Office of Inspector General

Key Safety, Modernization And Financial Issues Facing FAA

Department of Transportation

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Memorandum

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

Subject: **ACTION**: Key Safety, Modernization, and Financial Issues Facing FAA
AV-2000-072

Date: April 11, 2000

Reply To
Attn Of: JA-10:x60500

From: Alexis M. Stefani
Assistant Inspector General for Auditing

To: Federal Aviation Administrator

On March 22, 2000, at a hearing of the Subcommittee on Transportation and Related Agencies, Committee on Appropriations, U.S. House of Representatives, we provided testimony on key issues facing the Federal Aviation Administration (FAA). Our statement addressed areas that need special management attention in the coming year and included recommendations that you should be aware of. A copy of our statement is attached for your information. We made three overarching points with respect to safety, air traffic control modernization, and financing.

First, safety is, and must remain, the highest priority for FAA. FAA needs to be more effective in its actions to decrease the numbers of runway incursions and operational errors. We advised FAA that it should provide constant senior-level attention to reducing runway incursions similar to that provided to the Year-2000 effort. In addition, FAA needs to, among other things, encourage high-risk airports to use Airport Improvement Funds for runway incursion prevention devices and focus on a wide array of technologies for preventing incidents on runways, including in-cockpit moving map displays. Later this year, we will report on the results of our work on runway incursion technologies and air traffic operational errors in greater detail, and we will formally transmit recommendations at that time.

Second, while FAA has taken a more incremental approach to some acquisitions, two key modernization programs, the Wide Area Augmentation System (WAAS) and the Standard Terminal Automation Replacement System (STARS), continue to experience problems. These two programs account for over $4 billion in estimated total program costs and have experienced cost increases and schedule delays.

We are making recommendations aimed at improving the management of the WAAS and STARS efforts. WAAS has experienced a number of technical problems that will have significant cost and schedule implications that have yet to be determined. Until

solutions are identified, it would be prudent for FAA to make significant reductions in current contract expenditures, which are now almost $4 million a month. FAA should also seek advice on WAAS technical problems from an independent scientific group.

With respect to STARS, FAA was successful in achieving initial operations of the Early Display Configuration of the system. However, full replacement of 30-year-old systems at the Nation's terminal facilities is needed. The largest risk to the overall program is the amount of software that remains to be developed and tested to resolve human factors concerns for full STARS. FAA needs to definitize the STARS contract modification that incorporates the revised program strategy that was approved a year ago. Also, FAA needs to reinstitute earned value management techniques, which assist program managers in measuring contractor progress with large-scale acquisitions.

Accordingly, we recommend that FAA:

1. Make significant reductions in current WAAS contract expenditures until solutions for technical problems are identified.

2. Seek advice on how to solve WAAS technical problems from an independent scientific group, such as the National Academy of Sciences.

3. Definitize the STARS contract modification that incorporates the revised strategy for the program and reinstitute earned value management techniques. FAA should negotiate this modification with appropriate cost control mechanisms, as well as methods for withholding payment if progress is not satisfactory.

Finally, the Aviation Investment and Reform Act for the 21st Century provides about $40 billion in authorized funding for FAA programs over the next 3 years. While this level of funding offers significant investment opportunities, it underscores the need for FAA to take action to contain operations costs, implement an accurate cost accounting system, and develop a strategic business plan. Earlier this year, we recommended that FAA develop a strategic business plan and accelerate its efforts to implement a cost accounting system (OIG Report Number AV-2000-039). FAA agreed with our recommendation regarding a strategic business plan but not on accelerating its efforts to implement a cost accounting system. We continue to believe FAA needs a cost accounting system sooner, not later.

In accordance with Department of Transportation Order 8000.1C, we would appreciate receiving your written comments within 20 days. If you concur with our recommendations, please indicate for each recommendation the specific action taken or planned and target dates for completion. If you do not concur, please provide your

rationale. Furthermore, you may provide alternate courses of action that you believe would resolve the issues presented in this report.

We appreciate the courtesies and cooperation extended by your staff. If I can answer any questions or provide additional information, please call me at (202) 366-1992 or David A. Dobbs, Deputy Assistant Inspector General for Aviation, at (202) 366-0500.

Attachment

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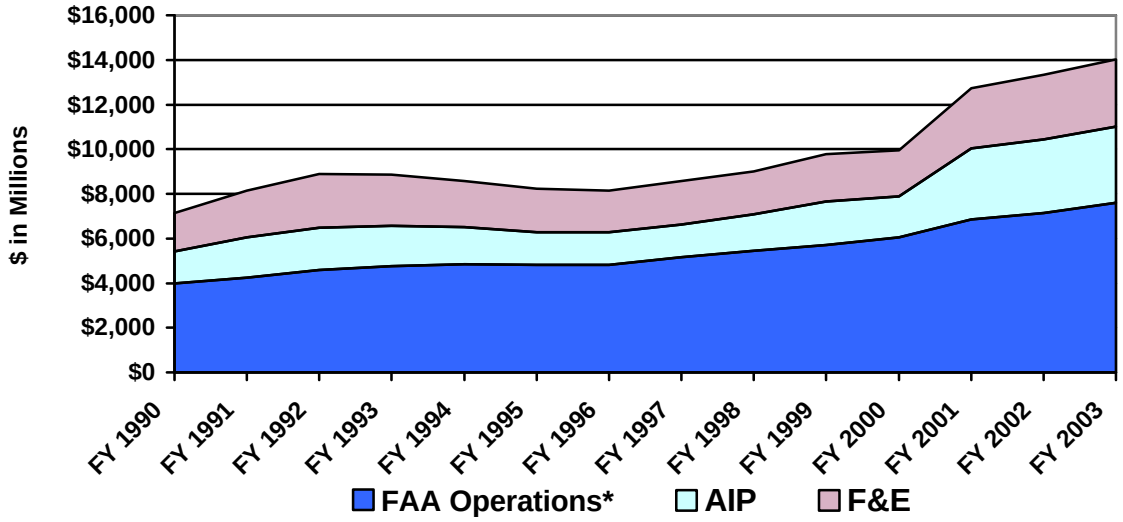
Mr. Chairman and Members of the Subcommittee:

We appreciate the opportunity to discuss the Federal Aviation Administration's (FAA) Fiscal Year (FY) 2001 budget request. FAA is requesting $11.2 billion for FY 2001, an increase of 12 percent over last year's level - this is exclusive of the $1.5 billion in additional funds provided for in the Reauthorization Bill. Last week, Congress passed the FAA Reauthorization Bill which, among other things, provides FAA with unprecedented access to the Aviation Trust Fund. FAA's Airport Improvement Program (AIP) and Facilities and Equipment (F&E) accounts will see significant increases over the next 3 years.

As we have previously stated, FAA's operations costs must be contained. The legislation provides a powerful incentive for this because the general framework calls for FAA's AIP and F&E accounts to be funded at the authorized levels *before* allocating any Trust Fund revenue to FAA's Operations account. Trust Fund receipts and interest will clearly be inadequate to fund all of FAA's operations costs.

