



Report to the Subcommittee on  
Tactical Air and Land Forces,  
Committee on Armed Services, House  
of Representatives

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May 2014

# F-22 MODERNIZATION

Cost and Schedule  
Transparency Is  
Improved, Further  
Visibility into  
Reliability Efforts Is  
Needed

# GAO Highlights

Highlights of [GAO-14-425](#), a report to the Subcommittee on Tactical Air and Land Forces, Committee on Armed Services, House of Representatives

## Why GAO Did This Study

The Air Force's cost estimate for modernizing the F-22 aircraft's capabilities and making improvements that address the aircraft's reliability and structural problems is \$11.3 billion, as of January 2014. In February 2013, the Air Force awarded a multibillion dollar contract for F-22 modernization efforts from 2013 through 2023. The National Defense Authorization Act for Fiscal Year 2013 directed the Air Force to report annually on improvement efforts.

GAO was asked to review F-22 modernization and improvement efforts. This report assesses (1) the Air Force's new approach to structuring its F-22 modernization efforts, (2) the Air Force's management of its F-22 reliability and structural improvement efforts, and (3) challenges facing efforts to modernize the F-22 and address reliability and structural problems moving forward. GAO analyzed program management, contracting, and other relevant documents; analyzed aircraft availability information; and spoke with Air Force officials.

## What GAO Recommends

To support program oversight and ensure efficient use of future funding, GAO recommends that the Air Force include comprehensive cost and schedule baselines for reliability projects in its annual report to Congress and expedite reassessment of the F-22 availability requirement. DOD disagreed with the first recommendation, stating that reliability programs cannot be baselined like major defense acquisition programs, and agreed with the second. GAO continues to believe the first recommendation is valid as discussed in the report.

View [GAO-14-425](#). For more information, contact Michael J. Sullivan at (202) 512-4841 or [sullivanm@gao.gov](mailto:sullivanm@gao.gov).

May 2014

## F-22 MODERNIZATION

### Cost and Schedule Transparency Is Improved, Further Visibility into Reliability Efforts Is Needed

## What GAO Found

After a decade of managing its efforts to modernize the F-22 as part of the original F-22 program, the Air Force has now begun structuring these efforts as distinct incremental programs, and plans to continue doing so moving forward. For example, the Department of Defense (DOD) recently designated F-22 modernization Increment 3.2B—intended to integrate two types of missiles onto the F-22 and upgrade other subsystems—as a major defense acquisition program with its own baseline cost and schedule estimate. This approach is consistent with the approach mandated in the National Defense Authorization Act for Fiscal Year 2013 and recommended in a May 2012 GAO report, and should allow decision makers to see a more precise view of cost and schedule changes. Furthermore, the Air Force plans to use individual contractual agreements for each modernization effort, a contracting approach that should support informed management and oversight of each increment by increasing visibility into funds obligated to individual efforts.

In contrast to modernization, the larger of the Air Force's two primary F-22 improvement efforts—the Reliability and Maintainability Maturation Program (RAMMP)—is not managed with its own cost and schedule baseline. This approach limits transparency of cost and schedule progress. The National Defense Authorization Act for Fiscal Year 2013 directed the Air Force to submit an annual report to the congressional defense committees on RAMMP and on F-22 structural repair efforts, to include baseline cost and schedule estimates. While the first report submitted under this requirement in April 2013 provided some cost and schedule information on the structural repair efforts, which could be used as a baseline estimate going forward, it did not include such information for RAMMP. Without a comprehensive baseline cost and schedule estimate for reliability efforts that encompasses the life of the aircraft across all types of funding, it is difficult to consistently track cost and schedule progress on projects that, to date, have cost almost \$1 billion.

The Air Force faces schedule and performance challenges in its management of F-22 modernization and improvement efforts as a result of continuing maintenance issues. Delays in completing depot-level maintenance have translated into delays in fielding modernization increments, which could also affect future increments. Further, the F-22 fleet will not achieve its availability requirement as scheduled, despite substantial investment in RAMMP projects. RAMMP is intended to increase the availability of the F-22 to perform its missions, primarily through improving reliability—the likelihood that the aircraft will operate without failure—and reducing the time required to maintain the aircraft. Air Combat Command officials stated that the current requirement is based on assumptions that may no longer be applicable, and that they expect to revisit this requirement at some future point, although they did not specify when that reassessment would occur. Thus, continued investment in some projects aimed at achieving a requirement that may no longer be valid may be unwarranted. Any delay in revisiting this requirement could limit funding DOD might be able to make available for other high priority activities in a time of austere federal budgets.

