

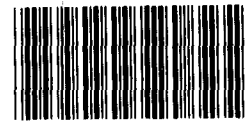
GAO

Report to the Chairman, Subcommittee
on Transportation and Related
Agencies, Committee on
Appropriations, U.S. Senate

August 1991

AIR TRAFFIC CONTROL

Voice Communications System Challenges Continue



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**Information Management and
Technology Division**

B-234691

August 5, 1991

The Honorable Frank R. Lautenberg
Chairman, Subcommittee on Transportation
and Related Agencies
Committee on Appropriations
United States Senate

Dear Mr. Chairman:

This report responds to your request that we assess the Federal Aviation Administration's (FAA) recently revised acquisition strategy for its Voice Switching and Control System (VSCS). (See app. I for details of our objective, scope, and methodology). VSCS is a highly complex system intended to improve voice communications at air traffic control facilities nationwide. VSCS is critical to FAA's plans to modernize the air traffic control system because it is to provide communications for new controller workstations being developed under the Advanced Automation System. Currently, two contractors—American Telephone and Telegraph Technologies, Incorporated (AT&T), and Harris Corporation—are designing and developing VSCS prototypes. This December, after testing and evaluating the contractors' prototypes, FAA plans to award a production contract to one of these companies to produce and install the system at multiple facilities.

Results in Brief

After nearly 5 years of development, neither VSCS contractor has been able to successfully produce a prototype system that meets FAA's requirements. As a result, total estimated project costs, originally estimated at \$258 million in 1982, have escalated to \$1.5 billion; and implementation of VSCS at the first operational site has been delayed from 1986 to 1994. Due to the contractors' difficulties, FAA recently restructured the acquisition of VSCS by extending the prototype contracts to December 1991 and exploring the development of alternative interim voice communications systems that could work with the new Advanced Automation System workstations.

FAA's revised acquisition strategy is a positive step toward completing important testing at the contractors' facilities and avoiding delays in Advanced Automation System workstation implementation. However, demanding system requirements present formidable challenges to the contractors in building prototypes that will pass testing this summer.

Background

FAA's air traffic control mission is to promote the safe, orderly, and expeditious flow of civilian and military aircraft. Using information processed by computers and displayed on video screens at their workstations, air traffic controllers maintain the required separation between aircraft, provide safety advisories to pilots, and ensure efficient use of airspace.

Performing these duties requires a system for both ground-to-ground and air-to-ground voice communications. The ground-to-ground system provides communications among air traffic controllers, supervisors, and support personnel at control facilities, as well as communications between facilities located in adjacent geographical areas of operation. The air-to-ground system provides voice communications between controllers and pilots.

VSCS is intended to provide a computer-controlled voice system for both ground-to-ground and air-to-ground communications. VSCS is also designed to significantly improve communications by replacing the existing system with one that is flexible, expandable, and highly reliable. It is to be deployed at 24 air traffic control centers and is expected to serve up to 430 controller positions at each center.

VSCS is critical to FAA's plans to modernize the air traffic control system because it is to provide communications for the new controller workstations, currently being developed under the Advanced Automation System. This system is intended to help the air traffic control system safely and efficiently accommodate expected large increases in traffic. The Advanced Automation System is supposed to meet these goals by replacing workstations as well as other computer hardware and software. However, because the new workstations are designed to work with VSCS, they cannot be fully tested or used until VSCS' essential capabilities are operational.

In October 1986 FAA awarded two VSCS prototype development contracts—one to AT&T Technologies, Incorporated, and one to Harris Corporation—to design, develop, and install prototype systems. As we reported in 1989,¹ both prototype contractors began experiencing unanticipated technical difficulties in meeting VSCS requirements after beginning work on the project. The original contractor proposals anticipated using off-the-shelf hardware and software to meet these requirements.

¹Air Traffic Control: Voice Communications System Continues to Encounter Difficulties (GAO/IMTEC-89-39, June 1, 1989).

However, after contract award, it became apparent to FAA and both contractors that the amount of work needed to meet system requirements was underestimated, and that significant changes were required to the off-the-shelf hardware and software.

Adverse Test Results Lead to Revised FAA Acquisition Strategy

Although both contractors were having problems in developing their prototypes, FAA officials stated in early 1989 that the contractors had resolved most of the development problems; they therefore believed that FAA would be able to award the production contract in November 1989. However, subsequent testing at contractor facilities in 1989 revealed continuing difficulties. FAA therefore decided to extend the prototype efforts into 1990, and to postpone the planned award of the production contract until November 1990.

During 1990 the contractors and FAA conducted acceptance testing and controller operational evaluations at each of the contractors' facilities. Again, neither contractor was able to demonstrate a prototype system that satisfied FAA's requirements. The test results for both contractors showed deficiencies in several critical areas.²

Cost and Schedule Problems Continue

Because of the problems in acquiring an acceptable prototype, the severe cost increases and schedule delays already encountered in vscs continue to mount. The total program cost has dramatically escalated. The total estimated cost to design, develop, produce, and install the system tripled between 1982 and 1989, from \$258 million to over \$786 million. Since 1989, the total projected cost has almost doubled, to \$1.5 billion. Similarly, the expected total prototype development costs for both contractors has now escalated from an original estimate of \$67 million to about \$400 million.

The schedule for vscs has been delayed 8 years. In 1982 FAA projected that the system would be operational at the first site in 1986. FAA now estimates that the first site will be operational in 1994.

FAA Revises Its Acquisition Strategy

Because of the difficulties both contractors were encountering in successfully completing required testing and because additional development work was required to meet vscs requirements, FAA decided in

²Contractor-specific details about the problems encountered are considered procurement-sensitive under the current prototype development phase of the project.

