FAA NEEDS TO IMPROVE ASDE-X MANAGEMENT CONTROLS TO ADDRESS COST GROWTH, SCHEDULE DELAYS, AND SAFETY RISKS

Federal Aviation Administration

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Memorandum

U.S. Department of Transportation
Office of the Secretary
of Transportation
Office of Inspector General

Subject: ACTION: FAA Needs To Improve ASDE-X Management Controls To Address Cost Growth, Schedule Delays, and Safety Risks
Federal Aviation Administration
Report Number AV-2008-004

Date: October 31, 2007

From: David A. Dobbs
Principal Assistant Inspector General
for Auditing and Evaluation

Reply to Attn. of: JA-1

To: Acting Federal Aviation Administrator

This report presents the results of our review of the Federal Aviation Administration's (FAA) Airport Surface Detection Equipment-Model X (ASDE-X) program. FAA is developing ASDE-X to aid air traffic controllers in preventing ground collisions on the airport surface and reducing runway incursions.[1] FAA also intended for ASDE-X to improve airport safety by operating in all-weather conditions, especially during low-visibility conditions—such as fog, rain, and snow—when controllers cannot see aircraft or vehicles as they move about the airport surface.

ASDE-X is an important safety program that has undergone significant changes since its inception in October 2000. FAA originally planned ASDE-X as a low-cost alternative to its existing Airport Surface Detection Equipment-Model 3/Airport Movement Area Safety System (ASDE-3/AMASS).[2] FAA planned to deploy ASDE-X at 25 small- to medium-sized airports that had no surface surveillance technology and at 1 larger airport that had ASDE-3/AMASS. However, in September 2005, FAA made a major shift in its ASDE-X acquisition strategy and now plans to upgrade 25 ASDE-3/AMASS airports with ASDE-X and deploy it at only 10 airports that had no surface surveillance technology. FAA

[1] A runway incursion is any incident at an airport involving an aircraft, a vehicle, person, or an object on the ground that creates a collision hazard or results in a loss of separation with an aircraft taking off, intending to take off, landing, or intending to land. FAA's definition only applies to airports with operating air traffic control towers.

[2] AMASS provides software enhancement for the ASDE-3 radar designed to monitor airport surface traffic and alert air traffic controllers to potential collisions on the runways. AMASS is deployed at 34 of the Nation's largest and busiest airports. FAA plans for ASDE-X to build upon AMASS's capabilities.

concluded that this would yield the greatest return on its investment and that the maximum safety benefits would be gained by deploying ASDE-X capabilities to airports with larger traffic counts or more complex operations (e.g., airports that use the same runways for arrivals and departures). Our audit objectives were to determine (1) whether FAA's strategy for deploying ASDE-X for operational use is cost effective, given the changes in the program's deployment strategy, and (2) to what extent the ASDE-X program will reduce the risk of ground collisions or accidents caused by runway incursions. We conducted this performance audit in accordance with generally accepted Government Auditing Standards as prescribed by the Comptroller General of the United States. Our objectives, scope, and methodology are discussed in exhibit A.

BACKGROUND

The purpose of ASDE-X is to help maintain safe separation of aircraft and vehicles on the airport surface and aid controllers in avoiding ground collisions—some of the most serious aviation incidents. In fact, the worst aviation accident in history, in which 583 people were killed, occurred in 1977 on a runway in the Canary Islands. Recent examples include the August 2006 accident in Lexington, Kentucky, that caused the loss of 49 lives when a pilot mistakenly taxied onto a closed runway and executed a take-off roll on a runway that was too short. The ASDE-X system is intended to provide direct alerts to controllers of potential aircraft collisions on closed runways.

Prevention of runway incursions and ground collisions has been on the National Transportation Safety Board's (NTSB) "Most Wanted Transportation Safety Improvements List" since 1990. FAA designed ASDE-X in response to the NTSB recommendations to require ground movement safety systems at airports with scheduled passenger service to prevent runway incursions and provide direct warnings to flight crews.

The ASDE-X core surveillance capabilities are intended to depict aircraft and vehicle position and identification overlaid on a color map of the airport. Through system enhancements, ASDE-X safety software monitors the traffic for conflict and, in various scenarios, is able to produce an alert (visual and audible) to warn controllers of pending ground collisions. To determine target positions, ASDE-X processes data from airport surface and terminal radars and receives data from airfield antennas that transmit and receive both transponder beacon and Automatic Dependent Surveillance-Broadcast (ADS-B)[3] data. A computer fuses all the data into a target position and, based on the trend of the target position movement, predicts future positions of aircraft and vehicles.

[3] ADS-B provides accurate Global Positioning System satellite-based position reports for equipped aircraft.

On October 11, 2000, FAA issued a letter contract to Sensis Corporation (the ASDE-X prime contractor) to begin ASDE-X development. FAA and Sensis agreed to the contract terms on November 22, 2000, and formed a cost-sharing agreement on the first system. The first ASDE-X system was priced at $8.3 million; however, the actual production cost escalated to $28.7 million (a 246-percent increase.) In September 2001, 11 months after development began, FAA's Joint Resource Council[4] (JRC) approved the first ASDE-X program baseline at a cost of $424.3 million to implement 26 operational systems by 2007. As table 1 shows, significant changes were made to the ASDE-X baseline even before FAA shifted its strategy in September 2005 thereby increasing the total program cost to $549.8 million and pushing program completion to 2011.

Table 1. History of ASDE-X Strategy Changes

Date	Purpose	No. of ASDE-X Airports	Planned Completion Date	Cost Increase ($ in millions)
Sept. 2001	First program baseline	26/a	2007	$424.3
Jun. 2002	Second baseline: upgrade seven more ASDE-3/AMASS airports	33/b	2007	$80.9
Oct. 2003	Upgrade two more ASDE-3/AMASS airports	35/c	2007	$0
Sept. 2005	Third baseline/major strategy shift: upgrade 25 ASDE-3/AMASS airports	35/d	2011	$44.6
Current Total		**35**	**2011**	**$549.8**

Source: ASDE-X JRC baseline documents

/a **25** airports without surface surveillance and **1** ASDE-3/AMASS airport
/b **25** airports without surface surveillance and **8** ASDE-3/AMASS airports
/c **25** airports without surface surveillance and **10** ASDE-3/AMASS airports
/d **10** airports without surface surveillance and **25** ASDE-3/AMASS airports

Congress continues to support the ASDE-X program. From 2000 to 2007, it appropriated about $400 million for ASDE-X implementation. In fiscal year (FY) 2006, FAA requested $27.2 million for the program but received an additional $3 million due to conferees' concerns about runway incursions and to expedite installation and deployment of ASDE-X equipment. In FY 2007, FAA requested $63.6 million—and Congress approved $70.6 million—for further software development, additional hardware equipment, test and evaluation activities, and program management support.

[4] The JRC is FAA's senior decision-making body that approves funding for major acquisitions.

RESULTS IN BRIEF

The ASDE-X program is at risk of not meeting its cost and schedule goals to commission all 35 ASDE-X systems for $549.8 million by 2011 and may not achieve all planned safety benefits. When we testified[5] in May 2007, FAA had already expended about $288 million (52 percent) and obligated about $350 million (64 percent) of ASDE-X program planned funding but had only deployed 8 of 35 systems for operational use. Additionally, at the deployed sites, FAA had yet to implement the planned capability to alert controllers of potential collisions on intersecting runways and taxiways.

In July 2007, FAA commissioned its ninth ASDE-X system for operational use at Louisville International Airport after addressing a number of longstanding technical problems. The Louisville system is the first to be deployed with the capability to alert controllers of potential collisions on intersecting runways and converging taxiways. Under certain circumstances, however, the system still does not provide timely alerts for controllers to take appropriate action. Moreover, FAA did not test the converging taxiway capability before operations began. Additionally, in June 2006, FAA issued policy[6] governing the use of ASDE-X during inclement weather after concluding the system was capable of reducing excessive false alerts during heavy precipitation. However, the system is susceptible to dropping targets during heavy precipitation. While FAA's efforts to address these problems have shown progress, it is too early to conclude whether ASDE-X can meet the unique needs of each airport scheduled to receive the system.

To achieve ASDE-X program goals and effectively manage the program, FAA needs to (1) improve ASDE-X management controls to reduce the risks of further cost growth and schedule delays; (2) resolve operational performance issues with key ASDE-X safety capabilities planned to reduce the risk of ground collisions on intersecting runways and taxiways, including during inclement weather; and (3) work with airlines and airport officials to provide safety enhancements that were not included in the ASDE-X program re-baseline but are vital to reducing the risks of ground collisions caused by pilot and vehicle operator errors.

FAA needs to improve ASDE-X management controls to reduce the risks of further cost growth and schedule delays. Although the JRC approved the re-baselined cost and schedule estimates for ASDE-X in September 2005, by December 2006, FAA had significantly increased cost estimates for six major ASDE-X activities. FAA also did not achieve ASDE-X schedule goals in FY 2006.

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[5] OIG Testimony, CC-2007-054, "FAA's FY 2008 Budget Request: Key Issues Facing the Agency," May 10, 2007. OIG reports and testimonies can be found on our website: www.oig.dot.gov.

[6] FAA Notice N JO 7210.660, "Safety Logic Systems Procedures for ASDE-X 5.0.7.2 and AMASS," June 1, 2007.

FAA needs to develop realistic cost estimates through ASDE-X completion to determine whether the program can be procured within the revised costs. FAA increased ASDE-X cost estimates for six activities central to implementing the program by $94 million; despite this significant increase, it did not revise the overall estimated program costs. These costs increased for two main reasons: (1) FAA underestimated the cost of ASDE-X hardware, software, and program management requirements and (2) FAA has not addressed improper contract administration practices that we advised the Agency of in June 2006 (such as lack of contract terms and conditions and payments to the contractor before the completion of meaningful work).

To stay within the baseline cost of $549.8 million, FAA offset the cost growth by decreasing other activities required to complete ASDE-X implementation (see exhibit B). However, we question the accuracy of these estimates because we found a $20 million disagreement between FAA's and the prime contractor's estimates of the installation costs. Also, ASDE-X program officials decreased the telecommunications cost estimates from $16.5 million to $8.5 million. They later reported that telecommunications costs were actually one to two times higher than the original estimates, which could increase the cost to at least $33 million. ASDE-X program officials need to develop realistic cost estimates for all activities required to complete ASDE-X implementation.

As of July 2007, FAA had expended about $314 million (57 percent) and obligated about $378 million (69 percent) of the planned funding but had only deployed 9 of 35 systems for operational use. FAA is now challenged with implementing the 26 remaining ASDE-X systems at the more complex airports with less than half of the planned funds remaining. Although FAA has initiated work to implement some of the remaining systems, we remain concerned because until FAA develops realistic cost estimates, it will be difficult to determine if ASDE-X is cost effective.

FAA also needs to correct identified prohibited and improper contract administration practices. In our 2006 management advisory to FAA (see exhibit C), we expressed concern that awarding fees for system enhancements based on costs incurred rather than negotiated fixed-fee dollar amounts encouraged rather than discouraged cost growth. Because FAA has allowed questionable contract practices, has not formalized a final agreement with the prime contractor for these activities, and does not compare actual contract funding to the current estimates, we are concerned that ASDE-X cost elements (e.g., Software Design and Development) do not have credible estimates.

ASDE-X program officials need a realistic master schedule through ASDE-X completion. FAA did not achieve ASDE-X schedule goals in FY 2006—only four of seven planned ASDE-X systems were commissioned for operational use. These

schedule delays occurred because of FAA's failure to establish a realistic master schedule through ASDE-X completion that outlines when all activities associated with commissioning each system for operational use will be completed. For example, at the three airports where ASDE-X systems failed to be commissioned, FAA: (1) did not resolve testing deficiencies at one airport, (2) installed equipment but did not initiate testing at another airport, and (3) did not install the equipment that was delivered to another airport. Delays also occurred because of challenges in interfacing ASDE-X with the legacy radar system. FAA has since revised the schedule for the three airports but did not report in the updated waterfall schedule when the systems will be commissioned for operational use. FAA also no longer reports the overall estimated completion date for the remaining ASDE-X systems. Since the waterfall schedule was released, FAA commissioned the ninth system in Louisville in July 2007; this leaves 26 systems remaining to be commissioned (see exhibit D).

FAA's plans to expedite ASDE-X deployment at Chicago O'Hare airport from 2009 to 2007 further highlight the need for FAA to develop a master schedule to manage the impact of unplanned schedule changes. According to FAA, refocusing resources on a single site can cause a domino effect on the schedule; this may impact FAA's ability to meet its schedule goals for 2007 and its current program goal to complete system deployment by 2011.

To address ASDE-X cost and schedule uncertainty, FAA needs to correct identified improper contract administration practices and establish a mechanism, such as earned valued management (EVM),[7] to track cost and schedule goals for all major activities associated with implementing ASDE-X as required by FAA's Acquisition Management System policy.

FAA needs to resolve operational performance issues associated with key ASDE-X safety capabilities to reduce the risks of ground collisions. The ASDE-X program is at risk of not achieving all of its planned safety benefits. Although the Louisville ASDE-X system provides key safety capabilities required to reduce the risks of ground collisions on intersecting runways and converging taxiways, under certain circumstances the system does not generate timely alerts for controllers to take appropriate action. FAA also needs to resolve operational problems associated with heavy rain that cause ASDE-X to be susceptible to dropped targets and subsequent system outages before commissioning this capability for operational use at other airports.

Safety alert capability for intersecting runways and converging taxiways: Last year, near collisions between aircraft on intersecting runways and converging

[7] EVM is a management tool that can be used to identify early warning indicators of potential cost overruns and schedule delays and to make critical decisions in managing contracts.

taxiways highlighted the need for FAA to implement this capability at all airports. For example, in March 2006, a controller at Chicago O'Hare mistakenly cleared two commercial aircraft for takeoff on intersecting runways. Another controller spotted the error and ordered both aircraft to abort their take-off rolls. Before stopping, however, the 2 aircraft came within 100 feet of each other at the runway intersection. In January 2007, there was a collision between two aircraft operating on converging taxiways at Milwaukee International Airport.

In July 2007, FAA commissioned its first ASDE-X system with the capability to alert controllers of potential collisions on intersecting runways and converging taxiways at Louisville International Airport. FAA commissioned the system after testing a new ASDE-X software build at Louisville that incorporates these capabilities. During testing, ASDE-X experienced several operational performance problems such as unscheduled system outages and untimely alerts to controllers. To address unscheduled system outages, FAA upgraded ASDE-3 radar with new software. The test result concluded that the problems associated with unscheduled system outages had been resolved.

With respect to timeliness of alerts, tests performed by FAA's Independent Operational Test and Evaluation (IOT&E) team raised some concerns. Specifically, under certain circumstances alerts on intersecting runways involving taxiing aircraft may not allow enough time for controllers to warn pilots or vehicle operators. For example, the team observed a scenario where ASDE-X alerts were considered to be too slow: an aircraft landed on one runway as another aircraft was taxiing on a runway toward the intersection where the other aircraft had landed. In a real-life situation, this could have caused a serious collision.

FAA also did not test the converging taxiway capability, although the January 2007 accident in Milwaukee highlighted the importance of verifying this key safety capability. Despite these operational performance risks, FAA decided to commission the ASDE-X safety alert capability for intersecting runways and converging taxiways. In our opinion, FAA needs to take corrective actions to address ASDE-X system limitations pertaining to alert timeliness for taxiing aircraft. FAA also needs to fully test the converging taxiway capability. While FAA's efforts to address these problems have shown progress at Louisville, it is too early to conclude whether ASDE-X can meet the unique needs of each airport scheduled to receive the system.

System susceptibility to dropped targets and system outages during periods of heavy rain: A key capability shortfall of ASDE-3/AMASS that ASDE-X was supposed to address involved improving airport safety by operating in all weather conditions and suppressing false alerts during heavy rain storms. FAA designated Orlando as its operational site to test a new ASDE-X software build or "rain configuration" that Sensis developed to address this problem. FAA finished

testing this upgrade and issued policy on June 1, 2007, governing ASDE-X usage of rain configuration software upgrade during moderate to extreme precipitation.

While we commend FAA's progress, we have concerns because (1) the ASDE-X upgraded system is susceptible to dropping targets and experiencing system outages and continues to generate false alerts and (2) FAA did not test the new rain configuration capability with intersecting runways or ASDE-3 radar, which are present at the majority of the ASDE-X airports that will receive this upgrade. Therefore, FAA needs to properly test this new capability as it is being implemented to ensure that it meets the unique needs of the 35 ASDE-X airports.

FAA needs to work with airports and airlines to provide safety enhancements that were not included in the ASDE-X program re-baseline but are vital to reducing the risks of pilot and vehicle operator errors. Although ASDE-X provides direct warnings to controllers of potential ground collisions, it does not provide direct warnings to pilots or vehicle operators—even though they caused about 70 percent of the runway incursions over the last 3 years.

Direct warnings to pilots: FAA initially planned ASDE-X in response to an NTSB recommendation to provide direct warnings to flight crews (e.g., pilots). However, current plans for ASDE-X do not include direct warnings to pilots, and, for this reason, NTSB rated ASDE-X as an unacceptable response to its recommendation. This is important because over the last 3 years about 54 percent of runway incursions were caused by pilot errors, which are precursors to ground collisions.

As we reported in the past,[8] technologies that help pilots know their and others' locations on the runway (e.g., in-cockpit moving map displays and ADS-B) must be expedited to avoid close calls that continue to pose a serious safety risk to airline crews and passengers. In March 2007, FAA announced plans to expedite the certification and use of in-cockpit moving map displays to show pilots their actual position on the airport surface. In August 2007, FAA also took important steps by awarding a contract for the development and installation of the ground infrastructure for ASD-B.

