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Report to Brock Adams, Secretary, Department of Transportation; by Richard W. Gutmann, Director, Logistics and Communications Div.

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Contact: Logistics and Communications Div.
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Organization Concerned: Federal Aviation Administration.
Congressional Relevance: Senate Committee on Commerce, Science, and Transportation.

The Federal Aviation Administration's (FAA's) planned modernization of its Very High Frequency Omnidirectional Range (VOR), Tactical Air Navigation (TACAN), and Distance Measuring Equipment (DME) navigation systems may exceed $120 million. They are scheduled to be installed over a 3- to 4-year period beginning in mid-1980. The replacement of about 135 solid-state DMEs does not appear to be cost beneficial, especially since the estimated $3 million replacement cost will not be fully recovered until after the year 2020. FAA's planned replacement schedule needs improvement, and its projected staff savings seem to be inflated. The Secretary of Transportation should: retain the 135 solid-state DMEs rather than purchase replacement equipment because the feature providing the capability for remote maintenance monitoring may be short-lived with the emergence of NAVSTAR, evaluate the equipment replacement priority schedule by giving appropriate consideration to the reason for system outages and revise it where necessary, and reevaluate the staff savings claimed by FAA for the VORTAC modernization program. (HTW)

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

LOGISTICS AND COMMUNICATIONS DIVISION

B-180715

OCTOBER 23, 1978

The Honorable Brock Adams
The Secretary of Transportation

Dear Mr. Secretary:

The General Accounting Office has completed a review of the Federal Aviation Administration's (FAA) planned modernization of their Very High Frequency Omnidirectional Range (VOR), Tactical Air Navigation (TACAN) and Distance Measuring Equipment (DME) navigation systems. The review was requested by two subcommittees of the Congress; Transportation Subcommittee, House Committee on Appropriations and the Subcommittee on Transportation, Aviation and Weather, House Committee on Science and Technology.

Our purpose was to evaluate FAA's cost benefit study for this modernization and to determine (1) if all equipment needed to be replaced and (2) what priorities FAA used in determining the equipment it would replace with fiscal year 1978 and 1979 funds. Our prior report to the Congress, "Navigation Planning--Need for a New Direction," March 21, 1978, (LCD-77-109), considered VORTAC to be potentially unneeded by the 1990s. Therefore, the subcommittees were especially concerned about whether the operating and maintenance cost savings of the proposed new system would offset the cost of new VORTAC equipment, (combination of VOR and TACAN) prior to the implementation of the military NAVSTAR/GPS satellite navigation system and a transition to that system by the early or mid 1990s.

On June 27, 1978, we briefed staff members of the Transportation Subcommittee, House Committee on Appropriations, on the results of our review and told them that we saw no reason to reduce the fiscal year 1979 funds requested for the VORTAC modernization. This conclusion was based on the age of the equipment, the maintenance required, the estimated patch up cost of the current system, heating and air conditioning cost

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savings which were not considered in FAA cost benefit studies, and the payoff date of the new equipment, which in our opinion, is about the same time NAVSTAR/GPS could conceivably replace VORTAC. However, in the course of our work we noted some matters which should be further addressed by FAA. In particular, we recommend that you:

--Retain the 135 solid-state DMEs, some of which only recently have been installed, rather than purchase the new replacement equipments because their feature providing the capability for remote maintenance monitoring (RMM) may be short-lived with the emergence of NAVSTAR.

--Evaluate the equipment replacement priority schedule, by giving appropriate consideration the reason for system outages, and then, where necessary, revise it. Analysis of the replacement schedule shows that those TACANs requiring the most maintenence were not being replaced first.

--Reevaluate the staff savings claimed by FAA for the VORTAC modernization program.

BACKGROUND

FAA operates the nationwide VORTAC system which provides the basic guidance for enroute air traffic in the United States. There are now 177 VOR, 704 VORTAC (combination VOR and TACAN), and 45 VOR/DME (combination VOR and DME) facilities commissioned in the National Air Space. The annual cost to operate these facilities is about $40 million. Most facilities, depending on importance, have dual (backup) equipment which helps ensure against facility outages. About 35 percent of the VOR equipment was installed during 1943-46, 27 percent during 1951-56 and 38 percent during 1957-62. The TACAN transmitters were installed from 1957-60. The majority of this equipment is vacuum tube operated; vacuum tube resupply sources are dwindling. The DMEs consist of nine of the TACANs whose azimuths have been shut off 1/ and 36 solid state transmitters installed after 1973.

1/ When the azimuths are shut off the TACANS provide distance measuring signals identical to DME transmitters.