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## Abbreviations

DOD	Department of Defense
ID/IQ	indefinite delivery / indefinite quantity
NDAA	National Defense Authorization Act
RAMMP	Reliability and Maintainability Maturation Program
SRP	Structural Repair Program

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May 15, 2014

The Honorable Michael R. Turner  
Chairman  
The Honorable Loretta Sanchez  
Ranking Member  
Subcommittee on Tactical Air and Land Forces  
Committee on Armed Services  
House of Representatives

Since 2003, the Air Force has undertaken a number of efforts to modernize the F-22 and make improvements that address the aircraft's reliability and structural problems. The most recent combined cost estimate for these efforts was approximately \$11.3 billion, of which nearly 60 percent has already been invested. In February 2013, the Air Force awarded a contract representing several billion dollars of that total to continue to modernize the F-22 from 2013 through 2023. The Air Force recently began development on the latest modernization effort, and continues significant investment in improvements aimed at achieving the F-22's original reliability and service life requirements. The National Defense Authorization Act for Fiscal Year 2013 (NDAA) established managing and reporting requirements for new modernization efforts and the aircraft's reliability and structural improvement programs.<sup>1</sup>

As billions of dollars continue to be invested in the F-22, you asked us to review the acquisition and contracting strategies for the F-22 modernization and improvement efforts. This report assesses (1) the Air Force's new approach to structuring its F-22 modernization efforts, (2) the Air Force's management of its F-22 reliability and structural improvement efforts, and (3) challenges facing efforts to modernize the F-22 and

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<sup>1</sup>Specifically, the NDAA requires the Department of Defense to treat the F-22A modernization Increment 3.2B (and any future program modernizations that would otherwise qualify for treatment as a major defense acquisition program) as a major defense acquisition program for which selected acquisition reports shall be submitted to Congress in accordance with section 2432 of title 10 of the U.S. Code. The act also requires annual congressional reports on the costs, schedules, and performances of the reliability and maintainability maturation program and the structural repair program of the F-22A modernization program. Pub. L. No. 112-239, § 144. Increment 3.2B is intended to integrate AIM-9X and AIM-120D missiles onto the F-22 aircraft, as well as upgrading geolocation and electronic protection subsystems.

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address reliability and structural problems moving forward. To assess the Air Force's new approach to structuring modernization efforts, we analyzed actual and projected program management data for fiscal years 2003 to 2023, from sources including acquisition decision memorandums, selected acquisition reports, and independent and program cost estimates. These sources were issued in 2012 or 2013. We also reviewed contracting and budget documents relevant to F-22 modernization. To assess the Air Force's management of its F-22 reliability and structural improvement efforts, we collected and analyzed Air Force reports and briefing materials on aircraft availability and reliability and repair projects. To assess challenges facing efforts to modernize the F-22 and address reliability and structural problems moving forward, we analyzed program schedules and actual and projected aircraft availability data for fiscal years 2011 to 2018, current as of August 2013, and reviewed program documents discussing maintenance issues affecting the aircraft. We also discussed progress and plans for modernization and improvement efforts with DOD, Air Force, and F-22 program officials. We assessed the reliability of DOD data on selected acquisition reports, cost estimates, and materiel availability rates and projections by reviewing documentation related to the data and interviewing agency officials knowledgeable about the data. We determined that the data were sufficiently reliable for the purposes of this report. Appendix I contains a more detailed description of our scope and methodology.

We conducted this performance audit from July 2013 to May 2014 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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## Background

The F-22 Raptor is the first operational tactical aircraft fielded by the Air Force that incorporates a low observable (stealth) and highly maneuverable airframe, advanced integrated avionics, and an engine capable of sustained supersonic flight. The F-22 acquisition program began in 1991 with an intended development period of 12 years and a planned quantity of 648 aircraft. However, F-22 development eventually spanned 14 years, during which time costs increased substantially and threats, missions, and some requirements changed. As a result, total quantities were significantly decreased, with 195 of the 648 planned aircraft being delivered to the Air Force. As of March 2014, the total

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number of active F-22 aircraft was 182.<sup>2</sup> When the final aircraft was delivered in 2012, the F-22 acquisition program was completed at a total estimated cost of over \$67 billion.

In 2003, the Air Force established an F-22 modernization program primarily to develop and insert new and enhanced ground attack capabilities considered necessary to meet current and future threats. The Air Force's current total cost estimate for F-22 modernization is around \$9.4 billion, which includes costs directly attributable to modernization, as well as costs to support testing and laboratory operations, provide periodic software updates, and ensure compliance with military and civilian standards for identifying other aircraft and avoiding collisions. According to Air Force officials, modernization is defined as a process of upgrading and modifying aircraft with a focus on adding new capabilities. The Air Force has divided its modernization efforts into a series of increments, each with multiple upgrades.<sup>3</sup> All of the currently active F-22 aircraft have been upgraded with Increment 2, and more than 140 of those aircraft are expected to be upgraded with subsequent modernization increments. Aircraft that are primarily used for training are not expected to receive upgrades beyond Increment 2. Table 1 lists the current F-22 modernization increments in order and identifies the main features and key events associated with each one.

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<sup>2</sup>Of the other 13 delivered aircraft currently considered inactive, 4 are being used by a contractor for testing, 4 were lost, and the remaining 5 are no longer flyable.

<sup>3</sup>The Air Force numbering scheme considers Increment 1 to be the baseline capabilities delivered by the F-22 acquisition program.

