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United States Government Accountability Office
Washington, DC 20548

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Congressional Committees

Subject: *GAO Review of the Department of Homeland Security's Certification of the Secure Flight Program—Cost and Schedule Estimates*

The matching of airline passenger information against terrorist watchlist records (watchlist matching) is a frontline defense against acts of terrorism that target the nation's civil aviation system. In general, passengers identified as matches to the No-Fly list are prohibited from boarding commercial flights, while those matched to the Selectee list are required to undergo additional screening.[1] Historically, airline passenger prescreening against watchlist records has been performed by commercial air carriers.

As required by the Intelligence Reform and Terrorism Prevention Act of 2004, the Department of Homeland Security's (DHS) Transportation Security Administration (TSA) has developed an advanced passenger prescreening program—known as Secure Flight—to assume from air carriers the function of matching passenger information against terrorist watchlist records.[2] Since fiscal year 2004, TSA has received $358 million in appropriated funds for the development and implementation of Secure Flight, according to program officials.

Also, since fiscal year 2004, GAO has been mandated to assess the development and implementation of the Secure Flight program.[3] We have reported on numerous challenges the program has faced, including those related to protecting passenger privacy, completing performance testing, fully defining and testing security requirements, and establishing reliable cost and schedule estimates, among other

[1]The No-Fly and Selectee lists contain the names of individuals with known or suspected links to terrorism. These lists are subsets of the consolidated terrorist watchlist that is maintained by the Federal Bureau of Investigation's Terrorist Screening Center.

[2]See Pub. L. No. 108-458, § 4012(a), 118 Stat. 3638, 3714-18 (2004) (codified at 49 U.S.C. § 44903(j)(2)(C)).

[3]GAO has performed this work in accordance with statutory mandates, beginning in fiscal year 2004 with the Department of Homeland Security Appropriations Act, 2004, Pub. L. No. 108-90, § 519, 117 Stat. 1137, 1155-56 (2003) (establishing the initial mandate that GAO assess the Computer-Assisted Passenger Prescreening System II, the precursor to Secure Flight, and setting forth the original eight statutory conditions related to the development and implementation of the prescreening system), and pursuant to the requests of various congressional committees.

things.[4] We have made recommendations to address these challenges, and TSA has generally agreed with them and has taken corrective actions.

Section 522(a) of the Department of Homeland Security Appropriations Act, 2005, set forth 10 conditions related to the development and implementation of the Secure Flight program that the Secretary of Homeland Security must certify have been successfully met before the program may be implemented or deployed on other than a test basis.[5] Although DHS certified that it had satisfied all 10 conditions in September 2008, our initial assessment found that TSA generally had not achieved 5 of the 10 statutory conditions and that the agency had not demonstrated Secure Flight's operational readiness. In response, TSA took additional actions and, in late January 2009, we found that the agency had generally achieved 6 of the 10 conditions, conditionally achieved 3 conditions—subject to the timely completion of planned activities—and generally had not achieved 1 condition. We also concluded that the actions TSA had taken were sufficient to support beginning Secure Flight initial operations. We continued to review the program and reported in May 2009 that TSA had generally achieved 9 of the 10 statutory conditions and had conditionally achieved 1 condition, subject to the timely completion of planned activities for developing appropriate cost and schedule estimates.[6] Table 1 shows the status of the 10 conditions as of April 2009.

[4]See, for example, GAO, *Aviation Security: Transportation Security Administration Has Strengthened Planning to Guide Investments in Key Aviation Security Programs, but More Work Remains*, GAO-08-456T (Washington, D.C.: Feb. 28, 2008); *Aviation Security: Significant Management Challenges May Adversely Affect Implementation of the Transportation Security Administration's Secure Flight Program*, GAO-06-374T (Washington, D.C.: Feb. 9, 2006); and *Aviation Security: Secure Flight Development and Testing Under Way, but Risks Should Be Managed as System Is Further Developed*, GAO-05-356 (Washington, D.C.: Mar. 28, 2005).

[5]See Pub. L. No. 108-334, § 522, 118 Stat. 1298, 1319-20 (2004). The appropriations acts for each subsequent fiscal year through fiscal year 2009 included the same requirement, referring back to the 10 conditions from fiscal year 2005. See Department of Homeland Security Appropriations Act, 2006, Pub. L. No. 109-90, § 518(a), 119 Stat. 2064, 2085 (2005); Department of Homeland Security Appropriations Act, 2007, Pub. L. No. 109-295, § 514(a), 120 Stat. 1355, 1379 (2006); Consolidated Appropriations Act, 2008, Pub. L. No. 110-161, div. E, § 513(a), 121 Stat. 1844, 2072 (2007); and Department of Homeland Security Appropriations Act, 2009, Pub. L. No. 110-329, div. D, § 512(a), 122 Stat. 3652, 3682 (2008).

