

GAO

Testimony

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MAJOR ACQUISITIONS

Top Management Attention  
Needed To Improve DOT's  
Acquisition Process

*Statement by*  
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*Before the*  
Subcommittee on Transportation and  
Related Agencies  
Committee on Appropriations  
House of Representatives



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Dear Mr. Chairman and Members of the Subcommittee:

We welcome the opportunity to appear before you today to provide our observations on acquisition management in the Federal Aviation Administration (FAA) and the U.S. Coast Guard.

As you know, dramatic increases in air travel have strained the capacity of the nation's air traffic control (ATC) system. Passenger demand increased 65 percent in the decade since deregulation. FAA forecasts that domestic passenger demand may double from today's level to over a billion enplanements a year by the year 2010. Aging and obsolete ATC equipment limit the FAA's ability to handle the increased traffic safely and efficiently. Likewise, replacement of antiquated and marginally effective equipment is essential to the Coast Guard's carrying out such missions as: assuring the safety of life and property at sea; enforcing laws and treaties relating to drug interdiction, commercial fisheries and illegal immigration; and protecting the marine environment.

Successful acquisition of new equipment is crucial to the timely implementation of modernization plans in both the FAA and the Coast Guard. Poorly planned and managed acquisitions often result in systems that must be redesigned or further developed to meet agency needs, are deployed late, and require additional funding to cover cost overruns.

Our testimony today is based on a body of work, most of which was done for this Subcommittee, on FAA's massive effort to modernize the ATC system, formerly called the National Airspace System (NAS) Plan and now known as the Capital Investment Plan<sup>1</sup>; and two ongoing reviews for this Subcommittee, one evaluating the

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<sup>1</sup>A listing of our recent reports and testimonies related to FAA's ATC modernization effort is provided in attachment I.

Coast Guard's Patrol Boat Replacement project, and the other reviewing how FAA budgets for its major acquisitions--generally acquisitions that are high in cost, critical to the agency's mission, and warrant management attention. We plan to issue reports on these two reviews later this year. Today, we will make three points:

-- First, FAA has experienced substantial cost increases and delays in modernizing the ATC system. FAA now estimates that modernization will require about \$31 billion through the year 2000, more than doubling the cost projected in 1983. The average delay from the 1983 NAS Plan to the 1990 Capital Investment Plan for first-site system implementation is about 5 years, with slips ranging from 1 to 12 years. As a result, long-awaited safety and efficiency benefits have been postponed, and existing equipment must be used longer than expected. Until recently, FAA did not follow federal acquisition guidance aimed at reducing cost, schedule and performance risks. Acquisitions often proceeded--some as far as production--without the agency knowing precisely what its needs were, whether the design was cost-effective, and whether the equipment would work in the day-to-day ATC environment. FAA and the Office of the Secretary of Transportation (OST) have taken steps to enhance the oversight of major acquisitions. Nevertheless, FAA's fiscal year (FY) 1992 budget request included \$89 million for 8 new projects whose needs were not approved by top management before this request was forwarded to the Congress.

-- Second, the Coast Guard has experienced similar acquisition problems in connection with its Patrol Boat Replacement project. Many of these problems can be traced to weaknesses in the identification of mission

needs. The Coast Guard failed to adequately consider the patrol boat fleet size and mix of vessel types and capabilities that would satisfy its needs at the lowest possible cost. Cost growth and schedule slippage, as well as the need for stopgap measures to avoid a patrol boat shortfall, have resulted from weaknesses in planning and analysis and skipping steps in the acquisition process. Our review of this project suggests that top Coast Guard and OST officials did not always play the critical, questioning role needed to ensure the soundness of acquisition decisionmaking.

- Third, an important way of controlling and monitoring acquisitions is for budgeting to be linked to the various phases of the acquisition process. Our work at FAA indicates that the agency has not ensured such linkage and has frequently funded development activities using the appropriation account intended for production. More accurately reflecting the status of an acquisition in an agency's funding request would provide a means of communicating cost, schedule, and progress to decisionmakers. This would tie approval for funding to the movement of projects from one acquisition phase to another.

Before providing further details on these points, we will describe the major acquisition process.

#### A-109 PROVIDES A BLUEPRINT FOR TOP MANAGEMENT INVOLVEMENT IN ACQUISITION

In offering our observations on acquisitions in FAA and the Coast Guard, we will refer to the acquisition management model contained in Office of Management and Budget (OMB) Circular A-109 (see attachment II). A-109 is the principal guidance for acquiring major systems in the federal government and has two primary objectives. First, to avoid the problems commonly experienced in

acquiring major systems, such as cost overruns and schedule delays, A-109 divides the acquisition process into five phases. Second, to secure agency top management involvement, it establishes four key decision points at which time the project's progress, problems, and risks are reviewed. The purpose of this review is to ensure that the acquisition does not advance to the next phase until management concerns are resolved.

