Office of Inspector General

The Year 2000 Computer Challenges

Federal Aviation Administration

Report Number: FE-1998-068
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Memorandum

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

Subject: ACTION: The Year 2000 Computer Challenges, FAA Report Number. FE-1998-068

Date: February 23, 1998

Reply to Attn of: JA-20:x61496

From: Lawrence H. Weintrob
Assistant Inspector General for Auditing

To: Federal Aviation Administrator

On February 4, 1998, at a hearing before the Subcommittee on Technology, House Committee on Science, and the Subcommittee on Government Management, Information and Technology, House Committee on Government Reform and Oversight, U.S. House of Representatives, we provided our observations on the Year 2000 computer problems facing the Federal Aviation Administration (FAA). Our statement is attached for your information.

To minimize risks, FAA needs strong central management and a continuing sense of urgency to identify Year 2000 problems and expedite solutions. We recommend that FAA (1) take prompt action to make necessary fixes to newly acquired but not yet operational systems, (2) expeditiously appoint a person with strong technical leadership and authority to manage the Year 2000-program, (3) make a prompt decision on the Host computer fixes, (4) develop a suitable contingency plan for the Host computer, (5) have an independent review of plans to fix and certify the existing Host computer, (6) develop a master schedule for fixing and testing all mission-critical systems, (7) promptly identify and secure resources needed to get the job done by no later than June 1999, and (8) report monthly to the Secretary and Congress on progress made toward fixing Year-2000 problems.

In testimony on February 4, 1998, you acknowledged FAA got a late start and concurred with our recommendations, but you did not commit to accelerating the implementation date. Please provide, within 30 days, specific actions taken or planned for each recommendation.

We will continue to monitor the Year-2000 project, provide assistance as needed and appropriate, and advise you, the Secretary, and Congress of progress. We appreciate the courtesies and cooperation of FAA representatives. If we can answer any questions or be of further assistance, please call me on (202) 366-1992, or John Meche on (202) 366-1496.

Attachment

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ATTACHMENT

Before the Subcommittee on Technology, House Committee on Science and the Subcommittee on Government Management, Information and Technology, House Committee on Government Reform and Oversight

U.S. House of Representatives

For Release on Delivery
Expected at
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The Year 2000 Presents Significant Challenges for the Air Traffic Control System

Statement of

The Honorable Kenneth M. Mead

Inspector General

U.S. Department of Transportation

Madam Chairwoman, Mr. Chairman, and Members of the Subcommittees:

We appreciate the opportunity to testify today. With all the recent publicity, most people know that many computer systems and software applications had been programmed with a two-digit year field. Computer systems programmed in this way will not be able to differentiate between the year 2000 and 1900, since both would have the same two-digit representation of "00." If the computer systems, including those used by air traffic controllers, are "confused" by an "00" year field, they could shut down or provide inaccurate information. Because of its critical safety function and the public reliance on air travel, any failure in the Air Traffic Control System is unacceptable.

We have been reviewing the Department's Year-2000 progress since May 1997, and have issued two reports.[1] The General Accounting Office also has been reviewing FAA as part of its Governmentwide oversight of Year-2000 problems. FAA has about 70 percent of the mission-critical systems in the Department, as shown in exhibit A. Our testimony today will address four areas:

- The importance of Year-2000 problems in the Air Traffic Control System,
- The status of actions to fix the FAA Year-2000 problems,
- Challenges ahead for FAA on Year-2000 work, and
- Actions FAA should undertake to solve its Year-2000 computer problems.

Before addressing these areas in detail, I will summarize our overall message and findings.

FAA got a very late start on fixing Year-2000 computer problems. It was not until about 6 months ago that FAA began addressing the Year-2000 issue with a sense of urgency. Consequently, FAA is behind schedule on assessing which of its systems have Year-2000 problems, determining what needs to be fixed, and testing and implementing solutions. The good news is that it is not too late. Strong central management and a continuing sense of urgency are the keys to success.

