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STATEMENT OF
DONALD L. SCANTLEBURY,
DIRECTOR, ACCOUNTING AND FINANCIAL MANAGEMENT DIVISION
and CHIEF ACCOUNTANT
UNITED STATES GENERAL ACCOUNTING OFFICE
BEFORE THE
SUBCOMMITTEE ON TRANSPORTATION,
AVIATION, AND MATERIALS
COMMITTEE ON SCIENCE AND TECHNOLOGY
HOUSE OF REPRESENTATIVES
ON THE FEDERAL AVIATION ADMINISTRATION'S AIR TRAFFIC CONTROL
COMPUTER MODERNIZATION PROGRAM

Mr. Chairman and Members of the Subcommittee:

We are pleased to be here today at your hearings on the Federal Aviation Administration's Air Traffic Control Computer Modernization Program. In response to your request, we have agreed to testify in three areas: (1) our analysis of the Federal Aviation Administration's reply to the Senate report; (2) the possibility of direct replacement of outmoded computers; and (3) the lessons learned about planning, acquisition, and cost estimating for large computer systems.

At the outset of my testimony, I would like to stress that we in the General Accounting Office have made no independent

[FAA Air Traffic Control Computer Modernization Program]

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assessment of FAA's Modernization Program or of the en route air traffic control computer system. Our comments are based on the extensive review conducted by the Senate investigations staff, the GAO analysis of FAA's reply to the Senate report, the GAO report on direct replacement of economically obsolescent and outmoded computers in the Federal Government, and lessons learned from our reviews of other large Government computer system acquisitions.

In response to reported concerns over the safety and reliability of the equipment being used by FAA for en route air traffic control, the Chairman of the Senate Appropriations Committee authorized and directed the Senate investigations staff to determine if a problem existed and, if so, what corrective action could be taken to improve the situation.

Federal Aviation Administration officials had proposed acquiring a new \$2.8 billion en route computer system sometime in the late 1980s. The replacement system would be designed to perform in the same manner the functions of the existing computers, be based on the advanced technology at the time, and be 10 times larger so as to later incorporate desired futuristic air traffic control functions.

In its report, the Senate investigations staff found serious management and planning deficiencies in the en route air traffic control computer system. Because of weaknesses in reporting equipment outages, lack of planning, and a poorly defined approach to managing system operations and software changes, the report concluded that FAA could not be certain that the

current system would adequately ensure the safety of the traveling public until the proposed late 1980s replacement system was operational.

The Senate report found that the computer workload capacity at each center is unknown; that to keep the software operating, machine-language patching is standard procedure; and that 8 of the 20 centers expect computer saturation between 1982 and 1985. Also, it is not uncommon for the centers to drop all nonessential operations and to go to the backup computer to support air traffic control operations during busy periods. The Federal Aviation Administration has no system for determining how often or how long a system is operated in a degraded mode or without a computerized backup capability. Further, deficiencies in the existing system have not been identified for correction. The most fundamental flaw we see in most major systems we have reviewed is the failure to properly study the current system to identify deficiencies, needs, and requirements.

The Senate report contained nine recommendations to the Federal Aviation Administration. The Committee of Conference directed that FAA report its actions on the recommendations to the appropriate committees by specific milestone dates.

In response to requests from the Chairman, Senate Appropriations Subcommittee on Transportation and the Chairman, House Government Operations Subcommittee on Government Activities and Transportation, we analyzed the the FAA response to the Senate report recommendations. (A copy of our analysis has been submitted for the record.) The Federal Aviation Administration has neither fully nor adequately responded to the recommendations and milestones in the

Senate and conference reports. Certain recommendations were inadequately addressed while some were either ignored or the responses did not meet the milestone dates.

Of particular concern to the Committee of Conference was the possibility that the existing system, which has been defined as technologically obsolete, will decline to an unacceptable performance level before the proposed replacement system is operational. The committee directed the Federal Aviation Administration to comprehensively evaluate the direct replacement of the current system as a short range alternative and report its conclusions by July 1981.

The FAA reply projects a 3 to 4-year milestone schedule for near term computer system improvements and analysis of direct replacement of the current computer system. This schedule is inconsistent with Senate committee concerns and recommendations.

GAO has recently reviewed and reported on equipment obsolescence in the Federal Government. We found that it is costing the Government more to continue using outmoded computers it now owns than it would to lease new, up-to-date computers. Modern computers use less energy, work faster and are more reliable. Half of the Government's computers use 1971 or earlier technology-- "stone age" in terms of computers. The FAA's computers are among this aged inventory.

