

United States General Accounting Office

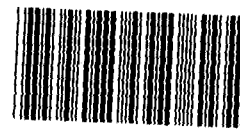
GAO

Report to the Chairman, Permanent
Subcommittee on Investigations,
Committee on Governmental Affairs,
U.S. Senate

April 1991

FAA REGISTRY SYSTEMS

Key Steps Need to Be Performed Before Modernization Proceeds



143834

**Information Management and
Technology Division**

B-242542.1

April 9, 1991

The Honorable Sam Nunn
Chairman, Permanent Subcommittee
on Investigations
Committee on Governmental Affairs
United States Senate

Dear Mr. Chairman:

In response to your request, we are reporting to you on the Federal Aviation Administration's (FAA) modernization plans for its Airmen and Aircraft Registry Systems. The Anti-Drug Abuse Act of 1988 requires changes to these systems to make them more effective in serving the needs of law enforcement agencies involved in aviation drug interdictions and investigations. As part of its proposed solution, FAA is planning to modernize its information systems by purchasing new automated records storage equipment and modifying existing mainframe data bases. To assess its efforts in this area, we evaluated whether FAA has (1) adequately defined users' needs, and (2) addressed other key system development steps that must be taken before proceeding with its planned \$23.2 million equipment and services procurement. Appendix I provides additional details on our objectives, scope, and methodology.

Results in Brief

FAA has not adequately defined the needs of its internal users or those of the law enforcement agencies involved in drug interdiction, even though improving support for those agencies was the prime justification for modernizing the Airmen and Aircraft Registry Systems. Moreover, FAA has used inadequately defined and documented functional requirements, a limited alternative systems design and configuration analysis, and a flawed cost/benefit analysis. These shortcomings in its analyses leave FAA with little assurance that it has selected the most appropriate technological solution, and increase the risk of cost overruns and schedule delays.

To improve the likelihood of successful systems implementation, FAA should (1) define users needs and system requirements and then (2) reformulate its alternatives and cost/benefit analyses. At the conclusion of our review, FAA officials stated that they planned to correct the deficiencies we identified.

Background

The Airmen and Aircraft Registry Systems were developed to promote air commerce and safety in accordance with the Federal Aviation Act of 1958. The act requires FAA to issue certificates to individuals showing the capacity in which they are authorized to work with aircraft (e.g., pilot, flight instructor, mechanic, inspector). Additionally, the act requires FAA to register and record ownership history and lien information on civil aircraft. FAA maintains this information in an Airmen Certification Information System and an Aircraft Registration Information System. The systems comprise (1) data bases residing in an on-site mainframe computer, (2) historical application and registration documents stored on microfilm and microfiche, and (3) semiautomated microfiche equipment used to store and access all documents required for aircraft registration.

Approximately 3.5 million airmen records are stored on microfilm and 279,000 records of active aircraft on microfiche. The micrographics storage equipment contain copies of all documents processed to date pertaining to airmen and aircraft registration, such as pilot certification ratings, physical descriptions, ownership records, aircraft identification numbers, lien records, and aircraft descriptions.

FAA personnel use information from these systems primarily for investigations involving accidents, suspensions or revocations of certificates or registrations, and for resolving questions on pilot qualification and aircraft ownership and liens. FAA's Law Enforcement Assistance Unit responds to approximately 15,000 inquiries annually by federal, state, and local law enforcement officials for information in the Registry Systems, often made in conjunction with ongoing investigations. Other federal agencies, the general public, law firms, and title companies also request information and copies of documents found in these systems.

Current Registry Systems Provide Inadequate Support for Drug Enforcement

In 1988, the House Committee on Public Works and Transportation investigated FAA's role and responsibilities in drug interdiction.¹ The Committee concluded that problems with the Airmen and Aircraft Registry Information Systems hampered FAA's ability to provide critical support information and assistance to law enforcement agencies. Specifically, 20 deficiencies were identified with the Registry Systems, including a lack of timely and adequate notice of the transfer of aircraft ownership, delays in processing and accessing information on aircraft

¹Federal Aviation Administration Drug Enforcement Assistance Act of 1988, Report 100-891 (Sept. 7, 1988).

fuel tank and fuel system modifications, use of false names and addresses of airmen and aircraft owners, and vulnerability to criminal abuse through stolen or counterfeit airmen certificates.