Growth in FAA's Operations, F&E, and AIP Accounts for FYs 1990-2003
(FAA Authorization Levels for FYs 2001-2003)



*For purposes of this analysis FAA's Operations include Operations and Research, Engineering and Development

Although FAA faces many challenges in the upcoming year, we would like to recognize the actions of Administrator Garvey and the FAA staff for the successes of the past year. FAA was successful in making its 152 mission-critical systems Y2K compliant. That success is due, in part, to the constant senior-level attention this effort received. FAA has also undertaken a major initiative to deal with delays and for the first time since inception of the Chief Financial Officers Act has received a "clean" opinion on its financial statements. FAA must now implement a better property

management system and simplify the process for recording amounts in its financial statements.

To its credit, we have seen evidence that FAA has learned from past mistakes on selected acquisitions and adopted a "build a little, test a little" approach. FAA agreed with our recommendations for controlling costs and sharing risks for new software-intensive Free Flight Phase 1 controller tools. Further, FAA has deployed systems such as the Display System Replacement (new controller displays for en route facilities) and the initial phase of HOST (computers that receive, process, and track aircraft movement throughout the domestic and en route airspace) on time and within budget.

FAA oversees the largest, busiest, and safest air transportation system in the world. FAA also is responsible for operating air traffic control, which is the nerve center of the Nation's air transportation system. Notwithstanding its accomplishments, FAA faces significant problem areas that need special management attention in the coming year. These challenges fall into three categories - safety, air traffic control modernization, and financing. Our testimony today will address each of these issues.

- First, safety is, and must remain, the highest priority for FAA. FAA needs to be more effective in its actions to decrease the numbers of runway incursions and operational errors and implement guidelines for U.S. carriers to follow in assessing the safety of their foreign code share partners.

  In 1999, runway incursions remained at a high level of 322. Administrator Garvey's recent initiatives to reduce runway incursions and make it a top agency priority are a step in the right direction. Now FAA must fully implement planned initiatives, deploy technologies to its high risk airports to assist controllers and pilots, encourage airports to use AIP funds for runway incursion prevention devices, and ensure vigorous adherence to runway incursion reporting requirements. Also, operational errors made by air traffic controllers continue to increase in FY 2000. In the first 5 months in FY 2000, operational errors increased 21 percent over the same period in FY 1999. *Instead of increasing the targeted operational error rate for FY 2001, FAA should aggressively try to reduce the number of operational errors.*

  Also, on February 28, 2000, the Department issued guidelines for U.S. carriers to follow in conducting audits of their foreign code share partners. FAA must move aggressively to implement these guidelines. Until these guidelines are implemented, new international code share agreements will continue to be approved without an assessment of the level of safety foreign carriers provide.

- Second, two key modernization programs, Wide Area Augmentation System (WAAS) and Standard Terminal Automation Replacement System (STARS), continue a succession of problems that need FAA's attention. These two programs account for over $4 billion in estimated total program costs and have experienced cost increases and schedule delays.

  WAAS is an effort to move toward satellite-based navigation. WAAS has experienced hardware and software problems that will have significant cost and schedule implications that have yet to be determined. Until solutions to technical problems are identified, it would be prudent for FAA to make significant downward adjustments in the current contract burn rate (almost $4 million a month). In addition, FAA should seek advice on how to solve WAAS technical problems from an independent and scientific group, such as the National Academy of Sciences. Such an independent group would not have a vested interest in the outcome.

  STARS, an effort to install new computer systems in the terminal environment, has undergone significant cost increases and schedule delays. As an interim measure, FAA has deployed an Early Display Configuration (EDC) of the system. *EDC should not be confused with full STARS*. EDC is primarily a display replacement and does not provide air traffic controllers and maintenance technicians with a full replacement of the 30-year old system currently in use. The largest risk to deploying full STARS is the amount of software that remains to be developed, tested, and integrated to resolve human factors issues raised by controllers and technicians. Specifically, over 50 percent of the estimated additional software for computer-human interface remains to be developed.

- Third, FAA's Reauthorization Bill provides about $40 billion in authorized funding for FAA programs over the next 3 years. While this level of funding offers significant investment opportunities, it underscores the need for FAA to take action to contain operations costs, implement an accurate cost accounting system, and develop a strategic business plan.

FAA's Efforts to Reduce Runway Incursions and Operational Errors Must Be Improved

Safety is, and must remain, the highest priority for FAA. With the expected growth in air travel, the challenge focuses on how to proactively maintain and improve safety.

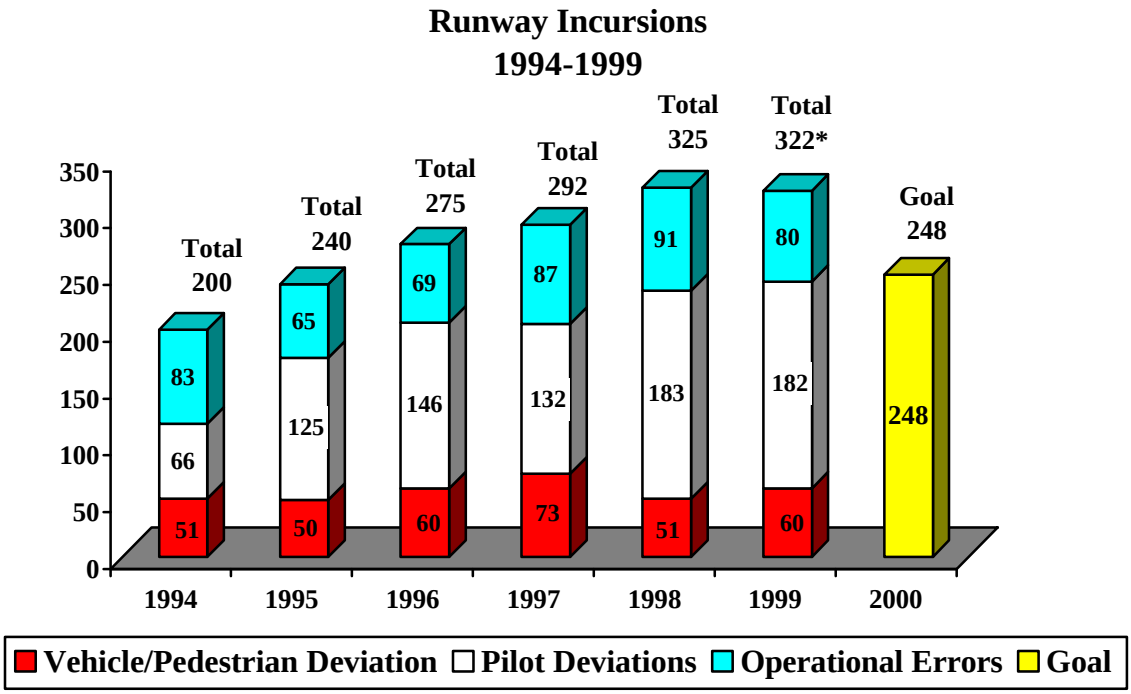
FAA has targeted areas including runway incursions and operational errors, where it can increase the margin of safety and reduce accidents, but actions have not been fully implemented or have not been effective. FAA's efforts to reduce runway incursions and operational errors must be improved to avoid tragic accidents, such as the one that occurred less that 2 weeks ago on the runway at Sarasota-Bradenton International Airport in Florida that resulted in four deaths.