The first and most important phase of the A-109 process involves determining mission needs, because it establishes the criteria for all subsequent decisions. A mission need statement should clearly demonstrate the purpose and requirements of the project, how it would meet the agency's needs, and the risks involved. The mission need statement must be reassessed and approved at each key decision point, before a project can move from one acquisition phase to the next. In Phase 2 the agency identifies and explores alternative designs and selects the most promising ones for further exploration. Phase 3 involves demonstrating alternative designs through initial building, testing, and evaluation of prototypes. In Phase 4 the agency conducts full-scale development and limited production of the system. The system is also subject to independent testing in the expected operational environment. Finally, Phase 5 involves the full production of the system and its deployment in the field. Ignoring or skipping phases undermines the intent of the A-109 principles by weakening discipline in the acquisition process. Such discipline is needed to minimize the occurrence of systems that do not work or cost significantly more than planned.

We have found a number of instances in which FAA and the Coast Guard did not follow the A-109 process. Using the A-109 framework, we will turn now to a discussion of some of these problems and actions recently taken or planned by agency officials to deal with them.

## Inadequate Definition and Justification of Mission Needs

The A-109 process begins with the determination of mission needs. Many a problem-plagued major acquisition can trace the origins of its troubles to deficiencies in clearly determining and justifying the agency's needs and requirements. Too often, identified requirements, established for meeting mission needs, represent more of a wish list than a statement of essential and cost-effective capabilities.

FAA did not prepare mission need statements for its major systems at the outset of its modernization effort. Instead, the agency used the NAS Plan as a blanket mission need statement for all of its 11 original major system acquisitions. Because no system specific need statements were established, the opportunity for review and approval by top management was lost. In addition, requirements were established that later proved to be extremely difficult and costly to achieve.

For example, in the case of the Voice Switching and Control System (VSCS) acquisition, FAA set a requirement that the installed system be available for use 99.99999 percent of the time. This is equal to less than four seconds of down time per year, a capability not available from any commercially-available system. As a result of this and other stringent requirements established for VSCS, FAA and its contractors have encountered serious difficulties in designing software for the system. The VSCS acquisition is now five years behind schedule and the total cost estimate has risen from \$258 million in 1982 to \$1.4 billion in 1991. From an operational perspective, VSCS delays are causing air traffic controllers to cope with faltering communications equipment far longer than envisioned.

OST has recognized the importance of carefully defining mission needs by strengthening the application of A-109 in the

Department of Transportation (DOT). A mid-1990 DOT Order requires DOT administrations to prepare mission need statements for all major acquisitions. In February 1991 FAA issued its own order implementing this DOT guidance. Both orders require projects to have approved mission need statements prior to their inclusion in the agency budget request. However, FAA included \$89 million in its FY 1992 budget for 8 new projects without approved need statements. Since the submission, 5 of these projects have had their need statements approved. We believe that including new projects in the budget before approving mission needs runs counter to the intent of the order.

Our work on the Coast Guard's Patrol Boat Replacement Project--specifically the proposed \$330 million Heritage acquisition which was the agency's choice for satisfying its future patrol boat requirements--also disclosed weaknesses in the identification and support of mission needs. While the Coast Guard developed a mission need statement for the overall project, the statement did not provide an adequate description or justification for the capabilities needed. Also, the Coast Guard did not identify the patrol boat fleet size and composition by vessel type which would represent the most cost-effective approach to satisfying its needs. Finally, the need statement and related documents did not adequately relate requirements to the specific programs that patrol boats have historically supported. For example, while the Military Preparedness program has historically required a minimal annual commitment of patrol boat time, military considerations appear to have exerted a disproportionate influence on the project. This has resulted in expensive and poorly-justified capabilities being incorporated into the Heritage design, as well as costly space and weight reservations for unspecified future military capabilities.

Alternative System Designs  
Not Fully Considered

In Phase 2 a number of alternative approaches to satisfying the identified mission needs are explored and evaluated, including a comparative analysis of capabilities, associated costs and benefits, and likely timetables for completion.

Generally, FAA has not evaluated a wide range of options for meeting its mission needs. This is illustrated by its acquisition of the \$425 million Mode S system, radars that will provide more accurate aircraft location information and allow controllers and pilots to exchange data. Although FAA initially considered five alternatives, combining surveillance and communications requirements had the effect of foreclosing all but the Mode S alternative from full consideration. Had it identified and evaluated system designs that separately satisfied surveillance and data communications requirements, FAA might have selected a more effective and less costly design.