**Table 1: Features and Key Events of F-22 Modernization Efforts**

Increment	Main features	Key events
2	<ul style="list-style-type: none"> <li>Resolution of problems left over from original development program</li> <li>Basic air-to-ground capabilities, including Joint Direct Attack Munition</li> </ul>	<ul style="list-style-type: none"> <li>Started development in 2003</li> <li>Currently fielded</li> </ul>
3.1	<ul style="list-style-type: none"> <li>Enhanced air-to-ground attack capabilities, including Small Diameter Bomb</li> <li>Enhanced radar capabilities</li> </ul>	<ul style="list-style-type: none"> <li>Started development in 2006</li> <li>Currently being fielded</li> <li>Expected to complete fielding in August 2017</li> </ul>
3.2A	<ul style="list-style-type: none"> <li>Enhanced electronic protection and combat identification capabilities</li> <li>Software-only modification requiring installation of Increment 3.1 hardware</li> </ul>	<ul style="list-style-type: none"> <li>Started development in 2011</li> <li>Currently in testing</li> <li>Expected to complete fielding in October 2017</li> </ul>
3.2B	<ul style="list-style-type: none"> <li>Integration of AIM-9X and AIM-120D missiles</li> <li>Upgraded geolocation and electronic protection subsystems</li> </ul>	<ul style="list-style-type: none"> <li>Started development in 2013<sup>a</sup></li> <li>Currently in development</li> <li>Expected to complete fielding in August 2020</li> </ul>

Source: GAO analysis of U.S. Air Force data.

<sup>a</sup>Development work for Increment 3.2B began in 2008 but a formal decision to begin a system development program was not made until 2013.

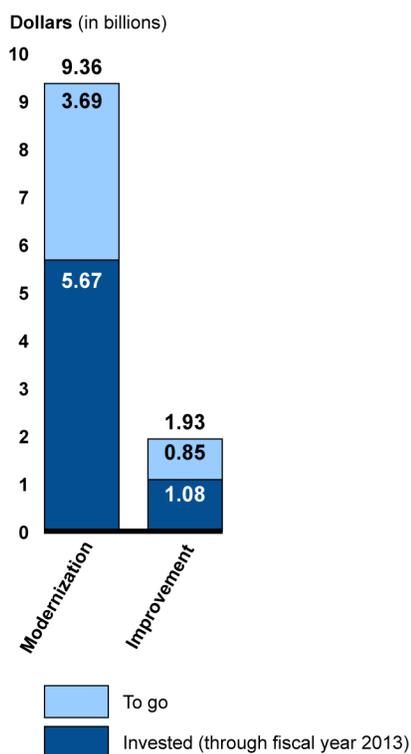
In addition to modernization efforts, the Air Force is also continuing to pursue two primary improvement efforts. These fix identified issues affecting the aircraft, rather than developing and adding new capabilities. One of the efforts, the Structural Repair Program (SRP), started in 2006, and involves installation of structural hardware that is needed for the aircraft to achieve its originally expected 8,000 flight hour service life.<sup>4</sup> SRP is expected to be completed in 2019. The other effort, known as the Reliability and Maintainability Maturation Program (RAMMP), started in 2005, and consists of a large number of individual projects primarily intended to increase the amount of time the aircraft are available for operational use. According to program officials, as of January 2014 there were over 100 RAMMP projects of varying scope and cost under way, and over 200 projects had been completed. Program officials have noted that new RAMMP projects can be initiated as maintenance issues are identified. They also noted that RAMMP is expected to continue

<sup>4</sup>The acronym for this effort is defined in a number of different ways, depending on the source. For example, it is referred to as Structures Retrofit Plan in Air Force budget documents, and Structural Retrofit Program in the Air Force's required annual report to Congress on its F-22 improvement efforts. For the purpose of this report we will use Structural Repair Program, as this is the term used in the NDAA.

throughout the life of the aircraft. These two primary improvement programs, as well as efforts to enhance engine reliability, are currently expected to cost a total of \$1.9 billion.

Figure 1 illustrates how the current cost estimate of \$11.3 billion is divided between modernization and improvement efforts, as well as the amounts invested through 2013 and still to be invested.

**Figure 1: Estimated Cost for F-22 Modernization and Improvement (billions of then year dollars)**



Source: GAO analysis of U.S. Air Force data.

Note: All data used in this cost estimate are from the F-22 Modernization Program Office Estimate dated November 16, 2012, or subsequent cost data provided by the program reflecting actual costs for fiscal years 2012 and 2013, with the exception of those relating to Increment 3.2B, which are taken from the F-22 Increment 3.2B Modernization Defense Acquisition Executive Summary dated November 26, 2013.

As illustrated in figure 1, more than half of the current estimated funding for both the modernization and improvement efforts has already been invested. Total spending to complete F-22 modernization and improvement efforts is uncertain as capability needs evolve and reliability

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improvement projects are identified. Program officials stated that they intend to issue an updated cost estimate later in 2014, to include cost projections through the life of the aircraft.