When displayed in the cockpit, ADS-B information can provide a "second set of eyes" by including the pilot in the loop to detect and alleviate hazardous surface situations. FAA plans to mandate "ADS-B Out" where aircraft will broadcast their position to ground systems but does not intend to mandate the use of

[8] OIG Report Number AV-2001-066, "Despite Significant Management Focus, Further Actions Are Needed To Reduce Runways Incursions," June 26, 2001.

"ADS-B In" or cockpit displays. FAA hopes the industry will voluntarily equip with the technology.[9]

Over the next several years, FAA plans to work with the United Parcel Service at Louisville to develop air-to-air and surface applications for ADS-B In and cockpit displays. FAA plans to integrate the use of ADS-B, cockpit displays, and ASDE-X. This presents FAA with a unique opportunity to determine whether these three technologies can be combined to simultaneously alert controllers and pilots of potential ground collisions. FAA should then determine the cost and timeline for implementing this capability at all ASDE-X airports.

Positive identification of vehicles operating on the airport surface: ASDE-X is designed to reduce the risks of ground collisions caused by vehicle operators by providing positive identification of vehicles operating on the airport surface. However, this safety feature only functions when airport vehicles are equipped with transponders. This capability is important because over the last 3 years, approximately 16 percent of runway incursions were caused by vehicle operators. For example, in February 2007 at Denver International Airport, an aircraft that had just landed nearly collided with a snow plow after the plow driver crossed a runway without clearance from air traffic control or airport operations directly in front of the aircraft. According to the flight crew, they had to use "significant" reverse thrust and brakes to halt the aircraft on the runway. Until airport vehicles are equipped with transponders, controllers will be limited in their use of ASDE-X because they will not be able to positively identify vehicles operating on the airport surface. Therefore, FAA should work with airports to aggressively promote equipping their vehicles with transponders as a vital step in reducing the risks of ground collisions caused by vehicle operator error.

To reduce the risk of ground collisions and maximize ASDE-X capabilities, FAA needs to (1) work with airlines to determine whether ASDE-X can be used with other planned technologies to provide direct warnings to pilots and (2) encourage airport officials to equip airport vehicles with transponders.

SUMMARY OF RECOMMENDATIONS

Our recommendations focus on actions that FAA needs to take to improve ASDE-X management controls to reduce cost growth, schedule delays, and safety risks. FAA needs a well-defined, executable plan that (a) aligns realistic cost estimates with firm schedule goals; (b) identifies when all ASDE-X systems with all planned capabilities will be implemented through program completion;

[9] OIG Testimony CC-2007-100, "Challenges Facing the Implementation of FAA's Automatic Dependent Surveillance–Broadcast Program," October 17, 2007.

(c) corrects improper contract administrative practices; and (d) establishes a mechanism to monitor and track ASDE-X program cost, schedule, and performance.

To reduce the risks of ground collisions caused by pilots and vehicle operators FAA should: (a) determine whether ASDE-X, ADS-B, and in-cockpit moving maps technologies can be combined to simultaneously alert controllers and pilots of potential ground collisions; (b) determine the cost and timeline for implementing this capability at all ASDE-X airports; and (c) work with airports to aggressively promote equipping their vehicles with transponders to maximize ASDE-X capabilities as a vital step in reducing the risks of ground collisions caused by vehicle operator error. Our full recommendations can be found on page 16.

AGENCY COMMENTS AND OIG RESPONSE

On August 6, 2007, we submitted our draft report to FAA for comment. FAA responded on September 25, 2007, and concurred with all six recommendations. FAA stated that each recommendation was valid. However, FAA's response to our recommendation for developing realistic cost and schedule parameters is unclear and does not fully address our concerns about reducing risks with this important safety program. Further, we strongly disagree with the Agency's comment that during the audit it had already begun employing what we recommended. We are concerned that the Agency's response will have the effect of masking ongoing problems with FAA's ASDE-X program management and oversight of contractor performance.

For example, it has been more than a year since we issued our management advisory (see exhibit C) to FAA in June 2006. The advisory recommended that the Agency take immediate steps to correct prohibited and improper contract administration practices with the ASDE-X program. At the time of our draft report submission in August 2007, FAA had yet to take corrective actions to address our concerns raised in June 2006. According to FAA's response, the ASDE-X contracting officer planned to establish new procedures with Sensis and FAA's Resident Quality Reliability Officer to correct prohibited and improper contract administration practices by the end of September 2007—about 15 months after we first brought this to FAA's attention.

FAA concurred with our recommendation to develop a realistic cost estimate to complete ASDE-X implementation. Although FAA has yet to complete contract negotiations with Sensis to obtain reliable and supportable contract cost estimates, the Agency states that costs are consistent with the FY 2005 baseline. FAA's response is difficult to understand since it did not plan to finalize cost estimates for two significant unpriced contract requirements with Sensis until the end of

September 2007. We continue to believe that ASDE-X is proving more costly to implement than expected and that considerable work lies ahead. As we note in our report, until negotiations are complete, FAA will not have a firm understanding of how much it will cost to complete ASDE-X or what capabilities will ultimately be delivered.

In response to our recommendation that FAA develop a master schedule that clearly details when all ASDE-X systems will be fully implemented for operational use, the Agency stated that the Program Office is using a "master integrated working schedule" to track deployment activities. Despite repeated requests during our review for a master schedule, the Program Office did not provide our office with this information. Instead, the Program Office only provided us with a waterfall schedule. This is an incomplete document because it lacks details regarding when all implementation activities and planned capabilities associated with commissioning ASDE-X for operational use will be completed for each airport.

FAA officials stated that they did not provide the Office of Inspector General with the master schedule because it is an internal document that is not released outside of the Agency. The ASDE-X Program Office's behavior and lack of transparency on this matter is unacceptable. This is a violation of the Inspector General Act of 1978.[10] The act authorizes the Inspector General to have access to all records relating to Federal programs and request such information or assistance as may be necessary for carrying out its duties and responsibilities. Accordingly, we are asking the Acting Administrator to take steps to prevent a reoccurrence of this problem.

We do not understand why FAA withheld this information pertaining to the master schedule given the importance of the program in reducing accidents on runways and recent congressional oversight. We testified before the Senate Committee on Appropriations in the spring of 2007, and cost and schedule risk with ASDE-X was a central issue of the hearing. ASDE-X is an important safety program, and Congress and stakeholders need a clear understanding of what it will take to complete this effort with all promised capabilities.

FAA provided us with an updated waterfall schedule in its response to our draft report. We continue to believe that this schedule is incomplete and therefore does not meet the intent of our recommendation. We believe that a system deployment should not be considered "complete" until all planned capabilities (e.g., core and system enhancements) are fully tested and in place. Moreover, while FAA refers to a master integrated working schedule in its response, the Agency still has not provided us with the information.

[10] Inspector General Act of 1978, 5 U.S.C. App. § 6 (1978).

FAA's response included attachments showing its current assessment of the ASDE-X program's cost and schedule along with other program elements. However, this information only serves to underscore our concerns. For example:

- **Attachment A - FAA's calculation of the ASDE-X program's re-baseline cost estimate including distribution of cost in the original estimate:** FAA commented that the ASDE-X program's baseline cost estimates have remained consistent with the September 2005 re-baseline. However, we question how FAA can arrive at this conclusion given the fact that the Agency acknowledges in its response that it has yet to complete negotiations with Sensis to obtain supportable contract cost estimates. FAA also acknowledges that it has yet to establish a mechanism such as EVM to track and monitor ASDE-X cost. We repeatedly requested ASDE-X program officials and cost analysts to provide us with cost estimates so we could verify ASDE-X original and actual costs. We either received conflicting cost information or were informed that the costs had changed for some implementation activities and that details did not exist to break out the costs for ASDE-X implementation activities. Finally, these estimates were released by FAA after we issued our draft report; therefore, we could not verify FAA's source or the accuracy of these estimates.

- **Attachment B – ASDE-X waterfall schedule:** This schedule is dated "as of August 30, 2007," but still shows airports without planned commissioning dates. This reaffirms our recommendation to develop an ASDE-X master schedule detailing when *all* activities and planned capabilities will be commissioned for operational use. Even some airports already listed as commissioned still have site enhancements scheduled for completion in 2008.

- **Attachment C - ASDE-X software enhancement schedule:** This was developed on September 21, 2007, after we issued our draft report. We commend FAA for taking action and acknowledge this as a step in the right direction.

- **Attachment D - ASDE-X software test events and completion dates:** According to FAA, this document shows evidence that the converging taxiway capability was fully tested by the test team from FAA's Technical Center. The intent of our recommendation was to ensure that FAA fully tests ASDE-X planned capabilities at *each* airport scheduled to receive the system given the unique characteristics of each site.

A complete discussion of FAA's comments and our response can be found on pages 17 through 20. FAA's complete response is included in the appendix.

ACTIONS REQUIRED

We consider FAA's actions taken or planned to be responsive to recommendations 2, 3, 4, 5, and 6. We consider these recommendations to be resolved but open until FAA completes all planned actions.

FAA's response to recommendation 1 (on ASDE-X cost and schedule) only partially addresses our concerns. FAA stated that it plans to complete several actions by the end of September 2007. Therefore, we request that FAA update its response for two specific areas: (1) describe how it finalized cost estimates for the two remaining significant unpriced contract requirements (i.e., engineering services and installation) and (2) provide a copy of FAA's new procedures with Sensis to correct prohibited and improper contract administration practices.

FAA also needs to provide an ASDE-X master schedule detailing when all implementation activities and planned capabilities will be commissioned for operational use. FAA's master schedule should not count a site as being commissioned until all planned capabilities (e.g., core and system enhancements) are fully tested and accepted at a site. The ASDE-X Program Office's behavior and lack of transparency on this matter is unacceptable. This is in violation of the Inspector General Act of 1978. Accordingly, we are asking the Acting Administrator to take steps to prevent a reoccurrence of this problem.

In accordance with Department of Transportation Order 8000.1, please provide us with this additional information within 30 days. If you have any questions regarding this report, please contact me at (202) 366-1427 or Kevin Dorsey, Program Director, at (202) 366-1518.

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cc: FAA Chief of Staff
Acting Director of Terminal Program Operations
Anthony Williams, ABU-100

TABLE OF CONTENTS

FINDINGS

We found that the ASDE-X program is at risk for further cost growth and schedule slips and may not achieve all planned safety benefits. To achieve ASDE-X program goals and effectively manage the program, FAA needs to (1) improve program management controls to reduce the risks of further cost growth and schedule delays; (2) resolve operational performance issues with key ASDE-X safety capabilities planned to reduce the risk of ground collisions on intersecting runways and taxiways, including during inclement weather; and (3) work with airlines and airport officials to provide safety enhancements that were not included in the ASDE-X program re-baseline but are vital to reducing the risks of ground collisions caused by pilot and vehicle operator errors.

FAA Needs To Improve ASDE-X Management Controls To Reduce the Risks of Further Cost Growth and Schedule Delays

As of July 2007, FAA had expended about $314 million (57 percent) and obligated about $378 million (69 percent) of the planned funding but had only deployed 9 of 35 systems for operational use. FAA is now challenged with implementing the 26 remaining ASDE-X systems at the more complex airports with less than half of the planned funds remaining. Although FAA has initiated work to implement some of the remaining systems, we remain concerned because until FAA develops realistic cost estimates and schedule goals and establishes better contract administration practices, it will be difficult to determine if ASDE-X is cost effective.

FAA's JRC approved re-baselined ASDE-X cost estimates in September 2005; yet, just 1 year later, ASDE-X program officials increased cost estimates by $94 million for six activities essential to acquiring and implementing ASDE-X (see table 2 on page 2). These costs increased for two main reasons: (1) FAA underestimated the cost for its hardware and software requirements for the new airports scheduled to receive ASDE-X and (2) FAA has not completely addressed improper contract administration practices that we advised the Agency of in June 2006. Also, since the JRC re-baseline, FAA has not met ASDE-X schedule goals and was not able to commission all systems planned for FY 2006.

FAA Needs To Improve ASDE-X Management Controls by Developing Realistic Cost Estimates

Our analysis of FAA's revised cost estimates for ASDE-X found that the Agency underestimated ASDE-X costs for hardware and software for the new airports scheduled to receive ASDE-X. This can be attributed to FAA's failure to

complete site surveys to obtain precise requirements for ASDE-X equipment needs for all new airports and FAA's need to continue developing and deploying additional software to meet ASDE-X requirements. For example, through November 2006, FAA had deployed 12 software builds to the 8 operational sites. By July 2007, FAA completed testing of its latest software build to address safety alert capabilities for intersecting runways, and inclement weather. However, FAA needs to resolve a number of operational performance issues associated with the software that will likely require more software development and additional costs.

FAA has also established an agreement with Sensis to begin developing and testing another ASDE-X software build, which allows ASDE-X technology to be used at airports with a precision runway monitoring capability. According to Sensis, a new national baseline will be established once this new software baseline is complete. FAA had completed negotiations and approved cost estimates with Sensis for this capability by June 2007. However, according to FAA, future requirements for precision runway monitoring are under review.

Table 2. ASDE-X Cost Estimates for Six Activities
(Dollars in Millions)

Cost Element	Planned Cost Estimate (as of Sept. 2005)	Current Cost Estimate (as of Dec. 2006)	Cost Growth
Procurement/ Production	$142.95	$179.74	$36.79
Program Management	$93.47	$120.10	$26.63
Software Design and Development	$38.49	$58.82	$20.33
Logistics Support	$11.00	$18.34	$7.34
Second-Level Engineering	$5.50	$7.90	$2.40
Test and Evaluation	$5.50	$6.23	$0.73
Total	**$296.91**	**$391.13**	**$94.22**

Source: OIG analysis of ASDE-X basis of estimates and ASDE-X updated costs estimates

Our review also found that even though the cost estimates for the six activities now exceed their planned life-cycle estimates by $94 million, the Agency continues to estimate that total ASDE-X program costs will not exceed $549.8 million. The largest cost growth occurred in procurement and production (about $37 million), program management (about $27 million), and software design and development (about $20 million). While FAA attempted to offset the cost growth by decreasing other activities required to complete ASDE-X implementation, we found that for one activity, installation, there is significant disagreement between what FAA estimates the total cost will be and what the prime contractor estimates. FAA estimates the cost to install ASDE-X equipment

at the remaining sites at $44 million, while Sensis estimates it at $64 million—a $20 million difference.

We also found that ASDE-X program officials decreased telecommunications cost estimates from $16.5 million to $8.5 million to remain within ASDE-X program baseline costs. However, ASDE-X program officials later reported that the telecommunications costs were actually one to two times higher than the original estimates, which could increase the costs to at least $33 million or up to $49.5 million. Therefore, we question how realistic FAA's total program costs are for ASDE-X and recommend that FAA develop realistic cost estimates for all ASDE-X implementation activities through program completion.

FAA Needs To Correct Identified Prohibited and Improper Contract Administration Practices

Our June 2006 management advisory to FAA points to some possible causes for FAA's ineffective management of the ASDE-X program. We identified prohibited and improper contract administration practices on the ASDE-X prime contract, including the lack of contract terms and conditions. We found that FAA (1) increased contractor fees based on costs incurred instead of the negotiated fixed-fee dollar amounts, (2) made payments to the contractor before the completion of meaningful work on fixed-price items, and (3) did not adequately document contract changes.

In August 2006, FAA responded to our management advisory. With respect to our first concern that the ASDE-X contract has been administered as a cost-plus-a-percentage-of-cost contract, FAA disagreed with our position. FAA stated that the statute prohibiting cost-plus-a-percentage-of-cost contracts does not apply but concluded that its Acquisition Management System (AMS) does prohibit use of this type of contract. We continue to believe that FAA is in violation of its AMS policy. For example, based on our review of ASDE-X invoices, despite numerous program changes to installation, the contractor bills and collects a fee that is a percentage of costs incurred. With regard to points 2 and 3, FAA indicated that it would begin taking corrective action to address our concerns. We continue to view these areas as major watch items that require FAA's attention.

Risks for further cost growth exist within ASDE-X cost elements, thus increasing the program's overall risk. FAA pays two of the three implementation activities that experienced the largest growth—Software Design and Development and Program Management—on a cost-plus-fixed-fee basis. In the 2006 management advisory, we expressed concern that the way in which ASDE-X program officials awarded fees for system enhancements (software design and development) based on costs incurred rather than negotiated fixed-fee

dollar amounts encouraged rather than discouraged cost growth. Because FAA has questionable contract practices, has not formalized a final agreement with the prime contractor for these activities, and does not compare actual contract funding to the current estimates, we are concerned that ASDE-X cost elements paid on a cost-plus-fee basis do not have credible estimates.

Procurement and Production estimates are also at risk for further increases because FAA has not conducted site surveys to determine precise requirements for ASDE-X equipment at all of the airports now on the deployment waterfall schedule. While FAA pays for Procurement and Production on a fixed-price basis, estimates have grown by $37 million since the last program re-baseline decision. Prior to September 2005, FAA had already given the prime contractor all the funds to produce systems for the previously planned sites. However, the JRC re-baseline decision changed both the airport and the equipment requirements for ASDE-X program, thus increasing the demand for Procurement and Production funding.

Since FAA plans to deploy ASDE-X to more complex airports (i.e., those with more runways; more traffic; and multiple, intersecting runways), it will need to consider the impact on cost estimates. For example, more complex airports such as Chicago O'Hare demand more equipment (such as multiple antennae and radars) to ensure that ASDE-X can track aircraft and vehicle targets on the airport surface. Until site surveys at all airports are done and precise requirements are established, the program is at risk for further cost growth and schedule delays due to unforeseen requirements.

