REPORT TO THE CONGRESS

BY THE COMPTROLLER GENERAL OF THE UNITED STATES

Difficulties Of The Federal Aviation Administration In Acquiring The ARSR-3 Long Range Radar System

Department of Transportation

The Federal Aviation Administration is buying ARSR-3 long range radar systems for en-route air traffic control purposes for about $45 million.

The agency did not follow certain well-recognized procurement practices in acquiring the new system. As a result, it (1) incurred additional costs, (2) permitted what appears to have been a buy-in by the contractor, and (3) is not yet assured that it will obtain satisfactory equipment.

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

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To the President of the Senate and the
Speaker of the House of Representatives

This report examines problems encountered by the Federal Aviation Administration in managing a prototype long range radar system contract and suggests ways by which the agency might improve its administration of future developmental efforts.

We made our review pursuant to the Budget and Accounting Act, 1921 (31 U.S.C. 53), and the Accounting and Auditing Act of 1950 (31 U.S.C. 67).

Copies of this report are being sent to the Director, Office of Management and Budget, and the Secretary of Transportation.

Comptroller General
of the United States

Contents

ABBREVIATIONS

AFS	Airway Facilities Service
ARSR	Air Route Surveillance Radar
BOB	Bureau of the Budget
FAA	Federal Aviation Administration
GAO	General Accounting Office
IFR	instrument flight rules
NAS	National Airspace System
TSARC	Transportation System Acquisition Review Council
USAF	United States Air Force

COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

DIFFICULTIES OF THE FEDERAL AVIATION ADMINISTRATION IN ACQUIRING THE ARSR-3 LONG RANGE RADAR SYSTEM
Department of Transportation

D I G E S T

The Federal Aviation Administration is acquiring an improved long range radar system intended to make flying between airports safer in the United States. However, the agency has encountered difficulties because it did not follow well-recognized procurement practices in acquiring the $45 million system.

The new long range equipment is called the Air Route Surveillance Radar-3. It is capable of tracking aircraft within a 200-mile radius and incorporates solid state electronics and other improvements over existing long range radars. The program includes acquiring 22 stationary and 4 mobile long range radars, 11 secondary beacon sites, and relocating several older long range radars.

By not following well-recognized procurement practices in contracting with the Westinghouse Electric Corporation, the Federal Aviation Administration

--incurred additional costs,

--permitted what appears to have been a buy-in by the contractor, and

--is not yet assured that it will obtain satisfactory equipment.

The circumstances are these:

--The agency entered into a cost-type contract for a prototype system based on a proposal that projected costs below what the agency estimated would be incurred by Westinghouse.

--Although a prototype system was not produced, costs of over $4 million were incurred on the original contract.

In addition to the inappropriate procurement practices leading to the award of the initial contract, the agency compounded its problems by not administering the contract properly. It did not establish a detailed in-house cost estimate for the prototype system and did not require Westinghouse to provide periodic estimates of costs incurred in relation to the complete cost of the contract.

Although Westinghouse informed the Federal Aviation Administration in April 1973 of a $175,000 overrun, the agency did not learn about a 100-percent cost increase until Westinghouse announced it in August 1973. The agency subsequently suspended the prototype effort and later, after a formally advertised, two-step competition, entered into a fixed-price production contract with Westinghouse.

There apparently has been a difference of opinion among agency personnel as to the technological risks involved in this program. It is not clear whether or not a prototype system was required to demonstrate operational capability. In view of the uncertainties as to the technical risks involved, it is questionable whether a fixed-price production contract should have been awarded.

The agency's poor management of this acquisition affected competition for both the prototype and production contracts. By awarding a prototype contract based on an unrealistically low cost estimate by Westinghouse, some contractors were eliminated from the program. Because Westinghouse had expended over $4 million in development and testing, it would naturally have had an advantage over any other contractor attempting to bid for the production contract.

CHAPTER 1

INTRODUCTION

During the mid-1950s, both congressional and executive committees found that the Nation's airspace was overcrowded, and airports, navigation aids, and the air traffic control system had become outdated. This was tragically confirmed in June 1956 when two airliners collided over the Grand Canyon, claiming 128 lives.

