GAO

Report to the Chairman, Subcommittee on Transportation and Related Agencies, Committee on Appropriations, House of Representatives

August 1996

AVIATION ACQUISITION

A Comprehensive Strategy Is Needed for Cultural Change at FAA

GAO

**United States
General Accounting Office
Washington, D.C. 20548**

**Resources, Community, and
Economic Development Division**

B-265985

August 22, 1996

The Honorable Frank R. Wolf
Chairman
Subcommittee on Transportation
    and Related Agencies
Committee on Appropriations
House of Representatives

Dear Mr. Chairman:

In response to your request, this report discusses how organizational culture has contributed to the persistent acquisition problems at the Federal Aviation Administration (FAA). The report also presents a recommendation to the Secretary of Transportation on the steps that FAA can take to strengthen its acquisition management by changing its organizational culture.

We are sending copies of the report to the Secretary of Transportation and interested congressional committees. We will also make copies available to others upon request.

I can be reached at (202) 512-2834 if you or your staff have any questions. Major contributors to this report are listed in appendix V.

Sincerely yours,

John H. Anderson, Jr.
Director, Transportation Issues

Executive Summary

Purpose

In light of the steady growth in air traffic operations and the failures of aging equipment in the air traffic control (ATC) system, the Federal Aviation Administration's (FAA) timely acquisition of new ATC equipment has become increasingly critical for aviation safety and efficiency. FAA estimates that it will need $13 billion over the next 7 years to continue its modernization program. However, persistent acquisition problems raise questions about the agency's ability to field new equipment within cost, schedule, and performance parameters.

Concerned about recurring problems with FAA's acquisitions, the Chairman, Subcommittee on Transportation and Related Agencies, House Committee on Appropriations, asked GAO to review the agency's management of the acquisition process to (1) determine whether the organizational culture[1] contributed to FAA's acquisition problems and (2) identify how FAA could improve its management of acquisitions through cultural change, if culture is a contributing factor.

Background

Over the past 15 years, FAA's modernization program has experienced substantial cost overruns, lengthy schedule delays, and shortfalls in performance. The long-time centerpiece of this modernization program—the Advanced Automation System project—was restructured in 1994 after estimated costs tripled to $7.6 billion from $2.5 billion and delays in putting key components into operation were expected to run 8 years or more. For five other major projects, increases in per-unit costs have ranged from 50 to 511 percent, and schedule delays have averaged almost 4 years. Shortfalls in performance have also affected many projects. For example, although FAA awarded a production contract for the Mode Select radar in 1984, FAA was not able to field its first full performance radar until February 1995.

GAO's work over the years has pointed to technical difficulties and weaknesses in FAA's management of the acquisition process as the primary causes for FAA's recurring cost, schedule, and performance problems. For example, FAA underestimated the technical complexity of developing systems, particularly those involving extensive software development. Also, FAA did not analyze its mission needs, performed flawed or limited analyses of alternative approaches for achieving those needs, and performed inadequate oversight of contractors' activities.

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[1]"Organizational culture" is the underlying assumptions, beliefs, values, attitudes, and expectations shared by an organization's members that affect their behavior and the behavior of the organization as a whole.

Organizational culture is a managerial factor that GAO has examined in its reviews of acquisition management at other federal agencies, such as the Departments of Defense and Energy, but not at FAA. Organizational theory and research describe an interdependent relationship between employees' beliefs, values, and attitudes—the basis of an organizational culture—and their individual and collective behaviors. Moreover, this culture is affected by forces both within and outside of the organization. Internal forces include the organization's structure, incentive systems, and leadership exercised by top management, while external forces include the needs of customers and, in the case of government agencies, congressional committees and Members of Congress.

Research has shown that organizations with more constructive cultures perform better and are more effective. In organizations with a more constructive culture, employees exhibit a stronger commitment to

- mission focus: pursuing goals that define the best course of action for an organization;
- accountability: empowering employees and holding them responsible for their decisions and actions;
- coordination: involving other employees in decisions affecting them, resolving differences collaboratively, and cooperating across organizational lines; and
- adaptability: accepting new approaches and responding positively to demands and opportunities posed from within and outside of the organization.

