



COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-203207

JUNE 1, 1981

RECOMMENDATION
Assigned
By

The Honorable Mark Andrews
Chairman, Subcommittee on
Transportation
Committee on Appropriations
United States Senate

Dear Mr. Chairman:

Subject: Review of Department of Transportation's Response
to Recommendations in the Senate Report on the Fed-
eral Aviation Administration's En Route Air Traffic
Control Computer System (AFMD-81-67)

On March 16, 1981, we met with your office to discuss the findings of the Senate report, "Federal Aviation Administration En Route Air Traffic Control System." At the same meeting we also discussed the Department of Transportation's (DOT's) reply to the Committee of Conference Report, pointed out areas where the cost of a replacement system could be reduced, and said that we plan to survey the Federal Aviation Administration's (FAA's) computerized airport terminal system. As agreed, we are providing this analysis of the DOT/FAA response and our recommendations. Our analysis was limited to review of the FAA developed report attached to the DOT response, the Senate Committee on Appropriations investigations staff report on FAA's en route air traffic control computer system, and the Committee of Conference Report. The enclosure to this letter discusses our analysis of the response in more detail.

SENATE REPORT FINDINGS

In its report, the Senate investigations staff found that FAA has not effectively managed its en route computerized air traffic control system. Because of weaknesses in reporting equipment outages, lack of planning, and a poorly defined approach to managing system operations and software changes, FAA cannot be certain that the current system will adequately ensure the safety of the traveling public until the proposed replacement system is operational.

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COMMITTEE DIRECTION TO FAA

The Senate investigations report contained nine recommendations to FAA. The Committee of Conference report on the Department of Transportation fiscal 1981 appropriations act regarding the FAA en route air traffic control computer system and its proposed \$2.8 billion replacement, established reporting milestones for each of the recommendations. Further, the Committee of Conference directed that FAA report its actions on the recommendations to the appropriate committees by specific milestone dates.

RESPONSE TO COMMITTEE DIRECTION

DOT/FAA has neither fully nor adequately addressed the recommendations and milestones in the conference report. Certain recommendations were inadequately addressed while some were either ignored or the responses did not meet the milestone dates.

Direct replacement alternative

Of particular concern to the Senate Committee 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 Senate Committee directed FAA to comprehensively evaluate as a short range alternative the direct replacement of the current system.

The DOT/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. These proposed DOT actions are inconsistent with Senate Committee concerns and recommendations since FAA was directed to complete this task and report its conclusions by July 1981.

FAA has consistently taken the position that direct replacement of the system is not a viable alternative to its proposed \$2.8 billion replacement, which is scheduled to be operational in the early 1990s. FAA claims the reason is that a direct replacement would be too costly in terms of equipment and time needed to convert. These concerns are valid and need to be addressed so that a knowledgeable and authoritative decision regarding near term direct replacement can be made.

A recent GAO report ^{1/} found that it is costing the Government more to continue using outmoded computers it now owns than

^{1/}"Continued Use Of Costly, Outmoded Computers In Federal Agencies Can Be Avoided" (AFMD-81-9, Dec. 15, 1980).

it would to lease new, up-to-date computers. Modern computers use less energy, work faster with greater reliability, and have larger memories. Half of the Government's computers use 1971 or earlier technology--"stone age" in terms of computers. GAO recommended that agencies analyze their computer equipment costs to see if their computers are "economically obsolescent," and if they are, replace them as soon as possible.

Using this approach, FAA could replace the old equipment with new equipment of approximately the same capacity that would use the same software and peripherals wherever possible. Also, FAA could institute the necessary guidance and management changes to prevent a recurrence of gross equipment obsolescence.

Cost data and analysis are needed

It is essential for two basic reasons that FAA come forth with 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 current 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 the current system is technologically obsolete and problems are anticipated in getting the parts necessary to keep it running.

Since FAA has stated that the proposed \$2.8 billion replacement system will continue to perform exactly the same functions as the current system, in the same manner, and there is a need to replace the current system because of obsolescence and nonavailability of parts, we believe FAA should immediately initiate a near term direct replacement system. FAA can then defer spending the billions of dollars for development and prototyping that will be required for its proposed replacement system. With present air safety assured, FAA can then adequately consider and plan for the air traffic needs of the 1990s and beyond.

