix IV: GAO Staff Acknowledgments

Acknowledgments

Marvin E. Bonner, Edward Browning, Arthur Cobb, Travis Masters, Gary Middleton, Robert D. Murphy, Don M. Springman, and John Van Schaik made key contributions to this report.

Related GAO Products

Tactical Aircraft: Continuing Difficulty Keeping F-22 Production Costs Within the Congressional Limitation. GAO-01-782. Washington, D.C.: July 16, 2001.

Tactical Aircraft: F-22 Development and Testing Delays Indicate Need for Limit on Low-Rate Production. GAO-01-310. Washington, D.C.: March 15, 2001.

Defense Acquisitions: Recent F-22 Production Cost Estimates Exceeded Congressional Limitation. GAO/NSIAD-00-178. Washington, D.C.: August 15, 2000.

Defense Acquisitions: Use of Cost Reduction Plans in Estimating F-22 Total Production Costs. GAO/T-NSIAD-00-200. Washington, D.C.: June 15, 2000.

Budget Issues: Budgetary Implications of Selected GAO Work for Fiscal Year 2001. GAO/OCG-00-8. Washington, D.C.: March 31, 2000.

F-22 Aircraft: Development Cost Goal Achievable If Major Problems Are Avoided. GAO/NSIAD-00-68. Washington, D.C.: March 14, 2000.

Defense Acquisitions: Progress in Meeting F-22 Cost and Schedule Goals. GAO/T-NSIAD-00-58. Washington, D.C.: December 7, 1999.

Fiscal Year 2000 Budget: DOD's Procurement and RDT&E Programs. GAO/NSIAD-99-233R. Washington, D.C.: September 23, 1999.

Budget Issues: Budgetary Implications of Selected GAO Work for Fiscal Year 2000. GAO/OCG-99-26. Washington, DC: April 16, 1999.

Defense Acquisitions: Progress of the F-22 and F/A-18E/F Engineering and Manufacturing Development Programs. GAO/T-NSIAD-99-113. Washington, D.C.: March 17, 1999.

F-22 Aircraft: Issues in Achieving Engineering and Manufacturing Development Goals. GAO/NSIAD-99-55. Washington, D.C.: March 15, 1999.

F-22 Aircraft: Progress of the Engineering and Manufacturing Development Program. GAO/T-NSIAD-98-137. Washington, D.C.: March 25, 1998.

F-22 Aircraft: Progress in Achieving Engineering and Manufacturing Development Goals. GAO/NSIAD-98-67. Washington, D.C.: March 10, 1998.

Tactical Aircraft: Restructuring of the Air Force F-22 Fighter Program. GAO/NSIAD-97-156. Washington, D.C.: June 4, 1997.

Defense Aircraft Investments: Major Program Commitments Based on Optimistic Budget Projections. GAO/T-NSIAD-97-103. Washington, D.C.: March 5, 1997.

F-22 Restructuring. GAO/NSIAD-97-100R. Washington, D.C.: February 28, 1997.

Tactical Aircraft: Concurrency in Development and Production of F-22 Aircraft Should Be Reduced. GAO/NSIAD-95-59. Washington, D.C.: April 19, 1995.

Tactical Aircraft: F-15 Replacement Issues. GAO/T-NSIAD-94-176. Washington, D.C.: May 5, 1994.

Tactical Aircraft: F-15 Replacement Is Premature as Currently Planned. GAO/NSIAD-94-118. Washington, D.C.: March 25, 1994.

GAO's Mission

The General Accounting Office, the investigative arm of Congress, exists to support Congress in meeting its constitutional responsibilities and to help improve the performance and accountability of the federal government for the American people. GAO examines the use of public funds; evaluates federal programs and policies; and provides analyses, recommendations, and other assistance to help Congress make informed oversight, policy, and funding decisions. GAO's commitment to good government is reflected in its core values of accountability, integrity, and reliability.

Obtaining Copies of GAO Reports and Testimony

The fastest and easiest way to obtain copies of GAO documents is through the Internet. GAO's Web site (www.gao.gov) contains abstracts and full-text files of current reports and testimony and an expanding archive of older products. The Web site features a search engine to help you locate documents using key words and phrases. You can print these documents in their entirety, including charts and other graphics.

Each day, GAO issues a list of newly released reports, testimony, and correspondence. GAO posts this list, known as "Today's Reports," on its Web site daily. The list contains links to the full-text document files. To have GAO e-mail this list to you every afternoon, go to www.gao.gov and select "Subscribe to daily e-mail alert for newly released products" under the GAO Reports heading.

Order by Mail or Phone

The first copy of each printed report is free. Additional copies are $2 each. A check or money order should be made out to the Superintendent of Documents. GAO also accepts VISA and Mastercard. Orders for 100 or more copies mailed to a single address are discounted 25 percent. Orders should be sent to:

U.S. General Accounting Office
P.O. Box 37050
Washington, D.C. 20013

To order by phone:
Voice: (202) 512-6000
TDD: (202) 512-2537
Fax: (202) 512-6061

Visit GAO's Document Distribution Center

GAO Building
Room 1100, 700 4th Street, NW (corner of 4th and G Streets, NW)
Washington, D.C. 20013

To Report Fraud, Waste, and Abuse in Federal Programs

Contact:

Web site: www.gao.gov/fraudnet/fraudnet.htm,
E-mail: fraudnet@gao.gov, or
(800) 424-5454 or (202) 512-7470 (automated answering system).

Public Affairs

Jeff Nelligan, managing director, NelliganJ@gao.gov (202) 512-4800
U.S. General Accounting Office, 441 G Street NW, Room 7149,
Washington, D.C. 20548