Runway Incursions

Runway incursions, incidents on the runway that create a collision hazard, are still a serious safety problem. The runway incursion problem is not new. For the last decade, reducing runway incursions has been on the National Transportation Safety Board's (NTSB) annual "Most Wanted" list of transportation safety improvements. It is important to point out that the worst accident in civil aviation history was a runway collision in March 1977 at Tenerife in the Canary Islands, where 583 people died. Since 1990, there have been 6 runway accidents which claimed 63 lives and damaged 12 aircraft.

In 1997, FAA set a goal to reduce runway incursions to 41 by the year 2001. With the numbers of runway incursions sharply increasing since 1993 to almost 300 in 1997, FAA raised its goal in 1998. Its new goal is to reduce the number of runway incursions by 15 percent from the 1997 baseline to no more than 248 by the end of calendar year 2000. Even after raising the goal by over 500 percent, it is still unlikely

FAA will meet its goal. Runway incursions have increased 61 percent, from 200 incursions in 1994 to 322 incursions in 1999. The following chart shows the number of runway incursions by the three types: vehicle or pedestrian deviations, pilot deviations, and operational errors.



***1999 numbers are preliminary**

FAA's program for reducing runway incursions was ineffective because, until recently, it was not a high enough priority. FAA made limited progress in implementing its plans to reduce runway incursions because its program office did not have the authority to oversee the planned activities, which crossed various lines of business in FAA such as Airports, Air Traffic, and Flight Standards. Also, until FY 2000, FAA did not provide funds to the program office to carry out planned initiatives.

Technologies to Reduce Runway Incursions Are Needed: FAA has been unsuccessful in fielding new technologies to assist controllers in reducing runway incursions and preventing runway accidents. For example, in August 1991, in response to an NTSB

recommendation, FAA advised the NTSB that it was developing the Airport Movement Area Safety System (AMASS), a key system to alert air traffic controllers of potential runway accidents. AMASS uses data from the Airport Surface Detection Equipment, Model 3 (ASDE-3) radar. After 8 years, AMASS is not operational at any of the 34 larger airports programmed to receive the system.

In 1993, FAA estimated that AMASS would cost $59.8 million and be installed in 1996. However, problems with software development, technical problems such as excessive false alerts to controllers, and human factor issues[1] caused the schedule for operation at the last site to slip. FAA currently estimates that the last AMASS system will not be operational until September 2002. Further, costs are now estimated at $151.8 million, a $92 million increase.

As a result of delays with AMASS, larger airports with recurring runway incursions such as Los Angeles, St. Louis, and Dallas-Fort Worth are at least a year away from receiving such technology. (See Attachment 1.) Even when AMASS becomes operational, FAA will initially limit AMASS capabilities to detecting conflicts that occur on the *active* runways for arrivals and departures because of the longstanding problem with excessive false alerts. Therefore, controllers will not be alerted to potential conflicts that involve traffic on runways or taxiways that intersect the active runways.

In addition, FAA has not identified technologies to reduce runway incursions and the risk of accidents at small to mid-size airports with recurring runway incursions. Under its Research, Engineering, and Development Program, FAA evaluated low cost radar at Milwaukee, Salt Lake City, and Norfolk in the last several years. However, FAA is

[1] For example, the AMASS alert message on the ASDE-3 display was not readable beyond 10 feet and aural alerts were not easily understood by the controllers.

against a radar only solution because of excessive false targets and the lack of aircraft identification information.

Congress expressed concern about FAA's inability to field technologies to reduce runway incursions and stated that "technology is *available and needed now* to address the worsening problem of runway incursions." Congress appropriated $7.6 million in FY 2000, with the expectation that by the end of the fiscal year, FAA would award a contract for a low-cost Airport Surface Detection Equipment radar for deployment in the highest priority airports.

FAA plans to award a contract by the end of September for ASDE-X for 30[2] small to medium airports. ASDE-X consists of a radar, processor, an ADS-B/multilateration[3] sensor, and a display. The concept is currently being evaluated at Dallas/Fort Worth International Airport.

We are concerned that the ASDE-X system does not meet the intent of Congress to deploy technologies currently available to high-risk airports. Congress expected FAA to deploy a low cost radar, instead of a complex system like the ASDE-X. The first system is not expected to be operational until September 2002. Based on FAA's experience in deploying AMASS, this aggressive schedule may be very optimistic. Further, FAA does not know how much this system will cost until offers from vendors are received. Lastly, FAA has yet to determine what technologies will best meet the needs of its high priority airports. Consequently, there is no assurance that small to medium-size airports with recurring runway incursion problems, such as airports in Orange County, California; Daytona Beach, Florida; and Boise, Idaho; will be receiving this technology.

[2] With the exception of the airport in Orlando, Florida, FAA has not yet determined which airports will receive the new system.

[3] Automatic Dependent Surveillance Broadcast (ADS-B) is a system that broadcasts the aircraft's identity, altitude, velocity, and position directly to ground receivers and other aircraft.

Recent Initiatives. In response to recommendations made in our July 1999 report on runway incursions, FAA assigned responsibility of its Runway Safety Program to a new program director in September 1999. This new director finally has oversight authority for all runway incursion safety work being performed by various FAA lines of business. The director's goal is to ensure implementation of initiatives in the 1998 Action Plan, which provides a solid foundation to reduce runway incursions. In response to Chairman Wolf's request, FAA intends to hold a National Summit Conference on Runway Incursions this summer. The summit will be preceded by regional workshops and the results from these workshops will be addressed during the National summit. In addition, Administrator Garvey has made reducing runway incursions a top agency priority. These actions are steps in the right direction.

Congress has provided a significant plus-up in funds for FAA's runway incursion program from $18.6 million in FY 1999 to $33.4 million in FY 2000. This includes additional funding for runway incursion technologies and $3.3 million specifically for FAA to carry out initiatives in its plan. Also, the Aviation Investment and Reform Act for the 21st Century (AIR 21) makes runway incursion prevention devices, such as in-pavement lighting systems for runways and taxiways, eligible for AIP funds.

