REPORT BY THE U.S.

General Accounting Office

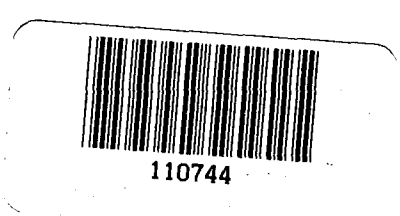
FAA's Program To Automate Flight Service Stations: Status And Needs

The Federal Aviation Administration (FAA) plans to spend about $175 million automating flight service stations. General aviation pilots can then obtain weather and other information and file flight plans without assistance from flight service specialists.

GAO and FAA agree on the need for automation and the concept of pilot self-briefing. They do not agree on how best to accomplish this.

FAA plans to award a production contract before it has developed the software required for automation. GAO states FAA could improve the plan by deleting a portion of the system and doing more development during the competitive development phase.

This report recommends action to develop a better system than under the FAA program and to encourage pilots to use it.



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UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

PROCUREMENT AND SYSTEMS
ACQUISITION DIVISION

B-164497(1)

The Honorable Neil E. Goldschmidt
The Secretary of Transportation

Dear Mr. Secretary:

AGC00030

This report discusses the Federal Aviation Administration's plans for improving flight service stations, the status of development for automating the stations, and the need to encourage and motivate general aviation pilots to use the system developed for self-briefings rather than briefings by specialists. This review was made as part of our ongoing review of major acquisitions of executive agencies.

This report contains recommendations to you on pages 7, 12, and 18. As you know, section 236 of the Legislative Reorganization Act of 1970 requires the head of a Federal agency to submit a written statement on actions taken on our recommendations to the Senate Committee on Governmental Affairs and the House Committee on Government Operations not later than 60 days after the date of the report and to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of the report.

We are sending copies of this report to the Director, Office of Management and Budget, and the Administrator, Federal Aviation Administration.

Sincerely yours,

J. H. Stolarow

J. H. Stolarow
Director

GENERAL ACCOUNTING OFFICE
REPORT TO THE SECRETARY
OF TRANSPORTATION

FAA'S PROGRAM TO AUTOMATE FLIGHT SERVICE STATIONS: STATUS AND NEEDS

D I G E S T

To meet a large anticipated demand for services by 1990, the Federal Aviation Administration (FAA) plans to automate flight service stations, enabling pilots to brief themselves either through a computer terminal or by use of a "touch-tone" telephone.

In carrying out its program, FAA needs to

--give more consideration to other station improvement programs,

--take more advantage of competition in the early development phase, and

--design ways to achieve maximum use of the automated system.

The system, which will cost about $175 million, will be implemented in three segments, called models 1, 2, and 3. With the first--model 1--FAA's objective is to quickly establish a limited-capability automated system at its 43 busiest stations. This objective is already being achieved by other FAA station improvement programs, and by eliminating model 1, FAA could save about $6 million. (See pp. 5 and 6.)

Model 2 will automate all the manual operations now carried out by specialists and will have the capacity to handle the workload of 290 stations. FAA's acquisition strategy is to begin production of model 2 after a competitive design verification phase that does not include software functions. The software, which has some high-risk items, is to be developed later while the system is being produced and installed. This plan could be improved by requiring some functional software development during the initial competitive

development phase. By using competition in the early phases of development when it is economically feasible, FAA would not only be adhering to a key concept of the Office of Management and Budget's Circular A-109, but it would have greater assurance of obtaining a better system. (See pp. 8 to 10.)

Model 3 will incorporate additions and improvements to models 1 and 2, enabling pilot self-briefings. In this way, the present and projected long-term demand for preflight services can be met without a proportional increase in staff or operating costs.

Self-briefing can meet the demand for preflight services, but the systems are not sufficiently developed to substitute for a specialist and are not available at a reasonable cost.

FAA specialists will be available to all pilots; therefore, some controls will be necessary to discourage recourse to specialists for preflight services if the benefits of self-briefing are to be achieved. Agency tests demonstrate user acceptance of self-briefing, but do not support the agency's contention that a significant number of pilots will use self-briefing exclusively. (See pp. 13 to 16.)

RECOMMENDATIONS

GAO recommends that the Secretary of Transportation should direct the Administrator of the Federal Aviation Administration to:

--Delete model 1 from the automation program because of (1) improvements already being made to flight service stations and (2) its deployment has not yet been demonstrated to be cost beneficial. (See p. 7.)

--Include more software development in the design verification phase to take advantage of the competition and adhere to the Office of Management and Budget's Circular A-109 acquisition approach. (See p. 12.)

--Without compromising flight safety, develop a mechanism to control pilots' demands for preflight services provided by specialists, discourage excessive recourse to specialists, and assure effective implementation of the pilot self-briefing concept. (See p. 18.)

AGENCY COMMENTS

GAO and FAA agree on the need for automating flight service stations and the concept of pilot self-briefing; however, they do not agree on how best to accomplish this program.