Later that year, the Civil Aeronautics Administration announced a contract award for 23 long range radar systems for enroute air traffic control purposes. Between 1957 and 1964, the Raytheon Company produced long range radar systems, designated Air Route Surveillance Radar (ARSR) -1 and -2, 49 of which are operational today.

The Congress responded to the need for increased air traffic control capability by passing the Federal Aviation Act of 1958. The act replaced the Civil Aeronautics Administration with the Federal Aviation Agency (now the Federal Aviation Administration (FAA)), an agency of the Department of Transportation which was given the authority to regulate the use of all airspace over the United States and to operate a unified air traffic control system.

To reduce air traffic hazards, the President requested FAA in March 1961 "to prepare a practicable long-range plan to insure efficient and safe control of all air traffic within the United States." The resulting Project Beacon task force recommended using general purpose computers to upgrade FAA's enroute and terminal air traffic control system.

In 1967 FAA developed the National Airspace System (NAS) to fulfill Project Beacon's objectives. When fully implemented, NAS is to provide automated air traffic control services throughout the 48 contiguous States to increase the capability of the Nation's airways to handle growing traffic volumes with greater safety and efficiency.

In 1966 and 1968, NAS planners studied (1) the long range radar system and evaluated its ability to meet predicted air route traffic control equipment needs and (2) how the long range radar data requirements would mesh with NAS. The studies noted that existing enroute system capacity problems would intensify as air traffic increased. Adequate enroute control, the studies concluded, could be achieved by expanding the long range radar system.

Objectives promulgated in the studies entailed providing continuous long range radar surveillance above 6,000 feet in most of the continental United States. This would detect about 85 percent of all enroute aircraft operating under instrument flight rules (IFR), cover all high density routes, and attain virtually complete coverage at 18,000 feet.

As a result of these studies, $6 million was appropriated in 1969 to purchase five ARSR-3s. This purchase, however, was postponed because of Bureau of the Budget (BOB) concern over possible duplication of the FAA system with the United States Air Force (USAF) system. USAF announced plans to phase out a number of its long range radars. Recognizing the availability of surplus units and that the FAA network could result in duplicative FAA-USAF long range coverage, BOB directed that the planned ARSR-3 program be suspended pending resolution of these factors. Accordingly, a joint FAA-USAF group was formed to develop a consolidation plan and establish joint-use long range radar sites. The group's report, completed in October 1970, reaffirmed the need for a 112 unit long range radar system, consisting of existing FAA units, USAF surplus systems, and ARSR-3s. Program funds were released by BOB late in 1971.

In January 1974 another FAA study reaffirmed the need for additional long range radar coverage. It considered using secondary beacon radar (which transmits signals for guidance) at low density locations without ARSR-3 primary equipment. As a result, 11 beacon-only sites were added to the long range system to meet radar coverage requirements in lightly used airspace.

IFR traffic handled by FAA air traffic control centers, which receive data from long range radar sites, has increased steadily from 11.7 million aircraft in 1964 to 23.1 million in 1974. During this period, FAA increased the number of long range radars by about 31 percent by acquiring and rehabilitating retired USAF radars. FAA estimates that by 1987 it will handle over 37 million IFR aircraft. By integrating the expanded long range radar system into NAS, FAA expects to accommodate this increasing traffic between terminals economically and safely.

We reported on the problem of midair collisions in our report entitled "Aircraft Midair Collisions: A Continuing Problem" (B-164497(1), Oct. 23, 1974). The development of FAA's Upgraded Third Generation developmental program is being addressed in one of our ongoing reviews. We

will report on the need to resolve issues and improve management of systems acquisitions for this program.

SYSTEM DESCRIPTION

ARSR-3 is to be an improved long range radar capable of tracking aircraft within a 200-mile radius. Utilizing solid state electronics, narrow band data transmission, and improved target detection features, the radar will itself act as a subsystem in the automated NAS.

While ARSR-3 will be similar to earlier long range radars in range, frequency, and transmitter power, it will embody some major improvements, such as:

--A higher level of reliability and, consequently, a greater time between failures. Solid state circuitry will replace the increasingly scarce and costly vacuum tubes used in earlier radars.

--Transforming radar signals into a form suitable for (1) computer processing by using a digital target extractor and (2) subsequent alphanumeric display in air traffic control centers. The digital target extractor will be dual channel for redundant capability in contrast to the present single channel digitizer used on all present FAA radars.