GAO focused on these four areas in determining whether FAA's culture affected its acquisitions.

To perform its analysis, GAO drew extensively on studies by FAA and other organizations, recent surveys of FAA employees who are working on acquisitions, and GAO's discussions with top agency officials and other stakeholders in the acquisition process. GAO also reviewed studies on organizational change and culture in the public and private sectors.

Results in Brief

FAA's organizational culture has been an underlying cause of the agency's acquisition problems. Its acquisitions were impaired because employees acted in ways that did not reflect a strong commitment to mission focus, accountability, coordination, and adaptability.

To its credit, FAA has recognized the need to improve its acquisition management process through cultural change. In November 1994, the agency began to implement a reform effort based on the creation of integrated product teams. The teams, which comprise representatives from various divisions across the agency, are responsible for acquiring systems and ensuring that they are installed and working properly. FAA expects the teams to improve accountability and coordination and infuse a more mission-oriented focus into the acquisition process. FAA has made some progress in implementing its reform effort. One concern, however, is the agency's difficulties in gaining the strong commitment of all employees who hold a stake in the acquisition process. As currently designed, the reform effort does not address how that commitment can be obtained.

Principal Findings

FAA's Culture Is an Underlying Cause of Long-Standing Acquisition Problems

In discussing why FAA's acquisitions were problematic, FAA's top officials and the external observers who have studied FAA's management, such as the Center for Naval Analyses and the National Research Council, focused on the role of FAA's culture. Their observations led GAO to reexamine the behavior of the stakeholders in the acquisition process and review such data as the results of FAA employee surveys. GAO found that the employees' attitudes and behaviors—in the areas of mission focus, accountability, coordination, and adaptability—pointed to FAA's culture as an underlying cause of the agency's acquisition problems.

Mission Focus

Ultimately, the goal of any acquisition program is to acquire only essential equipment and field it within agreed-to cost, schedule, and performance parameters. In organizations with more constructive cultures, employees are more customer-focused and more actively pursue goals that define the best course of action for the organization.

In reviewing FAA's acquisition problems, GAO found that agency officials acted in ways that did not reflect a strong commitment to its acquisition mission. They performed little or no mission needs analysis, set unrealistic cost and schedule estimates, and proceeded into the production of systems before having completed their development.

They also suppressed bad news. For example, in reporting when the Air Route Surveillance Radar, the first new long-range radar, would become

operational, FAA officials announced delays in 5 of the past 6 years. While a certain level of technical problems in commissioning a complex new radar can be expected, the consistent pattern of reporting that the radar was almost ready, followed by annual delays, indicates that officials were not disclosing the full extent of the difficulties being encountered. In its 1994 report on FAA's acquisition of the Advanced Automation System, the Center for Naval Analyses discussed how organizational incentives discouraged reporting news of cost increases, schedule delays, and performance problems. According to the Center's report, the suppression of bad news prevented top management from taking early action.

It is easy to understand how certain organizational incentives could cause employees involved in federal acquisitions, including FAA officials, to act in ways that do not reflect a mission focus. By analyzing mission needs, they risk raising questions about the need for "their" projects. By establishing realistic cost estimates, they may endanger the approval of near-term funding. By surfacing problems, they may expose their projects to heightened managerial and congressional oversight and risk criticism for their decisions and actions.

An analysis of FAA's 1993 survey of employees involved in acquisitions of air traffic control equipment concluded that considerable energy must be devoted to survival instead of mission accomplishment. Responses to a May 1995 survey of these employees indicated that a large percentage were concerned about the consequences of reporting bad news:

- A majority of the respondents (62 percent) agreed that employees are often hesitant to say what they really think for fear of retaliation.
- Nearly half (45 percent) of the respondents disagreed that pointing out when promised deadlines or deliverables are not realistic would not be held against them.

Accountability

Employees feel more empowered and are more likely to be held responsible for decisions and actions in organizations with more constructive cultures. In reporting on FAA's acquisitions, several observers have found that accountability was not well-defined or enforced for decisions on requirements and oversight of contracts—two essential responsibilities in managing acquisitions. For FAA's acquisition of the Airport Movement Area Safety System,[2] the National Transportation Safety

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[2]This system was designed to ensure the safety of traffic movements on airport runways and taxiways by detecting potential incursions and notifying air traffic controllers.