These findings were incorporated into the Anti-Drug Abuse Act of 1988, which directed FAA to improve procedures for (1) registering aircraft, (2) certifying airmen, (3) processing major aircraft repair and alteration forms, and (4) enforcing the requirements associated with such certifications and registrations. FAA has made several procedural changes to correct certain problems cited in the act, such as delays in processing aircraft fuel modification forms and fictitious airmen names and addresses.² Additionally, in March 1990, FAA published a Notice of Proposed Rulemaking to amend the Federal Aviation Regulations with new civil registration and application procedures. These procedures were aimed at precluding abuse of the system by persons with criminal intent. The Final Notice of Rulemaking is expected during the fall of 1991.

Systems Modernization Approach Selected by FAA Officials

FAA officials contend that the delays in obtaining information from the Registry Systems are largely attributable to the document preparation, filming, labeling, and manual or semiautomated storage and access methods required by microfilm and microfiche. These manually intensive and time-consuming processes contribute to document-entry backlogs and FAA's inability to provide information to users quickly and efficiently. Additionally, FAA officials noted that the changes being made to Federal Aviation Regulations to accommodate legislative requirements will impose additional work loads on the Registry staff and equipment. Agency officials decided that new, automated records storage technology was necessary to satisfy the information needs of the law enforcement community, alleviate the added burden on the Registry staff, and increase productivity.

In December 1989, FAA established a project team—the Registry Modernization Staff—responsible for modernizing the Airmen Certification and Aircraft Registration Information Systems. In August 1990, this group completed a systems modernization plan that evaluated the technology limitations of the current Registry Systems and recommended a technical solution requiring improvements to the mainframe data bases and replacement of the micrographics storage media with optical

²Specifically, FAA has (1) made the information on aircraft fuel tank system modification more accessible to drug enforcement agencies, and (2) reduced the possibility of issuing certificates to fictitious airmen by requiring face-to-face identification before these individuals can take flight tests.

imaging technology.³ This solution is intended to enable FAA personnel to quickly access records from optical disk; view records on high-resolution, full-page display monitors; and, when necessary, print records on high-speed laser printers. FAA officials believe that the improved access will provide increased responsiveness to requests for information from law enforcement agencies.

According to FAA, the new Registry Systems will provide law enforcement agencies with on-line access to information in the mainframe computer data bases. However, direct access to records stored on the optical disk system will be limited to FAA personnel and users in FAA's on-site public documents room. This arrangement will require outside users, such as the field units of selected law enforcement agencies, to make requests for historical or detailed information through FAA personnel.

In November 1990, the Modernization Staff initiated a request for procurement authority totaling \$23.2 million. The request specified the hiring of a systems integration firm to oversee the conversion of existing microfilm and microfiche records to optical disk, installation of optical disk equipment and workstations, and related supplies and services. At the conclusion of our work in February 1991, the request remained under review within FAA.

Users' Needs and Functional Requirements Have Not Been Adequately Defined

Federal regulations on management of information resources require that the acquisition of new or additional resources be based on mission needs, expressed in the form of deficiencies in existing capabilities, new or changed program requirements, or opportunities for increased economy and efficiency. The needs must be supported by a requirements analysis that is commensurate with the size and complexity of the need.⁴

We reviewed FAA's modernization plan and found that it merely discusses problems created by the technology and processes used to support the existing Registry Systems, and arrives at general conclusions about what type of system is needed to resolve these problems. The plan does not identify users' needs in ways necessary to establish functional requirement definitions or more specific systems specifications and performance standards. Instead, internal users' needs are presented as a

³Optical imaging technologies use lasers to record large amounts of digitized data onto small, high-capacity disks capable of storing thousands of documents. Source documents—such as paper or microfilm records—can sometimes be digitized using optical scanners.