Every piece of computer software and hardware must be assessed for problems, fixed as needed, and tested for Year-2000 compliance. The assessment work--identifying systems with Year-2000 problems--is almost finished, although it is 7 months after the target date specified by the Office of Management and Budget (OMB). Much of the assessment work on the Air Traffic Control System

[1] Management Advisory on Year 2000 Computer Problems, FAA, Report Number FE-1998-027, November 26, 1997, and Assessing the Year 2000 Computer Problem, DOT, Report Number FE-1998-053, December 18, 1997.

was completed last week under intensive central management and a firm requirement that the assessment work be finished by January 31.

FAA's most difficult challenges lie ahead--fixing the problems, including the Host computer which is used in the En-route Centers to direct high altitude traffic, testing systems to make sure these fixes work, and putting Year-2000 compliant systems online. FAA also has new systems scheduled to be operational before the Year 2000, including major systems like the Standard Terminal Automation Replacement System (STARS), a primary air traffic control system that will replace an obsolete system, and the Wide Area Augmentation System (WAAS), a system that will use satellites for communication, navigation, and surveillance between air traffic controllers and pilots. Twenty-three newly purchased but not deployed systems, each costing more than $100 million, had not been determined by FAA to be Year-2000 compliant as of February 2. FAA must determine very soon actions needed, if any, to make them compliant. All tasks must be done, must be done well, and completed well before January 1, 2000. Failure of mission-critical systems is not a viable option.

With less than 2 years to go, use of the limited remaining time is critical. FAA must strive to get the fixes done this year, and begin testing as soon as possible. Funding requirements must also be determined by FAA. The current funding estimate is at least $162 million without interim replacement of the Host computer and $322 million with its replacement. These estimates are likely to change as the magnitude of the problem and the cost of the fixes become clearer. Congress must be told what the plan of attack is, and what it will cost to make all mission-critical systems Year-2000 compliant, including new systems under development. **While money is important, the real issue is time.**

The Year-2000 problem is not just a major challenge for Government. The entire aviation industry, including aircraft manufacturers, airlines, and airports must be involved. The challenge to FAA is great because its on-time track record for completing computer and software intensive programs has been poor. FAA's scheduled November 1999 date to have the Year-2000 problem fixed brings us much too close to the "millennium bomb," a term recently used to describe the Year-2000 problem by the Government Executive Magazine. This time there is no room for schedule slippage; the due date is fixed. We urge FAA to move up the implementation date to have all systems Year-2000 compliant, tested, and operational no later than June 1999.

Our testimony today will identify actions FAA must take to effectively solve the Year-2000 problem. They include the need to (1) take prompt action to make necessary fixes to newly acquired but not yet operational systems, (2) expeditiously appoint a person with strong technical leadership and authority to

manage the Year-2000 program, (3) make a prompt decision on the Host computer fixes, (4) develop a suitable contingency plan for the Host computer in case the planned efforts fail, (5) have an independent review of plans to fix and certify the existing Host computer, (6) develop a master schedule for fixing and testing all mission-critical systems, (7) promptly identify and secure resources needed to get the job done, and (8) report monthly to the Secretary and Congress on the progress made toward fixing Year-2000 problems.

We are working closely with the FAA Administrator and her senior staff. We will continue to monitor this issue, and advise the FAA Administrator, the Secretary, and the Congress of problems and recommended solutions.

Background

OMB established a five-phase approach for addressing Year-2000 computer problems. According to the OMB schedule, agencies should have finished the second phase, which is to analyze existing systems for the scope of Year-2000 problems, by June 1997. In the next phase, agencies will fix Year-2000 problems by repairing existing software code or acquiring replacement systems. The OMB target for completion of this phase is September 1998. Then, the fix has to be tested to ensure it works as intended, including interfaces with other systems. Testing should be completed by January 1999. After successful testing, agencies will implement Year-2000 compliant systems to support their operations. OMB's target date for full implementation is March 1999.