Board found that the agency's failure to establish accountability for determining the requirements of the system delayed its implementation. The Safety Board concluded that if the system had been implemented on schedule, a fatal accident at a St. Louis airport may have been prevented. For the acquisition of the Advanced Automation System, the Center for Naval Analyses reported that FAA did not enforce such normal contract management procedures as continuously monitoring expenditures, milestones, and deliverables. GAO reported that weak oversight of the contractor was a contributing factor in the cost overruns and schedule delays in implementing that system.

According to internal and external observers of FAA's acquisition process, the agency's hierarchical structure has fostered a controlling environment in which employees do not feel empowered to make decisions or are not held accountable for the decisions they do make. In 1991, the National Research Council described FAA's organizational culture as a rigid hierarchy in which "upward communication is weak and personnel are expected to do what they are told without challenge." About 80 percent of the respondents to the May 1995 survey of employees involved in acquisitions stated that four or more layers of management review are between them and the head of their division. More than half (52 percent) disagreed that needed information flowed up and down freely in their division.

Coordination

In organizations with more constructive cultures, employees are more likely to involve others in decisions affecting them and resolve differences collaboratively. In FAA, ineffective coordination between system developers and operators led the agency to acquire systems that cost more and took longer to implement. For example, installations of new terminal doppler weather radars and airport surveillance radars were delayed because the project offices did not coordinate with field offices to ensure that sites suitable for installing these systems had been acquired.

One major factor impeding coordination is FAA's organization of key players in the acquisition process into different divisions whose stovepipes or upward lines of authority and communications are separate and distinct. Because FAA's operational divisions are based on a functional specialty, such as engineering, air traffic control, or equipment maintenance, getting the employees in these units to work together has been difficult. Internal and external studies have found that the operations and development sides of FAA have not forged an effective partnership.

Adaptability

Employees are more receptive to change and respond more positively to demands and opportunities posed from within and outside of their organization when that organization has a more constructive culture. FAA's acquisitions were impaired when employees resisted making needed changes in the agency's decisions on acquisitions. The Microwave Landing System was one acquisition in which FAA officials resisted change despite powerful reasons to reconsider their decision. In the 1970s, because of limitations in its Instrument Landing System and the expected large growth in air traffic operations, FAA decided to replace this system with the Microwave Landing System. Despite pressure from such user groups as the airlines and general aviation, evidence that the Instrument Landing System had been improved, lower-than-expected growth in air traffic, and the emergence of satellite-based navigation technology, FAA resisted changing its decision to acquire this system into the early 1990s.

Organizational incentives fostering the status quo have been cited in various studies and in the results of employee surveys as a key factor that helps to explain why employees resist change. The 1991 National Research Council report concluded that FAA must change its incentive system from a bureaucratic one that rewards those who "don't make waves" to one that encourages innovative behavior. A 1994 study for the Department of Transportation described FAA's culture as one that emphasizes conservatism and conformity, discourages innovation, and rewards employees for following rules. The results of the May 1995 employee survey questioned management's support for change. Half of the respondents disagreed that management is open and responsive to change, and only 20 percent of the respondents agreed that employees are given "soft landings" when innovations result in failure.

FAA Has Begun Efforts to Change Its Acquisition Culture

According to organizational theory and research, large-scale cultural change is a complex and time-consuming undertaking that requires a comprehensive strategy to create real and lasting improvements. The larger the organization, the more variables that tend to maintain the status quo and, thus, have to be manipulated to bring about desired changes. Efforts to achieve cultural change typically take 5 or more years to fully implement.

Recognizing the need to improve its acquisition management and change its organizational culture, FAA began a reform effort in November 1994 called the Integrated Product Development System. This reform effort is based on using cross-functional, integrated product teams that are

responsible for ensuring that air traffic control systems are developed and implemented properly. The goals of these teams are to improve accountability and coordination and infuse a more strategic, mission-oriented focus into the acquisition process. Team members include representatives from the engineering division as well as from the divisions that operate and maintain air traffic control equipment. In addition, FAA announced a new Acquisition Management System on April 1, 1996, which is intended to improve acquisitions by creating a more comprehensive, life-cycle focus on acquisitions; promoting innovation in contracting approaches; and developing an environment of continuous learning among acquisition employees. FAA identifies its Integrated Product Development System as an "implementing arm" of its new Acquisition Management System.