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## Air Force's New Approach to Structuring F-22 Modernization Should Improve Oversight and Transparency

The Air Force's decision to structure new F-22 modernization efforts as independent programs should provide greater visibility into each individual effort. We found in May 2012 that modernization efforts had initially been managed and funded as part of the original F-22 program and costs for specific increments were not individually tracked, which limited transparency. However, beginning with Increment 3.2B, the Air Force plans to manage each modernization effort as a distinct, stand-alone program with levels of oversight and approval set according to the dollar value of the program. Increment 3.2B was designated as a major defense acquisition program with an approved cost, schedule, and performance baseline in June 2013.<sup>5</sup> The Air Force is now funding the program as a discrete element within its budget and is required to provide periodic reports, known as selected acquisition reports, to Congress on its cost and schedule status. Looking ahead, the Air Force is planning to begin four smaller increments intended to ensure compliance with military and civilian standards for identification of other aircraft and avoidance of collisions. This incremental approach is consistent with the approach we recommended in May 2012 and Congress mandated in the 2013 NDAA, and should provide greater transparency into cost, schedule, and performance progress.<sup>6</sup>

F-22 modernization efforts are primarily performed under a contracting vehicle known as an indefinite delivery / indefinite quantity contract

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<sup>5</sup>While Increment 3.2B received approval to begin system development in June 2013, this event had originally been scheduled for the prior year. The delay was due to the Air Force not placing Cost and Software Data Reporting under contract for Increment 3.1 and Increment 3.2A, which delayed preparation of the required Independent Cost Estimate, as noted in GAO, *Defense Acquisitions: Assessments of Selected Weapon Programs*, [GAO-14-340SP](#) (Washington, D.C.: Mar. 31, 2014).

<sup>6</sup>GAO, *Tactical Aircraft: F-22A Modernization Program Faces Cost, Technical, and Sustainment Risks*, [GAO-12-447](#) (Washington, D.C.: May 2, 2012); Pub. L. No. 112-239, § 144.

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(ID/IQ).<sup>7</sup> In February 2013, the Air Force awarded an ID/IQ contract with a contract ceiling of \$6.9 billion to cover F-22 modernization efforts from 2013 to 2023. Program officials stated that about \$6.2 billion of the funding under this contract will be used to continue work on modernization efforts that began prior to the contract award as well as other planned efforts. They noted that the remaining \$700 million would be used to cover costs associated with future requirements that have not yet been defined. According to program officials, they plan to complete an updated cost estimate later in 2014 that is expected to reflect all modernization costs through the life of the aircraft. As of August 2013, less than \$500 million had been obligated under this contract, the majority of which is for engineering and manufacturing development work on Increment 3.2B. As a result, more than \$6.4 billion remained available to be obligated.

The Air Force plans to use individual contractual agreements, known as delivery orders, which are issued under the ID/IQ contract, for each modernization effort. The delivery orders establish, among other things, the requirements, cost or price, and schedule for the work to be performed under the order. Program officials have stated that they intend to issue a separate delivery order for each future modernization effort. Issuing delivery orders for each modernization effort should support informed management and oversight of each increment by increasing visibility into funds obligated to individual efforts.

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<sup>7</sup>This type of contract is used to acquire supplies or services during a specified contract period when the exact times and exact quantities of future deliveries are not known at the time of contract award. The base contract establishes, among other things, the procedures that the government will use in issuing orders. Federal Acquisition Regulation (FAR) §§ 16.501-2(a) and 16.504(a)(4)(iv). F-22 program officials note that these types of contracts have been used by the Air Force for previous upgrade programs, such as a performance enhancement effort on the C-17 transport aircraft.

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## Air Force's Approach to Managing Reliability Improvement Efforts Limits Transparency of Cost and Schedule Progress

The larger of the Air Force's two primary F-22 improvement efforts—RAMMP—is not managed with its own cost and schedule baseline. This approach limits transparency of cost and schedule progress. The 2013 NDAA directed the Secretary of the Air Force to submit an annual report to the congressional defense committees on the cost, schedule, and performance of RAMMP and SRP.<sup>8</sup> That direction required the Air Force to identify cost and schedule baselines for these two programs, which would provide Congress with visibility into the progress of these improvement efforts over time. The Air Force submitted its first report in April 2013, but did not explicitly identify baseline cost and schedule estimates for RAMMP or SRP.<sup>9</sup>

The Air Force's 2013 report included a cost estimate through completion for SRP, as well as some schedule information. Although not explicitly identified as baselines, these cost and schedule estimates may provide the information necessary for use as SRP baseline estimates going forward, if the Air Force chooses to do so. However, the report lacked information for RAMMP needed to serve as baseline cost and schedule estimates going forward. According to DOD guidance, program cost baselines should reflect realistic estimates that cover the entire program and schedule baselines should include projected dates for major decision points, among other things. For RAMMP, the report does not provide any schedule information, and it identifies projected development and procurement funding through fiscal year 2017. However, program officials have stated that RAMMP projects will continue for the life of the F-22, which is currently expected to retire around 2033. Additionally, RAMMP has received operations and maintenance funding, but this funding is not reflected in the report. Without a comprehensive baseline cost and schedule estimate for reliability efforts that encompasses the life of the aircraft across all types of funding, it is difficult to consistently track cost and schedule progress on projects that to date have cost almost \$1 billion. Air Force officials agreed that the 2013 report did not contain a complete cost and schedule baseline for RAMMP.