To reduce the number of runway incursions and the risk of another tragic accident, FAA needs to take the following steps:

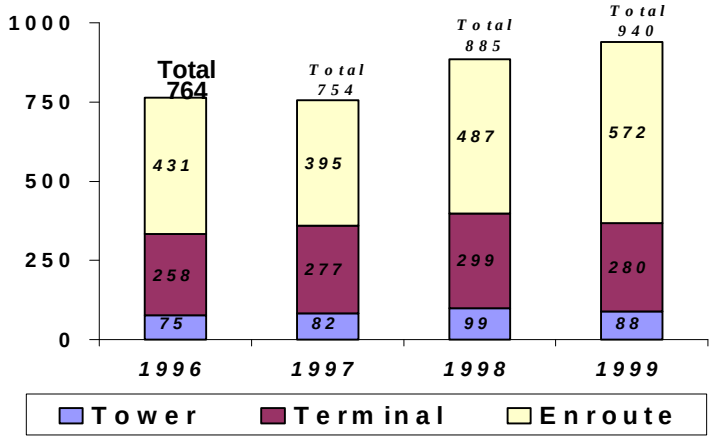
- Provide constant senior level attention to reducing runway incursions similar to that provided the recent successful Y2K effort;
- Fully implement initiatives included in its 1998 Action Plan;
- Encourage high risk airports to use AIP funds for runway incursion prevention devices;
- Evaluate high risk airports and determine what technologies, such as a low-cost ASDE radar or ASDE-X, are needed to prevent further incidents;

- Focus on technologies, such as in-cockpit moving map displays, that would identify what is on the runway and provide two sets of eyes, the pilots, and the controllers, observing risk situations; and
- Ensure vigorous adherence to reporting requirements to ensure that *all* runway incursions are reported.

Operational Errors

An operational error occurs when an air traffic controller does not ensure FAA prescribed minimum separation distance[4] is maintained. This loss of separation can occur between two aircraft, or between an aircraft and terrain or obstructions. These errors are an indicator of a risk to safety. Operational errors increased from 754 in FY 1997 to 940 in FY 1999 as shown in the following chart:

Operational Errors by Facility Type[5]
FYs 1996-1999



[4] Standard separation is 5 miles laterally and 1,000 feet vertically in the en route environment. Lateral separation in the terminal environment is generally between 3 and 5 miles depending on the type of aircraft.

[5] The facility types are: (i) **tower** representing operations that occur on the surface; (ii) **terminal** representing approach and departure operations at Terminal Radar Approach Control and towers; and (iii) **en route** representing operations controlled by Air Route Traffic Control Centers.

According to FAA, the operational error increase in FY 1999 is attributable to increases in traffic volume, improved data reporting, and transitioning to new equipment at the en route facilities and therefore is not comparable to earlier years. However, the agency has not quantified the impact of these changes on operational errors. In any event, operational errors continue to increase in FY 2000. For the first 5 months in FY 2000, operational errors have increased 21 percent over the same period in FY 1999 rising from 356 in FY 1999 to 432 in FY 2000.

During FY 1999, 70 percent of all operational errors occurred at just 25 facilities (See Attachment 2). Most of the operational errors occur at the en route facilities and operational errors at these facilities have been increasing since FY 1997. It is most important to point out that en route facilities are the only type of facilities with an automated means to detect operational errors. Operational errors at terminal and tower facilities are self-reported. FAA actively encourages reporting and takes adverse action against personnel that do not report errors. In addition, FAA set up a hotline to provide an alternative means outside of the normal air traffic reporting process for anyone, including the public, to report instances where an operational error may have occurred.

Timely reporting of potential operational errors is critical because the daily air traffic radar and audio tape recordings are erased and recorded after 15 days. If a suspected operational error is reported after 15 days, the FAA will not have a crucial piece of evidence to establish whether an operational error actually occurred. Therefore, FAA should consider extending the 15-day retention period.

We understand that FAA, in its FY 2001 Performance Plan, increased its targeted operational error rate above the actual FY 1999 rate. By raising the rate, FAA could actually incur more operational errors and still meet its FY 2001 goal. FAA should not

increase its targeted rate and should aggressively try to reduce the number of operational errors.

Reducing operational errors becomes even more important because of recent changes in air traffic operations. First, to reduce delays, local facilities are now required to obtain approval from FAA's Command Center to increase miles-in-trail restrictions. Second, the implementation of the controller-in-charge program reduces the number of operational supervisors and changes the controller to supervisor ratio from 7-to-1 to 10-to-1.

Aviation Safety Under International Code Share Agreements

Code sharing between U.S. and foreign carriers has more than tripled in the past 5 years. Thus far the overall record of safety under code share agreements has been positive. However, given the sheer growth in code share agreements and an increasingly global and complex aviation market, now is the right time to move proactively and make significant changes in the way FAA and the Department of Transportation exercise safety oversight when approving and renewing code share agreements. Last September[6] we recommended and the Department agreed to develop a process to ensure that safety is adequately considered as a condition of approval for international code share agreements.

On February 28, 2000, to strengthen the Department's safety oversight role, the Secretary of Transportation issued guidelines for U.S. carriers to follow in conducting safety audits and providing compliance statements for their foreign code share partners. Under these guidelines, DOT will not approve international code share

[6] "Aviation Safety Under International Code Share Agreements," September 30, 1999, OIG Report Number AV-1999-138.

agreements unless U.S. carriers can provide information DOT can use to determine that foreign code share carriers provide an acceptable level of safety.

The guidelines provide that U.S. carriers develop and implement FAA-approved audit programs that would be used in performing initial and periodic safety audits of each foreign code share carrier. The audits would look at foreign carriers' personnel qualifications, and aircraft maintenance and operation procedures to determine if the carriers comply with safety standards for these areas as established by the International Civil Aviation Organization. As part of the code share approval process, FAA will review the audit reports to determine that the carrier followed its approved audit program and that the results are consistent with other safety information available to FAA.

These guidelines build on the effort begun earlier this year by the Department of Defense and six U.S. carriers represented by the Air Transport Association. If effectively implemented and enforced, this new code share safety program should have a synergistic effect in improving global aviation safety. The key is in prompt and effective implementation.

In announcing the guidelines, the Secretary stated they would be implemented in 60 days, or May 2000, to allow time for U.S. carriers to obtain FAA approval of their audit programs. However, FAA has not yet completed development of the procedures it will use to review and approve the carriers' safety programs. FAA has yet to determine who will review the audit programs and how it will monitor carriers' implementation of the program. We urge FAA to move aggressively to resolve these issues so there is no delay in implementing these guidelines and to provide greater assurance that foreign code share partners adhere to appropriate safety standards.

Concerns Persist with Cost, Schedule, and Benefits of Key Air Traffic Control Modernization Programs

FAA is modernizing the Nation's air traffic control system by acquiring a network of radar, automated data processing, navigation, and communications equipment. Modernizing the air traffic control system is essential to increase the margin of safety, meet the growing demand for air travel, and reduce delays. FAA requested $2.49 billion for capital improvements in FY 2001, an increase of 20 percent over last year's level of $2.07 billion. The Reauthorization Bill provides for an additional $162 million for FY 2001.

To its credit, we have seen evidence that FAA has learned from past mistakes on selected acquisitions and adopted a "build a little, test a little" approach. FAA's Free Flight Phase 1, Data Link, and Safe Flight 21 initiatives reflect this new approach and combine for over $225 million in the agency's FY 2001 budget request. In addition, FAA has deployed systems such as the Display System Replacement (new controller displays for en route facilities) and the initial phase of HOST (computers that receive, process, and track aircraft movement throughout the domestic and en route airspace) on time and within budget.