As of February 2, 1998, FAA has identified 430 mission-critical systems, of which 209 currently support the Air Traffic Control System. The remaining mission-critical systems primarily involve administrative services (122 systems) such as payroll, or systems that are in the acquisition and research process (84 systems) such as STARS. The 209 mission-critical systems are used by 17,000 air traffic controllers to direct and control over 40 million flights annually. The Air Traffic Control System contains thousands of inter-dependent radars, computers, special display equipment, and telecommunication networks. Working together, the

system software and hardware capture flight plans and the location of flying aircraft, transmit this information to a mainframe computer, display these locations on air traffic controller screens, and tag the locations with aircraft identification. Based on information displayed, controllers then provide instructions to the pilots through communication links.

The Year-2000 Problem is Important to the Air Traffic Control System

Every piece of software and hardware in the Air Traffic Control System has to be assessed for Year-2000 problems. When Year-2000 problems are found, either the software and hardware must be fixed, or the computers and software have to be replaced. The fix or replacement must then be tested to make sure the systems will properly interface with all components of the Air Traffic Control System. This is an enormous task; however, it has to be done, and must be done well. Otherwise, key components of the Air Traffic Control System could malfunction. If this happens, controllers might not be able to tell the exact altitude and speed of aircraft or the distance between aircraft, which could cause flights to be delayed or grounded.

Here are examples of three mission-critical systems for air traffic control that have been diagnosed with Year-2000 problems and must be fixed.

- The systems used in the En-route Centers consist of 4,000 pieces of hardware and software, including the Host mainframe computers, that allow air traffic controllers to manage aircraft flying at high altitude.

- The Offshore Flight Data Processing System is used to communicate and display positioning and flight plan information for aircraft over the oceans.

- The Terminal Doppler Weather Radar System is used to detect microbursts, gust fronts, wind shifts, and precipitation. This system alerts aircraft of hazardous weather conditions around airports and provides advanced notice of changing weather conditions.

The Year-2000 Problem also is Important to the Airline Industry

Airlines and the aviation industry also will be affected by the Year-2000 problems since many of their operations are date sensitive. For example, airline reservation systems and fleet maintenance systems operate based on dates, and calculations using dates, and aircraft have sophisticated on-board computerized avionics equipment that must be Year-2000 compliant.

At a recent event sponsored by FAA, members of the airline industry raised concerns about how ready FAA, and the industry itself, would be for the Year 2000. In general, airlines were not very confident that the Air Traffic Control System would work correctly. Regional airlines thought the awareness level--the first step in addressing Year-2000 problems--among its members was not good. Airport representatives generally agreed that airports were not as aware of Year-2000 issues as they need to be.

The industry suggested FAA assume more of a leadership role in directing the industry's Year-2000 work. In December 1997, the Air Transport Association established a Year-2000 program office to coordinate and interface with FAA. FAA plans to hold another meeting with industry leaders later this month. The increased interactions on this issue between FAA and all parts of the industry is one step in the right direction.

FAA's Assessment Work is Well Behind OMB's Established Targets

FAA got a very late start on the Year-2000 problems. About 6 months ago, FAA began addressing these issues with a sense of urgency. Consequently, FAA is behind schedule on assessing its systems for Year-2000 problems, determining what needs to be fixed, and deciding how to solve these problems. The following chart shows the target dates established by OMB, the Department, and FAA for completing Year-2000 tasks. It also shows the cost estimates for the Department and FAA, excluding the cost to replace the interim Host computer.