November 1990 to restructure the project. FAA's project restructuring includes the following key elements:

- FAA extended the prototype development phase until December 1991, when it plans to award the production contract. Formal testing of the contractors' prototypes will occur again this summer.
- FAA decided to explore two interim voice switching systems currently operating at FAA facilities that could potentially be used with the Advanced Automation System workstations.

In implementing this restructuring, FAA noted that its goal was to complete acceptance and controller operational testing at the contractors' facilities before awarding the production contract. FAA also stated that it wanted to reduce production risks while retaining a schedule compatible with the implementation of the Advanced Automation System workstations.

Revised Strategy Addresses Key Issues but Challenges Remain

FAA's revised acquisition strategy is responsive to our previously reported concerns. In 1989 we reported that if sufficient prototype testing was not completed, FAA would select a production contractor before the agency had complete test results showing that the chosen prototype system would work. We therefore recommended that FAA complete needed testing before awarding a production contract.³ Under its revised strategy, acceptance and operational controller testing of the prototypes are planned to be completed at the contractors' facilities before awarding the production contract. Such testing would provide FAA with reasonable assurance that the system it eventually selects will meet functional and performance requirements.

FAA's exploration of alternative interim voice communication systems may decrease the risk of Advanced Automation System workstation implementation being delayed. As mentioned, continued delays in VSCS could eventually postpone implementation of the Advanced Automation System workstations, since VSCS' essential capabilities are required for the new workstations. Further, because VSCS is government-furnished equipment under the Advanced Automation System contract, the government could be responsible for delays in workstation implementation caused by late delivery of VSCS and could therefore incur additional costs. Although the exploration of other interim communications alternatives will impose additional initial costs on the government, it also

³GAO/IMTEC-89-39, June 1, 1989.

provides FAA with additional communications options. This in turn may allow FAA to proceed with workstation implementation without risking further delays attributable to VSCS problems.

VSCS Has Demanding Requirements

Although FAA has made progress in ensuring that it has a well-designed acquisition, some VSCS requirements remain difficult to attain.⁴ One demanding VSCS requirement is system availability. FAA requires the system to be available 99.99999 percent of the time, which is less than 4 seconds of down time per year. Because the principal way to achieve this requirement is through built-in redundancy, contractors have had to develop a large amount of software and hardware in their VSCS prototypes.

Another difficult VSCS requirement is the automated system reconfiguration function. FAA intends the Advanced Automation System to allow the amount of airspace a controller handles to be reapportioned several times a day to reflect changes in staffing, amount of air traffic, and availability of equipment. Therefore, the new workstations need to be able to reconfigure their maps and displays to match these changes in airspace. To accommodate these workstation changes, VSCS must be able to automatically reassign radio frequencies and reroute incoming calls—a complex task. While some reconfiguration can be done on the current system, it does not meet the Advanced Automation System requirements because such changes can only be made manually.

Conclusions

In revising its acquisition strategy, FAA has taken appropriate action to complete needed testing and avoid delays in Advanced Automation System workstation implementation. However, contractors confront formidable challenges in building prototypes that will meet requirements and pass this summer's testing.

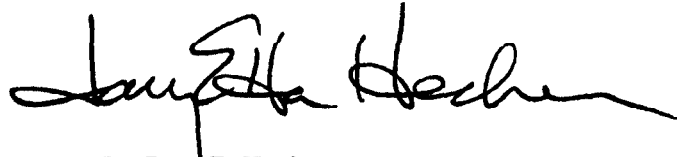
Although we did not obtain official agency comments on this report, the views of agency and contractor officials were sought during the course of our work, and have been incorporated where appropriate. Unless you publicly announce the contents of this report earlier, we plan no further distribution of it until 30 days after the date of this letter. We will then send copies to interested congressional committees; the Secretary,

⁴Contractor-specific details about test results and problems encountered are considered procurement-sensitive.

Department of Transportation; the Administrator, FAA; the Director, Office of Management and Budget; and other interested parties. Copies will also be made available to others upon request.

Should you have any questions about this report or require additional information, please contact me at (202) 275-9675. Major contributors to this report are listed in appendix II.

Sincerely yours,

A handwritten signature in black ink, appearing to read "JayEtta Hecker". The signature is fluid and cursive, with a long horizontal stroke at the end.

JayEtta Z. Hecker
Director, Resources, Community, and Economic
Development Information Systems

Objective, Scope, and Methodology

In response to the request of the Chairman, Subcommittee on Transportation and Related Agencies, Senate Committee on Appropriations, our objective was to assess FAA's revised acquisition strategy for VSCS.

To address this objective, we analyzed FAA's revised strategy, reviewed supporting documentation, and discussed the strategy with FAA program officials and contractor representatives. In addition, we reviewed test reports, contract administration data, and correspondence between FAA and the contractors. We reviewed cost, schedule, and status reports, and other applicable project documentation.

We also analyzed VSCS requirements, the contractors' proposed VSCS designs, and associated documents. We analyzed actual and projected VSCS software cost and sizing, and system availability. In doing this, we applied relevant Institute of Electrical and Electronics Engineers, Inc., guidance on standards for software reviews and audits. In addition, we discussed requirements and system designs with FAA and appropriate contractor officials.

We conducted our work between February and June 1991, at FAA headquarters in Washington, D.C. We also performed work at AT&T Technologies, Inc., in Naperville, Illinois, and in Greensboro, North Carolina; and at Harris Corporation in Melbourne, Florida. Our work was performed in accordance with generally accepted government auditing standards. We discussed the contents of this report with Department of Transportation and FAA officials, and have reflected their views in the report where appropriate.

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