The agency disagrees with GAO that model 1 is no longer needed. According to FAA officials, model 1 will allow greater employee productivity than the current improvement programs. GAO questions this increase in productivity. Studies by FAA on other automated systems have shown that productivity without self-briefing is very limited. Since model 1 does not have a self-briefing capability, GAO believes the other improvement programs will be as effective as model 1. FAA officials told GAO in follow-on discussions that there were cost benefits to deploying model 1. However, at the time, FAA could not provide a cost-benefit analysis to support its conclusions. (See pp. 6 and 7.)

FAA is confident that the amount of development and demonstration scheduled for design verification is all that is needed to address the high-risk areas affecting system design and that an adequate basis for evaluating contractor proposals will be provided. It cites the success experienced on other automation programs using the same acquisition process. GAO acknowledges the successful performance of the systems implemented, but notes that the agency fails to mention significant problems in the systems which resulted in sizable cost growth and schedule slippages--two items GAO believes share in importance with performance.

FAA has the opportunity to require its competing contractors to perform some more complex and high-risk work during the design

verification phase. By doing this, it will have greater assurance that the contractor it selects will be the best qualified; not only for its development work, but also to do the research and development for the work packages still to be defined. (See pp. 11 and 12.)

FAA agrees that pilots need to be encouraged to use self-briefing; however, it proposes to use education and useful products rather than negative persuasive mechanisms. The use of such features could reduce usage of the service and compromise flight safety. Automation and self-briefing should improve flight safety because briefings are improved and pilots are provided with a source of aeronautical data other than a specialist.

GAO believes that the mix between specialist and self-briefings is as important as the services provided. Access to a specialist should be controlled to assure that pilots who need assistance get it. The success of the program will depend on the system's ability to meet the needs of all pilots. (See pp. 17 and 18.)

Contents

ABBREVIATIONS

AWANS	Aviation Weather and Notice to Airmen System
DUAT	direct user access terminal
FAA	Federal Aviation Administration
GAO	General Accounting Office
MAPS	Meteorological and Aeronautical Presentation System
OMB	Office of Management and Budget
VRS	voice response system

CHAPTER 1

INTRODUCTION

The Federal Aviation Administration (FAA) operates a network of 290 flight service stations within the continental United States to aid general aviation pilots and promote flight safety. Flight service stations, operated by FAA specialists, provide pilots with the latest weather reports, forecasts, enroute radio communications, and the capability to file flight plans. The flight plans are forwarded to an air route traffic control center for approval if the flight is to be made under instrument flying rules or to a flight service station near the flight's destination if the flying is to be done under visual flight rules. Pilots can also maintain radio contact with the stations for inflight information or emergency assistance.

FAA estimated its flight service station activities provided 65.8 million services to pilots during fiscal year 1978. This demand is expected to more than double by 1990 when 134.5 million services should be provided. The annual operating cost for the system is about $150 million, 80 percent of which is for its 5,000 personnel--4,500 in operations and 500 in maintenance.

Critics describe the flight service station system as labor intensive, error prone, inefficient, and expensive. In all but a few stations, specialists receive weather information; notices to airmen (reports on the operational status of air traffic control facilities, navigational aids, and airports); and flight plans by teletypewriters. Computers in the central communications facility located in Kansas City, Missouri, collect and redistribute information for specialists over regular telephone lines. Although the computers are capable of sending the data in fractions of a second, the data can be transmitted no faster than 100 words a minute, the printing speed of the teletypewriter. Pilot briefings by specialists are time-consuming because they must search through a myriad of teletypewriter paper for needed information. Pilot organizations have been critical of the services because of the poor quality of information provided and the lack of access to a specialist when needed. The location of flight service stations in the current network is based on historical routes which are no longer applicable to current general aviation activity; therefore, some stations are overburdened with work while others have little to do.

CURRENT PROGRAM FOR IMPROVING FLIGHT SERVICE STATIONS

The Congress, FAA, pilots, and specialists have been concerned about flight service station problems since the 1960s. Over the years, FAA has developed and abandoned a series of plans and projects for improving the system. The latest plan, approved in January 1978, calls for automating 43 of the busiest stations and later, collocating and consolidating the 290 domestic stations (including the 43 to be automated) into 20 hub facilities located at air route traffic control centers. An alternative plan, should consolidation and collocation not be acceptable, is to extend automation from 43 stations up to a maximum of 150 stations. The fate of the remaining stations under this alternative has not been decided. FAA will decide which plan to implement before 1983.

Cost

FAA estimates the cost of automation, consolidation, and collocation of flight service stations to be $307.4 million (in fiscal year 1977 dollars), as shown below.

Estimated Cost to Automate, Consolidate, and Collocate Flight Service Stations

	Model 1	Model 2	Model 3	Consolidation and collocation	Total
	(millions)				
Research and development	$ -	$ 9.2	$25.5	$ -	$ 34.7
Engineering support	1.1	11.7	-	-	12.8
Automation	13.8	100.7	-	-	114.5
Software enhancements	-	-	2.2	-	2.2
Voice response system (VRS)	-	-	10.5	-	10.5
Hub buildings	-	-	-	61.8	61.8
Additional equipment	-	-	-	8.6	8.6
Relocation	-	-	-	11.3	11.3
Communications	-	-	-	51.0	51.0
Total	$14.9	$121.6	$38.2	$132.7	$307.4

The estimated cost to acquire and install the three models is based on a fully funded program. If the program is incrementally funded, FAA estimates its cost would increase by $37.5 million. According to FAA officials, full funding enables a contractor (1) to spread fixed costs over several years and a large number of units, resulting in lower unit prices and (2) to take advantage of quantity discounts from suppliers which could be passed on to the Government. Through fiscal year 1979, only $27.9 million has been appropriated. FAA's fiscal year 1980 request is for $1.9 million to continue engineering support.