⁴Federal Information Resources Management Regulation, 201-30.007.

compilation of suggestions made by individual staff members for improving the current system that have not been fully refined or evaluated. The plan does not address the needs of external users, the law enforcement agencies, although the system must meet these needs to be successful.

The project manager told us that the Modernization Staff is sufficiently aware of FAA users' needs to know that the current technology proposal will provide an acceptable solution. The project manager also stated that FAA should not have to be concerned with external users' needs because those needs have nothing to do with how FAA stores its data.

According to federal guidance, a comprehensive functional requirements analysis should consider the full range of data and system performance needs.⁵ This documented analysis provides a basis for a mutual understanding between users and designers of the initial definition of the system, including the requirements, operating environment, and development methodology. FAA has not yet conducted or documented this analysis.

The project manager told us that functional requirements are only necessary for the computer portion of the modernization project, not for an electronic records storage device, such as an optical disk system. He saw no reason why the agency should not be able to proceed with its request for procurement authority for the optical imaging technology.

Information processing resources are defined as any equipment or interconnected system or subsystems of equipment that are used in the automated acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of data or information by a federal agency.⁶ This definition includes computers, ancillary equipment, software, firmware, and related resources and services. Electronic information storage devices, such as optical disks, clearly fall under federal regulations governing the procurement of information processing equipment. Moreover, FAA's procurement request for an optical disk system includes computer workstations, laser printers, and telecommunications facilities.

⁵Functional requirements analyses are discussed in Guidelines for Documentation of Computer Programs and Automated Systems, Federal Information Processing Standards Publication 38 (Feb. 15, 1976).

⁶See 40 U.S.C. 759, commonly referred to as the Brooks Act.

FAA project officials said they understand the functional requirements of the optical disk system through discussions with technical support staff and system users. However, without established functional requirements based on clearly identified system users' needs, FAA's choice of technology is open to question. For example, on the basis of demonstrations by vendors of optical disk systems, FAA's plan specified that the user response time provided by the optical disk system it chooses should be no greater than 13 seconds.⁷ Project staff told us that this response time was not based on users' requirements. Further, it is not useful as a criterion for evaluating optical storage systems since it is defined without reference to other factors affecting system performance, such as the number of users accessing the system at any time, volume of documents stored, and capabilities of the telecommunications network. By setting response time requirements arbitrarily and without careful definition, FAA may have excluded an alternative system design concept that might better satisfy mission needs; conversely, the optical imaging technology it selected—"write-once, read many," or WORM—might not satisfy actual internal and external user response time requirements.⁸

The absence of an established set of functional requirements increases risks of unexpected problems with systems design and implementation as well. For example, FAA expects the optical disk system to interface with the mainframe data bases, providing users with simultaneous, on-screen access to both archived records and computerized summary information on specific airmen or aircraft registrations and certifications. To interconnect effectively, the interface (hardware, software, and functionality) between the optical disk system and the mainframe system must be carefully analyzed and managed.

Limited Alternatives Analysis Precludes Technology Choice

FAA's system modernization plan presented the following alternatives to systems modernization and provided costs and benefits for each:

- Alternative 1
Make no change in current operations.

⁷Thirteen seconds was defined as the maximum time required from the instant the user initiates the command to retrieve a document stored on the optical disk system to when an image appears on the user's terminal screen.

⁸WORM is an optical disk technology that allows data to be recorded once and then read many times, but offers no ability to change the data once they are stored. Alternatively, rewritable optical disks combine magnetic and laser recording technologies to allow data written on the disk to be changed.

- Alternative 2
Make minimum procedural changes accompanied by minimal automation enhancements, including purchasing equipment to produce nonforgeable airmen and aircraft certificates, constructing machine-readable certificates that could be optically scanned by the U.S. Customs Service and checked against Department of Treasury data bases, and adding a few new fields to the aircraft registry data base.
- Alternative 3
Make changes as outlined in alternative 2, and replace micrographic equipment with optical disk technology for records storage and retrieval, and redesign the Registry Systems data bases with additional capabilities, including interfaces with the optical disk system.
- Alternative 4
Incorporate changes in alternatives 2 and 3, and give FAA field offices and selected law enforcement agencies direct access 24 hours a day, 7 days a week, to information stored on optical disk.