YEAR-2000 PHASES AND TASKS	OMB TARGET	DOT TARGET	FAA TARGET	DOT COST (Includes FAA)	FAA COST
Assessment--Determine the Scope ofYear-2000 Problems	6/97	8/97	1/98	$10M	$8M
Renovation--Fix Year-2000 Problems	9/98	9/98	12/98	$99M	$90M
Validation--Test the Fix	1/99	1/99	7/99	(Included Below)	(Included Below)
Implementation--Implement Year-2000 Compliant Systems	3/99	3/99	11/99	$74M --------- $183M =====	$64M ---------- $162M =====

Recently FAA has been working very hard to complete its assessment work. To its credit, FAA implemented a two-step approach for Air Traffic Control Systems that has been effective. First, the assessment is done by system owners in the field. Then, an internal quality assurance review (QAR) team, assisted by the consulting firm Coopers & Lybrand, reviews the assessment results for adequacy.

As shown in the following two charts, a large number of assessments of Air Traffic computer systems was completed last week. Between January 23 and

February 2, the number of assessed systems by Air Traffic Services increased by 109, from 100 to 209. Furthermore, the number of air traffic mission-critical systems also decreased by 25, from 234 to 209.

FAA's Status as of January 23, 1998

Organization	Mission-critical	Assessed	Approved by Quality Assurance	Year-2000 Compliant
Air Traffic Services	234	100*	86	86
Administrative	107	93	N/A	0
Acquisition & Research	48	26	N/A	0
Others	15	12	N/A	0
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Total - All FAA	404	231	86	86

* Estimated since actual statistics were not available.

FAA's Status as of February 2, 1998

Organization	Mission-critical	Assessed	Approved by Quality Assurance	Year-2000 Compliant
Air Traffic Services	209	209	171	125
Administrative	122	122	N/A	0
Acquisition & Research	84	80	N/A	0
Others	15	14	N/A	0
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Total - All FAA	430	425	171	125

The number of assessments approved by the QAR team increased by 85, from 86 to 171. FAA must still run 38 mission-critical air traffic systems through its quality assurance process. Since FAA completed and approved a significant portion of its assessments and quality assurance reviews in the last week, we have not substantiated the accuracy of its reported numbers. Our confidence in the results will be much greater when all quality assurance reviews are completed and we have had the opportunity to validate these numbers. According to FAA

management, all QARs should be completed by mid-February 1998. We are encouraged by the sense of urgency FAA is now applying to this process.

As of February 2, FAA data shows that 125 of the 171 systems subjected to quality assurance reviews were Year-2000 compliant. Our review of these systems showed they were easy ones that had no date processing function, or could be fixed quickly. Much of the hard work for FAA is still ahead.

Projects under Development had not been determined to be Year-2000 Compliant

An additional concern is that FAA has not yet concluded that any of its Air Traffic Control Systems currently in the acquisition and research phase are Year-2000 compliant. There are 23 major projects under development, each costing more than $100 million. These projects are listed in exhibit B. We plan to do more work in this area during our ongoing audit.

On January 30, we reviewed contracts for WAAS and STARS, two major development projects. Although these systems have not been determined by FAA to be Year-2000 compliant, we were advised that the contractors have warranted that these systems will comply. We are in the process of making sure this is the case. FAA needs to validate for itself that there are no Year-2000 problems with these systems, and initiate corrective actions if problems are found.

Significant Challenges Lie Ahead for FAA on Year-2000 Work.

While FAA still needs to determine the resources needed to fix Year-2000 problems, the critical issue today is time. Being behind with less than 2 years to go, FAA has to commit to the Year-2000 project with an absolute sense of urgency. From what we have observed recently, FAA is now doing so. The most

difficult challenges lie ahead--fixing the problems, testing systems to make sure these fixes work, and putting Year-2000 compliant systems into operation.

- Prompt decision needed on strategy for addressing the Year-2000 problem in the aging Host computer

  The Host computer is a key part of the system that enables air traffic controllers to direct high altitude air traffic from the En-route Centers. There are two issues concerning continued service of the Host computer beyond Year 2000: Can FAA make it Year-2000 compliant, and can FAA find replacement parts, which are already scarce?