FAA's efforts over the past year are encouraging, but cost and schedule concerns persist with the Wide Area Augmentation System (WAAS) and Standard Terminal Automation Replacement System (STARS), as shown below. These two programs combine for over $4 billion dollar in program costs. Problems with these acquisitions are traceable to difficulties with intensive software development, human factors, and the establishment of realistic schedules.

Cost and Schedule Variances
in Two Key FAA Modernization Programs

	Estimated Total Program Cost [7],		Scheduled Operations*		
Program	**Original (in Millions)**	**Current (in Millions)**	**Original**	**Current**	**FY 2001 Request (in Millions)**
WAAS	$892.4	$2,900.0	1998	To be determined	$111.0
STARS	$940.2	$1,400.0	1998	2002	$179.2

*Note: The scheduled operation date for WAAS represents Phase-1 Initial Operating Capability, and for STARS represents first full service Operational Readiness Demonstration.

Wide Area Augmentation System (WAAS)

As part of its overall plan for modernizing the National Airspace System and transitioning to Free Flight, FAA plans to transition from a ground-based to a satellite-based navigation system using signals generated by the Department of Defense's Global Positioning System (GPS). FAA is developing WAAS to augment GPS to provide navigation services through all phases of flight.

In the past, the debate focused on whether WAAS could provide a "sole means" of navigation, meaning that GPS/WAAS - with appropriate augmentations - could satisfy the required performance as the only navigation system installed in an aircraft and the only service provided by FAA. This would have allowed FAA to realize cost savings from decommissioning existing ground-based navigation aids. FAA has since recognized the need for a secondary system of some type and is working on the details of its composition and cost. *Now, however, WAAS is experiencing highly complex technical problems, and significant questions exist about the system's integrity and performance.*

[7] Program costs include the Facilities and Equipment cost for the contract, program management, and testing of systems. Program costs do not include the cost of operating, maintaining, supporting and disposing of a system over its useful life.

Congress has appropriated about $600 million for WAAS thus far, and FAA is spending almost $4 million a month (the "burn rate") on the WAAS contract with Raytheon. However, WAAS has experienced hardware and software problems that will have significant cost and schedule implications yet to be determined. As a result, FAA will not meet its revised milestone for initial operating capability in September 2000, and the system will not provide Category I[8] precision approach capability as promised.

The key problem focuses on the *integrity* of the WAAS system, i.e. the ability of the system to alert a pilot when the WAAS signal cannot be relied upon and should not be used. This is now the key cost and schedule driver for the WAAS program. FAA analysis indicates that WAAS safety processors - systems that monitor and verify the WAAS signal - do not work correctly. In December 1999, safety processors failed to detect an instance where "hazardously misleading information" was transmitted.

Considerable *development* work will be required to develop the necessary safety algorithms and software, and the design of some WAAS components may need to be modified for pilots to use WAAS safely. FAA and Raytheon will work with a panel of experts (known as the WAAS Integrity and Performance Panel) over the next 9 months to determine how long it will take and how much it will cost to resolve technical issues, and for WAAS to meet expectations for "Category I look alike" service. Agency officials recognize that neither FAA nor Raytheon has the necessary expertise to resolve these issues.

[8] Category I precision approaches provide for an approach to a height above touchdown of not less than 200 feet and a visibility of ½ mile.

Despite delays and shortfalls in performance, industry officials expressed support for WAAS at a recent joint FAA/industry meeting on the subject. The bulk of benefits from WAAS accrue from providing precision approach capability to airports that currently do not have such capability. FAA officials believe the agency can deliver WAAS with some precision approach capability *(but less than Category I)* sometime in 2002. *Assuming that integrity issues are satisfactorily addressed, the system is certified as safe*[9]*, and users equip with new avionics, FAA and industry officials believe WAAS could provide the following benefits*.

- First, more flexible routes for commercial and general aviation pilots than the current ground based system offers today. This would not be the case for airspace users who have equipped with Flight Management Systems or other sophisticated onboard navigation systems.

- Second, some precision approach capability (approach minimums of 350 feet/ 1-mile) at most airports without requiring additional lighting systems or other ground improvements. While not providing Category I service, this would benefit general aviation and airlines that are taking delivery of new regional jets that serve airports without ground-based landing aids.

- Third, a more accurate signal for other satellite-based technologies, such as Automatic Dependent Surveillance Broadcast (ADS-B) for improving a pilot's situational awareness and preventing runway incursions as well as moving map cockpit displays of traffic information.

[9] The goal of the certification process is to ensure that safeguards are in place to prevent pilots from acting on misleading information. To certify WAAS, all air and ground components must undergo a safety analysis to determine how potential problems will be mitigated and their potential for affecting the safety of flight.

These benefits can only be realized if current problems with WAAS can be resolved. Given the uncertainty regarding how technical and performance concerns will be resolved, we believe a significant downward adjustment in current contract burn rate (almost $4 million a month) would be prudent until solutions are identified. Furthermore, in view of the highly technical nature of WAAS integrity and performance problems, FAA management should obtain views from an independent group, such as the National Academy of Sciences. Although FAA is assembling a panel of experts to work with Raytheon, the National Academy is an independent body that provides access to a wider range of disciplines and expertise. The Academy has no vested financial interest in the outcome. In addition to examining WAAS integrity and performance issues, an independent group could explore solutions and perspectives on alternative approaches, if necessary.

Standard Terminal Automation Replacement System (STARS)

The STARS Program, as originally envisioned, has undergone significant cost increases and schedule delays. As an interim measure, FAA has deployed an Early Display Configuration (EDC) of the system. *EDC should not be confused with full STARS.* Full STARS is the automation platform necessary for the nationwide deployment of Free Flight Phase 1 controller tools.

FAA's STARS Program will replace the current terminal automation system with a modern, fully digital system. STARS includes color radar displays and maintenance workstations, as well as computers and software, for over 170 terminal air traffic control facilities. STARS was designed to provide the software and hardware platform necessary to support such future air traffic control enhancements as a data link for controllers and pilots to communicate. While this acquisition was intended to maximize the use of commercially available equipment, the extensive unanticipated