CONCLUSIONS

In its report, the Senate investigations staff found serious management and planning deficiencies in the FAA's en route air traffic control computer system. Concerned that these deficiencies could degrade the operation of the en route system to unacceptable levels, the Committee of Conference directed FAA to respond to the report's recommendations by specified milestone dates. DOT has neither fully nor adequately addressed the recommendations and milestones in the Conference report. Certain recommendations were inadequately addressed while some were ignored or not responded to by the established milestones.

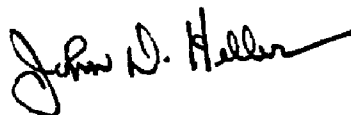
RECOMMENDATIONS

We recommend that the Senate and House Committees on Appropriations not accept DOT's reply as fully responsive to the Senate report, and that DOT be so informed. Of particular concern to the Senate Committee was the possibility that the existing system, which has been defined as technologically obsolete, will degrade to an unacceptable performance level before the proposed replacement system is operational. The Senate Committee requested assurance that direct near term replacement of the current system is not needed, that the current system will provide the required reliability and capacity needed to ensure the safety of the traveling public until the proposed long range replacement is operational, and that vitally needed management and reporting improvements are effected.

We believe the concerns and recommendations in the report are still valid and should be responded to as directed. Therefore, we recommend that the Senate and House Committees on Appropriations reassert to DOT the need for FAA to immediately reformulate its response and to comply with Senate Committee direction.

We will be glad to discuss these matters with you or with members of your staff. As arranged with your office, we are sending a copy of this letter and our analysis to the Chairman, Subcommittee on Transportation Appropriations, House Committee on Appropriations. Unless you publicly announce its contents earlier, no further distribution of this report will be made until 10 days from the date of this report.

Sincerely yours,



Acting Comptroller General
of the United States

Enclosure

GAO ANALYSIS OF DOT/FAA RESPONSE
AND GAO RECOMMENDATIONS

What the Committee of
Conference Directed

Based on the findings and recommendations of the Senate investigations staff, the Committee of Conference on the bill Making Appropriations for the Department of Transportation and Related Agencies for the Fiscal Year Ending September 30, 1981 (H.R. 7831), agreed with the Senate recommendation and directed that none of the funds in the Research, Engineering, and Development account be obligated for any new contracts for the replacement of the en route air traffic control computer system until the concerns raised by the Senate report have been adequately addressed. Further, the conferees were aware that in a letter dated September 15, 1980, the FAA administrator assured the Senate committee that FAA would address the concerns and recommendations of the Senate committee. The conferees directed that FAA should respond to the appropriate committees promptly, but not later than: June 1981 for Recommendation 1, July 1981 for Recommendations 2 and 8, September 1981 for Recommendation 3, January 1981 for Recommendation 4, December 1980 for Recommendation 5, and October 1980 for Recommendations 6 and 7.

DOT Response to Committee Direction

The Senate report seriously questioned FAA's management of the current computer system and proposed replacement. Due to the importance and scope of the air traffic system, the committee directed FAA to take recommended actions by established milestone dates. DOT should fully and completely respond to all recommendations and milestones in the committee report.

We believe that DOT has not fully or adequately addressed the recommendations in the Senate report and milestones in the Committee of Conference report. Responses to several recommendations were incomplete and other recommendations were not responded to at all--or did not meet the milestone dates.

Recommendation 1

No research, engineering, and development funding for fiscal 1981 be expended for the proposed replacement system pending completion of a comprehensive study and analysis by FAA to determine

--capacity, and current and anticipated deficiencies of the existing system;

--cost estimates of a replacement system to correct such deficiencies, meet current and future needs, ensure continuous safe separation of aircraft, and require minimum funding resources;

- best estimates and full disclosure of the required present and proposed future tasks offered as justification of the replacement system;
- nonessential tasks or functions which could be permanently shed from the current and replacement systems; and
- interim actions and funding necessary to correct identified deficiencies and enhance the current system to extend its operational life during the replacement system acquisition cycle.

GAO Analysis

The DOT response to this recommendation is incomplete since proposed FAA actions do not include or identify methodology to determine

- current and anticipated deficiencies of the existing system,
- cost estimates of a replacement system to correct such deficiencies,
- best estimates and full disclosure of the required present and proposed future tasks offered as justification of the replacement systems, and
- interim actions and funding necessary to correct identified deficiencies and enhance the current system to extend its operational life during the replacement system acquisition cycle.

The DOT response cites several FAA actions that are intended to extend the life of the current system such as more rigid control over system configuration and evaluating and testing all program changes with emphasis on software efficiency. If properly implemented, these actions should bring about certain changes in computer operations. They are, however, not the proper approach to a good solution, and are not aimed at correcting as yet unidentified deficiencies of the existing system.