Schedule

The scheduled milestones for the approved program, that is, automating 43 of the busiest stations, and the proposed start and completion dates for the hub program's adoption are shown below.

Approved program	Date
Master plan approved	January 1978 (note a)
Request for proposal issued	June 1978 (note a)
Receipt of technical and management proposals	September 1978 (note a)
Receipt of cost proposals	November 1978 (note a)
Award design verification contracts	October 1979
Award production contract	November 1980
First model 1 delivery	May 1981 (note b)
Last model 1 operational	December 1982 (note b)
First model 2 delivery	December 1982 (note b)
Last model 2 operational	Late 1986 (note c)
Model 3 operational	(note d)
Pending decision to consolidate and collocate flight service stations at 20 hub facilities:	
Start hub construction program	Mid-1983 (note c)
Last hub operational	Late 1989 (note c)

a/Actual date. All other dates are estimates.

b/Based on schedule in FAA's request for proposal dated 6/30/78.

c/Based on FAA's automation master plan dated 1/19/78.

d/Self-briefing will be implemented as the capability is developed.

Performance

The objective of the flight service station automation program is to meet the present and projected long-term demand for flight services without a proportional increase in staff and operating cost. Automation will eliminate the manual processing of information by flight specialists. It will also allow pilots to obtain weather and other information and to file a flight plan without the aid of a specialist. Automation will be implemented in segments designated as models 1, 2, and 3.

Model 1 is a system of limited capability designed to automate 43 stations. It will have 565 briefing positions and 16 data processing systems (14 for operations, 1 for training, and 1 for central support). The system will allow a specialist to enter flight plans for processing and to retrieve and display weather and aeronautical data on a television screen for briefing pilots.

Model 2 will replace model 1 and automate all the specialist functions with a capacity to handle the workload of 290 flight service stations. The configuration of the system depends on a future decision to consolidate and collocate flight service stations into 20 hubs located at air route traffic control centers. In the consolidated and collocated configuration, the system would have 1,088 briefing positions and 22 data processing systems (20 for operations, 1 for training, and 1 for central support). The system also has an aviation weather processor which edits incoming data and, in addition to model 1 functions, will be able to display weather graphics on a television screen.

Model 3 incorporates additions and improvements to models 1 and 2 and will provide a pilot self-briefing capability. The additions and improvements will depend on the type of equipment (terminals and telephones) pilots will use for self-briefing.

SCOPE OF REVIEW

We reviewed FAA's current and past efforts to automate flight service stations. Also, we examined planning documents and project reports and discussed current research and development programs with FAA officials. We visited four automated and nine nonautomated flight service stations located in FAA's New England, Great Lakes, and Southern Regions; three air route traffic control centers; the Weather Message Switching Center in Kansas City, Missouri; and the National Aviation Facilities Experimental Center in Pomona, New Jersey.

CHAPTER 2

MODEL 1 AUTOMATION NOT NEEDED

FAA's plans for improving flight service station operations include replacing teletypewriters in many stations with automated equipment which has capabilities similar to model 1. FAA could save about $6 million by eliminating model 1 from its flight service station automation program.

Model 1, which will be replaced when model 2 is deployed, is an automated system of limited capability intended to improve flight service station specialist operations by eliminating the manual processing of information. FAA believes model 1 is needed to promptly realize the benefits of automation. Currently, the agency is unable to meet the demand for flight services. Although limited in nature, FAA believes the model 1 system can be produced and installed in a relatively short time to meet its flight service needs.

Since the approval of the flight service station automation program in January 1978, FAA also initiated the following programs with capabilities similar to model 1 to improve the operation of flight service stations.

--A leased data storage system for use by specialists in briefing pilots will replace the teletypewriters in 150 flight service stations. Weather and other information will be displayed on a television screen, and the data storage system will be updated as necessary using high-speed communication circuits instead of the slower teletypewriter circuits. A study of the Chicago flight service station operation, which has been using similar equipment since 1975, showed improved station operations, elimination of teletypewriter paper shuffling, improved employee morale, and better briefings. FAA began installing the system at other locations in August 1979.

--Data terminal equipment is to be installed in FAA's 43 busiest stations to aid specialists in processing flight plans. This equipment, connected directly to the computer switching center in Kansas City, Missouri, uses a keyboard to input or retrieve information and displays it on a television screen. The data terminal equipment has been purchased and will be installed in stations as soon as the contractor is able to correct a minor problem with the equipment.

--Closed-circuit television systems have also been purchased and are in operation at some flight service stations. Graphic weather information received from the National Weather Service is shown on television screens for specialists' use in briefing pilots.

According to FAA, neither these improvements nor model 1 will fulfill the need for the more sophisticated automation system envisioned in model 2 and self-briefing in model 3 of the program. Also, an FAA official advised us that neither model 2 nor model 3 are dependent on the development of model 1.