FAA Needs To Address Schedule Delays by Developing Realistic Schedule Goals and a Master Schedule Through ASDE-X Completion

We found that ASDE-X program officials need a realistic master schedule through ASDE-X completion to effectively plan and manage ASDE-X implementation and avoid further schedule delays. Since the JRC re-baselined the program in 2005, FAA has not been able to meet ASDE-X schedule goals. For example, FAA did not achieve its schedule goals for FY 2006—only four of seven planned ASDE-X systems were commissioned for operational use. We found that FAA failed to commission ASDE-X for operational use at Louisville, Charlotte-Douglas, and Washington-Dulles International Airports because it did not resolve testing deficiencies at one airport, installed equipment but did not initiate testing at another airport, and never installed the equipment that was delivered to another airport. FAA has since revised the schedule for the three sites and reported July 2007, August 2007, and July 2008 initial operational dates for those airports, respectively, but did not report when the systems will be commissioned for operational use.

Findings

We also found that schedule delays can be attributed to challenges FAA faced during its first attempts to combine ASDE-X technology with ASDE-3 radars. For example,

- In April 2005, FAA experienced problems with false alerts at Louisville International Airport when it interfaced the newer ASDE-X technologies with ASDE-3 radar. As a result, FAA decided to delay ASDE-X deployment at airports continuing to use these radars until a solution was identified, which further complicated the ASDE-X implementation schedule.

  Two of the three overdue sites (Louisville and Charlotte-Douglas) that were planned for commissioning in FY 2006 but delayed until FY 2007 cause concern about FAA's ability to execute the remainder of the ASDE-X program. Although FAA delivered ASDE-X equipment to these airports in early 2004, it took until July 2007 before FAA could establish full operational status at Louisville, and Charlotte is still pending commissioning. In November 2004, FAA's testing of the combined system in Louisville resulted in the identification of 31 deficiencies that constituted a serious risk to the operational deployment of the ASDE-X/ASDE-3 system. In early March 2005, FAA still found serious deficiencies. After yet another test on March 31, 2005, FAA found that the combined system still generated more false alerts than the ASDE-3 radar had using the existing system, AMASS.

- Also, the ASDE-X system had problems with "stealing" the identification tags of the targets shown on controller displays. With an incorrect tag, a controller could misidentify an aircraft or issue a warning or an instruction to the wrong aircraft, thereby creating greater risk of a ground collision. We are concerned because the current ASDE-X baseline calls for FAA to deploy ASDE-X to 21 airports that will continue to use ASDE-3 radars. While FAA's efforts to address these problems have shown progress by FAA commissioning the Louisville system in July 2007, it is too early to conclude whether ASDE-X can meet the unique needs of each airport scheduled to receive the system.

Moreover, FAA's plans to expedite ASDE-X deployment at Chicago O'Hare airport from 2009 to 2007 further highlight the need for the Agency to develop a master ASDE-X schedule through the program completion. According to FAA, refocusing resources on a single site could cause a domino effect on the waterfall schedule and may impact FAA's schedule goals for 2007. For example, ASDE-X program officials reported that plans to begin upgrading previously commissioned sites with new software to address the safety risks at those airports could slip from 2007 to later years. ASDE-X program officials also reported that because resources have been shifted to Chicago, FAA may not be able to complete full system deployment by 2011.

Findings

We also found that because ASDE-X program officials continue to modify ASDE-X schedule goals, the true ASDE-X completion date remains unclear. In September 2005, FAA identified ASDE-X schedule goals for ordering, constructing, and installing systems along with the operational readiness date for all 35 ASDE-X airports approved by the JRC. In August 2006, however, FAA released an updated ASDE-X schedule and made significant changes to its schedule goals. This updated schedule no longer reported commissioning dates for ASDE-X sites.

FAA also reported different commissioning dates for the ASDE-X system deployed at Orlando International Airport. For example, FAA originally reported that Orlando was commissioned for operational use in September 2004 but later reported a January 2006 commissioning date. These variations in commissioning dates underscore the need for FAA to develop a realistic master schedule with firm dates indicating when ASDE-X will be implemented.

To address ASDE-X schedule uncertainty, FAA needs to develop a master schedule through program completion. The schedule should detail when all activities and planned capabilities associated with commissioning ASDE-X for operational use will be completed for each airport. These activities should include completion dates for procurement and production, equipment installation, software development and deployment, program management support, test and evaluation activities, system optimization, initial operational capability, and commissioning. These activities normally require long lead-times for FAA and Sensis to effectively plan and schedule the resources to complete them; however, according to Sensis officials, FAA only schedules work for them on an annual basis. Therefore, FAA needs to establish a master schedule with Sensis through ASDE-X completion that outlines when all implementation activities and planned capabilities will be commissioned for operational use.

FAA Needs To Establish a Stronger Performance Management Tool To Monitor and Track ASDE-X Cost and Schedule Goals

To address these cost and schedule uncertainties, FAA needs to establish a mechanism to monitor planned and actual costs and schedules for all major activities associated with implementing ASDE-X, as required by its own Acquisition Management System policy. For example, it was not until January 2007 that FAA requested Sensis to provide estimated costs to complete production and procurement, software development, and program management activities through the end of the program, just to name a few activities. FAA needs to implement a stronger performance management tool, such as earned value management, to provide FAA with current and integrated cost, schedule, and technical performance information and reliably forecast future performance. Also,

by implementing earned value management for ASDE-X, FAA decision makers could more effectively track and monitor cost, schedule, and performance goals.

FAA Needs To Resolve Operational Issues Associated With Key ASDE-X Safety Capabilities To Reduce the Risks of Ground Collisions

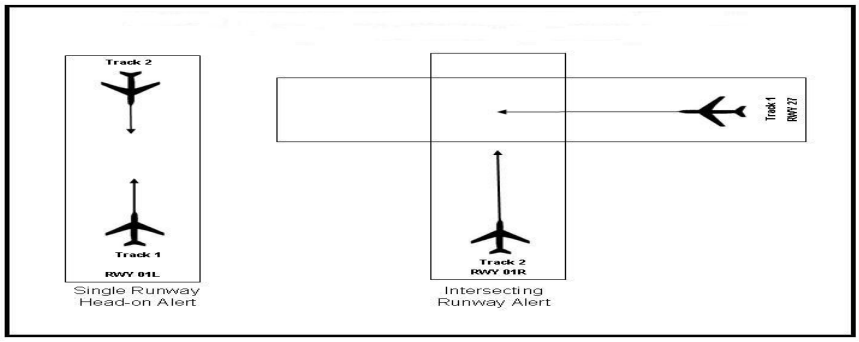
The ASDE-X program is at risk of not achieving all of its planned safety benefits. Although the Louisville ASDE-X system provides key safety capabilities required to reduce the risks of ground collisions on intersecting runways and converging taxiways, under certain circumstances the system does not generate timely alerts for controllers to take appropriate action. FAA also needs to resolve operational problems associated with heavy rain that cause ASDE-X to be susceptible to dropped targets and subsequent system outages before commissioning this capability for operational use at other airports.

The intent of the ASDE-X acquisition was to procure a first-article or "core" system that focused on surveillance capabilities only. The system has the ability to process multiple radar sources, transponder-equipped aircraft and vehicle information, and ADS-B sensor data to positively identify aircraft and vehicles operating on the airport surface to air traffic controllers. After operational acceptance of the core system, the acquisition would continue with system enhancements. These system enhancements include the ability for ASDE-X to operate dual primary radars, remote primary radar tower installation, an interface with the ASDE-3 radar, and development of ASDE-X safety logic.

ASDE-X safety logic is a software enhancement to the ASDE-X core system that predicts the path of aircraft landing or departing and vehicular movements on runways. Visual and auditory alerts are activated when the safety logic projects a potential collision. FAA plans to deploy ASDE-X safety logic software primarily in three successive builds.

- The first build will provide safety alert capability for aircraft or vehicles in collision situations on a single runway.
- The second build will provide alerts for intersecting runways and converging taxiways and during heavy rain storms.
- The third build will provide alerts for more complex runway and taxiway operations. Figure 1 shows possible collision situations in which this technology would be helpful on single and intersecting runways.

Figure 1. Example of a Potential Collision Situation for Single and Intersecting Runways



Source: ASDE-X Safety Logic specification

FAA completed the first build and began commissioning it for operational use at ASDE-X airports. Additionally, in July 2007, FAA began commissioning the second build item for operational use in Louisville—key ASDE-X safety alert capabilities to reduce the risks of ground collisions on intersecting runways and converging taxiways. It is important for FAA to implement these capabilities as soon as possible to reduce the risks of collisions and near collisions on intersecting runways and taxiways, such as those that occurred at Milwaukee General Mitchell, Chicago O'Hare, and Boston Logan International Airports (these incidents are discussed below). However FAA must still resolve operational performance issues associated with these capabilities.

FAA Needs To Resolve Problems With ASDE-X Providing Untimely Alerts To Warn Controllers of Potential Collisions on Intersecting Runways and Converging Taxiways

There are 22 airports with intersecting runways scheduled to receive ASDE-X. FAA has already deployed ASDE-X at six airports with intersecting runways or converging taxiways. However, the Louisville system is the first to be commissioned with the safety alert capability that will warn controllers of potential collisions on intersecting runway and converging taxiways. Recent collisions and near collisions between aircraft on intersecting runways and converging taxiways highlight the need for FAA to address these serious safety risks. For example:

- On June 9, 2005, a controller mistakenly cleared two commercial aircraft at Boston Logan (an Airbus 330 and a Boeing 737) to depart on intersecting runways. As the Airbus lifted off the ground, the Boeing pilot saw the potential hazard and kept his aircraft on the ground to avoid a collision; however, the 2 aircraft came within 171 feet of each other.

- On March 21, 2006, a controller mistakenly cleared two commercial aircraft at Chicago O'Hare (an Airbus 319 and an Embraer E145) for takeoff on intersecting runways. Another controller spotted the error and ordered both aircraft to abort their take-off rolls. Before stopping, however, the 2 aircraft came within 100 feet of each other at the runway intersection.
- On January 24, 2007, a controller mistakenly cleared two cargo aircraft at Milwaukee General Mitchell (a Beech BE99 and a Cessna 402-B) to taxi on converging taxiways, causing the two aircraft to collide. Both airplanes sustained substantial damage. The pilot of the Beech suffered minor injuries, and the pilot of the Cessna was not injured.

By July 2007, FAA completed testing of an ASDE-X software build at Louisville International Airport that has the safety alert capability to warn controllers of potential collisions on converging taxiways and intersecting runways. According to the May 27, 2007, IOT&E report, FAA conducted 23 flight tests representing a wide range of safety alert situations, with emphasis on intersecting runways. While ASDE-X provided timely alerts for most of the test scenarios, the IOT&E team raised concern that under certain circumstances, intersecting alerts involving taxiing aircraft may not provide sufficient time for controllers to take appropriate action. The team observed two scenarios where ASDE-X alerts were considered to be too slow. The first involved an aircraft on final arrival to a runway while another aircraft was taxiing on an intersecting runway. The other involved an aircraft that landed on one runway as another aircraft was taxiing onto a runway toward the intersection of the runway where the other aircraft had landed. FAA needs to take corrective actions to address ASDE-X system limitations pertaining to taxiing aircraft alert timeliness.

According to FAA officials at Louisville, the new ASDE-X software did alert controllers of potential collisions on intersecting runways during an initial test of the system. FAA commissioned the system with these capabilities after addressing a number of technical problems such as unscheduled outages; there were a total of 44 maintenance actions that needed to be addressed. To address the problems, FAA updated ASDE-3 radar with a new software build that it believes should resolve the problems that were contributing to the system outages. Also, Louisville officials did not test the safety alert capability for converging taxiways. While FAA's efforts to address these problems have shown progress at Louisville, it is too early to conclude whether ASDE-X can meet the unique needs of each airport scheduled to receive the system.

Findings

During Periods of Heavy Rain, ASDE-X Is Susceptible To Dropping Targets and Experiencing System Outages

A key capability shortfall of AMASS that ASDE-X was supposed to address involved improving airport safety by operating in all-weather conditions. Although ASDE-X was designed to perform better than AMASS in inclement weather by suppressing false alerts, it has had similar problems. Like AMASS, the ASDE-X primary radar has not been able to accurately identify targets on the airport surface during moderate to heavy rain storms; when this occurs, the system generates false alerts.

FAA designated Orlando International Airport as its operational facility to test a new ASDE-X software build that Sensis developed to address this problem. FAA completed the upgrade at Orlando and issued policy on June 1, 2007, governing ASDE-X usage during moderate to extreme precipitation. The new software build upgrades the ASDE-X radar system with a "rain configuration" to avoid false alerts during heavy rain. According to FAA, when this configuration is selected, it allows full-core alerting capabilities.

While we commend FAA's progress, we have concerns because (1) the ASDE-X upgraded system is still susceptible to dropped targets (i.e., "missing" real targets) and system outages and continues to generate false alerts and (2) FAA did not test the new capability with intersecting runways or ASDE-3 radar, which are present at the majority of the ASDE-X airports that will receive this upgrade. Therefore, FAA needs to properly test the new rain configuration capability as it is being implemented to ensure that it meets the unique needs of all 35 ASDE-X airports.

The ASDE-X rain configuration capability is susceptible to dropping targets and experiencing system outages during periods of heavy rain. FAA issued its new policy after concluding that, with the newly tested rain configuration, ASDE-X is now capable of suppressing excessive rain-generated false targets and preventing false alerts from occurring. However, FAA based this decision on its testing period at Orlando, during which only 20 hours worth of data were collected. In our opinion, this amount of data cannot fully indicate the new upgrade capabilities. Also, Orlando officials told us that even when ASDE-X operates with the rain configuration, it is still capable of missing real targets on the airport surface and displaying false targets. They also stated that if the new capability is operational the majority of the time, a certain level of risk is acceptable. We believe that to address safety risks the system needs to be fully operational.

We also note that FAA's IOT&E Assessment Report for the "ASDE-X Upgrade," dated May 25, 2007, concluded that ASDE-X is susceptible to target loss and system outages during periods of heavy rain. These problems occurred because

the radar interface unit and video detection malfunctioned during periods of heavy rain, and this caused the video levels to go below the threshold, resulting in dropped targets and system outages. Upon system restoration, not all aircraft were displayed. The operational impact of ASDE-X missing targets decreases the system's ability to provide data on the condition of the runways for aircraft and vehicle operations and decreases the system's ability to generate alerts, which could result in a collision. In addition, it reduces controllers' confidence in the reliability of the system.

The IOT&E team rated this as a "High Risk" area and recommended that heavy precipitation causing dropped targets and system outages should be resolved before ASDE-X operational readiness declaration at Louisville and initial operational capability at subsequent ASDE-3/AMASS sites. Additionally, to fully achieve the safety benefits of the ASDE-X Upgrade system, the IOT&E team also recommended that enhancements continue to be implemented to maximize system usage in heavy precipitation. We agree that FAA should resolve this problem prior to deploying the system at other airports.

To address false targets, FAA also issued policy that allows controllers to temporarily "drop" or remove ASDE-X false targets from their displays and from the safety logic processing after they have positively verified, either through pilot/vehicle operator position reports or visual observation, that the target is indeed false. We are concerned about the timeliness of verifying false targets in this way and the ability of controllers to accurately do so while managing air traffic.

FAA's testing for the rain configuration software upgrade did not consider requirements at other ASDE-X airports. The Orlando airport differs from the majority of the other ASDE-X airports in that it has no intersecting runways and does not use ASDE-3 radar input. We are concerned because:

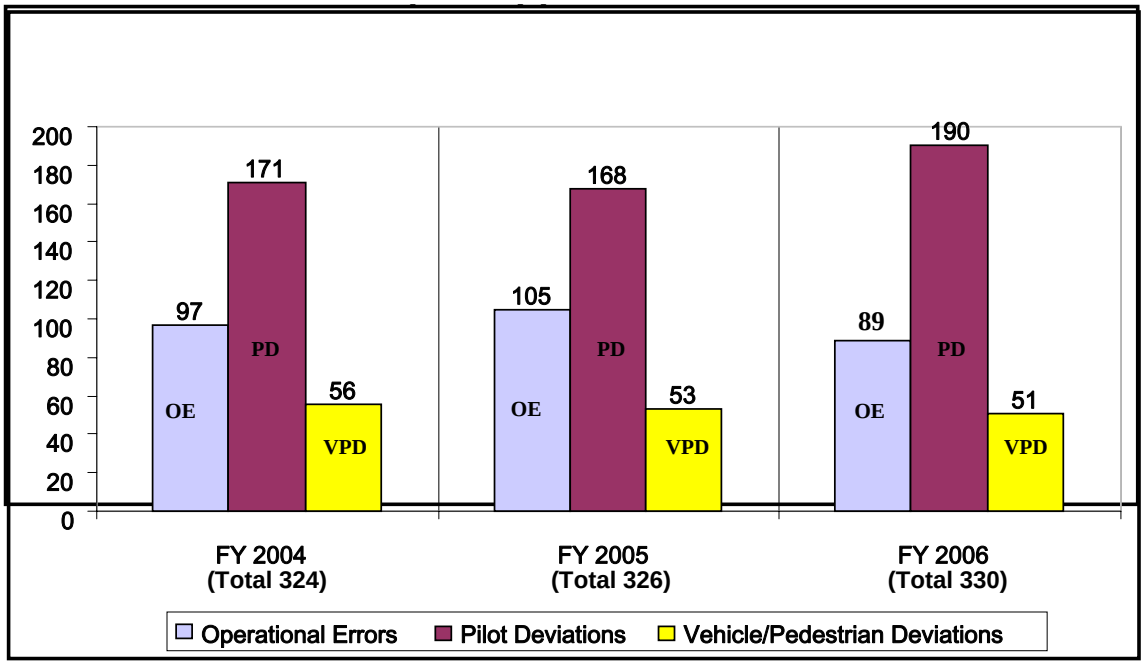
- Although FAA's policy states that the ASDE-X rain configuration software upgrade provides full-core alerting capability, FAA never tested it with intersecting runways or ASDE-3 radar. Therefore, implementation processes that worked with Orlando may not be easily transferable to other sites. We are concerned because 22 of the 35 airports planned to receive ASDE-X have intersecting runways, and 21 of the 35 will retain their ASDE-3 radar. Integration of new upgrades with these radar should be thoroughly tested since a key problem with AMASS's inability to operate during heavy rain storms was ASDE-3 radars causing false alerts.
- Each airport will be required to set site-specific parameters for determining when safety alerts should be generated for ASDE-X rain configuration because precipitation behaves differently depending on the location. Because each

airport has a unique layout and other requirements, this will take time and could further impact the waterfall schedule.