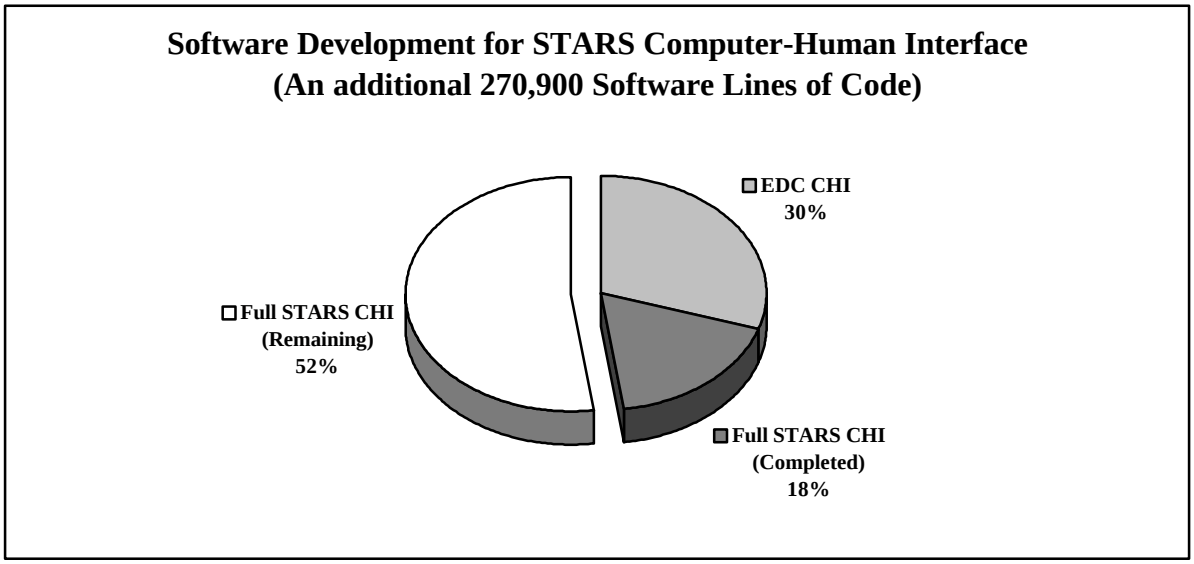
human factors revisions and software development have changed STARS to a developmental system. FAA originally estimated that approximately 120,000 lines of new software code would need to be developed. The current estimate is approximately 400,000 lines of developed code - a 230 percent increase.

The current estimated total cost of the STARS Program is $1.4 billion - an additional $462 million over the initial baseline of $940 million. This increase includes over $270 million for changes to the system's computer-human interface. In addition, FAA now estimates that the last full service STARS will be deployed by September 2008, over 3½ years behind schedule. The STARS schedule continues to be impacted by the software development needed to resolve the computer-human interface issues and other new requirements. If additional delays occur, we would anticipate associated cost increases.

Because of concerns with equipment outages, FAA agreed to replace the controller displays sooner than originally planned. To accomplish this, FAA established the EDC of STARS. EDC consists of new controller displays and maintenance workstations using the existing terminal automation system's (ARTS) computer processors and software along with the STARS emergency backup system.

FAA was successful in achieving initial operations of the EDC at the first site, El Paso, in December 1999 and at Syracuse in January 2000. However, this early deployment is primarily a display replacement and does not provide air traffic controllers and maintenance technicians with a full replacement of the 30-year old system currently in use. In addition to a hardware replacement, full STARS includes the capability for additional radar feeds and digital tower displays, and provides the platform to operate a Free Flight Phase 1 controller tool called the passive Final Approach Spacing Tool (pFAST).

The largest risk to the overall program is the amount of software that remains to be developed, tested, and integrated to resolve human factors issues raised by controllers and technicians. As shown below, over 50 percent of the estimated additional software for computer-human interface remains to be developed.



To effectively manage this program, FAA needs to definitize the STARS contract modification that will incorporate the revised strategy for the STARS program. This revised strategy, known as "Option 8R," was approved in April 1999, almost a year ago. Without a definitized contract modification, FAA does not know if its estimates for cost and schedule are reliable. In this regard, we are particularly concerned about cost increases and schedule delays that can occur in a program that requires extensive software development.

In addition, FAA cannot effectively monitor the contractor's performance without an agreement on contract cost and terms. Our recent work[10] on Free Flight Phase 1 shows the need to enhance contractor accountability and institute cost control mechanisms for

[10] "Management of Software-Intensive Acquisitions for Free Flight Phase 1," December 21, 1999, OIG Report Number AV-2000-028.

software-intensive contracts. FAA should negotiate contracts and modifications for software development with appropriate measures (cost ceilings, incentives, and earned value management techniques[11]) as well as methods for withholding payment if progress is not satisfactory.

Oceanic Automation Program

FAA is finally moving forward with its acquisition of an oceanic air traffic control system for the Oakland, New York, and Anchorage Air Route Traffic Control Centers. These three Centers are responsible for providing air traffic control services to all aircraft flying in approximately 22 million square miles of airspace over the Atlantic and Pacific Oceans.

Modernization of FAA's oceanic air traffic control system is *vital* to minimizing labor-intensive controller workload, supporting fuel-efficient routes, and managing the growing volume of international traffic. FAA needs to move forward to alleviate industry concerns regarding FAA's reluctance to fulfill its commitment to modernize the oceanic air traffic control system and the U.S.'s inability to remain a leader in air traffic control technology. The International Civil Aviation Organization delegated to the U.S. responsibility for providing air traffic control services in over 80 percent of the world's controlled oceanic airspace.

In the past, FAA has attempted to automate portions of the oceanic air traffic control system, but its efforts to date have produced limited results. For example, in 1995, FAA awarded a multi-year contract to develop and produce an Advanced Oceanic Automation System. However, due to funding limitations and contract performance

[11] Earned Value Management is a widely recognized way to measure technical progress with large scale, software intensive acquisitions. This management tool forecasts how much a program will cost and when it will be delivered.

issues, the contract scope was reduced in 1998 to include only the oceanic data link portion of the program.

In FY 1999, FAA selected a new approach for modernizing the oceanic air traffic system. Under this approach, FAA would contract with a service provider to install and maintain an integrated oceanic air traffic system. However, in response to industry, congressional, and our concerns with this approach, FAA revised its acquisition strategy.

We have worked with FAA extensively to better ensure that the solicitation for an oceanic air traffic control system provides an even playing field for interested vendors. In response to our concerns, FAA removed from the acquisition the requirement to provide communications, including those currently provided to FAA on a single-source basis. FAA has also taken actions to clarify the capabilities required of the system and perform a more comprehensive investment analysis. This analysis should assist FAA in defining the total program funds needed for the acquisition.

FAA recently initiated actions to acquire a fully integrated and interactive oceanic system consisting of flight data processing, radar data processing, weather data processing, conflict probe, and surveillance capabilities. FAA's plan consists of a three-phased approach, including an operational demonstration of each interested vendor's oceanic capabilities and two levels of testing. This approach was designed to narrow down the number of candidate vendors, identify risks, and determine the level of customization required. The operational demonstrations are scheduled to begin in April 2000. FAA expects to award a contract in FY 2001.

FAA's approach is to take advantage of available technology by purchasing a commercial off-the-shelf oceanic automation system. However, software development for adaptation to FAA-controlled airspace will still be necessary. Therefore, FAA

should negotiate and award a contract to establish cost ceilings and provide incentives for timely contractor work. Further, the oceanic contract should include clauses that would withhold payment to the contractor if progress on software development is not satisfactory, and require the contractor to implement an Earned Value Management System to provide FAA visibility into established cost and schedule milestones.