To measure the effects and cost/benefits of the proposed changes intended to extend the life of the current system, a baseline must be established as a criterion. The actions proposed by FAA to extend the life of the current system are not quantified in terms of cost/benefits and measurable expected efficiencies.

We believe that FAA needs to identify as a baseline, the deficiencies in the existing system and the expected cost/benefits of correcting deficiencies. By identifying these deficiencies and concentrating on resolving them, FAA can discontinue its "bandaid" approach which may be neither economical or effective.

Recommendation 2

FAA comprehensively evaluate and determine as a short range alternative to en masse replacement of the current system, the feasibility, cost/benefits, and funding requirements of buying or leasing computers for centers determined to exceed capacity in the 1980s, and of functionally splitting and upgrading the software.

GAO Analysis

FAA proposed several interim system alternatives which include further upgrading of the direct access radar channel to provide almost identical radar processing of the existing computer system and replacing the input/output compute element. FAA stated that all the alternatives will require new software which will take considerable time and effort to develop.

The proposed actions do not indicate that FAA has yet evaluated and determined the feasibility, cost/benefits, and funding requirements of buying or leasing computers for centers determined to exceed capacity in the 1980s as a short range solution. FAA stated the proposed actions are near term improvements. We believe that such actions aimed at an undetermined and/or floating baseline inherently lead to additional costs, more near term improvements, and so on.

Regarding examining near term direct replacement alternatives, we agree with FAA that there are a number of factors which influence the desirability of a particular system, and must be considered. These include the impact on existing en route operations, lead time, cost, impact on system reliability, service life, compatibility, and risk. We believe these considerations were understood by the committee in making its recommendations. The committee requested FAA to study the short range alternatives in light of these factors and so far, FAA has not responded.

FAA indicated the proposed near term improvements will take 3 to 4 years to complete. Also, FAA stated that buying or leasing computers would involve considerable time and effort for writing software because of the many special instructions in the existing computers. FAA explained that the special instructions in the software are needed to switch certain backup elements in and out of the system in the event of computer failure. We believe that the special instruction set of the current computer can be replicated on state-of-the-art computers. Consequently, this purported barrier would be removed.

Also, FAA 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 assembler code programming language. We believe that, as recommended by the committee, FAA 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. Further, to make an adequate and informed decision regarding near term direct replacement, we believe FAA needs to identify the full cost and implications of simply maintaining the current system in terms of operation, maintenance, and software.

Recommendation 3

FAA develop a comprehensive, formal, long range plan to reflect agency strategies, goals, and objectives. This plan should be reviewed and approved by top management. The plan should state milestones for measuring and controlling activities, funding requirements, achieving efficient and effective use of resources, and committing top management to act.

GAO Analysis

FAA stated that the agency has begun implementing an agency-wide strategic long range planning process. This long range planning will be done by the new Office of Aviation Policy and Plans. While we have not examined the responsibilities and charter of this new office, we believe it may achieve, if properly organized, the intent of this recommendation. However, we caution that the mission needs and plans for all current and future systems, including the en route computer system and all system interfaces, must be considered in the planning process. FAA should also consider, within the planning process, legislative and legal questions which relate to agency and air traffic controller responsibilities in this highly automated environment. Finally, the planning process needs to be an open communication process among all levels of management throughout the functional areas of FAA.

Recommendations 4 and 5

FAA develop a statement of goals for measuring overall efficiency of the current computer system including processing requirements for general overhead and recording functions with accompanying plan and implementation schedule.

FAA establish a computer performance management function to systematically evaluate the capacity and performance of its computer systems. Staffing needs and costs for this function should be identified and reported to the committee for consideration.

GAO Analysis

FAA has indicated a number of actions which relate to these two recommendations. Many of the proposed actions include establishing a new staff to organize and manage a national evaluation effort, updating automation directives, setting new performance

goals for the current system, determining nonessential functions and tasks which could be eliminated, and determining other actions to be completed by the second quarter of fiscal 1982.

The committee report identified the need for a comprehensive organization within FAA that would be responsible for measuring the efficiency and effectiveness of computer operations. Further, the report stated that for a computer performance management organization to be effective, it must have the support of, and access to, top management. It is unclear from the DOT reply whether or not the proposed national evaluation effort is intended to respond to these committee concerns and recommendations. Also, it is unclear what the responsibilities and charter of the new staff will be, where the new staff will be located within the organization, and what will be the focus of the national evaluation effort.