[6]GAO, *Aviation Security: TSA Has Completed Key Activities Associated with Implementing Secure Flight, but Additional Actions Are Needed to Mitigate Risks*, GAO-09-292 (Washington, D.C.: May 13, 2009).

Table 1: GAO Assessment of Whether DHS Had Achieved the 10 Statutory Conditions, as of April 2009

Legislative condition topic	Generally achieved[a]	Conditionally achieved[b]	Generally not achieved[c]
System of due process (redress)	X		
Extent of false-positive errors (misidentifications)	X		
Performance of stress testing and efficacy and accuracy of search tools	X		
Establishment of an internal oversight board	X		
Operational safeguards to reduce abuse opportunities	X		
Substantial security measures to prevent unauthorized access by hackers	X		
Effective oversight of system use and operation	X		
No specific privacy concerns with the system's technological architecture	X		
Accommodation of states with unique transportation needs	X		
Appropriateness of life-cycle cost estimates and program plans		X	

Source: GAO analysis.

[a]For generally achieved, TSA had demonstrated that it completed all key activities related to the condition in accordance with applicable federal guidelines and related best practices, which should reduce the risk of the program experiencing cost, schedule, or performance shortfalls.

[a]For conditionally achieved, TSA had completed some key activities and had defined plans for completing remaining activities that if effectively implemented as planned, should result in a reduced risk of the program experiencing cost, schedule, or performance shortfalls.

[c]For generally not achieved, TSA had not demonstrated that it completed all key activities related to the condition in accordance with applicable federal guidelines and related best practices and did not have defined plans for completing the remaining activities, and the uncompleted activities result in an increased risk of the program experiencing cost, schedule, or performance shortfalls.

In our May 2009 report, we concluded that the actions TSA had completed and those planned had reduced the risks associated with implementing the program. We noted, however, that while TSA's ability to fully achieve the statutory condition related to developing appropriate cost and schedule estimates did not affect the Secure Flight system's operational readiness, having reliable cost and schedule estimates would allow for better insight into the management of program resources and time frames as the program is deployed. DHS concurred with our assessment and noted that TSA would continue to work on the Secure Flight program's cost and schedule estimates until the statutory condition is generally achieved.

The Conference Report accompanying the Department of Homeland Security Appropriations Act, 2010, directed GAO to continue its review of the Secure Flight program until all 10 statutory conditions are generally achieved.[7] In accordance with that mandate, this report addresses the extent to which TSA met the Secure Flight condition related to the appropriateness of cost and schedule estimates and any

[7]See H.R. Rep. No. 111-298, at 80 (2009) (Conf. Rep.).

shortfalls or limitations in meeting the requirements in GAO's *Cost Estimating and Assessment Guide*.[8]

Our overall methodology included (1) identifying key activities related to the cost and schedule condition; (2) identifying federal guidance and related best practices that are relevant to successfully meeting the condition; (3) analyzing whether TSA has demonstrated through verifiable analysis and documentation, as well as oral explanation, that the guidance has been followed and best practices have been met; and (4) assessing any risks associated with not fully following applicable guidance and meeting best practices. Specifically, we reviewed the program's life-cycle cost estimate, integrated master schedule,[9] and other relevant documentation against best practices, including those contained in our *Cost Estimating and Assessment Guide*. We also interviewed key program officials overseeing these activities and consulted with a scheduling expert to identify risks to the integrated master schedule. We assessed the status of TSA's efforts to develop appropriate life-cycle cost estimates and program plans based on the agency's plan of action developed in early 2009 and related documentation that TSA provided to us through February 2010. The plan detailed the Secure Flight program management office's proposed activities and time frames for addressing weaknesses that we identified in the program's cost and schedule estimates.

We conducted this performance audit from October 2009 to April 2010 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.