  International Business Machines (IBM), the manufacturer, recommended FAA replace the existing hardware because replacement parts are getting harder to find, and because IBM lacks the talents and tools to assess the Year-2000 problems in the Host computer. However, FAA maintains the Host computer can be fixed, and is considering a parallel effort to both repair the existing computer and replace it with an interim Host before Year 2000. FAA estimates it will cost about $2 million for the repair job, and about $160 million for an interim replacement.

  FAA and IBM are at odds regarding the difficulties in evaluating and fixing Year-2000 problems in the Host computer. IBM has claimed the Host Year-2000 problems could not be properly assessed. In a letter dated October 2, 1997, IBM stated "Analysis of 3083 microcode (a machine language) involves reviewing hundreds of thousands of lines of microcode written in several different protocols. . . . IBM does not have the skills employed today that understand the microcode implemented in the 3083 well

enough to conduct an appropriate Year-2000 assessment. In addition, the tools required to properly analyze the microcode do not exist."

FAA has done limited testing on the Host computer microcode. To date, FAA has identified a Year-2000 problem with the computer's cooling system. FAA still must complete an analysis of the microcode, but, at this point, the FAA program office is maintaining that the microcode can be fixed. FAA hired one technical expert to work on the microcode assessment, and is searching for other technical experts. Within the next 90 days, FAA plans to make a decision on whether the Host can be repaired. If it can, FAA plans to self-certify the Host with the help of technical experts.

Replacement of the Host requires "rehosting" the mainframe computer. This involves taking the software from the existing computer and installing it into the replacement machine. This sounds simple, however, the reality is that rehosting a highly sophisticated and customized system like the Air Traffic Control System is a complex undertaking. The last time FAA rehosted these mainframe computers, the process took about 3 years. Another key concern is that both the replacement and repair efforts will demand the attention of the same FAA employees who are responsible for rolling out other new equipment. FAA must try to fix the Host and promptly make a decision on its replacement. Regardless of the decision, FAA must work toward repair of the existing Host because FAA's track record for replacing systems is poor, and rehosting in less than 2 years at all centers is extremely optimistic.

It should be recognized that even if FAA decides to adopt a parallel approach to the Host problem--i.e., fix and replace concurrently, there are risks. In order to mitigate the risk, FAA needs to have a contingency plan. FAA's current contingency plan for the Host computer is another system--the Direct Access

Radar Channel system (DARC). If the Host computer cannot function, DARC, assuming it is Year-2000 compliant, will enable the Air Traffic Control System to continue displaying aircraft location on the controller's screen. However, controllers will not be able to tag the aircraft with flight identification and will have to space aircraft further apart. This would slow air traffic. This is not the best solution, but it needs to be available in the event that the existing Host cannot be made Year-2000 compliant, and rehosting cannot be accomplished in sufficient time to be fully operational prior to January 1, 2000. FAA needs to ensure that DARC is Year-2000 compliant and that the operational procedures for its use are current.

- <u>FAA has not established central leadership for Year-2000 work.</u>

  The Host computer issue illustrates an underlying problem with FAA's Year-2000 program: a lack of strong leadership. While OMB guidance required agencies to establish Year-2000 program offices by December 1996, FAA did not take action until June 1997. Then, FAA established two program offices--an Air Traffic Services program office (responsible for the Air Traffic Control System), and an FAA-wide program office. The FAA-wide program office reports to the FAA's Chief Information Officer (CIO). However, the CIO is three levels down from the FAA Administrator, and has not provided effective FAA-wide leadership.

  The FAA Administrator is aware of the need for strong CIO leadership and is addressing the issue with her senior staff. The Department also is looking for candidates to head the Departmentwide CIO Office. Meanwhile, FAA's Year-2000 responsibility is divided. The Associate Administrator for Air Traffic Services continues to be responsible for the Air Traffic Control System, but not for Air Traffic Control Systems that are not yet operational. The

remaining Year-2000 responsibility recently was elevated from the CIO Office to the Deputy Associate Administrator for Research and Acquisitions.