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<sup>8</sup>Pub. L. No. 112-239, § 144(c).

<sup>9</sup>In both 2013 and 2014, the Air Force did not submit this report to Congress by March 1, which is the statutory deadline. The 2014 report was not available at the time of this review.

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In contrast to its approach of contracting for modernization efforts under individual delivery orders, the Air Force's approach to contracting for RAMMP makes it difficult to track funding obligated to individual projects. According to program officials, these projects are primarily funded through an F-22 air vehicle sustainment contract. Under this contract, work on individual projects can be split across multiple line items, making it difficult to manage and oversee cost and schedule performance of individual projects. These projects range in size and complexity from smaller efforts that cost less than \$1 million to a project to improve the durability of stealth coatings that is expected to cost more than \$50 million.

Unanticipated problems with the F-22 can generate additional RAMMP projects, which makes it challenging to accurately estimate future RAMMP costs. For example, to address concerns with the F-22 life support system, an Air Force committee that advises on science issues recommended that a back-up oxygen system be incorporated into the aircraft. Development of this system has resulted in at least \$20 million of unplanned work being funded through RAMMP.

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## F-22 Modernization and Improvement Efforts Will Continue to Face Schedule and Performance Challenges

The Air Force faces schedule and performance challenges in its management of F-22 modernization and improvement efforts as a result of continuing maintenance issues. Delays in completing depot-level maintenance have translated into delays in fielding modernization increments, which could also affect future increments. Despite substantial investments in improving F-22 reliability, the aircraft does not yet meet its availability requirement, and the Air Force does not expect it to meet this requirement.

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## Maintenance Delays Are Affecting Schedule for Fielding Modernization Efforts

Longer than expected time frames for completing depot-level maintenance on F-22 aircraft extended the near-term F-22 modernization schedule and could affect fielding of future modernization increments. Depot-level maintenance refers to major maintenance and repairs, such as overhauling, upgrading, or rebuilding parts, assemblies, or subassemblies, which is usually performed at a facility known as a depot. A contractor-run depot in Palmdale, California performing F-22 maintenance has returned multiple aircraft back to the fleet months later than planned. For example, in 2013 this depot returned one aircraft back to the fleet more than 10 months later than originally scheduled. Fielding of modernization increments can take place at a depot, and program officials noted that the delays at the Palmdale depot have affected the

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schedule for fielding Increment 3.1. As of May 2012, the Air Force expected Increment 3.1 to be fielded in fiscal year 2016. That increment is now not expected to complete fielding until August 2017. In addition, the SRP program, which was initially planned to complete in late 2017, is now not expected to finish until 2019 as a result of the depot maintenance delays.

Further delays may affect the time line for fielding future modernization increments because the increments build on each other sequentially. Increment 3.2A is a software upgrade that requires Increment 3.1 hardware, and delays in the Increment 3.1 schedule have caused the expected fielding of Increment 3.2A to move from fiscal year 2016 to fiscal year 2018. Similarly, any further delays in fielding these earlier increments could affect fielding of Increment 3.2B.

According to an Air Force analysis of F-22 maintenance issues, work related to maintaining the stealth features of the F-22 accounts for almost half of the time that the aircraft are unavailable due to maintenance.<sup>10</sup> Program officials noted that after repairs or modifications that involve removing a panel with stealth coatings, those coatings must be restored, which can take several days. As a result, minor repairs or modifications that would take a few hours on a non-stealth aircraft can require days of maintenance on an F-22. Therefore, when an aircraft is scheduled to enter a depot to receive modifications that need to be performed at the depot, the Air Force often plans to perform other major work that the aircraft is intended to receive at the same time, since the stealth coatings will need to be restored anyway. For example, when an F-22 aircraft enters a depot for SRP modifications, the Air Force may also schedule Increment 3.1 modifications during that time. However, officials noted that modernization efforts can be completed outside of the depot if needed.

One way the Air Force is attempting to address the depot maintenance situation is by consolidating all F-22 depot maintenance at a government-operated facility in Ogden, Utah. According to an Air Force analysis of F-22 depot operations, management turnover at the contractor-run depot in Palmdale and additional workload to address aircraft corrosion issues contributed to this depot's delays in delivering aircraft back to the fleet.

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<sup>10</sup>The program is also addressing an issue with the aircraft's stealth coatings that may require stripping the coatings from the aircraft and replacing them with a different coating.