Increases in Modernization and Airport Improvement Accounts Will Require Improvements in Financial Management

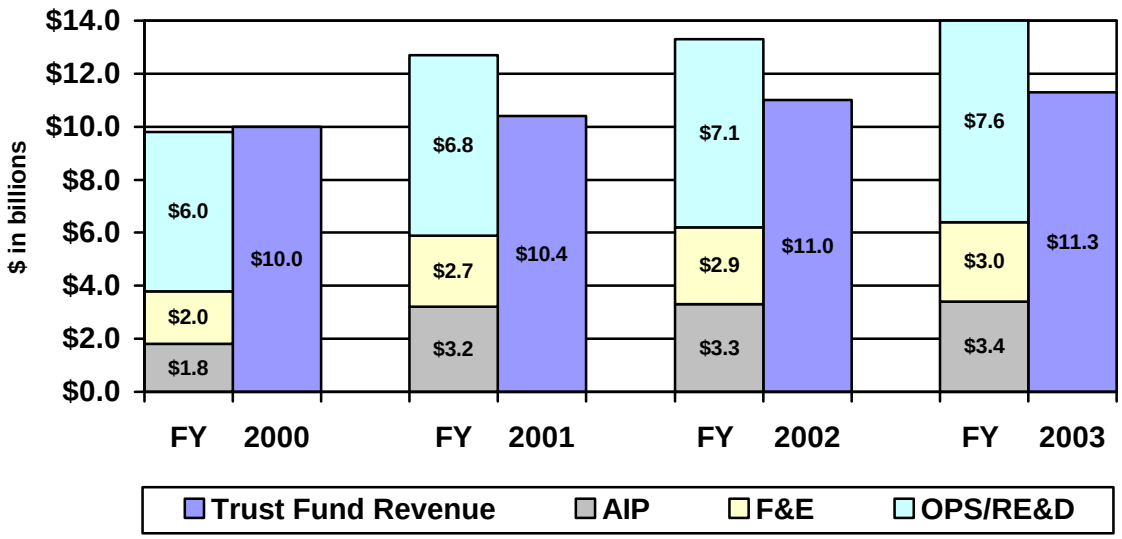
After much debate, FAA now has an Authorization Bill in place through 2003. The Aviation Investment and Reform Act for the 21st Century (AIR 21) provides about $40 billion in authorized funding for FAA programs over the next 3 years - an increase of nearly $5 billion above the President's budget. Approximately $4.8 billion of this increase is dedicated to FAA's Airport Improvement Program (AIP) and Facilities and Equipment (F&E) accounts. AIR 21 also contains special provisions that guarantee funding for those accounts. The general framework calls for (1) all revenue and interest from the Aviation Trust Fund to be spent solely on aviation programs, and (2) FAA's AIP and F&E accounts to be funded at the authorized levels *before* allocating any Trust Fund revenue to FAA's Operations account.

The Aviation Trust Fund revenues alone, however, will not sustain the level of funding called for by the new law. The net effect of the special provisions ensures full funding of FAA's AIP and F&E accounts but results in a projected shortfall of over $7 billion in funding FAA's operations[12] over the 3-year authorized period. For example, in FY 2001, Trust Fund revenue projections are $10.4 billion. Under provisions of AIR 21, FAA's F&E and AIP accounts will receive $5.9 billion of that revenue, leaving a

[12] Includes FAA's Operations and Research, Engineering, and Development accounts.

balance of $4.5 billion to fund FAA's Operations and Research, Engineering, and Development accounts – $2.3 billion less than FAA's request of $6.8 billion for those accounts. This shortfall will require funding from other sources or reductions in FAA's requirements. (Attachment 3 provides a schedule of shortfall projections through FY 2003.)

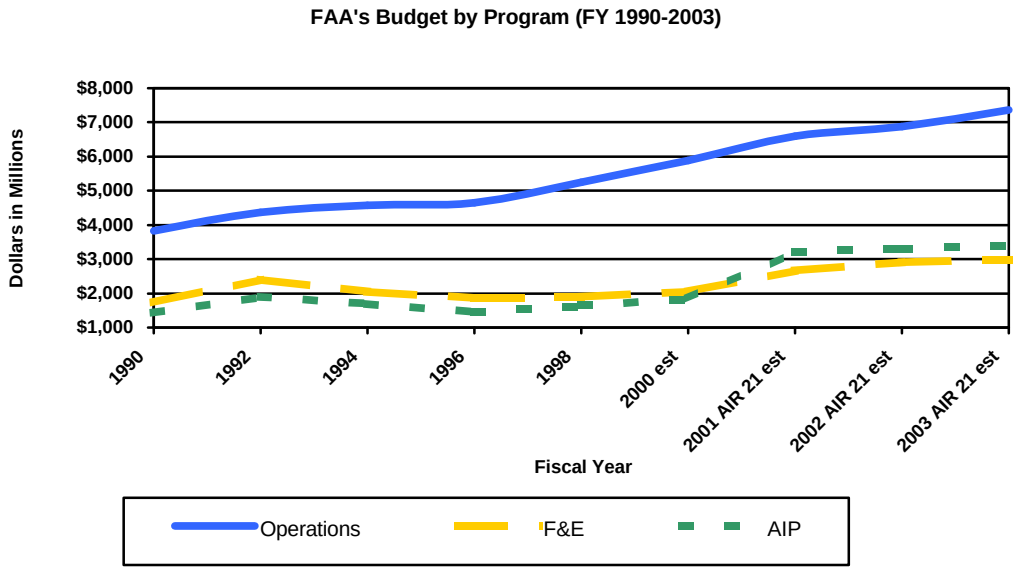
Authorized Funding Compared to FAA Revenue Projections



We have repeatedly cautioned that FAA's operations costs need to be contained. This legislation makes that a must. AIR 21 provides only enough Trust Fund revenue to meet about 65 percent of FAA's projected operations requirements through FY 2003. Funding for the remainder of FAA's operations requirements is not guaranteed.

The ways and means of bridging or reducing this shortfall is a significant issue. AIR 21 envisions FAA receiving annual contributions from the general fund. However, it is important to recognize that, in that scenario, FAA's operations accounts will compete with other Federal programs for resources. The potential shortfall highlights the need for FAA to improve its fiscal responsibility and develop the tools necessary to operate more like a business.

First, operations costs must be contained. FAA's operations costs have risen from $3.8 billion in 1990 to nearly $6 billion in FY 2000 and these figures continue to rise. FAA's FY 2001 operations budget request of $6.6 billion is a 12 percent increase over FY 2000 figures. By FY 2003, FAA projects its Operations account will grow to about $7.2 billion.



Operations costs are the largest portion of FAA's budget representing approximately 60 percent of FAA's total FY 2001 budget. Operations costs are made up primarily of salaries (about 73 percent of FAA's Operations budget). FAA estimates that for FY 2001, payroll costs will exceed $4.8 billion, which are approximately 7 percent more than FY 2000.

Payroll costs will increase further as FAA continues to negotiate new pay agreements with its various workforces. In FY 1999 FAA implemented a new pay system for controllers that requires approximately $1 billion in additional funding over the 5-year

life of the agreement. These risks are compounded as FAA negotiates new wage agreements with its other workforces who want similar treatment.