A variety of factors have created the current situation. Agencies have not recognized the costs and problems of continuing to use outmoded equipment. We found that at just the four Federal installations we reviewed, annual savings of \$1.4 million are attainable by replacing older equipment. Hundreds of other Federal installations have similar, old equipment.

This situation has occurred because the guidance called for in OMB's Circular A-71 for replacing outmoded equipment is needed to assist Federal managers' implementation of current technology, and this guidance has not been issued. Better knowledge of computer technology would enable Federal managers to better recognize and evaluate available economical alternatives. Also, the current murky acquisition cycle, which is long, complicated, and frustrating has contributed to the obsolescence of Federal computers.

We recommended that agencies analyze their computer equipment costs to see if their computers are "economically obsolescent," and if so, to replace them as soon as possible. Newer computers of similar capacity could (1) use existing software without significant changes; (2) provide such benefits as higher speeds, better reliability, greater capabilities, lower energy consumption; and (3) reduce operating cost.

The Federal Aviation Administration has consistently taken the position that near term direct replacement of the system is not a viable alternative to its proposed \$2.8 billion replacement scheduled to be operational in the early 1990s. The FAA claims that a direct replacement would be too costly in terms of

ment and time needed to convert. These concerns have value and should be addressed so that a knowledgeable and authoritative decision can be made regarding near term direct replacement.

There are a number of other factors that can influence such a decision. These include the impact on existing operations, lead time, operations cost, system reliability, service life, compatibility, and risk. FAA should determine the effects of these factors and act accordingly.

Also, FAA stated that buying or leasing computers would require considerable time and effort for writing software because of the many special instructions in the existing computers. The special instructions in the software are considered necessary to switch certain backup elements in and out of the system in the event of computer failure. We believe, however, that the special instruction set of the current computer can be replicated on state-of-the-art computers, which would eliminate this purported barrier. Further, the improved design and reliability may preclude the need for special instructions.

The Federal Aviation Administration stated that the software used to direct and operate the current system is time consuming and cumbersome. This software, which has been described as an "intertwined mess," is written in a low-level assembly code programming language. We believe that, as recommended by the Senate Appropriations Committee, the Federal Aviation Administration should consider the alternative of changing to a higher level software language after replacing the current hardware. A plan for such replacement and software transition

should be compared to the 3- to 4-year FAA plan for the near term improvements, continued use of current software, and extensive software "buy back" efforts.

To make an adequate and informed decision regarding near term direct replacement, we believe the Federal Aviation Administration needs to identify the full cost and all implications of simply maintaining the current system in terms of operations, maintenance, and software. It is essential for two basic reasons that FAA provide cost data and analysis regarding near term direct replacement of the current system. The first is that FAA's ability to safely control aircraft using the existing system has been seriously questioned by the Congress, the news media, the Professional Air Traffic Controllers Organization, and others vitally interested in the air safety of the traveling public. Secondly, FAA has claimed that the existing system is technologically obsolete and anticipates difficulty in getting the parts necessary to keep it running.

FAA has stated that the proposed \$2.8 billion replacement system will continue to perform exactly the same functions as the existing system, in the same manner. FAA has also said that there is a need to replace the existing system because of obsolescence and nonavailability of parts. We believe the Federal Aviation Administration should immediately initiate action to determine whether to buy a near term direct replacement system. With better assurance of adequate equipment support, FAA can then adequately consider and plan for the air traffic needs of the 1990s and beyond.

A well developed and thorough planning and procurement process will be essential for success of a critical system of this magnitude. The Federal Aviation Administration, as are many other Federal agencies, is apparently blocked between "start and initiate" in devising plans which not only define the need but how it must be met.

In our recent report, "FAA Has Not Gone Far Enough With Improvements to its Planning and Process," we found that because the Federal Aviation Administration has not implemented an agency-wide process it must rely on its budget process to fulfill its planning responsibilities. We also found that FAA has not implemented the parts of the planning and resource allocation order that apply to policy, mission analysis, long range planning, and program performance and evaluation.

Previous reports issued by GAO and others have documented widespread failures of Federal agencies in developing computer systems and/or considering alternatives. These failures have resulted in more than \$300 million being wasted on systems that were not cost effective, did not meet user needs, experienced prolonged development and cost overruns, or simply did not work.