The Modernization Staff decided that alternative 3 provided the most cost-effective solution. The group concluded that the present system does not allow effective and efficient support to drug interdiction and enforcement efforts, thereby eliminating alternative 1. In the group's assessment, alternative 2 merely patched over the existing inefficient systems. Alternative 4 was not, in view of "the realities of the fiscal environment," the most cost-effective and "management-efficient" solution. The alternatives analysis stated that alternative 3 was adopted as the most management-efficient alternative because it complied with the intent of the Anti-Drug Abuse Act, gave FAA the resources to respond to law enforcement agencies and other aviation interests, and provided a system that could be enhanced as new requirements arose.

However, FAA's analysis suffers from several weaknesses. Federal Information Resources Management Regulation 201-30.009 requires agencies to consider a full range of alternatives to meet their requirements. FAA's plan analyzed a relatively narrow range of alternative system design concepts, and these alternatives are predisposed towards using specific optical disk technology. The two alternatives that consider upgrading to a new data storage technology (alternatives 3 and 4) discuss only one of three prominent types of optical imaging technology—a WORM optical disk system. The plan did not compare characteristics of the WORM technology with those of other available data storage technologies, such as compact disk-read only memory optical disks or rewritable optical disks.

FAA's plan did not demonstrate that the chosen alternative is the best approach. The FAA Project Manager stated that he is generally aware of the available records storage technology, has attended various trade shows, and has discussed optical disk imaging with several vendors. However, none of this information is documented, nor has any assessment of technology options been tied to functional requirements.

Additionally, the proposed system configuration contained in the alternatives analysis is based upon information and analysis provided by one vendor using a specific optical disk product line. By designing its proposed system around a single vendor's product and analysis of FAA needs, the Modernization Staff may be excluding other solutions.

Cost/Benefit Analysis Inadequate to Support FAA's Approach

Cost/benefit analyses provide management with information on the quantifiable and nonquantifiable costs and benefits of the alternatives under consideration. These analyses should enable managers to determine the most effective and economical alternative for achieving agency objectives. Federal Information Processing Standards Publication 64 and Federal Information Resources Management Regulation 201-30.009 require a complete and supportable cost/benefit analysis that provides adequate information to analyze and evaluate alternative approaches.

FAA's cost/benefit analysis is based on unsupported assertions. For example, in the quantifiable benefits section of the cost/benefit analysis, FAA projects over \$468 million a year, beginning in 1992, in benefits to the public from an estimated 5-percent decrease in aircraft-related drug smuggling. This projection is particularly important because the reduction in drug trafficking represents virtually all of the total claimed benefits. However, the analysis provides no explanation of how the projected drug reduction benefits were derived.

Furthermore, the cost estimates used in FAA's analysis are suspect. FAA officials stated that some costs in the analysis, such as software revision costs, were "best guess" estimates and would be revised as costs are incurred. Additionally, FAA's costs estimates are largely based on information submitted by one vendor. This vendor cautioned FAA that in the absence of functional requirements or well-defined law enforcement agency information needs, the figures were preliminary at best.

Conclusions

Federal guidance for planning and implementing system development projects is designed to reduce the risk of cost overruns, schedule delays,

and systems that do not meet user needs. FAA has not followed these guidelines in its Registry Systems Modernization project. Users' needs and functional requirements have not been adequately identified and documented for FAA's Registry Systems, and these requirements are particularly vague and imprecise about the needs of law enforcement agencies involved in drug interdiction. Further, FAA's alternatives and cost/benefit analyses do not justify the system solution selected.

FAA does not know if it is adopting a technical solution that best meets its information storage, access, and dissemination needs. FAA's modernization plan places primary emphasis on replacing older-generation records storage technology with state-of-the-art equipment. As a result, FAA has narrowly framed its objective as "doing what we do now—only doing it faster," rather than determining what its information requirements actually are and seeking to identify the best overall approach for satisfying those requirements.