--Eliminating clutter or unwanted display of nonmoving objects on the radar screen by a combination of superior digital moving target indicator and range azimuth gating system. This pinpoints stationary targets and selectively removes their images from the display screen.

Each ARSR-3 site will include a secondary, or beacon, subsystem in addition to the primary reflective radar equipment. Acting as a component of the ARSR-3, the beacon transmits a signal to which aircraft equipped with transponders emit a response giving data on location and position. Simultaneous operation of the primary and secondary radars provides a high level of confidence that all aircraft within range have been identified.

Although no ARSR-3 equipment has entered service, three FAA staff studies have indicated that the long range radar system will provide the desired level of enroute coverage.

SCOPE OF REVIEW

Information for this review was obtained by reviewing reports, correspondence, cost, technical records, procurement contracts, and other records at the Federal Aviation Administration, Washington, D.C., and the Westinghouse Electric Corporation, Baltimore, Maryland. We also interviewed officials from the Department of Transportation and FAA headquarters in Washington, D. C.

FAA and Westinghouse Electric Corporation officials reviewed a draft of the report. There was no substantive disagreement with the contents of the report and their comments are incorporated as appropriate.

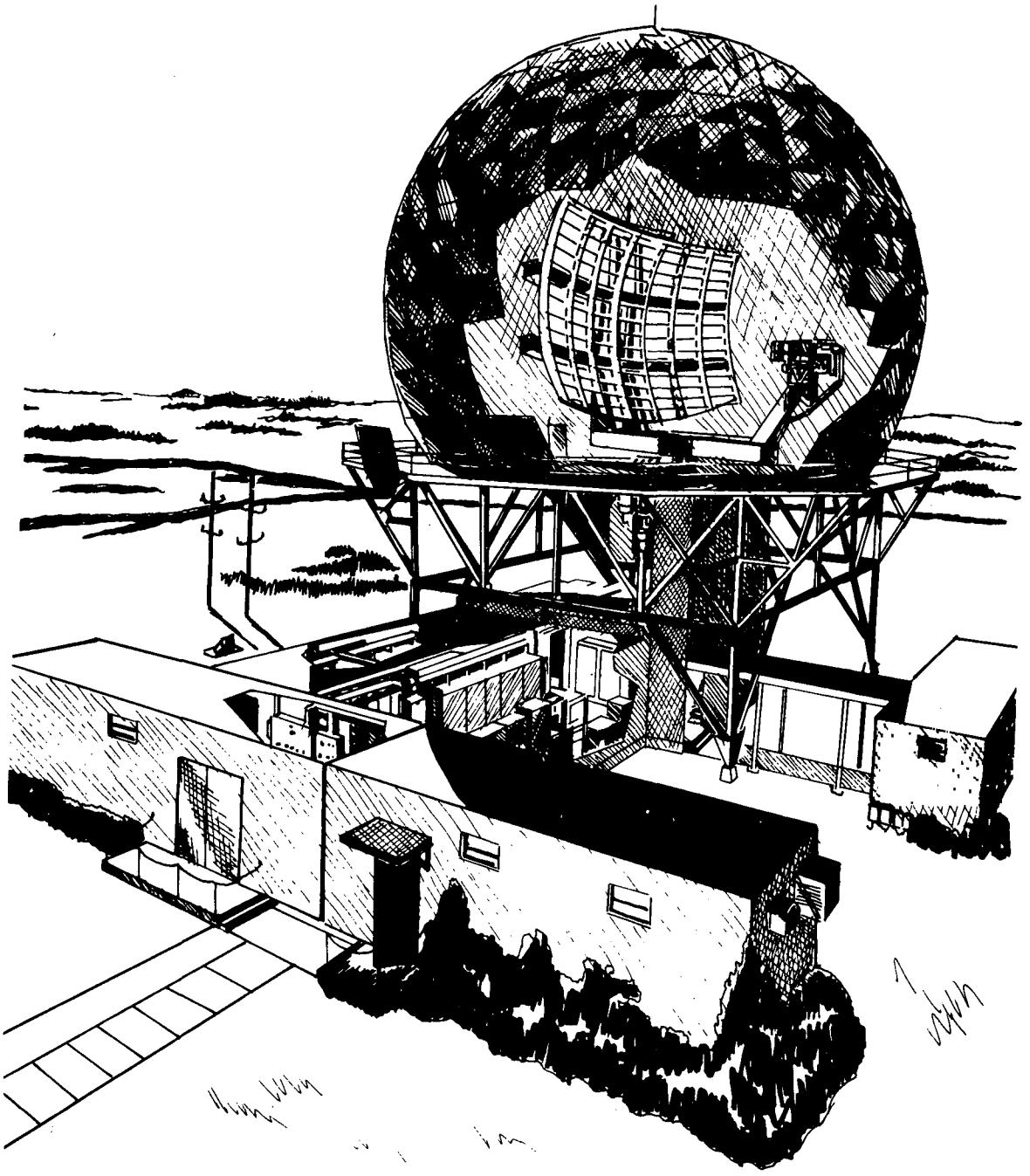
The Secretary of Transportation should:

--Require that the Federal Aviation Administration develop detailed independent cost estimates for systems it plans to purchase and evaluate differences between its internal estimates and contractor price proposals.

--Require that the Federal Aviation Administration assure, by a complete review of proposals, that contractors can produce at proposed prices, particularly when price proposals have been reduced significantly.

--Have the Federal Aviation Administration require that contractors provide periodic cost-to-complete estimates, especially when cost reimbursable contracts are used, so that the agency can monitor performance progress in relation to costs incurred.

Federal Aviation Administration and contractor officials reviewed a draft of this report. There was no substantive disagreement with the contents of the report and their comments are incorporated as appropriate.



ARTIST'S CONCEPTION OF AN ARSR-3 RADAR SITE

CHAPTER 2

ACQUISITION STRATEGY

The Federal Aviation Administration spent $4.1 million to construct, install, and test an operating Air Route Surveillance Radar-3 prototype, but obtained only limited subsystem tests.

In March 1972 FAA issued a request for proposals leading to a firm fixed-price contract for 29 units, with the first, a preproduction unit, to be field tested before producing the remaining 28. FAA's Airway Facilities Service (AFS) contended that the project was not developmental in nature because the technology required to meet ARSR-3 performance specifications had been collectively proven by industry.

A 1972 AFS summary of risks involved in designing and producing the ARSR-3 showed that agency engineering personnel doubted the need for a prototype system, provided that the contractor was strictly held to the specifications. Potential risk areas were identified in the summary and previous FAA, military, or foreign applications were described. The summary stated, however, that a prototype program would be beneficial if the manufacturer were allowed to deviate from the specifications to provide a superior system.

Department of Transportation regulations indicate that prototype development includes fabricating and testing a prototype system to assure that all system elements function properly together. The regulations, however, do not explicitly prescribe criteria for determining when prototype development is appropriate before acquiring production systems for operational use.

AFS endorsed the fixed-price, multiyear contract approach to protect against cost overruns, eliminate prototype costs, and provide timely acquisition. This approach had been formulated without input from the agency's contracting office, which advocated separate procurement of a prototype through a cost-plus-incentive-fee contract. Disagreement over the method of procurement was not resolved until May 1972, when, after a presentation before Transportation technical staff, the cost-plus prototype approach was adopted over AFS objections. This decision was predicated on the contracting office's belief that even though proven subsystems were to be used, a new configuration entailed considerable technical risk and should be viewed as a developmental effort.

Under the revised procurement strategy, the objective of the prototype program included constructing, installing, testing, and operating a complete ARSR-3 system. Although all major ARSR-3 subsystems had been previously used by the military or others, the subsystems had never been combined into an operative system. Thus, integrated system testing was to have been a critical phase of the prototype program.

ABORTING OF PROTOTYPE EFFORT

The prototype program was initiated in January 1973. Less than 8 months after the $3.49 million prototype contract was awarded, the contractor, Westinghouse Electric Corporation, notified FAA that its system cost estimate had risen by about 100 percent. Accordingly, the FAA project office reduced the scope of the prototype program to minimize expenditures. FAA instructed Westinghouse to proceed at a reduced level of effort to obtain design reports and conduct tests of experimental component assemblies. Integrated system tests, hardware fabrication, onsite installation, and operational tests were deleted.

Contract files show that after Westinghouse notified FAA of increased prototype costs, modifications for more than $600,000 were made to the original contract, bringing the contract price of the prototype to $4.1 million.