FAA believes the cost increases associated with the new pay systems will be partially mitigated by offsetting productivity gains such as freezing the staffing level of 15,000 air traffic controllers for 3 years, eliminating 4-day work weeks at 24-hour facilities, and initiating collateral duties for controllers. However, over a year after signing the agreement, FAA is still trying to identify and quantify productivity gains.

Last year, we recommended that FAA project the productivity offsets over the life of the agreement to better manage its future funding requirements. FAA did not agree, stating that a 5-year estimate would be speculative at best, relying too much on estimates regarding future aviation activity. In our opinion, it is not unreasonable to expect FAA to anticipate and plan for all the costs associated with multi-year commitments. FAA needs to forecast and monitor projected revenues, savings, and productivity gains.

Second, a reliable cost accounting system must be in place. An accurate cost accounting system should facilitate better management and control of operations costs. FAA needs a cost accounting system to accurately identify and allocate its costs in order to make sound financial and managerial decisions - controlling operations costs is one example. FAA's operations costs are not identified or allocated to the specific projects that they support. For example, FAA does not have a cost accounting system that tracks the portion of operations funds that are spent to support development of new systems such as STARS or WAAS. An accurate cost accounting system could help FAA identify and allocate the salaries and expenses that will be used to support specific programs in its capital accounts.

FAA originally planned for its cost accounting system to be fully implemented by October 1, 1998, but implementation is not complete. Earlier this year, FAA estimated its system would be fully implemented by September 30, 2001. However, FAA recently delayed the completion schedule until sometime in FY 2002 because of funding constraints. FAA needs a reliable cost accounting system sooner, not later. FAA should reverse its decision and accelerate the implementation schedule for its cost accounting system.

Before a cost accounting system can be useful, however, the basic financial data have to be accurate and reliable. In past years, FAA's financial data were not reliable, which is why we had been unable to render a "clean" audit opinion on its financial statements. During FY 1999, FAA made an extraordinary effort to produce better financial data which allowed us to issue a "clean" opinion on FAA's FY 1999 financial statements. However, that effort was extremely labor-intensive and required hiring additional contractors, detailing employees, and using extensive employee overtime and compensatory time. FAA needs a better property management system that will facilitate the accumulation of documentation to support cost and simplify the process for recording amounts on its financial statements.

Lastly, FAA needs to develop a strategic business plan. FAA has long called for a stable source of funding. AIR 21 now provides FAA with $18.5 billion in committed funding for capital investment over the next 3 years. FAA should now live up to its part of the bargain and provide Congress and the agency's stakeholders with a commitment of what they can expect from the increased investment. A strategic business plan is a key tool for communicating that commitment. Elements of that plan should:

- describe key corporate strategies and operating plans over the next several years and the timing and impact of those plans,

- define long-term capital requirements and strategies for investing in infrastructure and future technologies, and

- demonstrate the cash implications of the business plan actions, including strategies for controlling costs and implementing productivity enhancements.

Mr. Chairman, this concludes my statement. I would be pleased to answer any questions.

Attachment 1

Airports with Four or More Runway Incursions in 1999

Airport	1999
Los Angeles Intl, CA*	10
Orange County, CA	9
Lambert-St. Louis Intl, MO*	7
Dallas-Ft. Worth Intl, TX *	7
Daytona Beach, FL	6
Boise, ID	6
Atlanta-Hartsfield, GA*	6
San Juan Intl, PR	6
San Francisco Intl, CA*	6
Long Beach, CA	6
Tulsa Riverside, OK	5
Providence, RI	5
Chicago O'Hare, IL*	5
San Diego Montgomery, CA	5
Chicago Midway, IL	5
Las Vegas Intl, NV*	5
New York Kennedy, NY*	5
Fort Lauderdale Exec, FL	5
Republic, Farmingdale, NY	5
Springfield, IL	4
Salt Lake City, UT*	4
Seattle, WA*	4
San Antonio, TX	4
Palm Springs, CA	4
Minneapolis Crystal, MN	4
Lincoln, NE	4
Minneapolis Flying Cloud, MN	4
Fargo, ND	4
Denver Centennial, CO	4

* These airports are scheduled to receive AMASS. The other airports are not scheduled to receive any runway incursion technology.

Attachment 2

FY 1999 Top 25 Facilities for Errors

	Facility	Number of Errors	
1.	Washington ARTCC	74	
2.	Indianapolis ARTCC	55	
3.	Atlanta ARTCC	52	
4.	New York ARTCC	47	
5.	Cleveland ARTCC	48	
6.	Chicago ARTCC	41	
7.	New York TRACON	29	
8.	Kansas City ARTCC	26	
9.	Jacksonville ARTCC	24	
10.	Minneapolis ARTCC	23	
11.	Albuquerque ARTCC	22	
12.	Los Angeles ARTCC	22	
13.	Oakland ARTCC	21	
14.	Memphis ARTCC	21	
15.	Denver ARTCC	20	
16.	Washington Dulles Airport Tower/TRACON	18	
17.	Dallas-Fort Worth ARTCC	18	
18.	Southern California TRACON	16	
19.	Houston ARTCC	15	
20.	Miami ARTCC	14	
21.	Boston ARTCC	12	
22.	Dallas-Fort Worth TRACON	11	
23.	Chicago TRACON	10	
24.	San Francisco/Oakland Bay TRACON	10	
25.	San Juan CERAP	10	
	Total Top 25	659	70%
	Nationwide Total	940	100%

ARTCC = Air Route Traffic Control Centers provide air traffic services for the enroute phase of flights, generally above 10,000 feet.

TRACON = Terminal Radar Approach Control provides air traffic approach services within about 5 to 40 miles of an airport. Those listed on this exhibit are stand-alone facilities and provide TRACON services only.

CERAP = Center/Radar Approach Control is a combined ARTCC and TRACON.

Attachment 3

FAA's Projected Aviation Trust Fund Revenue and Allocation
FYs 2001 - 2003

	FY 2001	FY 2002	FY 2003	Total
Projected Trust Fund Revenue				
Taxes	$9.6	$10.2	$10.6	$30.4
Interest	$0.8	$0.8	$0.7	$2.3
Total Projected Trust Fund Revenues	**$10.4**	**$11.0**	**$11.3**	**$32.7**
Allocation of Trust Fund Revenue				
AIP (Mandatory)	$3.2	$3.3	$3.4	$9.9
F&E (Mandatory)	$2.7	$2.9	$3.0	$8.6
Mandatory Allocations	**$5.9**	**$6.2**	**$6.4**	**$18.5**
Balance Available for Operations	$4.5	$4.8	$4.9	$14.2
Total Allocations of Trust Fund	**$10.4**	**$11.0**	**$11.3**	**$32.7**
Operations/RE&D Authorization	**$6.8**	**$7.1**	**$7.6***	**$21.5**
Operations Shortfall	**($2.3)**	**($2.3)**	**($2.7)**	**($7.3)**
Total FAA Authorization	**$12.7**	**$13.3**	**$14.0**	**$40.0**

(*RE&D funding estimated at FY 2002 levels.)