Results in Brief

TSA has generally achieved the statutory condition related to the appropriateness of Secure Flight's life-cycle cost and schedule estimates, and thus has generally achieved all 10 statutory conditions related to the development and implementation of the program. Although the program's cost and schedule estimates do not fully meet all related best practices, TSA has demonstrated that it completed all key activities and our overall assessment found that the agency had substantially satisfied best practices for developing the cost and schedule estimates, as shown in table 2. In general, GAO's methodology for assessing a program's cost and schedule estimates is based on the extent to which an agency has "satisfied" best practices for developing the estimates. For purposes of this review, our assessment that TSA had substantially satisfied best practices equates to the agency generally achieving the statutory condition.

[8]GAO, *GAO Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs*, GAO-09-3SP (Washington, D.C.: March 2009).

[9]In general, an integrated master schedule contains all of the detailed work and planning activities necessary to support key program milestones.

Table 2: GAO Final Assessment of Secure Flight Cost and Schedule Estimates versus Best Practices, as of February 2010

	Best practice[a]	Extent satisfied	Overall assessment
Reliable cost estimate	*Comprehensive* – The estimate should include all costs over the life of the program.	Partially satisfied[b]	Substantially satisfied[c]
	Well documented – The estimate should clearly define all key program or system characteristics.	Satisfied[d]	
	Accurate – The estimate should provide for results that are unbiased and should not be overly conservative or optimistic.	Partially satisfied	
	Credible – The estimate should discuss any limitations because of uncertainty surrounding data or assumptions.	Satisfied	
Reliable schedule	*Capturing key activities* – The schedule should reflect all key government and contractor activities.	Partially satisfied	Substantially satisfied
	Sequencing key activities – The schedule should be planned so that critical program dates can be met.	Substantially satisfied	
	Establishing the duration of key activities – The schedule should realistically reflect how long each activity will take to execute.	Substantially satisfied	
	Assigning resources to key activities – The schedule should reflect what resources (e.g., labor and materials) are needed to do the work.	Satisfied	
	Integrating key activities horizontally and vertically – The schedule should sequentially link activities horizontally and show relationships between tasks and subtasks vertically.	Substantially satisfied	
	Establishing the critical path for key activities – The scheduling software should identify the longest duration path through the sequenced list of key activities.	Partially satisfied	
	Identifying the float time between key activities – The schedule should identify the time that a predecessor activity can slip before the delay affects successor activities.	Partially satisfied	
	Schedule risk analysis should be performed – The schedule risk analysis should predict the level of confidence in meeting a program's completion date.	Satisfied	
	Distributing reserves to high-risk activities – The schedule should include a buffer or reserve of extra time for contingencies.	Substantially satisfied	

Source: GAO analysis.

[a]Enc. I contains additional information on each cost and schedule best practice.

[b]For partially satisfied, TSA officials provided evidence that satisfies about half of the criterion.

[c]For substantially satisfied, TSA officials provided evidence that satisfies the majority of the criterion.

[d]For satisfied, TSA officials provided complete evidence that satisfies the entire criterion.

According to TSA, the Secure Flight program's estimated life-cycle cost is $1.36 billion through fiscal year 2020. TSA plans to complete assumption of the watchlist-matching function from air carriers for all domestic flights in May 2010 and to assume this function for all international flights departing to and from the United States by December 2010. If effectively maintained and updated, TSA's cost and schedule estimates should help ensure oversight and accountability of the Secure Flight program and provide assurance that it will be delivered within estimated costs and time frames.

TSA Has Generally Achieved the Statutory Condition Related to Appropriate Life-Cycle Cost and Schedule Estimates

In May 2009, we reported that TSA had conditionally achieved the statutory requirement related to Secure Flight's life-cycle cost and schedule estimates, based on the agency's plan of action for addressing weaknesses we identified. Since then, TSA has taken several steps to improve these estimates and implement our prior recommendations; thus, we now consider the legislative requirement to be generally achieved.

Secure Flight's Life-Cycle Cost Estimate Substantially Satisfies GAO Best Practices

A reliable cost estimate is critical to the success of any program since it provides the basis for informed investment decision making, realistic budget formulation and program resourcing, meaningful progress measurement, proactive course correction when warranted, and accountability for results.