Recommendations

We recommend that the Secretary of Transportation direct the FAA Administrator to take the following actions before soliciting a delegation of procurement authority and preparing a request for proposals:

- Define users' needs, within FAA and involved law enforcement agencies; system requirements, including functional requirements for interfacing with existing systems; and performance requirements.
- Subsequent to defining these requirements, consider a broad range of alternatives and prepare cost/benefit analyses based on these alternatives.

Agency Comments

FAA officials said that our report was timely and offered a constructive analysis that was helpful to FAA's own review of the project. They stated that FAA intends to correct the deficiencies we cited regarding user's needs, functional requirements, alternatives analysis, and the cost/benefit analysis. Further, the Associate Administrator for Aviation Standards said that FAA expects to hire a contractor to assist the Registry Modernization Staff in addressing and documenting solutions to these problems.

The Associate Administrator also stated that the agency would not go forward with a request for delegation of procurement authority for the entire modernization project until these problems had been addressed.

As arranged with your office, unless you publicly announce the contents of this report earlier, we plan no further distribution of the report until 30 days from the date of this letter. At that time, we will send copies to the Secretary of Transportation; the Administrator, FAA; interested congressional committees; and other interested parties. We will also make copies available to others upon request.

This report was prepared under the direction of JayEtta Z. Hecker, Director, Resources, Community, and Economic Development Information Systems, who can be contacted at (202) 275-9675. Other major contributors are listed in appendix II.

Sincerely yours,

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

Ralph V. Carlone
Assistant Comptroller General

Objectives, Scope, and Methodology

The objectives of our review were to evaluate whether FAA has (1) adequately defined users' needs, and (2) addressed other key system development steps that must be taken before proceeding with its planned \$23.2 million modernization of the Airmen and Aircraft Registry Systems. Specifically, we examined the proposals for the new systems and their intended uses, FAA's estimated system costs, and the agency's actions to date.

To accomplish our objectives, we interviewed FAA Aeronautical Center officials in charge of administering the Airmen and Aircraft Registry Systems and members of the Registry Modernization Staff responsible for planning and overseeing the proposed system modernization. Through interviews and reviews of agency documents, we collected information on the systems' proposed redesign. We reviewed federal regulations and guidelines pertaining to system development and acquisition, compared FAA's actions to the guidance, and identified key technical issues that could affect the modernization project's success.

Our audit work was conducted between May 1990 and February 1991 at FAA headquarters in Washington, D.C.; FAA's Mike Monroney Aeronautical Center in Oklahoma City, Oklahoma; and FileNet Corporation in Arlington, Virginia, the vendor that has provided cost estimates for the proposed optical disk system.

We performed this review in accordance with generally accepted government auditing standards. We discussed the results of our work with FAA officials and have reflected their views in the report as appropriate. In addition, we obtained official oral comments from the Department of Transportation and FAA officials on a draft of this report. These comments are also included in this report.

Major Contributors to This Report

**Information
Management and
Technology Division,
Washington, D.C.**

Joel C. Willemsen, Assistant Director
David L. McClure, Assignment Manager
David Chao, Technical Adviser

**Kansas City Regional
Office**

George L. Jones, Regional Assignment Manager
Denise M. Wempe, Evaluator-in-Charge
Bonnie S. Carter, Staff Evaluator

Ordering Information

The first five copies of each GAO report are free. Additional copies are \$2 each. Orders should be sent to the following address, accompanied by a check or money order made out to the Superintendent of Documents, when necessary. Orders for 100 or more copies to be mailed to a single address are discounted 25 percent.

**U.S. General Accounting Office
P. O. Box 6015
Gaithersburg, MD 20877**

Orders may also be placed by calling (202) 275-6241.

United States
General Accounting Office
Washington, D.C. 20548
Official Business
Penalty for Private Use \$300

First-Class Mail
Postage & Fees Paid
GAO
Permit No. G100