Because of technical difficulties, the Mode S contractor has not delivered a working system. Last year we reported that FAA was allowing the contractor, in the interim, to deliver systems that will not meet all of FAA's requirements. The agency also cancelled plans to purchase additional Mode S systems until an analysis of possible alternative designs could be completed. As a result of the problems encountered, the project is now 6 years behind its original schedule.

We noted similar weaknesses in the consideration of alternative system designs in the Coast Guard's Patrol Boat Project. The Coast Guard did initially evaluate alternatives for satisfying its needs. This included advanced vessel designs, such as hydrofoils and twin hull vessels, as well as a variety of conventional, single hull vessel designs. However, pressures to replace worn-out patrol boats as soon as possible favored



conventional design options. This eventually led to the premature selection of the conventional, but unproven, Heritage design as the mainstay of the Coast Guard's fleet. As a result, one important factor that received insufficient attention was cost, in particular the costs of modifying port facilities to accommodate the much larger Heritage and its larger crew.

Moreover, because it is a new and untried design, the Heritage will take longer to develop, test and deliver than a proven, off-the-shelf conventional design of similar capability. The current estimated delivery date of late 1995 is more than 5 years behind its original target date of 1990.

#### Alternative Design Concepts Not Demonstrated

Phase 3 provides for the competitive test and demonstration of selected alternative designs, typically involving the development of prototypes. Competitive demonstrations should verify that the chosen design concepts are sound and able to perform as claimed.

In FAA there has been little competitive testing and demonstration of alternative designs. Because of the significant amount of development required in ATC modernization, omitting a competitive evaluation of alternative designs added appreciably to the inherent risks and uncertainties of NAS Plan projects.

The \$4.4 billion Advanced Automation System (AAS)--the centerpiece of FAA's modernization effort--illustrates the consequences of not fully demonstrating and testing alternative designs. FAA concluded at the end of Phase 2 that it was too costly to fully demonstrate two competing systems. Instead, the agency awarded a single contract to complete the design and production of AAS. Subsequently, the selected AAS contractor experienced major difficulties in developing the system software. Such difficulties could have been identified earlier had more

evidence been secured that FAA's requirements could be met. Recently, FAA and the contractor agreed to modify the contract and incorporate a 19-month delay to resolve software and other problems.

As one of FAA's recent actions to reform its acquisition management, the agency created the position of Executive Director for Acquisition. The Executive Director is aware of the problems associated with inadequate demonstration of alternative designs and has stressed the value of following A-109's competitive test and demonstration procedure. Most recently, he ruled against awarding a production contract for the VSCS project because system prototypes did not meet established requirements.

In the case of the Coast Guard's Patrol Boat Replacement Project, most of the benefits of a competitive demonstration of alternative designs were not achieved. This resulted primarily from the agency accelerating consideration of the Heritage option and rejecting other options before demonstrations could take place. In April 1987, the Coast Guard requested OST approval to proceed to a Phase 3 competitive evaluation of various advanced vessel designs and to move directly to full-scale development and limited production of the Heritage. In other words, the agency proposed omitting Key Decision Point 2 and Phase 3 entirely in the case of the Heritage design option. In October 1987 the Coast Guard reiterated its request for approval of full-scale development and limited production of the Heritage. It also requested that further evaluation of advanced vessel designs, as well as alternative conventional designs, be terminated. These requests were approved in early 1989 by the DOT Deputy Secretary. Our review of this project suggests that top Coast Guard and OST managers, while periodically involved in the acquisition, did not always play the questioning, challenging role that would have brought more thorough analysis and decision discipline to the process.

### Operational Test and Evaluation Slighted

A key component of Phase 4 is independent test and evaluation of the system's performance under anticipated operating conditions. Independence, in this context, means that testing is conducted by organizations not associated with the unit responsible for development of the system.

With regard to FAA's modernization program, we have reported on a number of occasions the absence of operational testing of key systems and the lack of independence of the testing unit involved. We stated that contractors and agency development and user groups often had goals, such as meeting cost and schedule commitments, that could conflict with rigorous and impartial testing.

One example of inadequate operational testing is provided by the \$1.1 billion Microwave Landing System (MLS) project. MLS moved into full production even though limited testing was performed on units that were not built to agency specifications. Moreover, this testing was not conducted in an operational environment. Had this been the case, system deficiencies could have been raised earlier. Instead, the MLS contract continued until it was terminated for non-performance in 1989, 5 years after it was signed. By that time, the contractor had received about \$40 million and had delivered only two systems. At the direction of the Congress, FAA is undertaking a demonstration program to evaluate the economic and operational benefits of MLS to provide the basis for a decision on whether to resume production.