FAA is pursuing a program to replace each VOR, TACAN, and DME with remote-monitored solid-state equipment. The cost of the program may exceed $120 million and is scheduled to be installed over a 3 to 4 year period beginning in mid-1980. The new system will be capable of operating through the year 2000. FAA's cost benefit study estimates that its investment in facilities and equipment will be recovered by 1990 (payoff date) through savings in operating and maintenance costs. This is after discounting such savings to their present value to recognize the return they would earn, if invested at a 10 percent 1/ return, during this period. The replacement program is being undertaken primarily because of the age of the existing equipment and the large maintenance effort required to sustain the equipment. FAA estimates that when the new equipment is installed the annual operation and maintenance cost will be reduced to about $17.4 million. This is primarily the result of FAA's estimated savings of about 723 staff-years.

The Congress appropriated for FAA $15 million in fiscal year 1978 to begin replacing the oldest equipment. FAA has requested an additional $30 million in fiscal year 1979 and plans to request the remainder in 1980.

In April 1978, a Request for Proposal was issued which consolidated the purchases to be made with fiscal year 1978 and 1979 funds and allowed FAA the option (480 days after contract date) of acquiring the remaining equipment. A contract is expected to be awarded in early 1979.

REPLACEMENT OF SOLID-STATE DMEs NOT COST BENEFICIAL

The replacement of about 135 solid-state DMEs does not appear to be cost beneficial, especially since the estimated $3 million replacement cost will not be fully recovered until after the year 2020. Although FAA presently has only 36 solid-state DMEs collocated with VORs, an additional 99 solid-state

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1/ The discount rate is described as an estimate of the average rate of return on private investment, before taxes and after inflation. OMB specifies that a 10 percent discount rate should be used by Federal agencies when computing the payoff date for investments.

DMEs are under contract to be installed at VOR sites prior to the VORTAC modernization program. All DMEs are scheduled for replacement in the VORTAC modernization program. Officials said that the solid-state DMEs being replaced would be used by FAA at Instrument Landing System facilities.

Airway Facility Service officials of FAA advised us that the primary reason for replacing the 135 solid-state DMEs is to give the VORTAC system a complete remote maintenance monitoring (RMM) capability. Although some of the DMEs that will be replaced have this capability, Airway Facility Services officials advised us that they are not compatible with the remote maintenance equipment of the modernization program. They also stated that the possibility of making the RMM capability of the present solid-state DMEs compatible with the newer equipment should be evaluated.

FAA did not include the DMEs in the VORTAC cost benefit study because of the small number in service at the time of the study. An analysis of the replacement of the DMEs showed that the operations and maintenance savings for the remote capability associated with the DMEs would be only about $200,000 per year in 1978 dollars. If the $3 million facilities and equipment costs estimate is valid, then, at a 10 percent discount, the payoff would extend well beyond 2020. Agency officials agreed that the replacement of this equipment should be reconsidered due to the long payoff time.

Although we realize that one of the primary features of the new system is its ability to RMM the equipment, we believe that with NAVSTAR's emergence this feature may be short-lived. Therefore, we believe that rather than purchasing the new DMEs FAA should determine whether it would be cost effective prior to NAVSTAR to complete remote maintenance monitoring of the current solid-state DMEs. If FAA decides not to acquire these DMEs it would not alter their present contract proposal because 62 DMEs were listed as options and 74 inadvertently omitted from the request for proposal.

REPLACEMENT RRIORITY SCHEDULE NEEDS REVISING

FAA's planned replacement schedule can be improved. The facilities requiring the most maintanence time and resulting in the most outages are not being replaced first, nor is FAA

following the dictates of the Congress, which, in appropriating fiscal year 1978 funding for the replacement of VORTAC equipment, directed FAA to begin replacing the oldest equipment first. Instead, FAA established a replacement priority schedule based on replacing the oldest TACANs first, some of which have been in service 15 years less than the oldest VORs. Its justification was that TACANs were causing the most problems and were requiring the most maintenance.

We questioned this justification and FAA's criteria for this action. Analysis of the replacement schedule shows that those TACANs which, according to FAA's staffing standard, were requiring the most maintenance were not being replaced first. Further, a comparison of the replacement schedule with the facilities having the most outages during calendar year 1977 showed that these facilities were not being replaced first.

In reponse, FAA officials advised us that they realize additional consideration needs to be given the priority schedule. They also pointed out that there are other factors (i.e., weather conditions) besides equipment failure which cause outages and that these factors may account for the high number of outages experienced by some of the facilities.