In our May 2009 report, we noted that Secure Flight's $1.36 billion life-cycle cost estimate was well documented in that it clearly stated the purpose, source, assumptions used, and calculations made. However, it was not comprehensive (it did not include all costs), fully accurate, or credible. As a result, the life-cycle cost estimate did not provide a meaningful baseline from which to track progress, hold TSA accountable, and provide a basis for sound investment decision making. To address recommendations that were in the draft of our May 2009 report,[10] TSA established a plan of action to, among other things, (1) provide more detail in the work necessary to accomplish the program's objectives, (2) properly align the cost estimate with the schedule of work to be performed, (3) develop an independent cost estimate performed by a contractor, (4) have the DHS Cost Analysis Division assess the life-cycle cost estimate, and (5) perform cost uncertainty and sensitivity analyses on the estimate.[11]

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[10]Specifically, we recommended that TSA update the Secure Flight program's life-cycle cost estimate to include all costs, compare the updated estimate to an independent cost estimate, align cost estimates with the program's schedule, quantify the risks facing the program, and determine a level of confidence in meeting the cost estimate. Because TSA provided us with its plan of action to address these recommendations in April 2009, we did not include the recommendations in our May 2009 report.

[11]In general, an uncertainty analysis provides a level of confidence about the program's cost estimate, while a sensitivity analysis allows decision makers to understand the impact of changing one assumption or cost driver at a time (e.g., the effect of a program milestone delay on the total cost of the program).

Over the past year, TSA has significantly improved the Secure Flight program's life-cycle cost estimate and our overall assessment found that the agency has substantially satisfied GAO best practices related to the four characteristics of a reliable cost estimate—comprehensive, well documented, accurate, and credible. For example, in October 2009, a TSA contractor developed an independent cost estimate for the program, which the agency used to validate the credibility of the existing life-cycle cost estimate. TSA has also conducted a cost uncertainty analysis and a sensitivity analysis on the independent cost estimate.

The DHS Cost Analysis Division also reviewed the Secure Flight life-cycle cost estimate in late 2009 and found that the estimate generally met GAO best practices for cost estimating. One of the reasons the estimate still did not fully meet GAO best practices was because the estimate was based on a functional breakdown of the work to be performed (the work breakdown structure, or WBS), instead of a product-oriented structure. While functional activities—for example, engineering or quality control—are necessary for supporting a product's development, a WBS generally should not be organized around them. Rather, best practices recommend that a product-oriented WBS be used that reflects the cost, schedule, and technical performance on specific portions of a program so that project performance can be directly related to developed products. However, we recognize that it is not feasible to reorganize the WBS for Secure Flight at this point in the program, since the time to reorganize it would exceed the time phase of the program and rebaselining the program—which would be required for a new WBS—would be cost prohibitive.[12] DHS Cost Analysis Division officials stated that they expect the life-cycle cost estimate to adhere to a product-oriented WBS for the next major acquisition milestone, which is scheduled to be completed by February 2011. While it is important for TSA to develop a product-oriented WBS for Secure Flight, the other actions the agency has taken are sufficient for us to conclude that TSA has substantially satisfied GAO's best practices for developing a reliable cost estimate for the program.

Enclosure I contains additional information on our final assessment of Secure Flight's life-cycle cost estimate relative to GAO's best practices.

Secure Flight's Program Schedule Substantially Satisfies GAO Best Practices

The success of any program depends in part on having a reliable schedule specifying when the program's set of work activities will occur, how long they will take, and how they relate to one another. As such, the schedule not only provides a road map for the systematic execution of a program, but it also provides the means by which to gauge progress, identify and address potential problems, and promote accountability.

In our May 2009 report, we noted that Secure Flight's schedule was developed using some of GAO's best practices for developing schedules, but several key practices were not fully employed that are fundamental to having a schedule that provides a

[12]At times, an organization may conclude that the remaining budget and schedule targets for completing a program are significantly insufficient and that the current baseline is no longer valid for realistic performance measurement. If so, the program may be rebaselined.

sufficiently reliable basis for estimating costs, measuring progress, and forecasting slippages. In addition, best practices require that a schedule identify the longest duration path through the sequenced list of key activities—known as the schedule's critical path—where if any activity slips along this path, the entire program will be delayed. TSA's schedule did not include a critical path, which could help program managers better understand the effect of any delays. We also noted that updating the Secure Flight program's schedule is important because of the significant cost and time that remained to be incurred for TSA to assume the watchlist-matching function for all domestic flights and to develop, test, and deploy the functionality to assume the watchlist matching function for international flights.

To address recommendations that were in the draft of our May 2009 report,[13] TSA established a plan of action to develop, among other things, (1) a sequenced and logical schedule to accurately calculate float time and a critical path;[14] (2) a schedule that fully identifies the resources needed to complete key activities;[15] (3) a schedule that includes realistic estimates of activity duration; and (4) a schedule risk analysis that will be used by TSA leadership to distribute resources to high-risk activities on the critical path, which if delayed would delay the entire program. According to TSA, this revised schedule would better forecast the completion date for the project.