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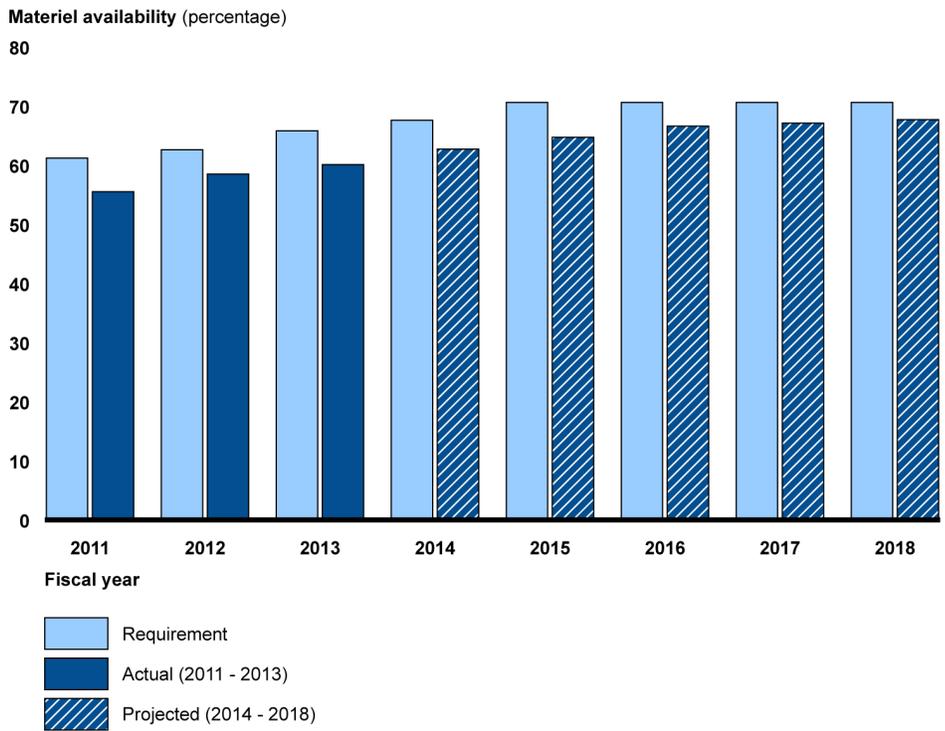
The Palmdale facility has higher labor rates than the Ogden facility and has charged more labor hours than the Ogden facility when performing modifications. The Air Force analysis also found that consolidating all F-22 depot maintenance at the Ogden facility should provide better schedule performance while reducing costs for F-22 depot maintenance by approximately \$20 million per year. The Air Force plans to mitigate schedule risks related to depot consolidation by retaining a residual capacity at Palmdale into 2015.

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**Despite Efforts to Improve Reliability and Maintainability, the F-22 Fleet Will Not Meet Its Availability Requirement**

The F-22 fleet will not achieve its availability requirement as scheduled despite substantial investments in RAMMP projects. RAMMP is intended to increase the availability of the F-22 to perform its missions, primarily through improving reliability—the likelihood that the aircraft will operate without failure—and reducing the time required to maintain the aircraft. Cumulative spending on RAMMP projects totals about \$900 million through the end of fiscal year 2013, and has had some positive effect on availability over time. However, the Air Force has never been able to meet the F-22's aircraft availability requirement and does not expect to meet that requirement within the next 4 years. The original requirement was expressed in average hours of flying time between maintenance events for the F-22 fleet, excluding routine servicing and inspections, and was set at an average of 3.0 hours. The program was not able to meet that requirement, and it was officially changed to a requirement for overall aircraft availability, set at 70.6 percent materiel availability. This is defined as the percentage of the fleet operationally capable of performing an assigned mission at any given time. The level of availability is required to build over time, from 61.2 percent by the end of fiscal year 2011 to 70.6 percent by the end of fiscal year 2015. This requirement was established to support readiness requirements for projected training and contingency operations. As shown in figure 2, the Air Force has consistently fallen short of its availability requirements. Program projections indicate that it will not achieve 70.6 percent availability by fiscal year 2018.

**Figure 2: Comparison of Required and Actual or Projected F-22 Materiel Availability**



Source: GAO analysis of U.S. Air Force data.

Officials from Air Combat Command, which is involved in developing requirements for the F-22, said that the current materiel availability requirement is based on assumptions that may no longer be applicable. According to Air Force guidance on calculating availability requirements, these assumptions include maintenance needs and the frequency and duration of flights. Command officials noted that they expect to revisit this requirement at some future point with the DOD office that approves F-22 operational requirements to discuss changing the requirement to reflect operational realities, but they did not tell us specifically when they plan to do such a reassessment.<sup>11</sup> Continued investment in some RAMMP projects aimed at achieving the current requirement may be unnecessary

<sup>11</sup> Air Force officials noted that the Command has established a separate standard for aircraft availability, currently set at 66.7 percent materiel availability, which takes into account factors such as updated requirements and expected funding for a particular year.

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if it is no longer considered valid. Moreover, any delay in revisiting this requirement could limit funding that DOD might be able to make available for other high priority activities in a time of austere federal budgets.