FAA estimates that it will cost $14.9 million for developing software, purchasing computer equipment, and testing and installing model 1. An FAA official responsible for managing the automation system estimates savings of $5.9 million by eliminating model 1. The $9 million difference represents the cost of model 1 computer equipment which will be used in model 2.

CONCLUSION

Model 1 is a system of limited capability designed to automate the specialist's functions. FAA's justification for model 1 ignores the fact that its current improvement programs will have already automated flight service stations to some extent. We believe that the equipment being installed by FAA will improve the operational capability of flight specialists significantly and enable FAA to meet the current need for flight services as effectively as model 1.

AGENCY COMMENTS AND OUR EVALUATION

The Department of Transportation considers its "evolutionary" approach to developing the flight service station automation program to be correct. According to the Department, by first initiating the model 1 system and gaining specialist and user acceptance before proceeding with the model 2 and 3 systems, it will achieve (1) early initiation of an automated system with attendant cost benefits from greater employee productivity and user availability and (2) a systematic expansion that allows FAA to build on its previous successes while isolating technical risks and minimizing cost waste.

The Department of Transportation does not agree that model 1 should be eliminated because it contains a number of operational refinements for route-oriented briefings and processing of flight plans which are not included in the current improvement programs. These refinements, according to the Department, will allow greater employee productivity and increase user data availability by eliminating much of the labor-intensive needs of the present system. We question the increase in employee productivity that is possible with model 1. Model 1 is based on research and development efforts of FAA's Aviation Weather and Notice to Airmen System (AWANS) and Meteorological and Aeronautical Presentation System (MAPS) programs. FAA performed before and after time and motion studies on these two systems to determine the effects automation had on flight service station operations. The capacity gains attributable to AWANS were offset by the increased personnel needed to operate the system, and MAPS had only a slight productivity gain over the manual system. Also, FAA reported in April 1978 on its cost analysis of alternative flight service station configurations that the major contributor to automation savings is pilot self-briefing. Model 1 does not have this capability. Without this, we do not believe model 1 will be more effective than the current improvements.

In follow-on discussions with FAA officials, we were told that there were cost benefits to deploying model 1. For instance, they noted the expense of leasing the data storage system would be reduced if the model 1 system were deployed at the 43 busiest stations. FAA could not provide us with a cost-benefit analysis to support its conclusion.

RECOMMENDATION

In view of the improvements already being made to flight service stations and in the absence of FAA demonstrating that the deployment of model 1 would be cost beneficial, we recommend that the Secretary of Transportation have the Administrator of FAA delete model 1 from the automation program, which would result in a savings of about $6 million.

CHAPTER 3

ACQUISITION PLAN FOR MODEL 2

According to FAA's acquisition plan, production of the model 2 system will begin before the software that is needed to achieve its operational requirements is developed. FAA's strategy is to award a production contract based upon a design verification competition that does not include software functions. This software will be developed later, while the system is being produced and installed. FAA's acquisition plan could be improved by requiring some functional software development during the initial competitive development phase. By maintaining competition in the early phase of development when it is economically feasible, FAA would not only be adhering to a key concept of the Office of Management and Budget's (OMB's) Circular A-109, but it would have greater assurance of obtaining a better system. We believe that the acquisition plan for model 2 demonstrates a need to revise the Department of Transportation and agency directives to reflect OMB's Circular A-109 acquisition approach.

ACQUISITION PLAN

FAA's acquisition plan for automating flight service stations is designed to achieve competition among contractors and to reduce risk. FAA will select up to three contractors from those that submit proposals for a 1-year design verification period. Each contractor will be required to

--develop and demonstrate solutions to specific high-risk problem areas,

--produce some simple model 1 software, and

--demonstrate the capacity of its system to handle flight service station data processing requirements.

Based on the results of this competition, a contractor will be selected to complete the development and to produce the system. FAA plans to award a fixed-price contract to the successful contractor to produce 16 model 1 and 16 model 2 systems and to award the same firm a cost-reimbursement contract for completing the development of model 1 and some model 2 software.

DEVELOPMENT TO BE ACCOMPLISHED AFTER A PRODUCTION CONTRACTOR IS SELECTED

The contractor will design, develop, produce, document, and factory test model 2 software as defined by FAA. In our opinion, developing the software for model 2 will be difficult.

While software specifications were being developed by FAA, data processing requirements increased significantly. The MITRE Corporation, FAA's technical advisors on flight service station development, recommended deferring or deleting many of the requirements so software procurement would be more manageable. MITRE believes some of the requirements have a high-technical risk associated with their development and are ill-defined without benefit of test or prototype. According to FAA, all the requirements were included in the software specification to define the total scope of the effort and to provide information for system capacity.

To reduce the high risk, FAA plans to divide software development into packages. The initial package will be small and contain only low-risk items. This allows the system to be deployed using this initial low-risk package while development continues on model 2 software. FAA officials said that when the software development contract is negotiated with the production contractor, each package will include only those requirements which are well-defined and the agency can thoroughly specify. Other high-risk software requirements will be subjected to research and development efforts under separate contracts, probably with other contractors. As the research and development is completed, the defined requirements will be included in subsequent software package awards to the production contractor.