Since we issued our May 2009 report, TSA has taken several steps to improve the Secure Flight program's schedule, and our overall assessment found that the agency has substantially satisfied GAO's best practices related to the nine characteristics of a reliable schedule estimate—capturing key activities, sequencing key activities, establishing duration of key activities, assigning resources to key activities, integrating key activities horizontally and vertically,[16] establishing a critical path, identifying float time, performing a schedule risk analysis, and distributing reserves to high-risk activities.[17] For example, TSA has assigned resources for each activity, conducted a schedule risk analysis, and undertaken strategies to mitigate risks to the program that could affect the schedule. To minimize the risk of schedule delay, TSA

[13]Specifically, we recommended that TSA establish a reliable benchmark schedule for the Secure Flight program's remaining activities using scheduling best practices, maintain the schedule throughout the program's life cycle using proper scheduling methods, rely on calculated dates in the schedule rather than imposing target dates, add projected resources to the program's schedule to better track progress, and periodically assess the risks to the schedule. Because TSA provided us with its plan of action to address these recommendations in April 2009, we did not include the recommendations in our May 2009 report.

[14]In general, float is the amount of time an activity can slip before affecting successor activities.

[15]The schedule should reflect what resources (e.g., labor, material, and overhead) are needed to do the work, whether all required resources will be available when needed, and whether any funding or time constraints exist.

[16]The schedule should be horizontally integrated, meaning that it links the products and outcomes associated with already sequenced activities, and should be vertically integrated, meaning that traceability exists among varying levels of activities and supporting tasks and subtasks.

[17]The schedule should include a buffer or a reserve of extra time to complete work. Generally, the reserve should be applied to high-risk activities, which are typically found along the critical path.

prioritized the schedule for assuming the watchlist-matching function from air carriers and reallocated staff resources.

In addition, TSA hired a contractor to complete an independent schedule risk analysis and implemented some of the recommendations made in that analysis. However, best practices for scheduling are not fully satisfied, because scheduling constraints prevent the scheduling software from automatically calculating the start and finish dates of remaining activities. These constraints also prevent the software from automatically creating a valid critical path, which hampers the ability of decision makers to optimally allocate resources (e.g., move resources from low-risk activities that are not on the critical path to high-risk activities). However, the Secure Flight program office has justified the use of these constraints, as the start dates for activities related to TSA's assumption of the watchlist-matching function from air carriers are legally binding between the Secure Flight program office and the airlines.

On January 27, 2009, the Secure Flight program began initial operations—assuming the watchlist-matching function for a limited number of domestic flights for one airline—and has since phased in additional flights and airlines. According to TSA, Secure Flight plans to assume this function for a total of over 70 U.S. air carriers and about 150 foreign carriers.[18] As of March 31, 2010, TSA was working with 74 U.S. air carriers and 19 foreign carriers. Specifically,

- Secure Flight had fully assumed the watch-list matching function for 39 U.S. air carriers (domestic flights only), had partially assumed this function for another 11 U.S. carriers,[19] and was in testing with another 24 U.S. carriers and

- Secure Flight had fully assumed the matching function for 5 foreign air carriers (international flights departing to and from the United States) and was in testing with another 14 foreign carriers.

TSA plans to complete assumption of the watchlist-matching function from air carriers for all domestic flights in May 2010 and to assume this function for all international flights departing to and from the United States by December 2010, assuming the air carriers make the necessary system changes as required to be compliant with the Secure Flight Final Rule.[20] Specifically, the rule contains requirements for air carriers to follow as TSA implements and operates Secure Flight, including the collection of full name and date-of-birth information from airline passengers to facilitate watch-list matching. To date, TSA has not experienced any unexpected challenges with aircraft operators currently testing with Secure Flight that would necessitate an extension to the schedule, according to program officials.

[18]Because of fluctuations in passenger service, the total number of covered carriers in the Secure Flight program will vary. For example, a new carrier could either start new service or cancel existing service.

[19]Partial assumption involves air carriers that are phasing in their flights or provide service to multiple airlines.

[20]See 73 Fed. Reg. 64,018 (Oct. 28, 2008) (codified at 49 C.F.R. pt. 1560).

Enclosure I contains additional information on our final assessment of Secure Flight's schedule estimate relative to GAO's best practices.