Although the entire replacement program is scheduled to take only 3 to 4 years, we believe that the facilities which have the most equipment failures and require the most staff time to maintain should be replaced first. By doing this, FAA could realize maximum staff savings more quickly and ensure that the least troublesome equipment is in operation should future years' funds not be available to complete the entire program. Therefore, we believe that FAA should evaluate the replacement priority schedule, giving appropriate consideration to the reason for the outages, and then, where necessary, revise it.

PROJECTED STAFF SAVINGS APPEAR TO BE INFLATED

In projecting the staff savings due to the VORTAC modernization program, FAA:

1. Did not consider an ongoing study which indicates that FAA may be performing excessive preventive maintenance on the present system.

2. Did not consider new solid-state equipment which will be installed prior to the modernization program.

3. Overstated staff savings resulting from the remote maintenance monitoring capability.

4. Used the factor most beneficial to FAA for computing support and administration savings under the new system.

As a result, projected staff savings are highly optimistic and probably will not be fully realized.

Since September 1977, the MITRE Corporation, under contract to FAA, has been conducting a study of VORTAC maintenance. The purpose of the study, which will be completed about September 1978, is to validate a mathematical model which indicates that if the visitation rate to VORTAC sites is reduced from the present twice weekly to biweekly, the resulting average number of failures (not synonymous with outages) per year for each facility will increase by approximately one failure. As of May 1978 the failure rates for all facility groups in the study were within the statistical bounds of the failure rate predictions. If the tests validate the model, it will mean that, by changing to biweekly visits, FAA could probably save about 100 staff years annually.

Prior to the VORTAC modernization program, FAA will install 150 solid-state VOR transmitters at various facilities. FAA estimates that this equipment will result in an annual savings of about 23 staff years. However, these savings were not considered when estimating the savings for the modernization program.

FAA also claimed a staff savings for environmental preventive maintenance due to remote maintenance monitoring. This was incorrect. Although the system will have the capability to accept environmental remote maintenance monitoring, FAA will have to provide this function at a later date. Therefore, staff savings projected in the cost study due to this feature will not be realized at the present projected cost.

FAA was also overly optimistic in estimating the support and administration workload savings under the modernization program. Workload savings are determined by multiplying a percentage factor by the direct workload staffing. In its cost benefit study for the VORTAC modernization program, the MITRE Corporation used a factor of 19 percent. FAA, however,

recomputed the support and administration savings using a factor of 34 percent. This 15 percent variance accounts for approximately $2 million of FAA's anticipated annual operations and maintenance savings which consist of an annual savings of approximately 30 staff-years.

FAA maintains that the problem with MITRE's 19 percent is that the number is used only when there is a small number of facility changes and includes only the variable support and administration positions. VORTAC, however, is national in scope and therefore may involve a reduction in some fixed support and administration positions. FAA's 34 percent allows for a proportionate reduction in all fixed support and administration positions, thus assuming that there will be a reduction in the number of geographic sectors.

Airway Facility Services officials did not have sufficient documentation to support FAA's contention that 34 percent is the appropriate factor for both generations of equipment; instead, they rely on estimates based on their experience and knowledge. After numerous meetings, the officials advised us that the percentage is an estimate based on the assumption that the sector field office chiefs will be reduced by an estimated 100 postions. The officials also advised us that the VORTAC modernization program will result in the elimination of five sectors and approximately 48 support and administration positions even though the Director, Airway Facility Services, advised us that FAA currently has no firm plans to revise its sector alinement because of the VORTAC modernization program. Although we agree with FAA that the 19 percent factor is not necessarily appropriate, we believe that the 34 percent factor is an overstatement of the reasonable support and administration workload savings because it assumes that all fixed support and administration positions will decrease proportionately to direct work staffing.

FAA officials advised us that even though some operations and maintenance cost savings may have been overstated, these will probably be offset by savings realized through reduced power comsumption. Building heating and air conditioning costs were not calculated into the previous cost benefit studies, and with anticipated consumption of the new equipment now available, FAA can reduce power requirements for the equipment by 50 percent instead of the 25 percent previously anticipated.

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 House Committee on Government Operations and the Senate Committee on Governmental Affairs 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 House and Senate Committees on Appropriations; House Committee on Government Operations; Senate Committee on Governmental Affairs; House Committee on Public Works and Transportation; Senate Committee on Commerce, Science and Transportation; and the House Committee on Science and Technology and its Subcommittee on Transportation, Aviation and Weather. We are also sending copies to the Director, Office of Management and Budget and the Assistant Secretary for Communications and Information, Department of Commerce.

Sincerely yours,

R. W. Gutmann
Director