The production contractor is also required to develop, produce, install, and test the model 2 computer system, including the aviation weather processor. Problems may be encountered in developing the computer system even after the 1-year design verification period, because the distributed processing system (which is a set of computers working together to perform a task) is not yet available as an off-the-shelf item.

In 1977 a joint FAA and MITRE Corporation study team evaluated the feasibility of a distributed processing system using minicomputers for the automation program. The team concluded that there were some high risks in such a system, but there appeared to be no technical reason why it could not be developed. FAA needs a system twice as large as any of the systems surveyed by the team and operational software which is not readily available with minicomputers.

Although some of the high-risk items are to be addressed during design verification, FAA does not require contractors to prototype their systems to demonstrate the successful operation of the model 2 hardware and software before production. FAA officials said that the amount of development and demonstration scheduled for design verification provides an adequate basis for them to adequately assess the high-risk areas affecting system design and evaluate the contractor proposals.

FAA's approach to acquiring the flight service station system demonstrates its reluctance to adhere to at least one key concept of OMB's Circular A-109--maintaining competition as long as it is economically feasible. In a previous report, 1/ we found the same conditions existed and recommended that (1) the Secretary of Transportation revise the Department of Transportation's and agency component directives to reflect the intended A-109 acquisition approach and (2) the revision should be coordinated with OMB and the Office of Federal Procurement Policy.

CONCLUSION

FAA's plan to use more than one contractor to develop a system is sound strategy, but limiting their development efforts restricts the benefits of this approach. Competitive development can result in obtaining better systems at lower costs and providing a hedge against failure of one or more technical approaches. We believe that too many high-risk items remain in the development of model 2 software for FAA to realize the benefits of competitive development. These risks should be resolved during the competitive development phase rather than wait and develop them in a sole-source

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1/"Implementation of Major System Acquisition Process--A-109--Is Inconsistent Among Civil Agencies," (PSAD-79-89, Aug. 14, 1979).

environment later. Going into production with unresolved problems increases the risks of incurring significantly higher program costs, deploying the system much later than scheduled, or accepting a system with reduced capabilities.

AGENCY COMMENTS AND OUR EVALUATION

FAA agrees there are risks in developing the model 2 system. However, it is confident the amount of development and demonstration scheduled for design verification is all that is needed to address all the high-risk areas affecting system design and that an adequate basis for evaluating contractor proposals will be provided. FAA points to its success in the enroute and terminal automation programs in developing its packaging of software requirements for production and implementation. According to the Department of Transportation, the enroute stage A and the automated radar terminal system III software were developed in packages along two paths: (1) those requirements that could be specified were produced and implemented in a sequence of packages about 6 to 9 months apart and (2) the other requirements that could not be specified were subjected to research and development before being included in the packaging scheme.

FAA views its process of developing software as effective because packaging has facilitated the implementation of automated systems. However, this process has not eliminated the problems of cost growth or schedule slippage--two items which we believe share in importance with performance.

Moreover, FAA's process of developing software for the two programs cited relied heavily on the experience of a single contractor for each system. If FAA is to have a successful implementation of its flight service station system, it is imperative that it select the best qualified contractor for development upon completion of the design verification phase. FAA's failure to take advantage of the opportunity to require the three competing contractors to perform more of the complex high-risk work during the design verification phase does not provide the greater assurance that the contractor it selects will be the best qualified; not only for the production phase, but also to do all the follow-on development that FAA may require.

The Commission on Government Procurement recommended that agencies limit premature system commitments and retain the benefit of system-level competition, at least through the

critical development stages to permit the use of firm commitments for final development and initial production. While providing for competitive development and packaging software requirements, FAA's acquisition plan for automating flight service stations requires much software development after the flight service station system design verification phase. FAA's selection of a contractor could be premature, which may result in cost growth or schedule slippage, problems it experienced in the enroute and terminal automation programs. Although FAA has some assurance of meeting its performance goals in an automated flight service station system, the amount of development remaining after design verification will probably affect its ability to meet its cost and schedule goals.

RECOMMENDATION

We recommend that the Secretary of Transportation have the Administrator of FAA include in the design verification phase the development that would be done later, taking advantage of the competition and adhering to OMB's Circular A-109 acquisition approach.

CHAPTER 4

MODEL 3 SELF-BRIEFING: FAA'S SOLUTION TO PREFLIGHT SERVICE REQUIREMENTS-- IF IT WORKS

Self-briefing, FAA's solution to providing preflight services to the general aviation public, is attractive if it works. The self-briefing feature of automation may allow FAA to meet expanding demand without increasing operating costs; however, the program lacks an effective implementation mechanism. Tests to demonstrate user acceptance of self-briefing do not support FAA's contention that a significant number of pilots will use self-briefing exclusively. Without some controls limiting pilot demands for briefings by specialists, FAA's effort to automate flight service stations could produce a system that is no more effective at meeting pilot demand than the current system.