FAA has made its test and evaluation unit more independent by placing it under the direction of the Executive Director for Acquisition. It is too soon to tell if FAA will use test results to identify system deficiencies and ensure that acquisitions do not advance to production until deficiencies are corrected.

The Heritage prototype is currently under construction at the Coast Guard's Curtis Bay Shipyard. However, the benefits of testing that prototype in an operational environment, before committing to production, may not be fully realized because of two decisions made by the Coast Guard. The agency had planned to construct and test two separate Heritage prototypes. It reasoned that the cost of building and evaluating two differently configured and equipped prototypes would be amply justified by the enhanced ability to assess the design's basic strengths and weaknesses under a wider range of conditions. However, by mid-1988, the Coast Guard decided to reduce the number of Heritage prototypes to one. Around the same time, it eliminated all designs except the Heritage from further consideration.

Altering its initial plans, the Coast Guard also decided to reduce the planned testing period from 24 months to 18 months, primarily to recoup some of the schedule slippage experienced to date. In an August 1989 briefing, Coast Guard officials were told by project staff that the performance and schedule risks for the Heritage acquisition would increase if the evaluation period were reduced. Officials now believe that shortening the testing period will not compromise the thoroughness and integrity of Heritage testing. The Coast Guard's desire to limit costs and hasten production of the Heritage is understandable. However, in our view, reducing needed operational testing now could prove to be false economy, opening the way to costly problems later on.

#### Premature Commitment to Full Production

The fifth and final phase of the A-109 acquisition model involves full production and system deployment. Top management gives authorization to move into this phase after assessing the test and evaluation results of Phase 4 and reconfirming mission need in light of these results and current conditions.

FAA has followed practices that have blurred distinctions between development and full production phases and often caused them to overlap. In part, this may be attributable to the belief, at the outset of the NAS Plan, that many modernization needs required little or no development and could be satisfied through the purchase of off-the-shelf technology. Closer adherence to the A-109 model could have surfaced technical difficulties early on, and could have prevented the premature award of production contracts.

FAA's \$540 million Flight Service Automation System (FSAS) project illustrates some of the consequences of moving to production without the assurance that systems will work. FSAS is intended to allow pilots to receive automated weather data before takeoff and simplify flight plan filing--information submitted by pilots related to their planned flight, such as destination and time of departure. FAA awarded an FSAS production contract before software was developed. As a result, there was no assurance that software and selected hardware would work together as the contractor claimed. Technical difficulties in developing the software caused the project to be delayed for 2 years. This forced FAA to store FSAS hardware until software became available.

The Coast Guard's Heritage project will not move to the stage of full production until late 1994 at the earliest. However, as a consequence of decisions, omissions, and overly optimistic assessments made earlier, the agency is now having to contend with a number of problems that will continue into and affect the Heritage production phase. Most of these relate to the need to avert a looming patrol boat shortage as a large portion of the existing fleet comes to the end of its useful life. Possible responses under consideration include undertaking costly modifications to prolong the life of old patrol boats and reviving the once-rejected option of a small off-the-shelf boat. Both of

these actions have implications for the number of Heritage boats the Coast Guard will ultimately need. In addition, modification costs of up to a million dollars or more per port to accommodate the Heritage vessels could further reduce the number of boats acquired.

#### BUDGETING FOR MAJOR ACQUISITIONS

One way of controlling and monitoring the progress of an acquisition is through the budgeting for the project. At the request of this Subcommittee, we are reviewing how FAA budgets for its major acquisitions and examining the criteria it uses to fund modernization projects in either its Facilities and Equipment (F&E) appropriation account or its Research, Engineering, and Development (RE&D) appropriation account. Our work indicates that FAA does not effectively link its budget to its process for acquiring major systems. While the agency has informal criteria for budgeting the different activities involved in major acquisitions, it has largely ignored them.

According to FAA's informal criteria, most projects should first be budgeted in the RE&D appropriation because they require some research and development. Projects should be funded in the F&E account once they are ready to enter production. This budgeting scheme is intended to help preserve the integrity of the appropriations accounts, show the logical progression in the development and production of a system, and serve as a tool to communicate to decisionmakers the cost, schedule, and progress of a project. However, FAA repeatedly has not followed this scheme and has budgeted preproduction activities in its F&E account.