FAA Needs To Work With Airlines and Airport Officials To Address Safety Risks That Were Not Considered in the ASDE-X Program Re-Baseline but Are Vital to Reducing the Risks of Pilots and Vehicle Operator Errors

Although ASDE-X is intended to provide direct alerts to air traffic controllers to warn of potential ground collisions, it does not address similar safety risks caused by pilot or vehicle operator errors—even though these types of errors caused about 70 percent of the runway incursions over the last 3 fiscal years (see figure 2). To reduce the risks of ground collisions and maximize ASDE-X capabilities, FAA needs to (1) determine whether ASDE-X can be used with other planned technologies to directly alert pilots to potential ground collisions and (2) encourage airport officials to equip vehicles with transponders so that controllers can positively identify vehicles operating on the airport surface.

Figure 2. Three-Year Comparison of Runway Incursions



Source: FAA Runway Safety Office: FY 2004-FY 2006 runway incursion data
Note: Operational Errors (OE) are runway incursions caused by air traffic controllers.
Pilot Deviations (PD) are runway incursions caused by pilots.
Vehicle/Pedestrian Deviations (VPD) are runway incursions caused by vehicle operators and pedestrians.

The ASDE-X System Does Not Provide Direct Alerts to Pilots, Which Has Been a Longstanding NTSB Recommendation

FAA designed ASDE-X in response to the NTSB recommendation to require ground movement safety systems at airports to provide direct warnings to flight crews. However, in November 2006, the NTSB reported that ASDE-X is an unacceptable response to its longstanding (6 years) safety recommendation because it does not provide direct warnings of potential ground collisions to flight crews.

Providing warnings directly to flight crews is a potentially significant tool to prevent runway incursions, since over 54 percent were caused by pilot error over the last 3 years. Pilots are subject to physical limitations that restrict visibility of the airport surface, including cockpit/vehicle line-of-sight restrictions. Pilots also rely on radio communications with controllers as a primary means of receiving airport surface movement instructions. Misinterpretation of these communications, which is a common occurrence, can lead to deviations from the stated instructions.

As we reported in the past, technologies to help pilots know their and others' locations on the runway, such as in-cockpit moving map displays and ADS-B, must be expedited to avoid close calls that continue to pose serious safety risks to airline crews and passengers. In March 2007, FAA took the first step to assist pilots by announcing plans to expedite the certification and use of in-cockpit moving map displays to show pilots their actual position and movement on the airport surface. However, moving map displays alone do not provide pilots with the capability of seeing the intent of other aircraft movement on the airport surface nor do they provide the shared situational awareness between pilots and controllers.

In August 2007, FAA also took important steps by awarding a contract for the development and installation of the ground infrastructure for ASD-B. When displayed in the cockpit, ADS-B information can provide a "second set of eyes" by including the pilot in the loop to detect and alleviate hazardous surface situations. However, FAA plans to mandate "ADS-B Out" where aircraft will broadcast their position to ground systems. FAA does not intend mandate the use of "ADS-B In" and the use of cockpit displays but hopes the industry will voluntarily equip with the technology.

Over the next several years, FAA plans to work with the United Parcel Service at Louisville to develop air-to-air and surface applications for ADS-B In and cockpit displays. FAA plans to integrate the use of ADS-B, cockpit displays, and ASDE-X. This presents FAA with a unique opportunity to determine whether these three technologies can be combined to simultaneously alert controllers and pilots of

potential ground collisions. FAA should then determine the cost and timeline for implementing this capability at all ASDE-X airports.

One key to reducing accidents caused by runway incursions is to provide "Shared Situational Awareness," where both the pilot and controller are viewing a common picture simultaneously while interacting with the data. FAA has identified ADS-B technology as the surveillance solution that can meet these needs by providing critical flight information simultaneously to pilots and air traffic controllers. ADS-B transmits air traffic and flight information to aircraft, vehicles, and ground stations to improve situational awareness and provides an unprecedented level of service both to the cockpit and air traffic control facilities. While ASDE-X as currently designed has the capability to receive and transmit ADS-B information to air traffic controllers and is intended to provide direct alerts to controllers of potential ground collisions, it does not provide a similar capability to pilots.

FAA plans to deploy ASDE-X and ADS-B in Louisville, Kentucky, in 2007. Therefore, FAA should determine whether ASDE-X, ADS-B, and in-cockpit moving maps technologies can be used to provide direct alerts to controllers and pilots simultaneously to reduce the risks of ground collisions caused by pilot errors. FAA should then determine the cost and timeline for implementing this capability at all ASDE-X airports.

Airports Scheduled To Receive ASDE-X Must Equip Their Vehicles With Transponders To Maximize ASDE-X Capabilities

The ASDE-X system is designed to reduce the risks of ground collisions caused by vehicle operators by providing positive identification of vehicles operating on the airport surface. However, airport vehicles must be equipped with transponders for ASDE-X to provide this key safety feature; otherwise, the system cannot positively identify vehicles.

Of the 9 airports (out of the 35 planned) that have received ASDE-X, the 2 we visited (Milwaukee and Orlando) had their vehicles equipped with transponders. We were informed that ASDE-X funds were used to pay for the transponders at these airports because they were both key test sites for ASDE-X. FAA paid $3,000 per vehicle to equip a fleet of 78 vehicles at General Mitchell International airport in Milwaukee Wisconsin.

It is important for FAA to encourage airport officials to equip vehicles with transponders because about 16 percent of the runway incursions were caused by vehicle operators, which poses a serious safety risk. For example, on February 2, 2007, at Denver International Airport, a commercial aircraft (a Boeing 737) that had just landed nearly collided with a snow plow, after the plow driver

crossed a runway without clearance from air traffic control or airport operations directly in front of the aircraft. According to the flight crew, they had to use "significant" reverse thrust and brakes to halt the aircraft on the runway.

Until airport vehicles are equipped with transponders, controllers will be limited in their use of ASDE-X because they will not be able to positively identify vehicles operating on the airport surface. Therefore, FAA should work with airports to aggressively promote equipping their vehicles with transponders as a vital step in reducing the risks of ground collisions caused by vehicle operator error.

RECOMMENDATIONS

To improve ASDE-X management controls and reduce the risks of further cost growth, schedule delays, and potential ground collisions, we are recommending that FAA:

1. Develop (a) realistic cost estimates for all activities required to complete ASDE-X implementation and (b) a master schedule through ASDE-X completion that outlines when all implementation activities and planned capabilities will be commissioned for operational use.

2. Correct prohibitive and improper contract administration procedures by (a) discontinuing the practice of increasing contractor fees based on costs incurred rather than negotiated fixed-fee dollar amounts, (b) discontinuing the practice of making payments before meaningful work has been completed on fixed-price items, and (c) adequately documenting any contract changes.

3. Implement a comprehensive earned value management tool to monitor and track ASDE-X cost, schedule, and performance goals.

4. Resolve operational performance issues identified during system testing before implementing key ASDE-X safety capabilities at other airports by (a) addressing timeliness of safety alert capabilities for intersecting runways and fully testing converging taxiways capability, (b) addressing problems with dropped targets and subsequent system outages during heavy rain storms, and (c) testing rain configuration software upgrades at airports with ASDE-3 radars and intersecting runways and taxiways.

5. Determine (a) the feasibility of combining ASDE-X, ADS-B, and in-cockpit moving maps technologies to simultaneously provide controllers and pilots with direct alerts to warn them of potential ground collisions and (b) the costs and timeline for implementing this capability at all ASDE-X airports.

6. Work with airports to aggressively promote equipping their vehicles with transponders to maximize ASDE-X capabilities as a vital step in reducing the risks of ground collisions caused by vehicle operator error.

AGENCY COMMENTS AND OIG RESPONSE

On September 25, 2007, FAA provided comments (see appendix) to our August 6, 2007, draft report. FAA concurred with all six recommendations. When successfully implemented, FAA's completed or planned actions will meet the intent of all but recommendation 1.

Recommendation 1: FAA concurred with our recommendation. FAA acknowledged that it has yet to complete negotiations with Sensis to obtain supportable contract cost estimates. FAA responded that the ASDE-X contracting officer planned to complete negotiations with Sensis to finalize cost estimates for the two remaining significant unpriced contract requirements (i.e., engineering services and installation) by the end of September 2007. FAA also acknowledged the importance of establishing a quantitatively supportable contract cost estimate for all activities required to enable ASDE-X commissioning. FAA indicated that baselining this estimate, as a function of a contractual requirement, is critical to evaluating the program's cost and schedule goal attainment.

FAA commented that the ASDE-X program's baseline cost estimates have remained consistent with the September 2005 re-baseline. However, we question how FAA can arrive at this conclusion given the fact that the Agency acknowledges in its response that it has yet to complete negotiations with Sensis to obtain supportable contract cost estimates. FAA also acknowledges that it has yet to establish a mechanism such as EVM to track and monitor ASDE-X cost. We repeatedly requested ASDE-X program officials and cost analysts to provide us with cost estimates so we could verify ASDE-X original and actual costs. We either received conflicting cost information or were informed that the costs had changed for some implementation activities and that details did not exist to break out the costs for ASDE-X implementation activities. Finally, these estimates were released by FAA after we issued our draft report; therefore, we could not verify the accuracy of these estimates.

Also at issue is our assessment that cost estimates for six activities now exceed their planned life-cycle estimates by $94 million. FAA stated that our conclusion is based on the re-baselined Life Cycle Cost Estimate that only includes data for fiscal years 2006-2030, not the distribution of costs in the original baseline. We disagree with FAA and question its disregard for our assessment for the following reasons.

To calculate the distribution of the original cost, we used data depicting the percentage of cost for each ASDE-X implementation activity from FAA's Life Cycle Cost Estimate document. We considered this data to represent the total life-cycle cost estimate of $549.8 million, which was approved for the re-baseline

decision in September 2005. The data does not reference fiscal years 2006-2030 as the scope period of the work. We briefed FAA on our preliminary findings during the final stages of our review, and the Agency never took issue with our conclusions. For example, in February 2007, we briefed ASDE-X senior officials on our cost growth assessment and informed them that we used FAA data from its Life Cycle Cost Estimate document—the FAA officials did not disagree with our finding at the time. Moreover, in April 2007—prior to our May 2007 testimony before Congress on ASDE-X cost, schedule, and performance risks—we again provided ASDE-X senior officials with a briefing that highlighted details of our conclusion about the $94 million cost growth. Again, FAA did not provide any comments questioning the accuracy or validity of our conclusions.

FAA did not dispute our conclusions about potential costs growth with ASDE-X installation and telecommunications activities. The Agency responded that wherever possible, it is trying to reduce telecommunications costs by using alternatives to the FAA Telecommunications Infrastructure, such as tying into existing FAA-owned communications lines. As for equipment installation, FAA stated that costs have been reduced by streamlining activities. However, FAA needs to complete negotiations with the ASDE-X contractor to finalize the installation cost. Until it does so, the ASDE-X program baseline remains at risk for potential cost growth.

In response to our recommendation that FAA develop a master schedule that clearly details when all ASDE-X systems will be fully implemented for operational use, the Agency stated that the Program Office is using a "master integrated working schedule" to track deployment activities. Despite repeated requests during our review for a master schedule, the Program Office did not provide our office with this information. Instead, the Program Office only provided us with a waterfall schedule. This is an incomplete document because it lacks details regarding when all implementation activities and planned capabilities associated with commissioning ASDE-X for operational use will be completed for each airport.

FAA officials stated that they did not provide the Office of Inspector General with the master schedule because it is an internal document that is not released outside of the Agency. The ASDE-X Program Office's behavior and lack of transparency on this matter is unacceptable. This is a violation of the Inspector General Act of 1978. The act authorizes the Inspector General to have access to all records relating to Federal programs and request such information or assistance as may be necessary for carrying out its duties and responsibilities. Accordingly, we are asking the Acting Administrator to take steps to prevent a reoccurrence of this problem.

Agency Comments and OIG Response

FAA's response continues to show airports that it considers as commissioned, even though planned system enhancements at those airports are scheduled for a later date. For example, FAA reported that Providence, Rhode Island; Houston, Texas; and Seattle, Washington, airports were commissioned in 2005 or 2006. Yet, the system enhancements are not scheduled for completion until 2008 (see attachments B and C of FAA's response). FAA also stated that 11 systems have been commissioned, but its schedule only shows 6 with current system enhancements. We continue to believe that a system deployment should not be counted as commissioned for operational use until all planned ASDE-X capabilities (e.g., core and system enhancements) are fully tested and accepted at a site.

Recommendation 2: FAA concurred and stated that the ASDE-X contracting officer planned to establish new procedures with the ASDE-X contractor and FAA's Resident Quality Reliability Officer (QRO) by the end of September 2007 to correct prohibitive and improper contract administration procedures. Specifically, the contracting officer was to request all contractor milestone payments for review and concurrence by the FAA QRO. The contractor was to submit the FAA QRO validation of the milestone event designated quantity as supporting documentation with the invoice. Additionally, the contracting officer planned to evaluate the proposed fixed fee to determine its reasonableness. The contracting officer was to comply with timely documentation of contract changes via contract modification. These are important steps that FAA must implement to address concerns raised in our June 2006 management advisory to FAA about the credibility of the program's cost estimates.

Recommendation 3: FAA concurred and stated that the Office of Management and Budget has mandated that all major FAA programs have strong business cases and are executable within budget. To ensure it meets these requirements, FAA has committed to the Office of Management and Budget that every major acquisition program will implement an Earned Value Management System. The ASDE-X Program Office is working with FAA's Earned Value Management Council to implement this system by December 2007.

Recommendation 4: FAA concurred and stated that the ASDE-X program thoroughly tests every system enhancement before it is implemented at an operational site. FAA's response indicates that Development Test and Evaluation is completed by the vendor to ensure the enhancement meets the requirements and does not negatively impact other aspects of the system. FAA test personnel complete Operational Test and Evaluation for the ASDE-X program at FAA's William J. Hughes Technical Center. Also, in certain cases, Independent Operational Test and Evaluation (IOT&E) personnel complete additional testing, usually when new systems are being introduced into the National Airspace

System. IOT&E was conducted on the "base" ASDE-X system, ASDE-X Safety Logic, and the ASDE-X Upgrade (ASDE-3 Interface.) As part of the ASDE-X Upgrade IOT&E assessment, the IOT&E team also tested intersecting runways. Additionally, Factory Acceptance Test, Site Acceptance Test, and Field Familiarization are performed on each system. We continue to believe that FAA needs to fully test and resolve any operational performance issues to ensure the ASDE-X system can meet the unique needs of each airport scheduled to receive the system over the next 4 years.

Recommendation 5: FAA concurred and stated that it is examining emerging capabilities, including in-cockpit moving map technologies, to determine the feasibility of such systems. Honeywell International and Sensis Corporation in cooperation with FAA recently demonstrated cockpit advisory technology using the ASDE-X system. The technology detects and communicates potential runway incursions directly to an aircraft cockpit crew. The demonstration took place at the FAA's Interim Contractor Depot Level Support facility at Syracuse Hancock International Airport and used an ASDE-X test system and a Honeywell test aircraft. Once the feasibility of this technology is determined, the Agency will begin to build the business case which will include cost and schedule information. In addition, FAA recently established the Runway Status Light Program Office for a new automatic system that conveys runway status directly to pilots and vehicle operators. A final investment decision on this program is expected in early FY 2008.

Recommendation 6: FAA concurred and stated that with the deployment of ASDE-X to the field, industry began producing squitters that operated on the 1090 MHz frequency. In the meantime, the FAA adopted the ICAO 978 MHz standard for the Universal Access Transceiver and instructed airports that vehicle squitters would have to operate under that frequency as well as the 1090 MHz frequency. Since there were no commercial squitter products available using the 978 MHz frequency, the FAA is expediting an interim rule that would allow airports to use 1090 MHz, 20-watt squitter until products are available that transmit in the 978 MHz frequency. To provide initial guidance for the voluntary acquisition and operation of this equipment in airport vehicles, FAA is planning to publish an advisory circular in early FY 2008.

EXHIBIT A. OBJECTIVES, SCOPE, AND METHODOLOGY

Our objectives for this performance audit were to determine (1) whether FAA's strategy for deploying ASDE-X for operational use is cost effective, given the changes in the program's deployment strategy, and (2) to what extent the ASDE-X program will reduce the risk of ground collisions or accidents caused by runway incursions.

To achieve our objectives, we analyzed contract data, budget data, acquisition documents, cost and schedule projections, and other supporting documentation from FAA. We also reviewed relevant data from Sensis Corporation, the prime contractor. We reviewed FAA's ASDE-X budget and cost estimates and ASDE-X strategy documents for reasonableness and cost effectiveness. We also examined FAA expenditure and obligation data for ASDE-X to determine how much has been spent for the ASDE-X program from its inception to July 2007.