METHODS OF SELF-BRIEFING

Pilot self-briefings will give pilots direct access to the flight service stations data base either by a direct user access terminal (DUAT) or a telephone-operated VRS. DUAT, a computer terminal owned or leased by pilots, companies operating planes, or local airports, allows a pilot to gain access to FAA's computer system directly to obtain weather and flight information and to file a flight plan. VRS, which is being developed by FAA, enables a pilot to listen to a variety of computer-generated weather products using a "touch-tone" phone or a dial phone equipped with a touch-tone pad. The pilot selects the weather product, such as surface observations or winds aloft, by entering codes with the touch-tone keys. The pilot could also file a flight plan by typing it into the system with the phone keys.

PILOT ACCEPTANCE IS KEY TO SUCCESS

Self-briefing is dependent upon pilot acceptance. Pilot acceptance will be determined by accessability of self-briefing devices, such as DUATs and touch-tone phones, simplicity of equipment operation, and the quality and type of information available.

Current limitations

Cost and availability of self-briefing devices and the amount of information to be automatically generated are problems that must be overcome before self-briefing is possible. FAA expects pilots to furnish their own DUAT. The availability of DUATs is presently limited by price. According to FAA officials, a DUAT ranges in cost from $800 to $20,000. At these prices, the agency does not expect many pilots to buy their own DUAT, but believes inexpensive DUATs will eventually be developed. Currently, FAA is relying on private industry to produce them as the market develops.

FAA officials hope an inexpensive DUAT costing as little as $100 to $150 will be developed under a joint Department of Agriculture and National Weather Service program called Green Thumb. The program is supposed to develop an inexpensive DUAT which will receive information over the telephone and display it on a television set acting like a computer terminal. Using this system, farmers would have access to a computerized agricultural information system from their homes.

Availability rather than price is a problem with touch-tone telephones. FAA estimates that only 40 percent of the telephones currently installed in the United States are touch-tone. FAA expects pilots will get them by the time VRS is operational nationwide. If the touch-tone telephone is not available, pilots can buy touch-tone key pads ranging in price from $30 to $80 and install them on their dial telephone.

The weather information presently available on VRS is also limited. If VRS is to be a substitute for a specialist, it must provide more information to pilots than it currently does. This will be difficult because FAA receives weather data in a nonstandard format and in free text containing many abbreviations and contractions. Under these conditions, it is impossible for a computer with a limited prestored vocabulary to automatically generate a weather briefing. The lack of standardization results from the wide variety of dissimilar and nonrecurring weather phenomenon and conditions which must be described. The more words provided in its computer vocabulary, the more complex and expensive VRS becomes. We were advised FAA is working on this problem. The agency is optimistic that by the early 1980s it will have developed the VRS product line to the point where it will substitute for a specialist briefing.

Despite the limited amount of information it now provides, VRS received an enthusiastic response from pilots who used it for weather briefings in a 1978 Washington, D.C., area test. Although the test results are still being evaluated, preliminary indications are that the pilots will be willing to use VRS if FAA is able to get the system to provide enough information.

Although the flight plan filing capabilities of VRS were not part of the Washington, D.C., test, some pilots suggested that using touch-tone keys to enter flight plans might be awkward. FAA believes it is feasible, based on the results of a VRS flight plan filing test that it conducted with its own pilots. It was the general consensus of FAA pilots that VRS was not an unwieldy flight plan filing method, despite the fact that anywhere from 110 to 265 keystrokes were required depending on the test format used. Development of this capability is continuing with a goal to reduce flight plan entry to 70 keystrokes. At the time of our review, FAA had not run a flight plan filing test with pilots from the private sector.

MECHANISM NEEDED FOR EFFECTIVE IMPLEMENTATION OF SELF-BRIEFING

Assuming that the equipment limitations can be solved in time, the question remains whether pilots will use the automated system or continue to rely on direct contact with specialists. For the automation program to be effective, self-briefing must significantly reduce pilot demands for specialist briefings.

By 1995 FAA assumes 70 percent of the weather briefings and 85 percent of the flight plan filings will be accomplished by pilots without assistance from flight service station specialists. Very little has been done to support these assumptions. FAA has not performed a market analysis to evaluate pilot reaction and motivation in choosing between self-briefing and a specialist briefing. Whether these results are obtainable is highly questionable. FAA believes its tests to demonstrate self-briefing were successful from the standpoint of establishing pilot acceptance. However, a major shift from specialist briefing to self-briefing did not occur.

An FAA official believes the projected 1995 self-briefing percentages are realistic goals which can be achieved by

simply limiting pilot access to specialists. If estimates of increasing demand prove correct and additional specialists or telephone lines are not added, pilots will be forced to rely on self-briefing. If this approach is implemented, we believe it would arbitrarily limit access to a specialist and deny access to pilots who need special assistance.

Flight service station officials and specialists were doubtful that many pilots would rely on self-briefings. In their opinion, pilots will be more confident getting weather information from a person rather than a machine. They noted the following problems which limit self-briefings and require pilots to contact specialists.

--Many pilots are part-time flyers who may not keep up their knowledge on interpreting weather or be willing to buy self-briefing equipment.

--Pilots who fly in unfamiliar areas may want to ask questions about their route of travel, such as local weather phenomena, that can not be answered through the self-briefing system.