The DOT response also raises questions about the responsibilities (and charter) of the recently brought together team of automation management experts which is to evaluate software practices-- as well as the responsibilities of the new staff to organize and manage a national evaluation effort. Based on our experience with the agency, these ad hoc activities previously have proven to be fragmented and uncoordinated. Such duties might be better assigned to a permanent computer performance management office.

We believe that FAA needs to identify and formulate staffing needs and costs for a computer performance function as recommended in the committee report.

Recommendations 6 and 7

The reporting criteria of 1 minute or more for reporting an outage be dropped and all outages of any duration be recorded to determine their impact on safety, service to users, and computer performance reliability.

FAA revise its reporting system to eliminate the practice of reporting unscheduled maintenance outages as scheduled outages. Scheduled maintenance should cover only periodic, routine preventive maintenance tasks. Reporting unscheduled outages as scheduled distorts recording of corrective maintenance actions and computer performance reporting.

GAO Analysis

FAA stated that by midsummer 1981, improvements in the performance reporting system for standardizing definitions and reporting criteria for equipment outages and maintenance actions should be in place. Pending availability of funds, FAA will consolidate this information into a single data base. Also, the maintenance portion of the new system will be implemented at all centers in fiscal 1983.

In its report and in hearings, the committee repeatedly expressed concern about FAA's reporting systems and the integrity of the data in these systems. The reason for this concern is that FAA uses the data from the reporting systems to assess and determine computer performance, system reliability, and ultimately, the ability of the system to provide the level of service that ensures the air safety of the traveling public. While the FAA actions indicated in the DOT response may fulfill internal agency objectives, they are not responsive to the committee's recommendations.

The recommendation regarding the reporting criteria of 1 minute or more for reporting an outage is not addressed or discussed. Also, it is not clear what actions FAA proposes to eliminate the practice of reporting unscheduled maintenance as scheduled maintenance.

If there are extenuating circumstances which preclude compliance with recommendations 6 and 7, they should be brought to the attention of the committee.

Recommendation 8

FAA should give top priority to developing an adequate backup capability for the current en route computer system. This should include determining effective and economical alternatives to sole source procurement of an additional \$38 million to upgrade the direct access radar channel. Consideration of alternatives should include offloading the radar processing from the current system to peripheral computers which would serve as a primary source and backup thereby extending the life of the current system or an interim replacement system.

GAO Analysis

The DOT response identified several FAA efforts as being considered. FAA stated that while not fully evaluated, all efforts will require development of some new software, additional funding, and 3 to 4 years to complete. There is no indication that, as recommended by the committee report, a high priority has been given to developing an adequate backup capability for the existing en route system. Also, FAA's proposal for upgrading the direct access radar channel to provide an almost identical capability for the existing system is not responsive to committee direction. The committee asked FAA to determine alternatives to spending an additional \$38 million to upgrade the direct access radar channel. The FAA's response and proposed actions do not identify any economical alternatives to this \$38 million sole source procurement.

FAA has stated that studies show it would be difficult to offload the radar processing function onto another processor. Also, that the studies show that offloading would require duplicate tables in both processors and would result in a complex interaction

between processors which could lead to decreased system reliability. In addition, channel capacity, another critical element of the existing computer system, may be adversely affected.

We believe it proper and intended in the recommendation that FAA determine what benefits could be realized by offloading and what the associated costs are. Also, FAA needs to determine how this cost affects the existing system life cycle and/or near term direct replacement. Therefore, we believe FAA needs to complete these tasks before determining that this obvious approach to solving many of the system's problems is not effective and economical.

Recommendation 9

The DOT Inspector General's Office should plan, conduct, and report on audits and studies of FAA's programs relating to air traffic control and safety.

GAO Analysis

The DOT response does not address the committee recommendation that the DOT Inspector General's Office should plan, conduct, and report on audits and studies of FAA's programs relating to air traffic control and safety.

CONCLUSIONS

In its report, the Senate investigations staff found serious management and planning deficiencies in the FAA's en route air traffic control computer system. Concerned that these deficiencies could degrade the operation of the en route system to unacceptable levels, the Committee of Conference directed FAA to respond to the report's recommendations by specified milestone dates. DOT has neither fully nor adequately addressed the recommendations of the Senate Committee and milestones in the Committee of Conference report. Certain recommendations were inadequately addressed while some were ignored or not responded to by the established milestones.

RECOMMENDATIONS

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