We interviewed key FAA and ASDE-X program officials at FAA Headquarters in Washington, D.C., including senior FAA executives responsible for Terminal Program Operations and FAA staff members in organizational units reporting to these executives. We discussed with these officials whether ASDE-X can meet overall airport safety needs and to what extent this technology will reduce runway incursions, ground collisions, or accidents. We interviewed ASDE-X prime contractor officials at Sensis Corporation to discuss the contract and the status of the system development, installation, and implementation. In addition, we visited FAA's Southern, Central, and Great Lakes Regional Offices to determine the roles and responsibilities of the regions in the installation, implementation, and deployment of the ASDE-X system. We visited several air traffic control towers (St. Louis, Missouri; Milwaukee, Wisconsin; Atlanta, Georgia; Orlando, Florida; and Washington, D.C). We discussed with these control tower staff the functionality, reliability, and maintainability of the system. We also had various discussions to determine the status of ASDE-X's operational use at the control towers and whether its use meets airports' individual safety needs.

We performed our survey and verification work from August 2005 through January 2007. This work was performed in accordance with generally accepted Government Auditing Standards as prescribed by the Comptroller General of the United States and included such tests as we considered necessary to provide reasonable assurance of detecting abuse or illegal acts.

EXHIBIT B. ASDE-X PROGRAM COST VARIANCES

(Dollars in Millions)

Cost Element	Planned Cost Estimate (as of Sept. 2005)	Current Cost Estimate (as of Dec. 2006)	Cost Variance
Procurement/Production	142.95	179.74	36.79
Program Management	93.47	120.10	26.63
Software Design and Development	38.49	58.82	20.33
Logistics Support	11.00	18.34	7.34
Second Level Engineering	5.50	7.90	2.40
Test and Evaluation	5.50	6.23	0.73
Subtotal	**296.91**	**391.13**	**94.22**
Disposition	60.48	28.90	-31.58
Construction	82.47	56.85	-25.62
Installation*	54.98	44.11	-10.87
Site survey	16.49	8.17	-8.32
Telecommunications**	16.49	8.49	-8.00
Logistics	11.00	6.13	-4.87
Systems Engineering	5.50	2.74	-2.76
Other	5.50		
Subtotal	**252.91**	**155.39**	**-92.02**
Grand Total	**$549.82**	**$546.52**	

Source: OIG analysis of ASDE-X Life Cycle Cost Estimates: September 2005 and current cost estimates

* Sensis submitted FAA cost estimates to complete ASDE-X installation totaling $64 million. The $20 million difference between the FAA and Sensis estimates ($64 million versus $44 million) would increase ASDE-X implementation costs to $566 million and exceed the current ASDE-X program baseline.

** We also found that ASDE-X program officials decreased telecommunications costs estimates from $16.5 million to $8.5 million to remain within ASDE-X program baseline costs. However, FAA later reported that the telecommunications costs were actually one to two times higher than its original estimates, which could increase the costs to at least $33 million or up to $49.5 million.

EXHIBIT C. OIG JUNE 2006 MANAGEMENT ADVISORY

Memorandum

U.S. Department of Transportation
Office of the Secretary of Transportation
Office of Inspector General

Subject: ACTION: Management Advisory on Contract Number DTFA01-01-C00011 (ASDE-X)

Date: June 20, 2006

From: David A. Dobbs
Assistant Inspector General
for Aviation and Special Programs Audits

Reply to Attn of: JA-10

To: Vice President of Acquisition and Business Services
Federal Aviation Administration

During our current audit of the Airport Surface Detection Equipment-Model X (ASDE-X) program, we identified prohibited and improper contract administration practices that should be brought to your immediate attention. These conditions relate to the prime contract for ASDE-X. Based on our limited review of the contract, responses from the Contracting Officer, we concluded that (1) the ASDE-X Contracting Officer is increasing contractor fees based on costs incurred rather than negotiated fixed-fee dollar amounts, (2) FAA is making payments before meaningful work has been completed on fixed-price items, and (3) the Contracting Officer is not adequately documenting contract changes.

These practices violate Federal statute and FAA's Acquisition Management System (AMS) best practices. Specifically:

- Federal statute and AMS guidance both prohibit the payment of a fee computed as a variable of cost.
- On firm-fixed-price items, AMS guidance requires that payments be made based on completion of meaningful work unless advance payment criteria are met and procedures followed.

- AMS guidance specifies that contract modifications should be properly documented to describe the changes made to the scope of work, the contract price, the period of performance, and other contract terms.

Our concerns about the contract administration of ASDE-X fall into the following three categories.

Administration of the contract bases contractor fees on a percentage of costs incurred rather than a negotiated fixed-fee dollar amount. Some contract items (e.g., installation and system enhancements, funded at $28 million and $56 million, respectively) have been administered using a methodology called "cost plus a percentage of cost", which is prohibited by statute and the AMS. The Contracting Officer described the fee for installation as a percentage of cost instead of as a negotiated fixed-dollar amount.

Our review of ASDE-X invoices also indicates that, despite numerous program changes to installation, the contractor bills and collects a fee that is a percentage of costs incurred. In a 1980 legal decision, the U.S. Comptroller General stated, "The evil of this [cost plus a percentage of cost] system is that the contractors have an incentive to pay liberally for reimbursable items, because higher costs mean higher profits."[1]

When fees increase with increases in costs, the contractor has an incentive to encourage cost growth. We also understand that many changes in the contract were negotiated after work began. However, even if the fees were not set as a percentage of cost in those instances, negotiating contract costs and fees after the work has been performed has the same result because the contractor had no incentive to control costs.

The contract provides payments before any meaningful work has been completed on fixed-price items. Most of the fixed-price line items inappropriately allow payment in advance of any meaningful work. As the AMS states, advance payments are the least preferred method of contract financing and must be used sparingly. We found examples showing that, as soon as the Government exercises its option to purchase a fixed-price item, this contract triggers a payment of 25 percent of the price. To date, FAA has exercised options that allowed over $21 million in payments of this type, which do not serve the Government's best interest.

Based on our preliminary review, these payments are advance payments made without following AMS procedures. Specifically, the procedures require that advance payments are made only after ensuring that partial or progress

[1] Comp. Gen. B-196, 556, Matter of Dept. of State—Method of Payment Provisions, Aug. 05, 1980.

payments are not feasible and that private financing is not reasonably available. Before advance payments are made, the Chief of the Contracting Office must review and approve them. These procedures must be followed because they help prevent the Government from expending money for no assured benefit.

The contract lacks adequate documentation of contract changes. We found that on numerous occasions the Contracting Officer did not document contract changes properly or in a timely manner. The Contracting Officer added funds to the contract but did not identify the changes in the scope of work, the prices, the periods of performance, or other terms. For example, Contract Line Item 30 was added to the contract in May 2003 and funded at $445,000, but the Contracting Officer did not include any description of the work to be done, a negotiated price, or a ceiling value. Since then, the Contracting Officer has repeatedly added funding, and this line item now includes $56 million in funds. However, the Contracting Officer has not yet defined this work in the contract. In another example, the Contracting Officer told us that funds added to the contract in March 2005 were for new work but has not modified the contract to include or define this new item.

Documenting contract changes is a basic and fundamental responsibility of the Contracting Officer. Unless the contract includes a clear definition of the work and its price, the Government is at risk of overpaying or paying for something it does not want.

We recommend that FAA thoroughly investigate these issues and take immediate steps to correct these practices. Please advise us within 30 calendar days of the actions taken and planned to resolve these issues. If I can answer any questions or be of further assistance, please contact me at (202) 366-0500 or the Program Director, Kevin Dorsey, at (202) 366-1518.

#

cc: Deputy Administrator
Chief Operating Officer

EXHIBIT D. ASDE-X WATERFALL SCHEDULE (AS OF AUGUST 14, 2006)

#	ID	New Establishment Airports	Delivery Date	IOC Date	ORD Date
1	MKE	General Mitchell International (Mil. WI)	3/12/02	6/5/03	10/30/03
2	MCO	Orlando International	9/25/03	9/1/04	9/30/04
3	PVD	Theodore Francis Green State (Prov. RI)	12/1/03	7/2/04	5/16/05
4	HOU	William P. Hobby Airport (Houston, TX)	10/29/04	8/4/05	8/31/05
5	BDL	Bradley International Airport (Hart. CT)	3/14/05	6/7/06	6/21/06
6	PHX	Phoenix Sky Harbor International	Nov-07	Dec-08	TBD
7	FLL	Ft. Lauderdale/Hollywood	May-08	Apr-09	TBD
8	SNA	John Wayne-Orange County	Mar-09	Feb-10	TBD
9	MDW	Chicago Midway	Aug-09	Jul-10	TBD
10	HNL	Honolulu International - Hickam AFB	Sep-09	Aug-10	TBD
		ASDE-3/AMASS Airports			
11	STL	Lambert-St. Louis International	12/3/03	10/21/04	5/24/06
12	SEA	Seattle-Tacoma International	12/23/04	1/27/06	2/24/06
13	ATL	Hartsfield-Jackson Atlanta International	7/11/05	5/5/06	6/7/06
14	IAD	Washington Dulles International	12/20/05*****	Jul-08	TBD
15	SDF	Louisville International –Standiford Field	3/8/04	Aug-07	TBD
16	CLT	Charlotte Douglas International	1/13/04	Jul-07	TBD
17	LAX	Los Angeles International	2/23/06*****	Jun-09	TBD
18	MSP	Minneapolis-St. Paul International	Mar-09	Feb-10	TBD
19	DFW	Dallas/Ft. Worth International	Apr-09	Apr-10	TBD
20	MEM	Memphis International	May-10	Apr-11	TBD
21	DEN	Denver International	Jun-08	Jul-09	TBD
22	ORD	Chicago O'Hare International	Jul-08	Aug-09	TBD
23	LAS	Las Vegas McCarran International	Sep-08	Aug-09	TBD
24	IAH	George Bush Intercontinental	Dec-08	Nov-09	TBD
25	DCA	Ronald Reagan Washington National	Feb-10	Jan-11	TBD
26	BWI	Baltimore-Washington International	Jul-09	Jun-10	TBD
27	EWR	Newark International	Jun-08	May-09	TBD
28	DTW	Detroit Metro Wayne County	Aug-07	Aug-08	TBD
29	BOS	Boston Logan International	Feb-08	Dec-08	TBD
30	JFK	John F. Kennedy International	Aug-08	Jul-09	TBD
31	MIA	Miami International	Sep-09	Aug-10	TBD
32	LGA	New York LaGuardia	Mar-10	Feb-11	TBD
33	PHL	Philadelphia International	Jan-09	Dec-09	TBD
34	SLC	Salt Lake City International	Jun-09	May-10	TBD
35	SAN	San Diego International	Apr-10	Mar-11	TBD
		Support Systems			
T1	ICDLS	Vendor Facility/ICDLS	10/16/01	N/A	
T2	PSF	FAA Program Support Facility	2/27/04	N/A	
T3	FAAAC	FAA Academy – OKC	6/10/04	N/A	

Source: FAA Internal Program Review, March 2007

Washington Dulles (IAD) and **Los Angeles International (LAX)** delivered to airport but not yet installed.
Louisville (SDF), Charlotte (CLT), and Dulles (IAD) International Airports **did not** meet their FY 06 ORD dates.
Initial Operating Capability (IOC) – The declaration by site personnel that the ASDE-X system is ready for conditional operational use in the NAS and denotes the end of Field Familiarization at that site.
Operational Readiness Date (ORD) - Signifies the official date to switchover to the new system.
TBD- to be determined and **N/A-**not applicable

Exhibit D. ASDE-X Waterfall Schedule (as of August 14, 2006)

APPENDIX. AGENCY COMMENTS

Federal Aviation Administration

Memorandum

Date: September 25, 2007

To: Robert E. Martin, Assistant Inspector General for Aviation and Special Program Audits

From: Ramesh K. Punwani, Assistant Administrator for Financial Services/CFO

Prepared by: Anthony Williams, x79000

Subject: OIG Draft Report: FAA Needs to Improve ASDE-X Management Controls To Address Cost Growth, Schedule Delays, and Safety Risks, Federal Aviation Administration

Thank you for the opportunity to comment on the findings and recommendations of the subject draft report, dated August 6. As each of the recommendations is valid, the FAA concurs with all six of them. However, FAA would like to outline the various actions that have already been taken with respect to the recommendations, and also to present our assessment of the total baseline cost of the ASDE-X program.

The DOT OIG announced the audit of the ASDE-X Program in August 2005. Five months later in January 2006 the objectives of the audit were revised. Two years after the audit was first announced the draft report was issued to the FAA. During these two years the FAA had already begun employing most of what is being recommended. These actions and any additional actions the FAA plans to take are described below.

OIG Recommendation 1: Develop (a) realistic cost estimates for all activities required to complete ASDE-X implementation and (b) a master schedule through ASDE-X completion that outlines when all implementation activities and planned capabilities will be commissioned for operational use.

FAA Response: Concur. (a) The FAA acknowledges the importance of establishing a quantitatively supportable contract cost estimate for all activities required to enable ASDE-X commissioning. Baselining this estimate, as a function of a contractual requirement, is critical to evaluating program cost/schedule goal attainment, and taking appropriate corrective action to address identified variances that may adversely affect program success.

The ASDE-X Contracting Officer (CO) has taken the following corrective action to address these concerns.

1. Issued Letter No. ASDE-X-2027 dated 1/20/07 informing Sensis Corp (ASDE-X Contractor) that the CO was considering incorporating EVMS reporting methodology, consistent with AMS 4.16 and Part 2, Section I clause 1.13-2 EVMS (April 2000). The ASDE-X contract, at inception, only required cost/performance reporting for contract line item number (CLIN) 0001.
2. Issued Letter No. ASDE-X-4007 dated 7/30/07 outlining the required actions necessary to definitize the remaining unpriced CLINs. Sensis Corp. provided their comprehensive Estimate at Completion (EAC) summary via email dated 8/10/07.
3. Issued Letter No. ASDE-X-4007a dated 8/25/07 providing CO comments to the Contractor's EAC submittal and advising same of additional supplemental information required to support the planned negotiation for CLINs 0004 and 0023 scheduled for 9/6-9/7/07.

ASDE-X program baseline cost estimates have remained consistent with the September 2005 rebaseline. The DOT OIG assessment that "cost estimates for six activities now exceed their planned life-cycle estimates by $94 million" and the "FAA attempted to offset the cost growth by decreasing other activities…" is based on the data in the rebaseline Life Cycle Cost Estimate (LCCE) including fiscal year (FY) 2006-FY 2030 only and not the distribution of the costs in the original baseline [1]. See Attachment A for rebaseline life cycle cost estimate including distribution of cost in the original baseline.

The report indicates the DOT OIG believes installation costs and telecommunications costs are particularly at risk of increasing. The ASDE-X Program Office has implemented measures to control the telecommunications and equipment installation costs. Wherever possible, the FAA is trying to reduce telecommunications cost by using, alternatives to FTI, such as tying into existing FAA owned communications lines or installing Radio Frequency (RF) modems. As for equipment installation, costs have been reduced by streamlining activities, conducting activities in parallel when possible, and reducing iterations of written reports and other contract deliverables.

(b) The ASDE-X schedule is on track with the September 2005 rebaseline. Although Charlotte[2], Louisville[3] and Washington Dulles[4] were delayed from the planning schedule included in the rebaseline LCCE the next five sites, including Chicago O'Hare (1 year expedited schedule), completed on schedule and all current implementation activities are on or ahead of schedule.

[1]Section 2.1 of the LCCE "Ground Rules and Assumptions; Estimating and Programmatic - Life cycle Cost Estimate analysis timeframe is FY06-FY30. "

[2] Charlotte delayed due to Remote Unit (RU) siting and site prep issues

[3] Louisville delayed due to the decision by the Office of Independent Test and Evaluation (IOT&E) to conduct ASDE-X Upgrade key site testing at Charlotte (both Charlotte and louisville were further delayed by the higher Agency priorities of Seattle (cost share with Airport Authority and the ADE-3 tower had to be dismantled to accommodate the Airport's new runway) and Atlanta (to accommodate new air traffic control tower and new runway)

[4] Washington Dulles was delayed due to delays in the new tower construction

The ASDE-X Program Office uses a master integrated implementation schedule to manage and track all implementation activities. This is not the waterfall schedule. The waterfall schedule is a public reporting tool that maps to the September 2005 baseline. It is a risk adjusted schedule that now only reports two high level milestones, equipment delivery and Initial Operating Capability (IOC)[5] until a system achieves Operational Readiness Date (ORD)[6]. For all intents and purposes the system is operational at IOC. The FAA has previously provided the DOT OIG with complete copies of the waterfall (system delivery, IOC, ORD)[7] although the report only referenced an incomplete waterfall pulled from an Internal Program Review package. The current ASDE-X Waterfall is included as Attachment B.

To manage the program, the ASDE-X Program use a master integrated working schedule to track deployment activities including the development test and implementation of change orders (major software builds) and the retrofit of change orders into systems that commissioned with an earlier software build. It is a site by site rolling schedule broken down by phase then by activity. The schedule dates in the working schedule are more aggressive to allow for contingencies without missing the baseline schedule dates. The working schedule dates are provided to the ASDE-X prime vendor Sensis Corporation contractually to ensure diligence towards meeting the dates. The ASDE-X working schedule comes in two formats – the Work Plan, a graphical representation of the plan for each site by phase, and the Integrated Master Schedule (IMS), a Microsoft Project schedule by activity, maintained by the vendor. The IMS is updated, at a minimum, on a monthly basis to reflect the current status at each site, i.e., completed dates are added, schedule may be readjusted based on current status, etc. The vendor works with the ASDE-X Implementation team to update the IMS. The vendor uses the IMS for cost and resource planning. The working schedule is an internal schedule that is not released outside the agency.