--The self-briefing system will not be capable of differentiating between experienced and inexperienced pilots. Specialists tailor their briefings to the needs and experience of each pilot and the capabilities of the aircraft.

--Pilots frequently file incorrect flight plans which will be rejected by the system requiring assistance from a specialist. (Processing flight plans is a significant part of the flight service station workload.)

CONCLUSIONS

We believe the general aviation demand for preflight services can be accomplished through self-briefing. However, self-briefing is not possible at this time. VRS does not yet provide pilots with all the weather information necessary for planning a flight nor is it wholly suitable for flight plan filing. DUATs probably would be more acceptable for this function, but most pilots may not be willing to buy the terminal unless the price is reduced drastically.

If automation is to be successful, self-briefing must be substituted for a specialist's assistance and pilots should have access to the specialists only when necessary. Because of their experience and knowledge of unusual conditions in certain areas, specialists can assist pilots with special problems and provide information which may not be available in the computer data base. Some control on specialist preflight services is necessary to achieve high rates of self-briefing. Meeting the demand for specialist services is a problem when pilots have unlimited access to a limited number of specialists.

FAA's test to demonstrate self-briefing indicates pilots will use self-briefing and continue to seek the services of specialists. Without some control over pilots, however, a potential exists for excessive recourse to specialists, denying pilots who need special help access to a specialist and eliminating the benefits of self-briefing.

AGENCY COMMENTS AND OUR EVALUATION

The Department of Transportation agrees that pilots need to be encouraged to use self-briefing. It believes user education and development of useful products will be the key to success of the program rather than negative persuasive mechanisms. The use of such features could, in the agency's opinion, reduce usage of the service and compromise flight safety.

We believe automation and self-briefing should improve flight safety. FAA's studies have shown a definite improvement in the quality of briefings with automation. Quality is improved by using the most recent weather data, pilot reports, and greater access to enroute weather conditions. It is difficult to quantify these factors, but they contribute to avoidance of aircraft accidents and enhance the pilot's ability to operate the aircraft more economically.

When implemented on a national scale, self-briefing will provide another source for pilots to get aeronautical data other than going to FAA specialists. This is important because the future demand for services is estimated to grow but the authorized FAA staffing level to do the job will not increase proportionately, making one-on-one briefings impossible. Even now, the demand for flight services cannot be met during peak periods.

The future demand for flight services will be satisfied by both specialists and self-briefings. We believe the mix between specialists and self-briefing is as important as the services provided. Although education and development of useful products are important to encourage self-briefing, the program's success is dependent on meeting the needs of pilots. FAA's own estimates note that about 30 percent of the demand for information will be met by specialists. We believe that access to a specialist should be controlled to assure that those pilots who need this assistance get it. Further, the first come, first serve approach being adopted by the agency is inadequate because it does not discriminate between pilots who need special help and those who are able but unwilling to self-brief. It is important to note that pilots will have to incur some expense to self-brief by purchasing DUATs or leasing touch-tone telephones. However, as long as access to a specialist remains free, a significant number of pilots may not invest in a self-briefing capability.

RECOMMENDATION

Without compromising flight safety, the Secretary of Transportation should require the Administrator of FAA to develop a mechanism controlling pilots' demands for specialist preflight services, discouraging excessive recourse to specialists, and assuring effective implementation of the pilot self-briefing concept.

APPENDIX I

OFFICE OF THE SECRETARY OF TRANSPORTATION

WASHINGTON, D.C. 20590

ASSISTANT SECRETARY
FOR ADMINISTRATION

May 30, 1979

Mr. Henry Eschwege
Director
Community and Economic
Development Division
U. S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Eschwege:

We have enclosed two copies of the Department of Transportation's (DOT) reply to the General Accounting Office (GAO) report, "FAA's Plans For And Status Of Its Flight Service Station Automation Program." GAO and the Department are in agreement with the need for developing an automated Flight Service Station system. However, we do not agree on how best to accomplish this automation program. Our detailed comments are provided in the enclosed statement.

If we can assist you further, please let us know.

Sincerely,

Edward W. Scott, Jr.

Enclosure

APPENDIX I

DEPARTMENT OF TRANSPORTATION REPLY TO GAO DRAFT REPORT OF APRIL 6, 1979 ON FAA'S PLANS FOR AND STATUS OF ITS FLIGHT SERVICE STATION AUTOMATION PROGRAM

SUMMARY OF GAO FINDINGS AND RECOMMENDATIONS

The General Accounting Office (GAO) report recognizes the need for developing an automated Flight Service Station system but is critical of the Federal Aviation Administration's (FAA) proposed automation plans. GAO states that automation will be implemented in segments called Models 1, 2, and 3. GAO believes that Model 1, a temporary system designed to automate the 43 busiest stations in the network, is no longer needed because of other improvement programs and that $6 million in costs could be saved.

With respect to Model 2, which will automate the specialist functions for Flight Service Stations, GAO states that FAA's concurrent development and production plan will result in production of the Model 2 units before the high-risk software required for automation has been developed. GAO recognizes that FAA plans to divide software development into packages so as to minimize risk; however, they conclude that the initial software package as defined in the current request for proposals is large and contains many high-risk items which negates the packaging concept. GAO foresees complications in developing the production systems and notes that although most of the high-risk items will be addressed during the one-year design verification, FAA does not require contractors to prototype their system to demonstrate system capabilities, both hardware and software.