At the time the contract scope was reduced, the contractor had not submitted detailed test plans to FAA. Preliminary plans, however, indicated that about 69 test areas were contemplated. Of these, 11 subsystem tests were performed and limited component tests were completed under the reduced effort.

In a February 1974 acquisition paper to the Department of Transportation's Transportation System Acquisition Review Council (TSARC), FAA recommended abandoning the limited prototype program and purchasing 26 production ARSR-3s. FAA stated that continuing design reviews with the contractor had shown that no significant technical risks remained in the electronics subsystem and antenna designs, and major areas of concern and their integration into an operational system had been reduced to completed design drawings suitable for final fabrication. Upon TSARC approval, endorsed by the Under Secretary of Transportation in April 1974, FAA discontinued the prototype program.

TRANSPORTATION'S REVIEW OF SUSPENSION AND SUBSEQUENT ACQUISITION

We found no records showing the basis for the April 1974 TSARC decision to permit the suspension of the ARSR-3 prototype program and initiation of the production contract.

The March 1974 TSARC review files contained comments of three TSARC members, all of whom appeared to favor continuing prototype development. The Deputy Under Secretary, considering the planned premature suspension of the prototype, noted major issues involving procurement of these facilities with procurement policy implications. The Deputy Assistant Secretary for Systems Development and Technology stated that the acquisition paper did not show that "an adequate level of additional information and documentation has been acquired during the current prototype design to support truly competitive procurement." Similarly, a third TSARC member cited the attractiveness of continuing the prototype contract and issuing a two-step competitive contract upon its completion because of the availability of a prototype for evaluation.

PRODUCTION CONTRACT

Efforts to initiate ARSR-3 production began in April 1974. A request for technical proposals was issued in August 1974 as part of a two-step procurement. The second step was to obtain bids on a formally advertised contract. Following submission of bids in March 1975, FAA signed a $41 million contract with Westinghouse in June 1975 to deliver and install 26 production systems. FAA officials state, however, that limited tests and simulations accomplished under the prototype contract, successful application of similar subsystems in military and foreign radars, and Westinghouse's construction of two similar systems for Iran eliminated the need for full prototype development. Installation, checkout, field testing, and reliability/maintainability demonstrations for the initial ARSR-3 are scheduled for completion in July 1977. The first unit will go into service in January 1978.

CONCLUSIONS

It is not clear whether or not a prototype system was really required to demonstrate operational capability of the radar. Nevertheless, a primary purpose of the prototype program--fabricating and testing an operating ARSR-3--was not accomplished. In view of the uncertainties as to the technical risks involved, it is questionable whether a production contract should have been awarded. FAA officials

believe, however, that ARSR-3 equipment now in production shows every indication of meeting operational requirements.

While limited subsystem test data was accumulated, we believe the procurement approach was similar to that envisioned by the AFS in 1972, with operational test data to be obtained from the initial production unit.

One Transportation regulation, which became effective in 1972, requires that TSARC review FAA major acquisitions to evaluate the desirability of proceeding into subsequent procurement phases. This is to insure that each proposed major system obtains proper consideration by the Secretary at appropriate times during the system life cycle. We believe that this would entail (1) assuring that sound acquisition strategies have been planned and (2) endorsing or challenging component agency rationale for planned procurement actions.

The lack of records supporting the TSARC decision to permit ARSR-3 prototype program suspension and initiation of the production procurement makes it difficult to determine the basis for TSARC's decision.

CHAPTER 3

NEED FOR AGENCY COST ESTIMATES

The Federal Aviation Administration did not follow certain well-recognized procurement practices in estimating and maintaining visibility over prototype contract costs.

The Airway Facilities Service did not anticipate purchasing a single prototype Air Route Surveillance Radar-3 system in its procurement strategy and had not prepared an estimate of such an acquisition based upon the detailed specifications available. When the contracting method was changed from a fixed-price production contract to a contract for a prototype, FAA was placed in the position of receiving proposals for a prototype on a cost-type contract without a sound basis for evaluating their reasonableness. In the negotiation process the agency accepted reductions to the proposed prices, but did not assure itself by a complete review of proposals that the contractor could produce the prototype at the reduced price.

EVALUATION OF PRICE PROPOSALS

In February 1971, almost 2 years before issuing a request for proposals, AFS prepared a rough prototype cost estimate. Based essentially upon ARSR-1 and -2 costs updated for inflation levels, this $7.8 million preliminary prototype estimate excluded inflation after February 1971.