Agency Comments

On March 29, 2010, we provided a draft of this report to DHS for comment. DHS did not provide written agency comments. However, TSA provided technical comments, which we incorporated in this report where appropriate. TSA also noted that it appreciated the assistance we have provided in helping TSA meet Congress' 10 statutory conditions related to the Secure Flight program, and our public recognition that TSA has generally achieved the single outstanding statutory condition related to the program's appropriate life-cycle cost and schedule estimates.

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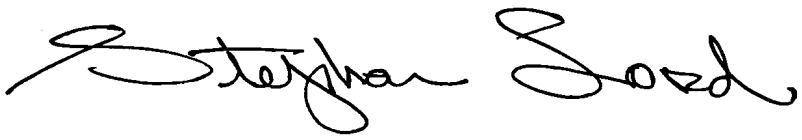
We are sending copies of this report to the appropriate congressional committees, the Secretary of Homeland Security, and other interested parties. This report also is available at no charge on the GAO Web site at http://www.gao.gov.

Should you or your staff have any questions about this report, please contact me at (202) 512-4379 or lords@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Key contributors to this report were Karen Richey, Assistant Director; Eric Erdman, Assistant Director; Jason Lee; and Victoria Miller.



Stephen M. Lord
Director, Homeland Security and Justice Issues

Enclosures – 1

List of Committees

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The Honorable David E. Price
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The Honorable Harold Rogers
Ranking Member
Subcommittee on Homeland Security
Committee on Appropriations
House of Representatives

Enclosure I: GAO Analyses of Secure Flight's Life-Cycle Cost and Schedule Estimates against Best Practices

Our research has identified several best practices that serve as the basis for effective program cost and schedule estimating.[21] Our assessments of the extent to which Secure Flight's cost and schedule estimates satisfied best practices were based on the following criteria:

- Not satisfied: Project officials provided no evidence that satisfies any part of the criterion.
- Minimally satisfied: Project officials provided evidence that satisfies less than half of the criterion.
- Partially satisfied: Project officials provided evidence that satisfies about half of the criterion.
- Substantially satisfied: Project officials provided evidence that satisfies the majority of the criterion.
- Satisfied: Project officials provided complete evidence that satisfies the entire criterion.

Specifically, we have identified four characteristics of a reliable cost estimate: comprehensive, well documented, accurate, and credible. Table 3 summarizes the results of our final assessment of the Secure Flight program's cost estimate relative to the four characteristics of a reliable cost estimate, as of February 2010.

Table 3: GAO Final Assessment of Secure Flight Cost Estimate Compared to Best Practices for a Reliable Cost Estimate, as of February 2010

Best practice	Explanation	Satisfied?	GAO analysis
Comprehensive	The cost estimates should include both government and contractor costs over the program's full life cycle, from the inception of the program through design, development, deployment, and operation and maintenance to retirement. They should also provide an appropriate level of detail to ensure that cost elements are neither omitted nor double counted and include documentation of all cost-influencing ground rules and assumptions.	Partially satisfied	The Department of Homeland Security's (DHS) Cost Analysis Division (CAD) reviewed the Secure Flight life-cycle cost estimate in 2009. CAD concluded that one of the reasons the estimate did not entirely meet GAO best practices for cost estimating was because the cost estimate adhered to a functional work breakdown structure (WBS) instead of the best practice standard product-oriented WBS. However, CAD accepted the estimate conditionally, determining that the time to correct the WBS would exceed the time phase of the program, and that rebaselining the program—required for a new WBS—would be cost prohibitive. CAD officials stated that they expected the life cycle cost estimate to adhere to a product-oriented WBS for the next major acquisition milestone. GAO agreed with CAD's conclusions.

[21]GAO-09-3SP.