Developing central leadership for FAA's Year-2000 program is critical because of the close relationship between its two groups. Also, central leadership is critical for prioritizing and determining how time and resources should be spent for fixing Year-2000 problems in FAA's mission-critical systems.

o Fixing and testing Year-2000 problems are time consuming.

FAA started its Year-2000 work in mid-1996, and is about to finish its assessment work. However, the hard and time-consuming work lies ahead. Fixing non-compliant software code, testing the fix, and implementing compliant systems require more work, as demonstrated by FAA's cost estimates. FAA has spent $8 million on assessing Year-2000 problems. Excluding the Host, cost estimates for fixing software code and testing/implementing Year-2000 compliant systems are $90 and $64 million for FY 1998 and FY 1999, respectively.

The Air Traffic Control System is a complex and inter-dependent system. FAA has to analyze millions of lines of code and thousands of pieces of hardware for their individual Year-2000 problems, but also must ensure the systems will continue working together after Year-2000 fixes. FAA's recent experience with the Enhanced Traffic Management System (ETMS) illustrates the complexity of the Air Traffic Control System and highlights the importance of comprehensive testing. ETMS displays the location of aircraft on a national and local scale to alert controllers when traffic exceeds certain limits. About 2 years ago, FAA found it had to upgrade ETMS software because the operating system software was unable to process times and dates after November 2,

1997. FAA developed a fix to the operating system software and successfully tested the fixes. However, just 1 month before the November 2 deadline, FAA found the fix did not work with the application system software. As a result, FAA had to initiate an emergency task to make the last-minute change.

The testing of all Year-2000 fixes and recommissioning the entire Air Traffic Control System is something FAA has never undertaken. FAA's plan is to construct an integrated test environment to perform end-to-end (i.e., from radar to the air traffic control screen) testing of the Year-2000 fixes for the Air Traffic Control System. We fully support this endeavor. To effectively manage this process, a master schedule (for repairing, testing, and implementing Year-2000 fixes for all mission-critical systems) is needed to ensure coordination among inter-dependent systems and to facilitate management, including early detection of schedule slippage.

- FAA's target date for implementing Year-2000 fixes should be accelerated to minimize risk.

  Even with a well structured integrated test environment, FAA has no assurance all Year-2000 fixes will work as intended because field conditions are different from a test environment. The task is further complicated by the fact that local software changes have been made to the Air Traffic Control System. FAA has over 8,000 employees maintaining the Air Traffic Control System. The software developed or changed by local maintenance teams could result in different conditions from site to site. As a result, Year-2000 fixes working in a test environment may not work properly when implemented in the field.

  FAA's November 1999 target completion date for implementing all Year-2000 fixes for all mission-critical systems leaves little cushion for schedule slippage or corrective actions to solve problems unique to individual sites. FAA's track record for solving hardware and software problems does not instill a high confidence level that the fixes can be made on schedule. To avoid a crisis situation in November 1999, we recommend the FAA Administrator move the date by which all systems have been fixed, tested and operational, to no later than June 1999. FAA has informed us they will look for opportunities to move up implementation dates after the assessment and quality assurance work is completed.

- Year-2000 cost estimates are still evolving.

  Until all assessment work is approved, the cost estimates to fix Year-2000 computer problems remain uncertain. FAA's current cost estimate of $162 million does not include $160 million for the interim Host computer replacement. FAA's estimate does not provide sufficient coverage for

hardware replacement cost, so there is the potential for additional funding requirements. Also, the cost to make major projects currently under development Year-2000 compliant, and the cost to accelerate FAA's implementation schedule by at least 5 months, are unknown.

If unexpected problems are identified during testing or implementation, FAA has to repeat much of the entire exercise--changing program code, retesting, and implementing new fixes. The closer it gets to Year 2000, the more it will cost to fix additional problems identified and to repeat such exercises. FAA should reassess its Year-2000 cost estimates after considering all of these factors, and inform the Secretary and Congress of its requirements.