Two months after FAA requested proposals for a firm fixed-price contract for production units in March 1972, the agency contracting office directed that the request for proposals be modified to provide for a single prototype ARSR-3 under a cost-plus-incentive-fee contract.

Four technically qualified contractors submitted proposals and all were in the lower range of, or below, the $6 to $9 million level informally expected by FAA engineers. Negotiations were conducted between May and November 1972. During this period, Westinghouse reduced its proposal by 50.7 percent--from $7.1 million to $3.5 million--and was awarded the contract in January 1973. In justifying the reductions to FAA, the firm cited direct labor and material rate reductions arising from other radar contracts being negotiated, one-time savings to the prototype due to eliminating setup costs for subsequent production, favorable agreements with subcontractors, and savings accruing from in-house design efforts. The major categories of reductions included:

	Amount (000 omitted)
Rate reductions	$741
Production provision elimination	292
Subcontract cost reductions	72
In-house design efforts	855
Duplication of effort	558
Offer to absorb costs	250
Reduction in target fees	333

Westinghouse stated that sharp increases in engineering and factory productive hours, resulting from the award of other radar contracts, would sufficiently offset salary and benefit increases, projected over the life of the contract, to allow a $272,483 decrease due to rate reductions. Similarly, Westinghouse lowered rates for material production allowances, reducing the price by $302,728. A third rate reduction eliminated a factory labor production change factor of $165,951.

The Defense Contract Audit Agency examined these rate reductions and noted that "it is not Westinghouse's policy to exclude these factors in preparing price proposal estimates." The Audit Agency recommended that due consideration be given to the possibility that the voluntary cost reduction might not materialize as a reduction in incurred costs. Subsequently, Westinghouse submitted three additional price proposal reductions, none of which were examined by the Audit Agency.

In its best and final offer, Westinghouse also proposed to absorb $250,000 out of corporate funds. The Department of Transportation's Assistant Secretary for Administration noted that since the contractor's profit was estimated at $194,000 under the best circumstances, the Westinghouse offer eliminated the possibility of profit under the prototype contract. We were informed that FAA did not reconcile the best and final offer with its own rough estimate.

AFS engineering personnel accepted the price proposal reductions, but believed that the prototype would cost between $6 million and $9 million.

NEED FOR INFORMATION ON COST TO COMPLETE

In administering a cost-type contract, we believe it is essential that the contracting agency maintain a close check

over estimated costs to complete the work. Primary responsibility for timely, satisfactory estimates rests with the contractor, but the Government must monitor progress carefully for early signs of problem areas which endanger cost and schedule baselines.

FAA received monthly actual and budgeted cost data information and required notification from the contractor, under a limitation of costs clause, of significant cost increases. Westinghouse was not contractually required to submit periodic estimates of the cost to complete the prototype contract. Nonetheless, FAA received an estimate from the contractor in May 1973 which indicated that a $175,000 overrun would be incurred. According to Westinghouse, however, this report forwarded to FAA on April 27, 1973, was made only to advise that the cost of the program would be adversely affected by rate changes. It did not include the full effect of all known cost increases to that time.

During the January 1973 to August 1973 period, several factors occurred which indicated that actual prototype costs would exceed the contract price. According to Westinghouse officials, the firm's best and final offer--the contract price--was predicated upon the most favorable possible assumptions and excluded all delay and risk factors. However, as the prototype system design progressed, the contractor experienced difficulty meeting detailed specifications. For example, the supplier of the Klystron tube insisted on specification relief which necessitated the redesign and subsequent computer simulation of the radar pulse forming networks, high voltage power supply components, and other effects on the system.

While Westinghouse would not provide us with precise figures, its officials said that costs doubled primarily because of other factors. Revisions, including those outlined below, were made which raised the prototype cost estimate to $7.6 million, an amount consistent with FAA's earlier rough estimate.

--FAA interpreted the full system mean time between failures to be 750 hours rather than the 375 hours assumed in the Westinghouse design. According to the contractor, the redesign to accommodate the higher mean time between failures increased the costs by $950,000.