While it is too early to identify the results of the new Acquisition Management System, FAA has made some progress in implementing its reform effort by creating 13 integrated product teams and training and collocating team members. For example, to enhance the required skills of the team members, FAA developed a program for training them to work together more effectively, make decisions more collaboratively, and resolve conflicts more constructively. In a complementary action, the divisions responsible for operating and maintaining FAA's air traffic control equipment have restructured their units that set requirements to align with the integrated product teams.

Some areas for concern have, however, arisen. As of June 1996, some 19 months after the Integrated Product Development System was announced, FAA has still approved only one team's plan. Each team plan is important because it defines the roles and empowerment boundaries as well as establishes operating procedures and performance measures for that team. Also, GAO's interviews with team members indicated difficulties in gaining stakeholders' commitment to the new system and in forging true partnerships across organizational "stovepipes." These indications were confirmed in a September 1995 internal FAA report, which concluded that two functional stakeholder divisions had not "bought into" the new system at all, while a third had bought into the concept at the leadership—but not the working—level. Another internal review revealed the following problems:

- Some officials doubt the long-term viability of the new system.
- Empowerment supported by top management had been negated by resistance from functional managers.

- Some functional managers will not support collocation or conduct business within this team structure.

As currently designed, the Integrated Product Development System does not address how FAA can gain the strong commitment of all stakeholders to its reform effort. The system is targeted only toward members of the 13 integrated product teams (about 500 of the 2,000 employees in the acquisition organization) and 250 other FAA employees. The system also does little to identify ways to influence the beliefs, values, attitudes, and behaviors of FAA employees who are not team members. A comprehensive strategy would define responsibilities, provide performance measures, and identify incentives for all stakeholders in the acquisition process to help make the new system a success and promote a more constructive culture throughout FAA.

Recommendation

GAO recommends that the Secretary of Transportation direct the FAA Administrator to develop a comprehensive strategy for cultural change. This strategy should include specific responsibilities and performance measures for all stakeholders throughout FAA and provide the incentives needed to promote the desired behaviors and to achieve agencywide cultural change.
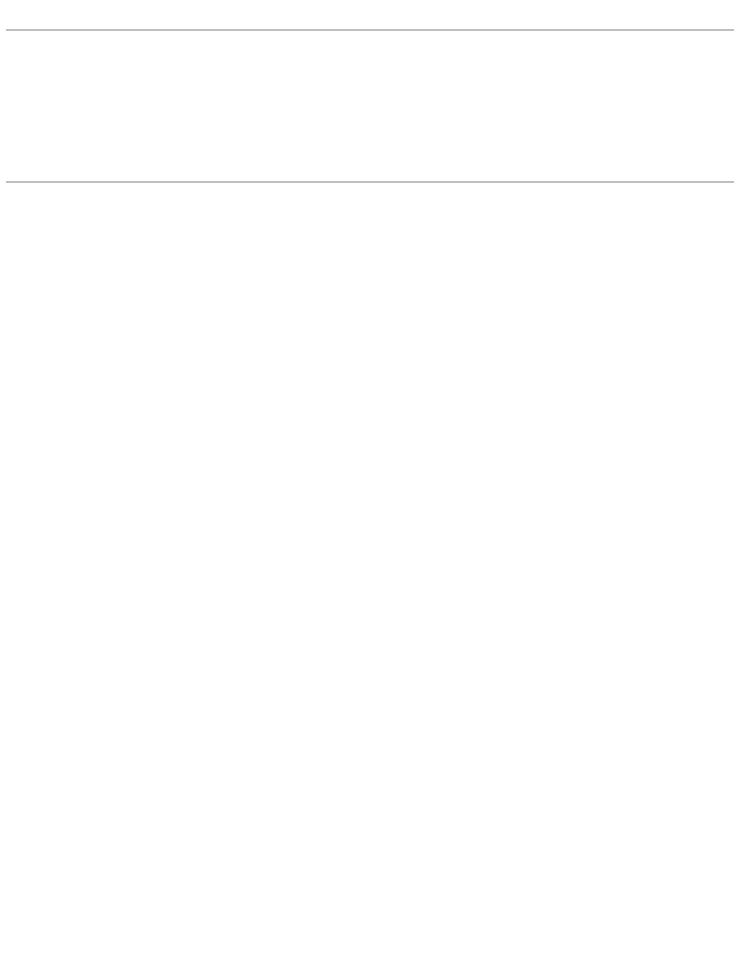
Agency Comments