There are currently eleven commissioned systems. The remaining 24 systems are in various stages of the ASDE-X deployment process. It takes approximately three years for an ASDE-X system to become operational at an airport. This process includes site survey, site design, lease approval, completion of environmental requirements, site preparation and construction, installation, system optimization, training, and acceptance and commissioning activities. All planned system capabilities have been deployed. The site by site software build and system enhancement status and schedule is included as Attachment C.

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[5] IOC is the declaration that the ASDE-X system is ready for conditional use in the National Airspace System. After IOC is declared, the system is considered fully operational. The air traffic controllers in the tower cab are using the system in what's known as the Operational Suitability Demonstration (OSD) period prior to "commissioning" the system. OSD is a time period during which the system is operated under intense scrutiny to ensure the system satisfies all operational requirements including: availability, compatibility, interoperability, reliability, maintainability, safety, human factors, and logistics supportability.

[6] Once the site determines that they are comfortable with the new system, they declare ORD. ORD signifies the end of OSD, at which time, switchover to the new system is complete. ORD is usually about 30 days after IOC. Once the system is formally accepted by the site via the Joint Acceptance Inspection (JAI) process, the system is commissioned.

[7] In February 2006 the FAA provided Partial ASDE-X Waterfall as of February 22, 2006 (reflected 2005 rebaseline, but only included 17 airports; the names of the other airports had not yet been released); in May 2006 the FAA provided ASDE-X Waterfall (Del-IOC-ORD) as of April 27, 2006

Appendix. Agency Comments

OIG Recommendation 2: Correct prohibitive and improper contract administration procedures by (a) discontinuing the practice of increasing contractor fees based on costs incurred rather than negotiated fixed-fee dollar amounts, (b) discontinuing the practice of making payments before meaningful work has been completed on fixed-price items, and (c) adequately documenting any contract changes.

FAA Response: Concur. (a) In addition to the actions described in the response to Recommendation 1 above, the CO has completed the definitization of CLIN 0030 via Modifications 0033 & 0034. These modifications established the estimated cost and fixed fee for CLIN 0030. As noted above, the CO has informed the Contractor of the plan to complete the definitization of CLINs 0004 and 0023 which represent the two remaining significant unpriced contractual requirements. The CO will negotiate these two CLINs on the basis of the Government's analysis of the Contractor's proposed cost and distinct evaluation of the proposed fixed fee to determine its reasonableness. The target completion date for the definitization of CLINs 0004 and 0023 is the end of September 2007.

(b) The CO has revisited Part 2, Section G, Contract Administration, Clause G-8, Milestone Payments to ascertain the allowability of payments on fixed-price line items. This clause specified milestone payments defined by contract deemed commensurate with promoting efficient and economical contract performance. Each applicable CLIN allowing for milestone payments has a defined milestone event which the Contractor must achieve and document before he is entitled to receive a percent of the dollar value of the CLIN. The Contractor must submit a written certification to the CO concurrent with his invoice for payment. To ensure that this clause is properly administered the CO has taken the following corrective action:

1. Contractor requests for milestone payments submitted in accordance with G-8 must also include a review and concurrence by the FAA Resident Quality Reliability Officer (QRO) attesting to having accounted for the types and quantities of fixed-price items conforming to the percent of total items defined for the specific CLIN milestone being billed.
2. The FAA QRO validation of the milestone event designated quantity will be submitted by the Contractor as supporting documentation with his invoice. Only those line items allowing for milestone payments in accordance with the clause will be allowed for this type of payment arrangement. The CO acknowledges the need to ensure that this clause is administered properly to achieve its desired effect without increasing the risk to the government of not incentivising payment for commensurate performance.

The CO has verbally informed the Contractor and the QRO of the above actions and plans to issue a formal letter by the end of September 2007.

(c) The CO acknowledges the significance of untimely documenting and memorializing of contract changes via contract modification, as a significant contributor to the potential for cost growth and improper contract administration practices. The CO will comply with timely documentation of contract changes via contract modification.

OIG Recommendation 3: Implement a comprehensive earned value management tool to monitor and track ASDE-X cost, schedule, and performance goals.

FAA Response: Concur. The Office of Management and Budget (OMB) has mandated that all major FAA programs have strong business cases and are executable within budget. To ensure meeting the requirements of the mandate the FAA has committed to the OMB and the General Accounting Office (GAO) that every major acquisition program will implement an Earned Value Management System (EVMS). The FAA's Acquisition Management System (AMS) was subsequently updated to include EVM policy. The ASDE-X Program Office is working with the FAA's EVM Council to implement an EVMS that is compliant with ANSI/EIS 748 Standard. The target date for completion is December 2007.

In the mean time the CO plans to incorporate cost reporting methodology consistent with AMS EVMS requirements as a part of the definitization process for CLINs 0004 and 0023 (see response to Recommendation 1 above) by September 28, 2007.

OIG Recommendation 4: Resolve operational performance issues identified during system testing before implementing key ASDE-X safety capabilities at other airports by (a) addressing timeliness of safety alert capabilities for intersecting runways and fully testing converging taxiway capability, (b) addressing problems with dropped targets and subsequent system outages during heavy rain storms, and (c) testing rain configuration software upgrades at airports with ASDE-3 radars and intersecting runways and taxiways.

FAA Response: Concur. The ASDE-X Program thoroughly tests every system enhancement before it is implemented at an operational site. Development Test and Evaluation is completed by the vendor to ensure the enhancement meets the requirements and does not negatively impact other aspects of the system. The FAA also completes Operational Test and Evaluation (OT&E) either at a site or in a simulated lab environment using recorded data from one or more sites. On the ASDE-X Program, OT&E is completed by FAA test personnel at the FAA's William J. Hughes Technical Center. Also, in certain cases, Independent Operational Test and Evaluation (IOT&E) completes additional testing, usually when new systems are being introduced into the National Airspace System. IOT&E was conducted on the "base" ASDE-X system, ASDE-X Safety Logic, and the ASDE-X Upgrade (ASDE-3 interface). As part of the ASDE-X Upgrade IOT&E assessment, the IOT&E team also tested intersecting runways.

Additionally, Factory Acceptance Test (FAT), Site Acceptance Test (SAT), and Field Familiarization is performed on each system. FAT is performed by the vendor to verify manufacturing defects are not present in the production system. SAT is performed in the field by the vendor to ensure the system is installed and working correctly. Field familiarization is conducted by second level engineering and site personnel to ensure the system meets operational requirements and the site is ready to transition to the new system. ASDE-X software build 5.0.7.2 test events and completion dates are included as Attachment D.

(a) The specific example the OIG refers to when discussing the timeliness of the safety alerting capability comes from IOT&E's ASDE-X Upgrade Assessment Report. Of the 23 intersecting runway scenarios tested by IOT&E, the IOT&E team felt that 2 scenarios alerted in an untimely manner. The ASDE-X Program Office analyzed these events and found that while the system can be adapted to provide an increase in warning time for these particular events; however, doing so would increase the likelihood of nuisance alerts for vehicles approaching the runway intersections and for aircraft performing certain land and hold short operations. Nuisance alerts impact system safety. These default parameters were not changed at Louisville, the IOT&E test site. Since Louisville achieved Initial Operating Capability in March 2007, there has been no report of missing or nuisance alerts involving intersecting runways.

The converging taxiway capability fully tested by the test team from the FAA's William J. Hughes Technical Center (see Attachment D).

(b) Due to the nature of radar, heavy rains do have the potential to degrade radar performance. This is a fact for all radar systems, not just specifically for ASDE-X. However, because of improved radar processing and the addition of multilateration, the ASDE-X system performs significantly better in all levels of rain as compared to the ASDE-3 system. The ASDE-X Program also implemented a rain configuration system enhancement designed to allow the ASDE-X system to operate in full core alerting mode during inclement weather (including moderate to heavy rain). Suspected weather induced false tracks on the runway(s) are eliminated from ASDE-X safety logic processing; however, they remain as unknown icon(s) on the ASDE-X tower display.

The specific example that the OIG references regarding "problems with dropped targets and subsequent system outages during heavy rain storms" comes from IOT&E's ASDE-X Upgrade Assessment Report. This assessment was completed in March/April 2007 at Louisville. The ASDE-X system was adapted to address all Louisville rain events so that a system outage would not occur in the event of heavy precipitation. After IOT&E and prior to commissioning, Louisville had three significant rain events without an outage. The facility was satisfied with the system performance and commissioned on July 19, 2007.

(c) Regarding the recommendation to specifically test the rain configuration enhancement at an airport with an ASDE-3 radar, the ASDE-3 data or the ASDE-X Surface Movement Radar (SMR) data is fused with the multilateration system data prior to safety logic processing so safety logic functions the same regardless of the source of radar data. The rain mode configuration was thoroughly tested at Orlando. High speed data playback analysis was conducted, in addition to operational testing, to evaluate the performance of the rain configuration. Thirty days of previously collected data from Orlando was played back and analyzed along with an additional 20 hours of specific rain event data collected over a 30 day operational testing period. Rain mode became operational at Orlando in June 2007. Rain mode configuration is also operating with positive results at the 3 commissioned ASDE-X airports with ASDE-3 radars Louisville, Charlotte, and Chicago O'Hare.

OIG Recommendation 5: Determine (a) whether ASDE-X, ADS-B, and in-cockpit moving maps technologies can be combined to simultaneously provide controllers and pilots with direct alerts to warn them of potential ground collisions and (b) the costs and timeline for implementing this capability at all ASDE-X airports.

FAA Response: Concur. (a) The FAA is examining emerging capabilities including in-cockpit moving map technologies to determine the feasibility of such systems. Honeywell International and Sensis Corporation in cooperation with the FAA recently demonstrated cockpit advisory technology using the ASDE-X system. The technology, which detects and communicates potential runway incursions directly to an aircraft cockpit crew, was demonstrated at the FAA's Interim Contractor Depot Level Support facility at Syracuse Hancock International Airport with an ASDE-X test system and a Honeywell test aircraft.

(b) Once the feasibility of the capability is determined, the FAA will begin to build the business case including cost and schedule.

Additionally, the FAA has recently established the Runway Status Light (RWSL) Program Office. RWSL is an automatic system of airfield lights that convey runway status directly to pilots and vehicle operators. A final investment decision is expected early in FY08.

OIG Recommendation 6: Work with airports to aggressively promote equipping their vehicles with transponders to maximize ASDE-X capabilities as a vital step in reducing the risks of ground collisions caused by vehicle operator error.

FAA Response: Concur. With the deployment of ASDE-X to the field, industry began producing squitters that operated on the 1090 MHz frequency. In the meantime, the FAA adopted the ICAO 978 MHz standard for the Universal Access Transceiver and instructed airports that vehicle squitters would have to operate under that frequency as well as the 1090 MHz frequency. Since here were no commercial squitter products available using the 978 MHz frequency, the FAA is expediting an interim rule that would allow airports to use 1090 MHz, 20 watt squitters until products are available that transmit in the 978 MHz frequency.

To provide initial guidance for the voluntary acquisition and operation of this equipment in airport vehicles, Advisory Circular 150/5220-XX was drafted and will be published early next fiscal year.

Attachment A: ASDE-X Cost Estimates
(Items in yellow are directly from the table in Exhibit B of the OIG Draft Report.)

Cost Element	**ASDE-X Program Rebaseline Cost Estimate (as of Sept. 2005) ($M)**	**Current Cost Estimate (as of Dec. 2006) [from OIG Draft Report, Exhibit B]**
Procurement/Production	$179.736	$179.74
Program Management	$120.097	$120.10
Software Design and Development	$58.821	$58.82
Logistics Support	$18.343	$18.34
Second Level Engineering	$7.898	$7.90
Test and Evaluation	$6.231	$6.23
Subtotal	**$391.126**	**$391.13**
Disposition	$28.900	$28.90
Construction	$56.849	$56.85
Installation	$44.109	$44.11
Site Survey	$8.170	$8.17
Telecommunications	$8.492	$8.49
Logistics	$6.131	$6.13
Systems Engineering	$2.736	$2.74
Subtotal	**$155.387**	**$155.39**
Other (Leases)	$3.324	$3.32
Grand Total	**$549.837**	**$549.84**

ASDE-X Program Baseline Cost Estimate

WBS Number	Cost Element	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012- FY2030	Total ($M)
	Life Cycle Cost Estimate	**$7.585**	**$10.792**	**$22.400**	**$106.926**	**$104.285**	**$48.842**	**$29.869**	**$66.309**	**$41.756**	**$31.064**	**$18.803**	**$11.682**	**$306.074**	**$806.388**
	Facilities and Equipment Costs (F&E)	**$7.585**	**$10.792**	**$22.400**	**$106.800**	**$103.900**	**$47.721**	**$27.564**	**$63.908**	**$37.947**	**$26.122**	**$13.230**	**$4.821**	**$77.046**	**$549.836**
3.0	**Solution Development**	**$4.300**	**$7.393**	**$14.263**	**$74.120**	**$51.974**	**$24.945**	**$10.848**	**$28.061**	**$2.417**	**$0.835**	**$0.567**		**$46.143**	**$265.867**
3.1	**Program Management**														
3.2	**Systems Engineering**				**$0.583**		**$0.198**	**$1.481**	**$0.474**						**$2.736**
3.2.7.1	Engineering Change Orders														
3.2.9.1	INFOSEC				$0.583		$0.198	$1.481	$0.474						$2.736
3.3	**HW/SW Design, Development and Production**	**$4.300**	**$6.993**	**$13.441**	**$67.203**	**$43.702**	**$21.800**	**$7.096**	**$24.436**	**$2.041**	**$0.835**	**$0.567**		**$46.143**	**$238.556**
3.3.1	Hardware Design and Development														
3.3.2	Software Design and Development				$14.756	$14.568	$16.515	$5.977	$6.164	$0.840					$58.821
3.3.2.1	Enhancements				$11.728	$5.695	$8.031	$4.538	$2.441						$32.433
3.3.2.2	New Software Requirements				$3.029	$8.873	$8.484	$1.439	$3.723	$0.840					$26.388
3.3.5	Procurement/Production	$4.300	$6.993	$13.441	$52.446	$29.134	$5.285	$1.119	$18.271	$1.201	$0.835	$0.567		$46.143	$179.736
3.3.5.1	System Hardware	$4.300	$6.585	$12.362	$48.121	$26.749	$1.370	$0.114	$15.048						$114.650
3.3.5.1.1	Non-Recurring (CLIN 1)	$4.300	$5.477	$11.596	$7.479		$0.250								$29.102
3.3.5.1.2	Recurring		$1.108	$0.766	$40.642	$26.749			$11.744						$81.010
3.3.5.1.3	New Hardware Requirements						$1.120	$0.114	$3.304						$4.539
3.3.5.5	System Engineering/Program Management		$0.408	$1.079	$4.326	$2.385	$3.915	$1.005	$3.223	$1.201	$0.835	$0.567			$18.942
3.3.5.6	Technology Refresh													$46.143	$46.143
3.4	**Physical and Airspace Infrastructure Design & Development**														
3.5	**Test and Evaluation**		**$0.400**	**$0.822**	**$1.907**	**$0.499**	**$0.885**	**$0.966**	**$0.586**	**$0.166**					**$6.231**
3.5.2	Test and Evaluation Support			$0.422	$1.507	$0.499	$0.385	$0.458	$0.327	$0.166					$3.764
3.5.5	Government Conduct IOT&E		$0.400	$0.400	$0.400		$0.500	$0.509	$0.259						$2.467
3.6	**Data and Documentation**														
3.7	**Logistic Support**				**$4.427**	**$7.773**	**$2.062**	**$1.305**	**$2.566**	**$0.210**					**$18.343**
3.7.4	Industrial Facilities				$0.124	$0.474	$1.160								$1.758
3.7.4.1	ICDLS Setup						$0.310								$0.310
3.7.4.2	Program Support Facility				$0.124	$0.474	$0.850								$1.448
3.7.4.2.1	Design PSF														
3.7.4.2.2	PSF Setup				$0.124	$0.474	$0.850								$1.448
3.7.5	Support Equipment					$1.880	$0.399	$0.135	$0.069	$0.210					$2.692
3.7.6	Support Facilities and Equipment Maintenance														
3.7.7	Initial Spares and Repair Parts				$4.303	$4.052		$1.170	$2.498						$12.022
3.7.7.1	Radar Spares				$4.303	$4.052		$1.170	$2.498						$12.022
3.7.7.1.1	Initial Spares-Site				$4.103	$1.352									$5.455
3.7.7.1.2	Initial Spares-Depot				$0.200	$2.700		$1.170	$2.498						$6.567
3.7.8	Initial Training					$1.367	$0.504								$1.871
3.7.8.1	Training Set Up					$1.367									$1.367
3.7.8.2	Training Development														
3.7.8.3	Depot Training														
3.7.8.4	Second Level Training														
3.7.8.5	Site Technician Training						$0.504								$0.504
3.7.8.6	ATC Training														
3.7.8.7	TOR														
WBS Number	**Cost Element**	**FY 2000**	**FY 2001**	**FY 2002**	**FY 2003**	**FY 2004**	**FY 2005**	**FY 2006**	**FY 2007**	**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**	**FY 2012- FY2030**	**Total ($M)**
4.0	**Implementation**	**$3.285**	**$3.149**	**$7.147**	**$30.678**	**$50.226**	**$20.898**	**$13.576**	**$34.124**	**$34.201**	**$21.026**	**$7.987**	**$1.963**	**$0.965**	**$229.225**
4.1	**Program Management**	**$3.285**	**$2.327**	**$4.354**	**$19.892**	**$34.813**	**$11.983**	**$10.420**	**$14.352**	**$6.990**	**$5.768**	**$2.985**	**$1.963**	**$0.965**	**$120.097**
4.1.1	Program Planning, Authorization Management and Control	$3.285	$2.327	$4.354	$19.184	$33.920	$8.047	$6.439	$8.123	$6.961	$5.709	$2.985	$1.963	$0.965	$104.263
4.1.1.1	Administrative Support			$1.016	$2.908	$4.143	$1.678	$1.530	$2.737	$1.645	$1.128	$0.567	$0.202	$0.067	$17.622
4.1.1.2	Program Office Support	$3.285	$2.327	$3.338	$16.276	$29.777	$6.369	$4.909	$5.385	$5.316	$4.581	$2.418	$1.762	$0.898	$86.641
4.1.2	Clin4 (Program Management)				$0.708	$0.893	$3.936	$3.981	$6.229	$0.029	$0.058				$15.834
4.2	**Engineering, Planning, and Design**						**$0.700**	**$2.136**	**$3.409**	**$1.925**					**$8.170**
4.3	**Environmental And Occupational Safety and Health Compliance**														
4.4	**Site Selection and Acquisition**														
4.5	**Construction**			**$0.451**	**$5.595**	**$7.965**	**$5.290**	**$0.292**	**$16.363**	**$15.561**	**$5.333**				**$56.849**
4.5.1	Site Survey/Design/Preparation			$0.451	$3.223	$4.730	$4.790	$0.275	$13.589	$12.903	$4.769				$44.729
4.5.1.1	Processing Equipment			$0.451	$3.223	$1.343	$1.000	$0.051	$1.860	$1.373	$0.316				$9.617
4.5.1.2	RU's					$1.408	$2.750	$0.086	$8.238	$9.950	$3.809				$26.241
4.5.1.3	Stand Alone Tower					$1.979	$0.440	$0.122	$2.110						$4.651
4.5.1.4	Equipment Room						$0.600	$0.015	$1.381	$1.579	$0.644				$4.219
4.5.2	Construction Labor				$2.372	$3.235	$0.500	$0.017	$2.774	$2.658	$0.564				$12.121
4.6	**Site Preparation, Installation, Test and Checkout**		**$0.822**	**$2.342**	**$5.191**	**$7.448**	**$2.925**	**$0.729**		**$9.725**	**$9.925**	**$5.002**			**$44.109**
4.6.1	Installation		$0.822	$2.342	$5.191	$7.448	$2.925	$0.729		$9.725	$9.925	$5.002			$44.109
4.6.1.1	Equipment Installation Costs		$0.822	$2.342	$5.191	$7.448	$1.925	$0.415		$5.935	$6.063	$2.815			$32.956
4.6.1.2	Site Related Costs						$1.000	$0.314		$3.790	$3.862	$2.187			$11.153
4.6.1.3	PM Activities														
4.7	**Commissioning/Closeout**														
4.8	**Telecommunications**														
5.0	**In-Service Management**		**$0.250**	**$0.990**	**$2.002**	**$1.700**	**$1.428**	**$2.225**	**$1.659**	**$0.301**	**$4.262**	**$4.676**	**$2.858**	**$3.495**	**$25.845**
5.1	**Preventative Maintenance**														
5.2	**Corrective Maintenance**														
5.3	**Modifications**														
5.4	**Maintenance Control**														
5.5	**Technical Teaming**														
5.6	**Watch Standing Coverage**														
5.7	**Program Support**														