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## Conclusions

The Air Force's decision to structure F-22 modernization efforts as distinct incremental programs should increase transparency and provide greater visibility into cost, schedule and performance. It is consistent with both GAO's prior recommendation and statutory direction. However, opportunities remain for the Air Force to achieve greater transparency. In particular, the first annual report to Congress on F-22 improvement efforts lacked full baseline cost and schedule estimates for RAMMP projects. In addition, the report did not include operations and maintenance funding associated with such projects. Rather, it provided development and procurement funding projections through fiscal year 2017, although the program is expected to continue through the life of the aircraft. A more comprehensive baseline estimate for RAMMP would make it easier to track changes in cost and schedule, supporting better program oversight.

Although the Air Force has made substantial investment in RAMMP projects and seen some improvement in aircraft availability, the F-22 program has not been able to achieve its availability requirements. If, as stated by Air Force officials, the current availability requirement is based on assumptions that are no longer valid, then spending on some RAMMP projects could be unnecessary. Promptly revisiting this requirement would help minimize any such unnecessary investment of future funding.

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## Recommendations for Executive Action

To support program oversight and ensure efficient use of future funding, we recommend that the Secretary of Defense direct the Secretary of the Air Force to take the following two actions:

- Incorporate into the Air Force's annual report to Congress on F-22 improvement projects a comprehensive cost and schedule baseline estimate for RAMMP that includes development, procurement, and operations and maintenance costs through the expected life cycle of the fleet.
- Expedite reassessment of the F-22 materiel availability requirement and determine the necessary changes, if any, to the number and scope of RAMMP projects.

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## Agency Comments and Our Evaluation

We provided a draft of this product to DOD for comment. In its written comments, reprinted in appendix II, DOD disagreed with one recommendation and agreed with the other. DOD also provided technical comments, which were incorporated as appropriate.

DOD did not agree with our first recommendation to incorporate a comprehensive cost and schedule baseline estimate for RAMMP that includes development, procurement, and operations and maintenance costs through the expected life cycle of the fleet into the Air Force's annual report to Congress on F-22 improvement projects. DOD's response stated that reliability and maintainability programs cannot be baselined like major defense acquisition programs because of cost fluctuations based on life cycle issues that arise as the weapon system ages. We recognize that RAMMP is not a major defense acquisition program and did not intend to imply that it was, although we believe that DOD guidance for program cost and schedule baselines provides elements of sound baseline estimates that could be used in relation to RAMMP. We acknowledge in our report the challenges of accurately estimating future RAMMP costs. Nevertheless, the 2013 NDAA required comparison of costs and schedules to an appropriate baseline, and the Air Force's April 2013 report did not identify a cost or schedule baseline for RAMMP. Rather, it used the funding levels requested in the fiscal year 2013 President's Budget submission. Continuing to use this approach will not provide visibility into the extent to which RAMMP projects are being executed efficiently. As noted in our report, program officials expect to issue an updated cost estimate for F-22 modernization and improvement efforts later in 2014. That updated estimate is expected to include cost projections through the life of the aircraft, and to the extent that it incorporates RAMMP costs, it could provide a starting point for a baseline estimate to be included in future reports to Congress. The Air Force's April 2013 report states that the way it is structuring and managing RAMMP helps the Air Force get the most value for its money while making judicious use of its time. Inclusion of appropriate cost and schedule baseline estimates would support both goals. Therefore, we continue to believe the recommendation is valid.

DOD agreed with our second recommendation to expedite reassessment of the F-22 materiel availability requirement and determine any necessary changes to the number and scope of RAMMP projects. DOD's response stated that the Air Force assesses weapon system materiel availability annually during formulation of flying hour programs to sustain required levels of readiness, and added that the Air Force will continue to reassess the F-22 materiel availability requirement and adjust RAMMP priorities

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accordingly. While DOD's commitment to regularly reassessing the F-22 materiel availability requirement is commendable, the intent of our recommendation is that DOD should formally reassess the requirement with the Joint Requirements Oversight Council—the DOD office that approves key weapon system requirements. As we noted in our report, Air Combat Command officials stated that they intend to do this at some future point, and our recommendation is simply that they do so as expeditiously as possible.

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We are sending copies of this report to interested congressional committees, the Secretary of Defense, and the Secretary of the Air Force. In addition, the report is available at no charge on the GAO website at <http://www.gao.gov>.

If you or your staff have any questions about this report, please contact me at (202) 512-4841 or [sullivanm@gao.gov](mailto:sullivanm@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix III.

A handwritten signature in black ink, appearing to read "Michael J. Sullivan". The signature is fluid and cursive, with a long horizontal stroke at the end.

Michael J. Sullivan  
Director  
Acquisition and Sourcing Management

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# Appendix I: Objectives, Scope, and Methodology

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We were asked to review and report on the F-22 modernization and improvement efforts. This report assesses: (1) the Air Force's new approach to structuring its F-22 modernization efforts, (2) the Air Force's management of its F-22 reliability and structural improvement efforts, and (3) challenges facing efforts to modernize the F-22 and address reliability and structural problems moving forward.