--Westinghouse assumed that it would participate in two similar land-based radar programs and that costs for

nonrecurring engineering, drafting, tooling, and documentation could be shared. It further assumed reduced manufacturing and material costs through combined purchases and reduced startup and setup costs. Because the contractor lost one program in February 1973 and the other was delayed indefinitely, the firm increased its estimated costs by $1.35 million. Also, the contractor claimed that FAA delays in appraising the firm's technical submissions forced it to proceed in accordance with existing specifications, increasing costs by $750,000.

--An 8-month period required for negotiating the contract, from May 1972 to January 1973, caused subcontract options to expire at the end of 1972, a month after the company submitted its best and final offer. Westinghouse officials said that the new subcontract costs were higher and increased costs by $300,000.

Consequently, in August 1973, less than 8 months after the contract was awarded, Westinghouse notified FAA that its estimate of the cost to complete the system had risen by about 100 percent.

FAA personnel said that during this period they pressed several times for other cost-to-complete estimates, but the lack of any contractual requirement for such estimates made the contractor reluctant to devote resources to that purpose. In August 1973, when the cost-to-complete estimate of $7.6 million was prepared at the request of FAA, the inadequacies of the contract amount became evident. Westinghouse said that the August report was the first comprehensive evaluation of overall program cost increases. According to FAA officials, the magnitude of the cost increase was quite unexpected.

Responding to the increased cost estimate, FAA asked the contractor to complete the prototype for $7.1 million under a fixed-price contract. Westinghouse refused, stating that compliance with the untested specifications could prove very costly. Faced with the large estimated contract cost increase, FAA elected in September 1973 to reduce the scope of the prototype program.

CONCLUSIONS

FAA did not establish a separate prototype cost estimate based on the detailed specifications it had prepared. This

limited FAA's capability to evaluate the reasonableness of the ARSR-3 price proposals it received. When used in conjunction with cost-plus contracts, such a policy unduly exposes the agency to the danger of buy-ins at unrealistically low prices. Westinghouse's reduced proposal was based on several assumptions whose speculative character warranted close FAA scrutiny to assure itself that the contractor could produce at the reduced price.

The agency's poor management of this acquisition affected competition for both the prototype and production contracts. By awarding a cost-type prototype contract based on an unrealistically low price proposal, some contractors were eliminated from the program. Because Westinghouse had expended over $4 million in development and testing, it would naturally have had an advantage over any other contractor attempting to bid for the production contract.

The lack of a requirement for periodically updated cost-to-complete estimates deprived FAA of visibility on how the contractor was progressing in meeting contract objectives.

In many cases, cost-type contracts are appropriate for developmental projects. Their use, however, necessitates precautions to assure project managers that the desired work will be performed within reasonable limits of the estimated contract cost. After the award, the contractor should be required to provide the Government periodic updates of estimated costs to complete the contract to provide early visibility of potential cost growth so that remedial action may be initiated.

RECOMMENDATIONS

We recommend that the Secretary of Transportation:

--Require that FAA develop detailed independent cost estimates for systems it plans to purchase and evaluate differences between its internal estimates and contractor price proposals.

--Require that FAA assure that contractors can produce at proposed prices by a complete review of proposals, particularly when price proposals have been reduced significantly.

--Require that contractors provide periodic cost-to-complete estimates, especially when cost reimbursable contracts are used, so that the agency can monitor performance progress in relation to costs incurred.

PRINCIPAL OFFICIALS OF THE DEPARTMENT OF TRANSPORTATION RESPONSIBLE FOR ADMINISTERING ACTIVITIES DISCUSSED IN THIS REPORT

	Tenure of office	
	From	To
DEPARTMENT OF TRANSPORTATION		
SECRETARY OF TRANSPORTATION:		
William T. Coleman, Jr.	Mar. 1975	Present
John T. Barnum (acting)	Feb. 1975	Mar. 1975
Claude S. Brinegar	Feb. 1973	Feb. 1975
John A. Volpe	Jan. 1969	Feb. 1973
FEDERAL AVIATION ADMINISTRATION		
ADMINISTRATOR:		
John L. McLucas	Nov. 1975	Present
James E. Dow (acting)	Apr. 1975	Nov. 1975
Alexander P. Butterfield	Mar. 1973	Mar. 1975
John H. Shaffer	Mar. 1969	Mar. 1973
David D. Thomas (acting)	Aug. 1968	Mar. 1969