WBS Number	Cost Element	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012- FY2030	Total ($M)
5.8	**Logistics**				**$0.127**	**$1.136**	**$0.360**	**$0.671**	**$0.586**	**$0.066**	**$0.608**	**$1.308**	**$0.982**	**$0.286**	**$6.131**
5.8.1	Supply Support														
5.8.2	Replenishment Spares														
5.8.3	Repair				$0.127	$1.136	$0.360	$0.671	$0.586	$0.066	$0.608	$1.308	$0.982	$0.286	$6.131
5.8.3.1	Logistics Support Management (AML)														
5.8.3.2	ICDLS				$0.127	$1.136	$0.360	$0.671	$0.586	$0.066	$0.608	$1.308	$0.982	$0.286	$6.131
5.8.3.3	Contractor Repair (F&E)														
5.9	**In-Service Training**														
5.10	**Second Level Engineering**		**$0.250**	**$0.990**	**$1.875**	**$0.520**	**$0.782**	**$0.763**	**$0.652**	**$0.166**	**$0.507**	**$0.689**	**$0.527**	**$0.179**	**$7.898**
5.10.3	Hardware and Software Engineering Support		$0.250	$0.990	$1.875	$0.520	$0.782	$0.763	$0.652	$0.166	$0.507	$0.689	$0.527	$0.179	$7.898
5.10.3.1	2nd level engineering support														
5.10.3.2	2nd Level Engineering Services (AOS)		$0.250	$0.990	$1.875	$0.520	$0.782	$0.763	$0.652	$0.166	$0.507	$0.689	$0.527	$0.179	$7.898
5.10.3.3	Contractor Site Support														
5.11	**Infrastructure Support**					**$0.044**	**$0.287**	**$0.791**	**$0.421**	**$0.069**	**$3.147**	**$2.679**	**$1.349**	**$3.030**	**$11.816**
5.11.2	Utilities														
5.11.3	Leased Telecom					$0.044	$0.276	$0.769	$0.398	$0.033	$3.050	$2.556	$1.224	$0.142	$8.492
5.11.3.1	(Non-Recurring)					$0.038	$0.150	$0.519	$0.171		$2.748	$1.906	$0.735		$6.266
5.11.3.2	(Recurring)					$0.006	$0.126	$0.250	$0.227	$0.033	$0.302	$0.650	$0.489	$0.142	$2.226
5.11.5	Leases						$0.011	$0.022	$0.023	$0.036	$0.096	$0.123	$0.125	$2.888	$3.324
6.0	**Disposition**						**$0.450**	**$0.915**	**$0.063**	**$1.028**				**$26.443**	**$28.900**
6.5	**Dismantle/Removal**						**$0.450**	**$0.915**	**$0.063**	**$1.028**				**$26.443**	**$28.900**
WBS Number	**Cost Element**	**FY 2000**	**FY 2001**	**FY 2002**	**FY 2003**	**FY 2004**	**FY 2005**	**FY 2006**	**FY 2007**	**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**	**FY 2012- FY2030**	**Total ($M)**
5.0	**In-Service Management**				**$0.126**	**$0.385**	**$1.121**	**$2.305**	**$2.401**	**$3.810**	**$4.942**	**$5.573**	**$6.861**	**$229.028**	**$256.551**
5.1	**Preventative Maintenance**														
5.2	**Corrective Maintenance**						**$0.171**	**$0.586**	**$0.468**	**$0.464**	**$1.116**	**$1.631**	**$1.703**	**$50.560**	**$56.699**
5.2.1	Corrective Maintenance Staffing						$0.140	$0.480	$0.383	$0.380	$0.914	$1.336	$1.395	$41.408	$46.436
5.2.2	SMO						$0.031	$0.106	$0.085	$0.084	$0.202	$0.295	$0.308	$9.152	$10.263
5.3	**Modifications**														
5.4	**Maintenance Control**														
5.5	**Technical Teaming**														
5.6	**Watch Standing Coverage**						**$0.032**	**$0.108**	**$0.016**		**$0.147**	**$0.166**	**$0.068**		**$0.537**
5.6.1	Site Technician Training						$0.022	$0.065	$0.009		$0.088	$0.100	$0.041		$0.325
5.6.2	ATC Training						$0.010	$0.043	$0.006		$0.059	$0.066	$0.027		$0.212
5.7	**Program Support**													**$4.616**	**$4.616**
5.7.1	FAA Employee													$2.690	$2.690
5.7.2	Contractor FTE													$1.927	$1.927
5.8	**Logistics**							**$0.228**	**$0.469**	**$1.195**	**$1.282**	**$1.306**	**$2.121**	**$76.886**	**$83.488**
5.8.1	Supply Support							$0.002	$0.004	$0.012	$0.013	$0.013	$0.024	$5.554	$5.622
5.8.1.1	Supply Support Services													$4.648	$4.648
5.8.1.2	Packaging, Handling, Storage, and Transportation (PHS&T) - FAALC							$0.002	$0.004	$0.012	$0.013	$0.013	$0.024	$0.905	$0.973
5.8.2	Replenishment Spares							$0.029	$0.059	$0.163	$0.179	$0.182	$0.326	$12.392	$13.330
5.8.2.1	Consumables							$0.026	$0.052	$0.146	$0.161	$0.164	$0.297	$11.440	$12.287
5.8.2.2	E&R/R&R							$0.003	$0.007	$0.017	$0.018	$0.018	$0.029	$0.952	$1.044
5.8.3	Repair							$0.181	$0.373	$0.942	$1.004	$1.023	$1.629	$53.775	$58.929
5.8.3.1	FAA Repair (Organic)														
5.8.3.2	Commercial Depot Repair							$0.181	$0.373	$0.942	$1.004	$1.023	$1.629	$53.775	$58.929
5.8.5	Support Equipment							$0.016	$0.033	$0.078	$0.086	$0.087	$0.142	$5.165	$5.607
5.8.5.1	Standard Test and Support Equipment							$0.016	$0.033	$0.078	$0.086	$0.087	$0.142	$5.165	$5.607
5.8.5.2	Special Support Equipment														
5.8.5.3	Calibration Standards/ Services														
5.8.6	Technical Data														
5.9	**In-Service Training**						**$0.072**	**$0.305**	**$0.043**		**$0.327**	**$0.369**	**$0.266**	**$4.452**	**$5.835**
5.9.1	Depot Training														
5.9.1.1	Instructor														
5.9.1.2	Student														
5.9.2	Second Level Training							$0.062							$0.062
5.9.3	Site Technician Training						$0.055	$0.167	$0.032		$0.223	$0.252	$0.182	$3.071	$3.982
5.9.3.1	Instructor						$0.029	$0.066	$0.018		$0.086	$0.096	$0.072	$1.250	$1.616
5.9.3.2	Student						$0.026	$0.101	$0.015		$0.137	$0.155	$0.111	$1.821	$2.366
5.9.4	ATC Training						$0.017	$0.077	$0.011		$0.104	$0.118	$0.084	$1.381	$1.791
5.9.4.1	Instructor						$0.017	$0.077	$0.011		$0.104	$0.118	$0.084	$1.381	$1.791
5.9.4.2	Student														
5.10	**Second Level Engineering Direct work Maintenance Staffing**				**$0.102**	**$0.310**	**$0.698**	**$0.722**	**$0.942**	**$1.475**	**$1.186**	**$1.058**	**$1.275**	**$48.080**	**$55.847**
5.10.1	FAA Personnel				$0.102	$0.310	$0.542	$0.569	$0.617	$0.648	$0.680	$0.714	$0.750	$24.037	$28.967
5.10.2	Contractor Personnel						$0.156	$0.153	$0.325	$0.827	$0.506	$0.344	$0.525	$24.044	$26.880
5.10.3	Fixed Cost														
5.11	**Infrastructure Support**				**$0.025**	**$0.075**	**$0.147**	**$0.355**	**$0.463**	**$0.676**	**$0.885**	**$1.043**	**$1.428**	**$44.434**	**$49.530**
5.11.2	Utilities				$0.025	$0.075	$0.147	$0.294	$0.323	$0.329	$0.496	$0.647	$0.700	$16.148	$19.185
5.11.3	Leased Telecommunications							$0.061	$0.140	$0.347	$0.388	$0.395	$0.728	$28.286	$30.345
5.12	**Flight Inspections and SIAP Development**														
5.13	**System Performance Assessment**														
5.14	**System Operations-AT Staffing**														
5.15	**Travel to and From FAA Sites**														

Attachment B: ASDE-X Waterfall (as of August 30, 2007)

#	ID	Region	Airport	Delivery	IOC	ORD
1	MKE	AGL	General Mitchell International Airport (Milwaukee, WI)	3/12/02	6/5/03	10/30/03
2	MCO	ASO	Orlando International Airport	9/25/03	9/1/04	9/30/04
3	PVD	ANE	Theodore Francis Green State Airport (Providence, RI)	12/1/03	7/2/04	5/16/05
4	HOU	ASW	William P. Hobby Airport (Houston, TX)	10/29/04	8/4/05	8/31/05
5	SEA	ANM	Seattle-Tacoma International Airport	12/23/04	1/27/06	2/24/06
6	STL	ACE	Lambert-St. Louis International Airport	12/3/03	10/21/04	5/24/06
7	ATL	ASO	Hartsfield-Jackson Atlanta International Airport	7/11/05	5/5/06	6/7/06
8	BDL	ANE	Bradley International Airport (Hartford, CT)	3/14/05	6/7/06	6/21/06
9	SDF	ASO	Louisville International Airport-Standiford Field	3/8/04	3/11/07	7/19/07
10	CLT	ASO	Charlotte Douglas International Airport	1/13/04	7/6/07	8/30/07
11	IAD	AEA	Washington Dulles International Airport	12/20/05	Jul-08	
12	PHX	AWP	Phoenix Sky Harbor International Airport	4/19/07	Dec-08	
13	BOS	ANE	Boston Logan International Airport	Sep-08	Jul-09	
14	DTW	AGL	Detroit Metro Wayne County Airport	5/16/07	Jun-08	
15	EWR	AEA	Newark International Airport	Sep-08	Jul-09	
16	LAX	AWP	Los Angeles International Airport	2/23/06	Jun-09	
17	DEN	ANM	Denver International Airport	Jan-09	Nov-09	
18	JFK	AEA	John F. Kennedy International Airport	Aug-08	Jul-09	
19	ORD	AGL	Chicago O'Hare International Airport	3/26/07	7/29/07	8/29/07
20	LAS	AWP	Las Vegas McCarran International Airport	Feb-09	Dec-09	
21	IAH	ASW	George Bush Intercontinental Airport	Dec-08	Nov-09	
22	PHL	AEA	Philadelphia International Airport	Jan-09	Dec-09	
23	FLL	ASO	Ft. Lauderdale/Hollywood Airport	May-08	Apr-09	
24	MSP	AGL	Minneapolis-St. Paul International Airport	Mar-09	Feb-10	
25	SNA	AWP	John Wayne-Orange County Airport	Mar-09	Feb-10	
26	DFW	ASW	Dallas/Ft. Worth International Airport	Apr-09	Apr-10	
27	SLC	ANM	Salt Lake City International Airport	Jun-09	May-10	
28	BWI	AEA	Baltimore-Washington International Airport	Jul-09	Jun-10	
29	MDW	AGL	Chicago Midway Airport	Aug-09	Jul-10	
30	HNL	AWP	Honolulu International - Hickam AFB Airport	Sep-09	Aug-10	
31	MIA	ASO	Miami International Airport	Sep-09	Aug-10	
32	DCA	AEA	Ronald Reagan Washington National Airport	Feb-10	Dec-10	
33	LGA	AEA	New York LaGuardia Airport	Feb-10	Dec-10	
34	SAN	AWP	San Diego International Airport	Mar-10	Jan-11	
35	MEM	ASO	Memphis International Airport	Mar-10	Jan-11	
T1	ICDLS		Test & Interim Contractor Depot Logistics Support (ICDLS) - Syracuse [Oklahoma City - FAA Logistics Center (AML Depot)]	10/16/01	N/A	
T2	PSF		Oklahoma City - NAS Engineering Program Support Facility (PSF)	2/27/04	N/A	
T3	ACA		Oklahoma City - Academy	6/10/04	N/A	

mm/dd/yy = actual

Appendix. Agency Comments

Attachment C: ASDE-X Software Enhancement Schedule

Build & System Enhancements Status by Site (09/21/2007)					
#	ID	Region	Airport	5.0.7.2.2 Deployed [Includes Rain Mode, Tower Config, Intersecting Runway Alerts, ASDE-X Upgrade (formerly ASDE-3X)]	Change Order 6 NLT IOC date [Includes PRM-A, Split Ops, Security Enhancements]
1	MKE	AGL	General Mitchell International Airport (Milwaukee, WI)	Jul 2007	
2	MCO	ASO	Orlando International Airport	Jan 2007	
3	PVD	ANE	Theodore Francis Green State Airport (Providence, RI)	Feb 2008	
4	HOU	ASW	William P. Hobby Airport (Houston, TX)	May 2008	
5	SEA	ANM	Seattle-Tacoma International Airport		Feb 2008 (key site)
6	STL	ACE	Lambert-St. Louis International Airport	Feb 2008	
7	ATL	ASO	Hartsfield-Jackson Atlanta International Airport	Sep 2007	
8	BDL	ANE	Bradley International Airport (Hartford, CT)	Feb 2008	
9	SDF	ASO	Louisville International Airport-Standiford Field	Jul 2007	
10	CLT	ASO	Charlotte Douglas International Airport	Aug 2007	
11	IAD	AEA	Washington Dulles International Airport		Jul 2008
12	PHX	AWP	Phoenix Sky Harbor International Airport		Dec 2008
13	BOS	ANE	Boston Logan International Airport		Jul 2009
14	DTW	AGL	Detroit Metro Wayne County Airport		Jun 2008
15	EWR	AEA	Newark International Airport		Jul 2009
16	LAX	AWP	Los Angeles International Airport		Jun 2009
17	DEN	ANM	Denver International Airport		Nov 2009
18	JFK	AEA	John F. Kennedy International Airport		Jul 2009
19	ORD	AGL	Chicago O'Hare International Airport	Aug 2007	Nov 2008 (2nd tower)
20	LAS	AWP	Las Vegas McCarran International Airport		Dec 2009
21	IAH	ASW	George Bush Intercontinental Airport		Nov 2009
22	PHL	AEA	Philadelphia International Airport		Dec 2009
23	FLL	ASO	Ft. Lauderdale/Hollywood Airport		Apr 2009
24	MSP	AGL	Minneapolis-St. Paul International Airport		Feb 2010
25	SNA	AWP	John Wayne-Orange County Airport		Feb 2010
26	DFW	ASW	Dallas/Ft. Worth International Airport		Apr 2010
27	SLC	ANM	Salt Lake City International Airport		May 2010
28	BWI	AEA	Baltimore-Washington International Airport		Jun 2010
29	MDW	AGL	Chicago Midway Airport		Jul 2010
30	HNL	AWP	Honolulu International - Hickam AFB Airport		Aug 2010
31	MIA	ASO	Miami International Airport		Aug 2010
32	DCA	AEA	Ronald Reagan Washington National Airport		Dec 2010
33	LGA	AEA	New York LaGuardia Airport		Dec 2010
34	SAN	AWP	San Diego International Airport		Jan 2011
35	MEM	ASO	Memphis International Airport		Jan 2011

Current Enhancements
Upcoming Enhancement

Appendix. Agency Comments

Attachment D: ASDE-X Software Build 5.0.7.2 Test Events and Completion Dates

Test Event	Test Organization	Test Location	Test Dates
ASDE-X Software Build 5.0.7.2 Factory Acceptance Test [Includes Rain Mode, Tower Configuration, Intersecting Runway Alerts, ASDE-X Upgrade (formerly ASDE-3X)]	Sensis	Syracuse, NY	1. Engineering Dry Runs: 11/16/06 to 11/22/06 2. FAA-Witnessed Dry Runs: 11/2706 to 12/14/06 3. Formal Test: 12/8/06 to 12/15/06
ASDE-X Software Build 5.0.7.2 National Baseline Test [Includes Rain Mode, Tower Configuration, Intersecting Runway Alerts, ASDE-X Upgrade (formerly ASDE-3X)]	FAA Technical Center	1. ASDE-X Lab in Washington DC 2. Orlando, FL	1. 9/1/06 to present 2. 1/9/07 to 1/11/07
ASDE-X Upgrade Independent Operational Test & Evaluation (IOT&E) Assessment [Includes converging runway capability]	FAA Office of Independent Operational Test & Evaluation	Louisville, KY	3/11/07 to 4/4/07

The following pages contain textual versions of the graphs and charts found in this document. These pages were not in the original document but have been added here to accommodate assistive technology.