Actions FAA Should Undertake to Solve Its Year-2000 Computer Problem.

The FAA Administrator is aware of the need to make sure Air Traffic Control System computers are fixed and operational well before January 1, 2000. A sense of urgency has been established, but there are risks even if the work is tightly controlled and managed. To minimize these risks, we offer the following recommendations:

- Assign a high priority to complete the assessment work, including the quality assurance reviews, on existing systems. Also, determine whether or not systems currently being purchased are Year-2000 compliant and take appropriate action to fix those that are not. Amend contracts if necessary.

- Appoint, by the end of February, a central Year-2000 program manager with sufficient technical background and authority to direct remaining work, who reports directly to the Administrator.

- Promptly decide on the strategy for addressing Year-2000 problems in the aging Host computer. If the parallel repair/replacement option is selected, milestones should be established for repair and replacement work at each En-route Center. The Secretary and Congress should be advised of the impact this will have on the implementation schedule for other systems FAA is acquiring.

- Develop a suitable contingency plan for directing high altitude aircraft in case both the Host repair and replacement efforts are not completed by Year 2000.

- Have an independent review of plans to fix and certify the existing Host computer. The staff involved with this must have a sufficiant expertise of IBM 3083 system architecture.

- Develop, by the end of March 1998, the master schedule for fixing all mission-critical systems. The plan should contain a goal to have all mission-critical systems fixed, tested, and fully operational no later than June 1999.

- Determine, by mid-March 1998, the resources needed for repairs, replacements, comprehensive testing, and for an earlier Year-2000 implementation date; and notify the Secretary and Congress of the resource requirements.

- Continue reporting to the Secretary on the progress made toward fixing Year-2000 problems, and provide the same information to Congress on a monthly basis.

Madam Chairwoman and Mr. Chairman, this concludes our statement. I would be pleased to answer questions.

EXHIBIT A

Total number of mission-critical systems

(As of February 2, 1998)

Operating Administrations	Total Number of Mission-critical	Number Already Compliant
BTS	1	0
FAA	430	125
FHWA	9	0
FRA	8	4
FTA	2	0
MARAD	14	0
NHTSA	27	0
RSPA	27	0
SLSDC	10	4
USCG	78	25
OIG	1	0
OST	4	0
STB	2	1
TASC	4	0
Totals	617	159

EXHIBIT B

FAA MAJOR DEVELOPMENT PROJECTS

Acronym	Development Project Description	Program Costs
VSCS	Voice Switching and Control System	$1,453M
DSR	Display System Replacement	1,055M
STARS	Standard Terminal Automation Replacement System	940M
ASR-9	Airport Surveillance Radar Model 9	832M
TFM	Traffic Flow Management	795M
MODE-S	Mode Select-discrete addressable secondary radar system with data-link	454M
LRR	ARSR-4 Long Range Radar Replacement	409M
TDWR	Terminal Doppler Weather Radar System	384M
NIMS	NAS Infrastructure Management System	379M
WAAS	Wide Area Augmentation System	261M
ITWS	Integrated Terminal Weather System	276M
OSDS	Oceanic System Development and Support	264M
ASOS	Automated Surface Observing System	252M
RCE	Radio Control Equipment	248M
ASDE-3	Airport Surface Detection Equipment	243M
COMMON ARTS	Automated Radar Terminal System	196M
OASIS	Operational & Supportability Implementation System	175M
PRM	Precision Runway Monitor	128M
WARP	Weather and Radar Processor	126M
TVSR/ETVS	Enhanced Terminal Voice Switch/Terminal Voice Switch Replacement	112M
NEXRAD*	Next Generation Radar	285M
ADLS*	Aeronautical Data Link System	279M
ALSIP*	Approach Lighting System Improvement Program	133M

*Not found in FAA's Year-2000 System Inventory Listing as of January 23, 1998