Well documented	The cost estimates should have clearly defined descriptions of key program or system characteristics. Additionally, they should capture in writing such things as the source data used and their significance, the calculations performed and their results, and the rationale for choosing a particular estimating method. Moreover, this information should be captured in such a way that the data used to derive the estimate can be traced back to, and verified against, their sources. The final cost estimate should be reviewed and accepted by management.	Satisfied	TSA has fully met this criterion.
Accurate	The cost estimates should provide for results that are unbiased and not overly conservative or optimistic. In addition, the estimates should be updated regularly to reflect material changes in the program, and steps should be taken to minimize mathematical mistakes and their significance. Among other things, an estimate should be grounded in a historical record of cost estimating and actual experiences on comparable programs.	Partially satisfied	As in the case of the "Comprehensive" best practice, CAD concluded that one of the reasons the estimate did not entirely meet GAO best practices for cost estimating was because the cost estimate adhered to a functional WBS instead of the best practice standard product-oriented WBS. However, CAD accepted the estimate conditionally, determining that the time to correct the WBS would exceed the time phase of the program, and that rebaselining the program—required for a new WBS—would be cost prohibitive. CAD officials stated that they expected the life cycle cost estimate to adhere to a product-oriented WBS for the next major acquisition milestone. GAO agreed with CAD's conclusions.
Credible	The cost estimates should discuss any limitations in the analysis performed due to uncertainty surrounding data or assumptions. Further, the estimates' derivation should provide for varying any major assumptions and recalculating outcomes based on sensitivity analyses, and their associated risks/uncertainty should be disclosed. Also, the estimates should be verified based on cross-checks using other estimating methods and by comparing the results with those of independent cost estimates.	Satisfied	CAD had performed assessments of the Secure Flight life- cycle cost estimate prior to 2009 and identified several areas of deficiency in the estimate. These deficiencies included the estimate not being well documented, an inability to trace data back to their original sources, a functional WBS instead of the best practice standard product-oriented WBS, and the lack of a risk analysis. However, CAD accepted the estimates conditionally, determining that the time to correct these deficiencies would exceed the time phase of the program, and rebaselining the program—required for a new WBS—would be cost prohibitive. CAD officials reviewed an updated Secure Flight life-cycle cost estimate from April 2009 and determined that the estimate generally adhered to best practices

			in GAO's *Cost Estimating and Assessment Guide*. CAD officials told us that they will require the Secure Flight program to adhere to a product-oriented WBS for the next major acquisition milestone point. The Secure Flight program office hired a contractor to develop an independent cost estimate, which was completed in October 2009. This independent estimate was reviewed by the program office and used to assess the reasonableness of the Secure Flight life-cycle cost estimate. The independent cost estimate included a sensitivity analysis on key variables that might affect the long-term cost of the program, as well as a cost risk uncertainty analysis that determined the level of confidence associated with the point estimate.

Source: GAO analysis.

GAO has also identified nine best practices that characterize a reliable schedule estimate—capturing key activities, sequencing key activities, establishing duration of key activities, assigning resources to key activities, integrating key activities horizontally and vertically, establishing critical path, identifying float time, performing a schedule risk analysis, and distributing reserves to high-risk activities. Table 4 summarizes the results of our final assessment of the Secure Flight program's schedule relative to the nine schedule estimating best practices, as of February 2010.

Table 4: GAO Final Assessment of Secure Flight Schedule Compared to Best Practices for Schedule Estimating, as of February 2010

Best practice	Explanation	Satisfied?	GAO analysis
Capturing key activities	The schedule should reflect all key activities as defined in the program's WBS, to include activities to be performed by both the government and its contractors.	Partially satisfied	The updated integrated master schedule (IMS) includes baselined international deployment dates. DHS's CAD reviewed the Secure Flight WBS in 2009 and concluded that it was functionally based rather than being product oriented, which is the best practice standard. However, CAD accepted the WBS conditionally, determining that the time to correct the WBS would exceed the time phase of the program, and that rebaselining the program—required for a new WBS—would be cost prohibitive. CAD officials stated that they expected the program to adhere to a product-oriented WBS for the next major acquisition milestone. GAO agreed with CAD's conclusions.