GAO provided the Department of Transportation with a draft report for review and comment. GAO met with FAA officials, including the Director, Office of Acquisitions; the Chief of Staff to the Associate Administrator for Research and Acquisitions; and the Program Directors for Air Traffic Plans and Requirements and Airway Facilities Requirements. These officials generally agreed that the report accurately described FAA's acquisition problems and correctly identified its organizational culture as a contributing factor. In concurring with the report's conclusions and recommendations, they said that although FAA has made great strides toward changing its organizational culture, the GAO report is correct in pointing out deficiencies that may prevent FAA from accomplishing such change.

The Program Director of Air Traffic Plans and Requirements emphasized that procedural deficiencies, such as weak controls over requirements changes, have been instrumental in causing past acquisition problems. He said that changes in acquisition procedures could have an immediate, beneficial effect on the agency's acquisitions and that FAA is making those

changes. GAO agrees that procedural deficiencies have caused problems with FAA's acquisitions; over the years, GAO reports have focused on these deficiencies. However, this review found that FAA's culture is also a cause, and GAO believes that FAA is correct in looking to cultural change as an important part of the solution.

These officials also said that this report should recognize FAA's many structural and procedural initiatives that could affect its organizational culture. It was not within the scope of GAO's review to catalog and evaluate all organizational change initiatives that could potentially affect FAA's culture. This review focused instead on the primary reform effort—the Integrated Product Development System—whose explicit purpose was to improve FAA's acquisition process by changing the agency's organizational culture. However, references to some of FAA's initiatives were included, as appropriate, in the text.

Contents

Related GAO Products

Tables

Abbreviations

AAS	Advanced Automation System
ADL	Aeronautical Data Link
AMASS	Airport Movement Area Safety System
ARA	Office of the Associate Administrator for Research and Acquisitions
ARSR	Air Route Surveillance Radar
ASDE	Airport Surface Detection Equipment
ASOS	Automated Surface Observing System
ASR	Airport Surveillance Radar
ATC	air traffic control
ATS	Air Traffic Services
AWOS	Aviation Weather Observing System
CAMI	Civil Aeromedical Institute
CNA	Center for Naval Analyses
FAA	Federal Aviation Administration
FSAS	Flight Service Automation System
FQI	Federal Quality Institute
GAO	General Accounting Office
GPS	Global Positioning System
ILS	Instrument Landing System
IPDS	Integrated Product Development System
IPT	Integrated Product Team
ITWS	Integrated Terminal Weather System
JSS	Job Satisfaction Survey
MLS	Microwave Landing System
Mode S	Mode Select
ODAPS	Oceanic Display and Planning System
OMB	Office of Management and Budget
OTA	Office of Technology Assessment
TDWR	Terminal Doppler Weather Radar
VSCS	Voice Switching and Control System

Introduction

The Federal Aviation Administration's (FAA) primary mission is to ensure safe and efficient air travel throughout the United States. FAA's ability to fulfill this mission depends on the adequacy and reliability of the nation's air traffic control (ATC) system, which FAA is responsible for managing and maintaining. Growth in air traffic operations and deteriorating equipment have strained the current ATC system and FAA's ability to sustain its exemplary safety record. These factors have increased the urgency for FAA to modernize ATC equipment.

FAA began its program to modernize the ATC system in the early 1980s. The program included the acquisition of new radars and automated data processing, navigation, and communications equipment. As of March 1996, FAA estimated that from 1982 through 2003, the total cost of this modernization program will be about $35 billion. Through fiscal year 1996, the Congress will have provided FAA with approximately $22 billion of the $35 billion.