During the past year the agency has begun to make changes to its process for acquiring major systems, adhering more closely to the A-109 model. However, no modifications have been made to the way it budgets for major acquisitions. Linking the budget to the

acquisition process by segmenting funding for each major project into A-109 phases would strengthen FAA's capacity to implement and institutionalize the improvements it is seeking.

#### SUMMARY

The experiences of FAA and the Coast Guard in acquiring major systems vividly illustrate the risks involved and the importance of taking all possible steps to minimize these risks. Schedule slippage, cost overruns, and performance weaknesses can usually be traced directly to deficiencies in identifying and justifying needs, shortcomings in considering alternatives and associated costs and benefits, and shortcuts in testing and evaluating before committing to production. These deficiencies, in turn, generally result from a failure to adhere to a cautious, step-by-step approach to managing the acquisition and an absence of top management involvement in key decisions to move the acquisition from one stage to the next. Besides having major budgetary impacts, poorly managed acquisitions directly affect the agency's performance and productivity and its ability to carry out its basic responsibilities. In the case of FAA's ATC system, this can adversely affect FAA's ability to handle increased traffic safely and efficiently. In the case of the Coast Guard, it can result in a lessened ability to protect the safety of life and property at sea, interdict drugs, and police commercial fisheries.

The acquisition management model outlined in federal guidance provides a logical, orderly and highly useful procedure for managing major system acquisitions and helping to reduce their inherent risks. However, the process by itself is not a cure-all or guarantor of success. The effective participation of top management in key acquisition decisionmaking is indispensable to bringing discipline and analytical rigor to the process and developing a prudent strategy tailored to each project's specific requirements. Linking project budgeting to the acquisition process

is yet another way of instilling discipline and managing risks. This is particularly true in maintaining the important distinction between developmental and production activities.

Mr. Chairman, this concludes our statement. We would be pleased to answer questions you might have at this time.



LISTING OF RECENT GAO REPORTS AND TESTIMONIES  
RELATED TO FAA'S ATC MODERNIZATION PROGRAM

AIR TRAFFIC CONTROL: Status of FAA's Modernization Effort  
(GAO/RCED-91-132FS, Apr. 15, 1991).

AIR TRAFFIC CONTROL: Efforts to Modernize Oceanic System Delayed  
(GAO/IMTEC-91-2, Jan. 16, 1991).

AIR TRAFFIC CONTROL: The Interim Support Plan Does Not Meet FAA's Needs  
(GAO/RCED-90-213, Sept. 11, 1990).

AIR TRAFFIC CONTROL: Continuing Delays Anticipated for the Advanced Automation System  
(GAO/IMTEC-90-63, Jul. 18, 1990).

AIR TRAFFIC CONTROL: Ineffective Management Plagues \$1.7 Billion Radar Program  
(GAO/IMTEC-90-37, May 31, 1990).

FAA Encountering Problems in Acquiring Major Automated Systems  
(GAO/T-IMTEC-90-6, Apr. 18, 1990).

Issues Related to FAA's Fiscal Year 1991 Budget Request  
(GAO/T-RCED-90-66, Apr. 18, 1990).

AIR TRAFFIC CONTROL: Status of FAA's Efforts to Modernize the System  
(GAO/RCED-90-146FS, Apr. 17, 1990).

Issues Related to FAA's Modernization of the Air Traffic Control System  
(GAO/T-RCED-90-32, Feb. 27, 1990).

AVIATION WEATHER: FAA Needs to Resolve Questions Involving the Use of New Radars  
(GAO/RCED-90-17, Oct. 12, 1989).

AIR TRAFFIC CONTROL: FAA Needs to Implement an Effective Testing Program  
(GAO/IMTEC-89-62, Sept. 14, 1989).

AIR TRAFFIC CONTROL: FAA's Implementation of Modernization Projects in the Field  
(GAO/RCED-89-92, Jun. 28, 1989).

AIR TRAFFIC CONTROL: Voice Communications System Continues to Encounter Difficulties  
(GAO/IMTEC-89-39, Jun. 1, 1989).

AIR TRAFFIC CONTROL: FAA Should Define the Optimal Advanced Automation System Alternative  
(GAO/IMTEC-89-5, Nov. 30, 1988).

AIR TRAFFIC CONTROL: Continued Improvements Needed in FAA's Management of the NAS Plan  
(GAO/RCED-89-7, Nov. 10, 1988).

MICROWAVE LANDING SYSTEMS: Additional Systems Should Not Be Procured Unless Benefits Proven  
(GAO/RCED-88-118, May 16, 1988).

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# GAO A-109 Major System Acquisition Process

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