Sequencing key activities	The schedule should be planned so that it can meet critical program dates. To meet this objective, key activities need to be logically sequenced in the order that they are to be carried out. In particular, activities that must finish prior to the start of other activities (i.e., predecessor activities), as well as activities that cannot begin until other activities are completed (i.e., successor activities), should be identified. By doing so, interdependencies among activities that collectively lead to the accomplishment of events or milestones can be established and used as a basis for guiding work and measuring progress.	Substantially satisfied	The logic in the updated IMS is straightforward, and none of the remaining activities have missing dependencies. However, the use of "Start No Earlier Than" constraints for each airline testing phase 1 activity prevents the schedule from being able to dynamically calculate the completion date. The program office has justified the use of these constraints, as airline testing phase start dates are legally binding dates negotiated between the program office and each of the approximately 200 airlines.
Establishing the duration of key activities	The schedule should realistically reflect how long each activity will take to execute. In determining the duration of each activity, the same rationale, historical data, and assumptions used for cost estimating should be used. Durations should be as short as possible and have specific start and end dates. Excessively long periods needed to execute an activity should prompt further decomposition so that shorter execution durations will result. The schedule should be continually monitored to determine when forecasted completion dates differ from the planned dates, which can determine whether schedule variances will affect downstream work.	Substantially satisfied	The remaining activities in the updated IMS generally met best practices for activity duration. For example, 75 percent of the remaining activities have duration of 4 days or less, and only 1 percent of remaining activities have duration of greater than 13 days. However, because 48 percent of the remaining activities have duration of 1 day, concern remains that the schedule is assuming too much productivity for an 8-hour day.
Assigning resources to key activities	The schedule should reflect what resources (e.g., labor, material, and overhead) are needed to do the work, whether all required resources will be available when needed, and whether any funding or time constraints exist.	Satisfied	Based on our analysis of the December 2009 IMS and interviews with program office officials, we found that the IMS is resource loaded and the program office is actively assessing the loaded resources.
Integrating key activities horizontally and vertically	The schedule is horizontally integrated, meaning that it linked the products and outcomes associated with already sequenced activities. These links are commonly referred to as "handoffs" and serve to verify that activities are arranged in the right order to achieve aggregated products or outcomes. The schedule should also be vertically integrated, meaning that traceability exists among varying levels of activities and supporting tasks and subtasks. Such mapping or alignment among levels enables different groups to work to the same master schedule.	Substantially satisfied	The updated IMS is fully integrated vertically and somewhat integrated horizontally. The use of Start No Earlier Than constraints for each airline testing phase 1 activity prevents the schedule from being able to dynamically calculate the completion date. However, as airline testing phase start dates are legally binding dates negotiated between the program office and each of the approximately 200 airlines, the program office has justified the use of these constraints.
Establishing the critical path for key activities	Using scheduling software, the critical path—the longest duration path through the sequenced list of key activities—should be identified. The establishment of a program's critical path is necessary for examining the effects of any activity	Partially satisfied	The updated IMS does not contain a valid critical path as calculated by the software because of the Start No Earlier Than constraints on each airline testing phase beginning

	slipping along this path. Potential problems that might occur along or near the critical path should also be identified and reflected in the scheduling of the time for high-risk activities.		milestone. However, as airline testing phase start dates are legally binding dates negotiated between the program office and each of the approximately 200 airlines, the program office has justified the use of these constraints.
Identifying the float time between key activities	The schedule should identify float time—the time that a predecessor activity can slip before the delay affects successor activities—so that schedule flexibility can be determined. Generally, activities along the critical path typically have the least amount of float time. Total float describes the amount of time flexibility an activity has without delaying the project completion (if everything else goes according to plan). Total float is used to find out which activities or paths are crucial to project completion.	Partially satisfied	The updated IMS schedule does not reflect realistic float values because of the high number of Start No Earlier Than constraints on the on each airline testing phase beginning milestone. However, as airline testing phase start dates are legally binding dates negotiated between the program office and each of the approximately 200 airlines, the program office has justified the use of these constraints. The IMS shows that 159 activities have from 250 to 300 days of float, suggesting that these activities can slip up to 300 days and not affect the completion date of the project. The updated IMS contains baselined international deployment dates.
Schedule risk analysis should be performed	A schedule risk analysis should be performed using statistical techniques to predict the level of confidence in meeting a program's completion date. This analysis focuses not only on critical path activities but also on activities near the critical path, since they can potentially affect program status.	Satisfied	A schedule risk analysis was performed by an independent contractor and delivered in August 2009. The schedule risk analysis made several recommendations regarding the technical aspects of the schedule as well as programmatic risk reduction recommendations. Among the risk reduction recommendations made were (1) that the amount of work required for each task be estimated before resources are assigned and that an attempt be made to capture the actual work performed throughout the project; (2) that aircraft operator start dates be moved earlier when resources are available; (3) that because the schedule may be delayed if less than 17 aircraft operators are deployed concurrently, the program office should determine the maximum number of aircraft operators that can be deployed concurrently; and (4) that additional resources be assigned to the testing environment.

Distributing reserves to high-risk activities	The baseline schedule should include a buffer or a reserve of extra time. Schedule reserve for contingencies should be calculated by performing a schedule risk analysis. Generally, the reserve should be applied to high-risk activities, which are typically found along the critical path.	Substantially satisfied	According to TSA's plan of action, the schedule risk analysis was completed in August 2009, and program leadership took related actions to distribute reserves.

Source: GAO analysis.

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