FAA Needs To Improve Airport Surface Detection Equipment-Model X (ASDE-X) Management Controls To Address Cost Growth, Schedule Delays, and Safety Risks

Section 508 Compliant Presentation

Table 1. History of ASDE-X Strategy Changes

Item 1. Date of change: September 2001. Purpose of change: first program baseline. Number of ASDE-X airports planned: 26 (Note: these airports were comprised of 25 airports without surface surveillance and 1 ASDE-3/AMASS airport). Planned completion date was 2007. Cost increase $424,300,000.

Item 2. Date of change: June 2002. Purpose of change: second baseline—included plan to upgrade seven more ASDE-3/AMASS airports. Number of ASDE-X airports planned: 33 (Note: these airports were comprised of 25 airports without surface surveillance and 8 ASDE-3/AMASS airports). Planned completion date was 2007. Cost increase $80,900,000.

Item 3. Date of change: October 2003. Purpose of change: to upgrade two more ASDE-3/AMASS airports. Number of ASDE-X airports planned: 35 (Note: these airports were comprised of 25 airports without surface surveillance and 10 ASDE-3/AMASS airports). Planned completion date was 2007. Cost increase: $0

Item 4. Date of change: September 2005. Purpose of change: third baseline and major strategy shift to upgrade 25 ASDE-3/AMASS airports. Number of ASDE-X airports planned: 35 (Note: these airports were comprised of 10 airports without surface surveillance and 25 ASDE-3/AMASS airports). Planned completion date is 2011. Cost increase: $44,600,000.

The current total number of ASDE-X airports planned is 35. The current planned completion date is 2011. The current ASDE-X cost estimate is $549,800,000.

Source: ASDE-X JRC baseline documents

Table 2. ASDE-X Cost Estimates for Six Activities

Cost Element: Procurement/ Production	Planned Cost Estimate: (as of September 2005) $142,950,000	Current Cost Estimate: (as of December 2006) $179,740,000	Cost Growth: $36,790,000
Cost Element: Program Management	Planned Cost Estimate: (as of September 2005) $93,470,000	Current Cost Estimate: (as of December 2006) $120,100,000	Cost Growth: $26,630,000
Cost Element: Software Design and Development	Planned Cost Estimate: (as of September 2005) $38,490,000	Current Cost Estimate: (as of December 2006) $58,820,000	Cost Growth: $20,330,000
Cost Element: Logistics Support	Planned Cost Estimate: (as of September 2005) $11,000,000	Current Cost Estimate: (as of December 2006) $18,340,000	Cost Growth: $7,340,000
Cost Element: Second-Level Engineering	Planned Cost Estimate: (as of September 2005) $5,500,000	Current Cost Estimate: (as of December 2006) $7,900,000	Cost Growth: $2,400,000
Cost Element: Test and Evaluation	Planned Cost Estimate: (as of September 2005) $5,500,000	Current Cost Estimate: (as of December 2006) $6,230,000	Cost Growth: $730,000

The total planned cost estimate for these six activities (as of September 2005) was $296,910,000. The total current cost estimate for these six activities (as of December 2006) is $391,130,000. The total cost growth for these six activities is $94,220,000.

Source: OIG analysis of ASDE-X basis of estimates and ASDE-X updated costs estimates

Figure 1. Example of a Potential Collision Situation for Single and Intersecting Runways

Item 1: Depiction of two aircraft causing a single runway head-on alert.

Item 2: Depiction of two aircraft causing an intersecting runway alert.

Source: ASDE-X Safety Logic specification

Figure 2. Three-Year Comparison of Runway Incursions

In fiscal year 2004, there were 324 runway incursions. Of these, 97 were operational errors (caused by air traffic controllers), 171 were pilot deviations (caused by pilot error), and 56 were vehicle/pedestrian deviations (caused by vehicle operators and pedestrians).

In fiscal year 2005, there were 326 runway incursions. Of these, 105 were operational errors (caused by air traffic controllers), 168 were pilot deviations (caused by pilot error), and 53 were vehicle/pedestrian deviations (caused by vehicle operators and pedestrians).

In fiscal year 2006, there were 330 runway incursions. Of these, 89 were operational errors (caused by air traffic controllers), 190 were pilot deviations (caused by pilot error), and 51 were vehicle/pedestrian deviations (caused by vehicle operators and pedestrians).

Source: FAA Runway Safety Office: FY 2004-FY 2006 runway incursion data

Exhibit B. ASDE-X Program Cost Variances

Cost Element: Procurement/Production	Planned Cost Estimate for this element (as of September 2005): $142,950,000	Current Cost Estimate for this element (as of December 2006) $179,740,000	Cost Variance for this element: $36,790,000
Cost Element: Program Management	Planned Cost Estimate for this element (as of September 2005): $93,470,000	Current Cost Estimate for this element (as of December 2006): $120,100,000	Cost Variance for this element: $26,630,000
Cost Element: Software Design and Development	Planned Cost Estimate for this element (as of September 2005): $38,490,000	Current Cost Estimate for this element (as of December 2006): $58,820,000	Cost Variance for this element: $20,330,000
Cost Element: Logistics Support	Planned Cost Estimate for this element (as of September 2005):$11,000,000	Current Cost Estimate for this element (as of December 2006): $18,340,000	Cost Variance for this element: $7,340,000
Cost Element: Second Level Engineering	Planned Cost Estimate for this element (as of September 2005): $5,500,000	Current Cost Estimate for this element (as of December 2006): $7,900,000	Cost Variance for this element: $2,400,000

Cost Element: Test and Evaluation	Planned Cost Estimate for this element (as of September 2005): $5,500,000	Current Cost Estimate for this element (as of December 2006): $6,230,000	Cost Variance for this element: $730,000
The subtotals for these cost elements are as follows:	Planned Cost Estimate subtotal for these elements (as of September 2005): $296,910,000	Current Cost Estimate subtotal for these elements (as of December 2006): $391,130,000	Cost Variance subtotal for these elements: $94,220,000
Cost Element: Disposition	Planned Cost Estimate for this element (as of September 2005): $60,480,000	Current Cost Estimate for this element (as of December 2006): $28,900,000	Cost Variance for this element: -$31,580,000
Cost Element: Construction	Planned Cost Estimate for this element (as of September 2005): $82,470,000	Current Cost Estimate for this element (as of December 2006): $56,850,000	Cost Variance for this element: -$25,620,000
Cost Element: Installation*	Planned Cost Estimate for this element (as of September 2005): $54,980,000	Current Cost Estimate for this element (as of December 2006): $44,110,000	Cost Variance for this element: -$10,870,000
Cost Element: Site survey	Planned Cost Estimate for this element (as of September 2005): $16,490,000	Current Cost Estimate for this element (as of December 2006): $8,170,000	Cost Variance for this element: -$8,320,000
Cost Element: Telecommunications**	Planned Cost Estimate for this element (as of September 2005): $16,490,000	Current Cost Estimate for this element (as of December 2006): $8,490,000	Cost Variance for this element: -$8,000,000
Cost Element: Logistics	Planned Cost Estimate for this element (as of September 2005): $11,000,000	Current Cost Estimate for this element (as of December 2006): $6,130,000	Cost Variance for this element: -$4,870,000

Cost Element: Systems Engineering	Planned Cost Estimate for this element (as of September 2005):5,500,000	Current Cost Estimate for this element (as of December 2006): $2,740,000	Cost Variance for this element: -$2,760,000
Cost Element: Other	Planned Cost Estimate for this element (as of September 2005): $5,500,000	Current Cost Estimate for this element (as of December 2006): $0	Cost Variance for this element: $0
The subtotals for these cost elements are as follows:	Planned Cost Estimate subtotal for these elements (as of September 2005): $252,910,000	Current Cost Estimate subtotal for these elements (as of December 2006): $155,390,000	Cost Variance subtotal for these elements: -$92,020,000
The grand totals for all cost elements are as follows:	Planned Cost Estimate grand total for all cost elements (as of September 2005): $549,820,000	Current Cost Estimate grand total for all cost elements (as of December 2006):$546,520,000	Cost Variance grand total for all cost elements: Not Applicable

Source: OIG analysis of ASDE-X Life Cycle Cost Estimates: September 2005 and current cost estimates

Note: Sensis submitted FAA cost estimates to complete ASDE-X installation totaling $64 million. The $20 million difference between the FAA and Sensis estimates ($64 million versus $44 million) would increase ASDE-X implementation costs to $566 million and exceed the current ASDE-X program baseline.

Note: We also found that ASDE-X program officials decreased telecommunications costs estimates from $16.5 million to $8.5 million to remain within ASDE-X program baseline costs. However, FAA later reported that the telecommunications costs were actually one to two times higher than its original estimates, which could increase the costs to at least $33 million or up to $49.5 million.

Exhibit D. ASDE-X Waterfall Schedule (as of August 14, 2006)

Table Item 1. New Establishment Airports

1	Airport Identification: MKE	General Mitchell International (Mil. WI)	Delivery Date 3/12/02	Initial Operating Capability Date 6/5/03	Operational Readiness Date 10/30/03
2	Airport Identification: MCO	Orlando International	Delivery Date 9/25/03	Initial Operating Capability Date 9/1/04	Operational Readiness Date 9/30/04
3	Airport Identification: PVD	Theodore Francis Green State (Prov. RI)	Delivery Date 12/1/03	Initial Operating Capability Date 7/2/04	Operational Readiness Date 5/16/05
4	Airport Identification: HOU	William P. Hobby Airport (Houston, TX)	Delivery Date 10/29/04	Initial Operating Capability Date 8/4/05	Operational Readiness Date 8/31/05
5	Airport Identification: BDL	Bradley International Airport (Hart. CT)	Delivery Date 3/14/05	Initial Operating Capability Date 6/7/06	Operational Readiness Date 6/21/06
6	Airport Identification: PHX	Phoenix Sky Harbor International	Delivery Date November 2007	Initial Operating Capability Date December 2008	Operational Readiness Date to be determined
7	Airport Identification: FLL	Ft. Lauderdale/Hollywood	Delivery Date May 2008	Initial Operating Capability Date April 2009	Operational Readiness Date to be determined
8	Airport Identification: SNA	John Wayne-Orange County	Delivery Date March 2009	Initial Operating Capability Date February 2010	Operational Readiness Date to be determined
9	Airport Identification: MDW	Chicago Midway	Delivery Date August 2009	Initial Operating Capability Date July 2010	Operational Readiness Date to be determined
10	Airport Identification: HNL	Honolulu International - Hickam AFB	Delivery Date September 2009	Initial Operating Capability Date August 2010	Operational Readiness Date to be determined

Table Item 2. Airports with Airport Surface Detection Equipment-Model 3/Airport Movement Area Safety System (ASDE-3/AMASS)

11	Airport Identification: STL	Lambert-St. Louis International	Delivery Date 12/3/03	Initial Operating Capability Date 10/21/04	Operational Readiness Date 5/24/06
12	Airport Identification: SEA	Seattle-Tacoma International	Delivery Date 12/23/04	Initial Operating Capability Date 1/27/06	Operational Readiness Date 2/24/06
13	Airport Identification: ATL	Hartsfield-Jackson Atlanta International	Delivery Date 7/11/05	Initial Operating Capability Date 5/5/06	Operational Readiness Date 6/7/06
14	Airport Identification: IAD	Washington Dulles International	Delivery Date 12/20/05*	Initial Operating Capability Date July 2008	Operational Readiness Date to be determined
15	Airport Identification: SDF	Louisville International –Standiford Field	Delivery Date 3/8/04	Initial Operating Capability Date August 2007	Operational Readiness Date to be determined
16	Airport Identification: CLT	Charlotte Douglas International	Delivery Date 1/13/04	Initial Operating Capability Date July 2007	Operational Readiness Date to be determined
17	Airport Identification: LAX	Los Angeles International	Delivery Date 2/23/06*	Initial Operating Capability Date June 2009	Operational Readiness Date to be determined
18	Airport Identification: MSP	Minneapolis-St. Paul International	Delivery Date March 2009	Initial Operating Capability Date February 2010	Operational Readiness Date to be determined

19	Airport Identification: DFW	Dallas/Ft. Worth International	Delivery Date April 2009	Initial Operating Capability Date April 2010	Operational Readiness Date to be determined
20	Airport Identification: MEM	Memphis International	Delivery Date May 2010	Initial Operating Capability Date April 2011	Operational Readiness Date to be determined
21	Airport Identification: DEN	Denver International	Delivery Date June 2008	Initial Operating Capability Date July 2009	Operational Readiness Date to be determined
22	Airport Identification: ORD	Chicago O'Hare International	Delivery Date July 2008	Initial Operating Capability Date August 2009	Operational Readiness Date to be determined
23	Airport Identification: LAS	Las Vegas McCarran International	Delivery Date September 2008	Initial Operating Capability Date August 2009	Operational Readiness Date to be determined
24	Airport Identification: IAH	George Bush Intercontinental	Delivery Date December 2008	Initial Operating Capability Date November 2009	Operational Readiness Date to be determined
25	Airport Identification: DCA	Ronald Reagan Washington National	Delivery Date February 2010	Initial Operating Capability Date January 2011	Operational Readiness Date to be determined
26	Airport Identification: BWI	Baltimore-Washington International	Delivery Date July 2009	Initial Operating Capability Date June 2010	Operational Readiness Date to be determined
27	Airport Identification: EWR	Newark International	Delivery Date June 2008	Initial Operating Capability Date May 2009	Operational Readiness Date to be determined
28	Airport Identification: DTW	Detroit Metro Wayne County	Delivery Date August 2007	Initial Operating Capability Date August 2008	Operational Readiness Date to be determined
29	Airport Identification: BOS	Boston Logan International	Delivery Date February 2008	Initial Operating Capability Date December 2008	Operational Readiness Date to be determined
30	Airport Identification: JFK	John F. Kennedy International	Delivery Date August 2008	Initial Operating Capability Date July 2009	Operational Readiness Date to be determined
31	Airport Identification: MIA	Miami International	Delivery Date September 2009	Initial Operating Capability Date August 2010	Operational Readiness Date to be determined
32	Airport Identification: LGA	New York LaGuardia	Delivery Date March 2010	Initial Operating Capability Date February 2011	Operational Readiness Date to be determined
33	Airport Identification: PHL	Philadelphia International	Delivery Date January 2009	Initial Operating Capability Date December 2009	Operational Readiness Date to be determined
34	Airport Identification: SLC	Salt Lake City International	Delivery Date June 2009	Initial Operating Capability Date May 2010	Operational Readiness Date to be determined
35	Airport Identification: SAN	San Diego International	Delivery Date April 2010	Initial Operating Capability Date March 2011	Operational Readiness Date to be determined

Table Item 3. Support Systems

T1	Interim Contractor Depot Level Support	Vendor Facility/ICDLS	Delivery Date 10/16/01
T2	Program Support Facility	FAA Program Support Facility	Delivery Date 2/27/04
T3	Mike Moroney Aeronautical Center	FAA Academy – Oklahoma City	Delivery Date 6/10/04

Note: Washington Dulles (IAD) and Los Angeles International (LAX) delivered to airport but not yet installed.

Note: Louisville (SDF), Charlotte (CLT), and Dulles (IAD) International Airports did not meet their FY 06 ORD dates.

Note: Initial Operating Capability (IOC) – The declaration by site personnel that the ASDE-X system is ready for conditional operational use in the NAS and denotes the end of Field Familiarization at that site.

Note: Operational Readiness Date (ORD) - Signifies the official date to switchover to the new system.

Source: FAA Internal Program Review, March 2007