To assess the Air Force's new approach to structuring modernization efforts, we analyzed actual and projected program management data for fiscal years 2003 to 2023, from sources including acquisition decision memorandums, selected acquisition reports, and independent and program cost estimates. These sources were issued in 2012 or 2013. We also reviewed contracting and budget documents relevant to F-22 modernization. To assess the Air Force's management of its F-22 reliability and structural improvement efforts, we collected and analyzed Air Force reports and briefing materials on aircraft availability and reliability and repair projects. To assess challenges facing efforts to modernize the F-22 and address reliability and structural problems moving forward, we analyzed program schedules and actual and projected aircraft availability data for fiscal years 2011 to 2018, current as of August 2013, and reviewed program documents discussing maintenance issues affecting the aircraft.

In performing our work, we obtained information and interviewed officials from the F-22 System Program Office at Wright-Patterson Air Force Base, Ohio, and Hill Air Force Base, Utah; Air Combat Command, Joint Base Langley-Eustis, Virginia; Office of the Secretary of Defense, Arlington, Virginia; and the Defense Contract Management Agency, Fort Worth, Texas.

We assessed the reliability of DOD data on selected acquisition reports, cost estimates, and materiel availability rates and projections by reviewing documentation related to the data and interviewing agency officials knowledgeable about the data. We determined that the data were sufficiently reliable for the purposes of this report.

We conducted this performance audit from July 2013 to May 2014 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

# Appendix II: Comments from the Department of Defense



DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS UNITED STATES AIR FORCE  
WASHINGTON DC

22 April 2014

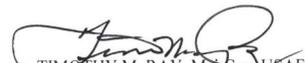
Mr Michael J. Sullivan  
Director, Acquisition and Sourcing Management  
U.S. Government Accountability Office  
441 G Street, NW  
Washington DC 20548

Dear Mr Sullivan:

This is the Department of Defense (DoD) response to the GAO Draft Report GAO-14-425, "F-22 Modernization: Cost and Schedule Transparency is Improved, Further Visibility Into Reliability Efforts is Needed", dated April 3, 2014 (GAO Code 121163).

The Department is providing official written comments for inclusion in the report.

Sincerely,

  
TIMOTHY M. RAY, Maj Gen, USAF  
Director, Global Power Programs  
Assistant Secretary (Acquisition)

Attachment:  
DoD Comments on the GAO Recommendations

GAO DRAFT REPORT DATED APRIL 3, 2014  
GAO-14-425 (GAO CODE 121163)

“F-22 MODERNIZATION: COST AND SCHEDULE TRANSPARENCY IS  
IMPROVED, FURTHER VISIBILITY INTO RELIABILITY EFFORTS IS NEEDED”

DEPARTMENT OF DEFENSE COMMENTS  
ON THE GAO RECOMMENDATION

**RECOMMENDATION 1:** The GAO recommends that the Secretary of Defense direct the Secretary of the Air Force to incorporate into the Air Force’s annual report to Congress on F-22 improvement projects a comprehensive cost and schedule baseline estimate for RAMMP that includes development, procurement, and operations and maintenance costs through the expected lifecycle of the fleet.

**DoD RESPONSE:** The Secretary of Defense non-concurs with the GAO’s recommendation because the GAO’s recommendation infers the RAMMP program should be baselined like a Major Defense Acquisition Program (MDAP). Reliability and Maintainability (R&M) programs cannot be baselined like MDAPs because there will be fluctuations in the cost based on life-cycle issues that arise as the weapon system ages. Additionally, the current F-22 Sustainment Projects report does outline project costs for kit procurement and installation across the Future Years Defense Programs (FYDP), as well as provide rationale for increases to the number of kits procured in the current Fiscal Year. Furthermore, the report quantifies the annual RAMMP contribution to improved aircraft availability and mean-time-between-maintenance--key performance metrics for F-22 sustainment. Lastly, prior to the first F-22 Sustainment Projects report submission to Congress, the Air Force worked closely with the House and Senate Armed Services Committees to obtain concurrence with the design and content of the report to ensure the intent of the Congressional language was met.

**RECOMMENDATION 2:** The GAO recommends that the Secretary of Defense direct the Secretary of the Air Force to expedite reassessment of the F-22 materiel availability requirement and determine the necessary changes, if any, to the number and scope of RAMMP projects.

**DoD RESPONSE:** The Secretary of Defense concurs with the GAO’s recommendation. The AF assesses weapon system materiel availability annually during formulation of flying hour programs to sustain required levels of readiness. Accordingly, the AF will continue to reassess the F-22 materiel availability requirement and continue to adjust RAMMP priorities to optimize improved readiness and life cycle support costs.

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# Appendix III: GAO Contact and Staff Acknowledgments

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## GAO Contact

Michael J. Sullivan, (202) 512-4841 or [sullivanm@gao.gov](mailto:sullivanm@gao.gov).

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## Staff Acknowledgments

In addition to the contact named above, key contributors to this report were Travis J. Masters, Assistant Director; Marie P. Ahearn; Robert P. Bullock; Laura Greifner; Kristine R. Hassinger; Roxanna T. Sun; and Christopher D. Zbrozek.

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