At the time of the Senate report the Federal Aviation Administration, although in the first stages of procuring probably the largest computer system in the Federal Government, had not identified the problems and deficiencies in the existing system so they could be solved. Unanswered questions include: What is the present computer capacity and what is needed? (A computer is

like a furnace or air conditioner for a home; if it is too small or too large it will either not do the job or waste money.) What are the existing system operating costs for hardware and software maintenance? (The Senate report found FAA has no formal system to track these costs.) What is needed to improve existing air traffic control operations? (Answered by interviewing the operators and users of the system--air traffic controllers and pilots.)

Completing this last effort could stave off another direct access radar channel situation where the Federal Aviation Administration determined for the controllers what they needed for backup to replace the existing broadband. Because controllers were not consulted in planning, the cost of this \$11 million backup system has accelerated to about \$45 million. FAA claims this four-fold cost increase is required to include features the air traffic controllers consider basic necessities to safely control aircraft. Better planning and communication could have reduced the cost and delivered a user approved system.

In our many reports on computer systems development we have found that managerial weaknesses are a common thread in uncontrolled cost increases. Repeated failures by Federal agencies in developing large, complex computer systems stem from lack of proper guidance and assistance from top management.

We believe the Government clearly needs a chartered, Federal computer service center to provide managers, particularly top managers, with managerial and technical systems development

expertise. We have recommended to the Chairman of the House Government Operations Committee that such a center be established.

We have also developed a structured management approach for computer systems development. This framework of principles and procedures represents essential elements of management control and are the product of extensive analyses of management weaknesses we have observed in systems development. They are: formal system planning; top management involvement; user participation; project steering committee; project manager; internal audit and quality assurance; systematic management review and control; cost accounting and reporting procedures; technical evaluation procedures; formal acceptance testing and change control procedures; and, standard phasing of key activities. We believe the latter, which includes development work, should include problem definition, design, programming and testing, and operations and maintenance.

In the meantime, what can Federal agencies do to improve the management and development of large and complex computer systems? First one must differentiate between "wants" and "needs." Wants are easy to define, it is needs that require hard study and analysis. Needs should be defined in terms of mission and should be based on overall capabilities, priorities, and resources. Analysis of need should reflect identified deficiencies in existing capabilities, opportunities to establish new capabilities in response to a technologically feasible

change, and opportunities for significant cost reductions due to changing circumstances.

Also, it is essential that agencies avoid grandiose conceptualistic plans involving unproven capabilities. The evolution rather than revolution approach should be used. For example, the Air Force, after 9 years of work and expenditures of about \$250 million, was directed to terminate its \$800 million Advanced Logistics System (ALS) because of untested software, data base management shortcomings, computer equipment failures, and system concept and design problems. Many factors contributed to this unsuccessful design and development effort. The major factor that the system was not managed properly. Another factor was that the system concept was based on the leading edge of technology available at the time. Although the Air Force was aware of these problems, it continued system design apparently hoping that time and software and system design changes would overcome the problems. This did not happen.

The chain of similar unsatisfactory experiences must be broken. It will be difficult. An immediate need exists to establish strong leadership and management over the development of these large and complex computer systems.

Regarding the system we are discussing in these hearings, a dedicated, strong, full-time team should be established within FAA to manage and execute the program--through development to operation.

This team should operate as a coalition since it will cut across organizational lines. It should be chartered and be manned

by the best people available, and they should be full time and not distracted by other duties. The team's authority should be clearly stated and it should be given adequate budget resources for support. The line of communication and authority should be direct to the agency head.

Our review of hearings on the Federal Aviation Administration and of internal documents show formulation of the team to be long promised but short on action. We believe that an immediate effort by the Administrator is the only way such a team will be established. Unless this happens, it is likely that continued committee direction will result in the human tendency for just one more study.

We agree with the Senate report that there is no question that the existing equipment will ultimately need to be replaced. Further, we believe that a direct replacement of the existing system, based on analysis of economic obsolescence and on current problems and deficiencies in the existing system, will not preclude a future well planned 1990s replacement. The Federal Aviation Administration must decide what is the problem now, how it will be solved, and what must be done to plan for the future. Others must realize that for such an effort, be it direct replacement or replacement in years to come, there must be an adequate, realistic level of funding.

This concludes my prepared statement, Mr. Chairman. If there are any questions, I or my staff will respond to them. Thank you.