Concerning Model 3, pilot self-briefing, GAO believes this to be a viable concept for obtaining preflight services, but they believe that most pilots will resort to the use of a specialist for these services unless discouraged.

GAO recommends (1) deletion of Model 1 from the automation program, (2) an increase in the amount of Model 2 development planned during the design verification phase, requiring contractors to develop software packages and run them on an operational prototype of the proposed system, before contracting for production, and (3) develop a mechanism to discourage pilots' demands for preflight services from specialists and thus assure effective implementation of the pilot self-briefing concept.

POSITION STATEMENT

GAO and the Department are in agreement with the need for developing an automated Flight Service Station system; we do not, however, agree on how best to accomplish this automation program.

2

The Department considers its "evolutionary" approach to developing the Flight Service Station Automation Program to be correct. By first initiating its Model 1 system and gaining specialist and user acceptance prior to proceeding with the Model 2 and 3 systems, the agency will achieve (1) early initiation of an automated system with attendant cost benefits from greater employee productivity and user availability, and (2) a systematic expansion that allows the agency to build on its previous successes while isolating technical risks and minimizing cost waste. Our comments with regards to the GAO recommendations follow:

1. With respect to the first recommendation, we do not agree that Model 1 should be deleted. Model 1 is not a temporary system; it is a subset of Model 2 hardware and software. Model 1 contains a number of operational refinements not included in the current Flight Service Station improvement programs. These refinements will allow greater employee productivity and increase user data availability by eliminating much of the labor intensive needs of the present system. For example, Model 1 will provide:

   - o Dynamic Briefing Selectivity - The ability to select weather data by route or localized areas in detailed, summary, or trend formats.
   - o Storage, Processing, and Selective Display of Flight Movement Data - The storing, processing and recall of individual flight plans.
   - o Route Validation of Flight Plans - The ability of the system to identify and reject improperly filed flight plans.
   - o Prestored Flight Plans - A recall and entry mechanism for filing repetitive flight plans from the same user.
   - o Message Accountability and Event Reconstruction - Total recall of all messages received and sent, and events that have occurred.
   - o Position Alerts - Automatic alert of special conditions such as abnormal weather or facility outages.
   - o Random and/or Fixed Format Data Entry - The ability to change portions of previously filed flight plans and initiate new flight plans through a fixed format.

2. Concerning the second recommendation, the Design Verification phase was specifically planned to promote competition from computer systems designers with emphasis on those areas we determined to be technical risks.

3

Model 2 operations software, as specified in the initial request for proposals, does include some operational requirements not thoroughly defined. This was purposely done to establish the scope of the effort and to provide a basis for systems sizing. A year from now when the software production contract is negotiated, the Model 2 software will be defined in packages for design and production. Each package will include only those functions we can thoroughly specify. There are functions requiring further research and development, and these will be added into the packaging scheme when appropriate.

Packaging of requirements for software production and implementation is a process developed by the agency through years of experience in en route and terminal automation. Some 15 years ago, as air traffic control automation for the National Airspace System got underway, software production plans encompassed requirements that were not well defined and required some conceptual work before production. At that time we experienced implementation difficulties.

From this experience, En Route Stage A and ARTS III program software plans developed along two paths. Production and implementation were based on a sequence of packages, about 6 to 9 months apart, each package was of known requirements; i.e., specifications were available to guide production. Along another path those requirements that could not be specified for production were subjected to research and development. Through successive tests the unknowns were determined culminating in test demonstrations conducted on the current field operational software. Success in the latter, complemented by software production specifications, resulted in production packages for implementation. An example of this process was the development and implementation of conflict alert in both the en route and terminal areas.

3. With respect to the third recommendation, we agree that pilots need to be encouraged to use self-briefing. It is our opinion that self-briefing will, in time, absorb more and more of the user demand. We believe that user education, and system products of value to the user, will be the key to this success. We do not support negative persuasion such as a user charge or toll calls, since this could lead to reduced usage and a compromise of flight safety.

4. Regarding the Voice Response System (VRS) implementation program for pilot-initiated weather briefings, we do not agree with GAO that a system technical problem (computer vocabulary) as well as product standardization will require a protracted effort to resolve.

4

We do agree that "computer vocabulary" currently excludes entry of flight plans into the system. We believe, however, that the vocabulary is fully adequate to produce all products currently required to meet the needs of a large segment of the general aviation community.

As noted in the report, message standardization is a key to triggering computer-generated voice response weather briefings. Standardizing the products at the source has greatly alleviated the vocabulary problem. This work is progressing very well as a joint effort of the FAA and the National Weather Service (NWS). This summer, for example, hazardous weather information available from the NWS will become an added VRS product. We are optimistic that by the early 1980's as we implement automation for pilot self-briefing the product line will be a viable substitute for a specialist briefing.

Specific comments on facts, conclusions and recommendations contained in the draft report are enumerated in the enclosure.

We thank you for the opportunity to comment on the draft report.

GAO note: Detailed comments in the enclosure have been considered and are not included in this report.

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