GAO Has Reported on Long-Standing Acquisition Problems at FAA and Identified Contributing Factors

We have been involved in evaluating FAA's acquisitions of major systems since FAA began its ATC modernization program. We have chronicled how FAA's modernization program has experienced substantial cost overruns, lengthy schedule delays, and performance shortfalls. Our reviews have traditionally focused on the technical difficulties and managerial weaknesses that caused these problems. Until undertaking this review, we had examined the role of an underlying managerial factor—organizational culture—in acquisition management at other federal agencies but not at FAA.

Cost, Schedule, and Performance Problems Persist

The most vivid example of FAA's cost, schedule, and performance problems was FAA's effort to replace existing display and computer systems in ATC facilities across the nation. The Advanced Automation System (AAS), the long-time centerpiece of the modernization program and the most costly project, was restructured in 1994 after costs tripled to an estimated $7.6 billion from the 1983 estimate of $2.5 billion and after the planned implementation of key components was up to 8 years behind the original 1983 schedule.

The critical Initial Sector Suites System segment of the AAS project, intended to replace controllers' existing work stations at en-route centers[3]

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[3]Controllers in en-route centers, also known as air route traffic control centers, maintain control of aircraft leaving airspace near the originating airport until the aircraft enters airspace near the destination airport.

and provide controllers with new hardware and software, including radar displays, was particularly troublesome. Before scaling back this segment, FAA was attempting to address several serious technical problems, such as (1) ensuring that 210 separate work stations would communicate in a stable network, (2) reducing the need to revise each software code (on average, every line of software needed to be rewritten once), and (3) converting a system for communicating flight information on printed paper strips to an electronic system.

Unplanned cost increases have characterized many other FAA acquisitions. Per-unit costs increased substantially for eight of the nine key projects that we have tracked in our annual status reports on the ATC modernization program.[4] (Table 1.1 shows the percentage change in unit costs for the nine projects.)

Table 1.1: Changes in Unit Cost for Nine Major FAA Projects

Dollars in millions

Project	Original unit cost estimate	1995 unit cost estimate	Percentage change in unit cost
Aeronautical Data Link (ADL)	$3.049	$2.732	−10
Air Route Surveillance Radar (ARSR-4)	8.870	9.992	13
Airport Surface Detection Equipment (ASDE-3)	3.961	6.182	56
Aviation Weather Observing System (AWOS)	0.229	0.346	51
Flight Service Automation System (FSAS)	5.001	6.462	29
Integrated Terminal Weather System (ITWS)	2.955	6.775	129
Mode Select (Mode S)	2.473	3.291	33
Terminal Doppler Weather Radar (TDWR)	5.392	8.104	50
Voice Switching and Control System (VSCS)	10.344	63.169	511

Since beginning the ATC modernization program in the early 1980s, FAA has completed smaller projects, but efforts to develop and implement most major acquisitions—such as replacing automated systems and communications equipment—have suffered extensive delays. As of

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[4]Since the original estimates, FAA changed the quantity required for seven of the nine projects. To calculate unit costs, we divided the original and current costs by the number of units—radars, sites, or facilities—scheduled to be established under the original and current estimates.

March 1996, 74 projects totaling $5.1 billion—only about 15 percent of the modernization program's overall cost—were completed, and 147 projects remained active. For the nine acquisitions cited above, delays have averaged almost 5 years per project from original estimates. (Table 1.2 shows the schedule delays experienced by these nine projects.)

Table 1.2: Changes in First-Site Implementation Milestones for Nine Major FAA Projects

	First-site implementation		Years delayed
	Year		Original estimate to 1995
Project	Original estimate	Actual/current estimate	
ADL	1993	1995	2
ARSR-4	1988	1996	8
ASDE-3	1987	1993	6
AWOS	1986	1989	4
FSAS	1984	1991	7
ITWS	1999	2000	1
Mode S	1988	1994	6
TDWR	1992	1994	2
VSCS	1989	1995	6

Performance shortfalls have also affected many projects and have caused rework, redesign, and even cancellation of projects. The following three key projects that we have reviewed are examples.

- The Automated Surface Observing System (ASOS) is designed to (1) measure wind speed, temperature, cloud height, visibility, and the types and amounts of precipitation near airport runways and (2) send computer-generated information to pilots. Although FAA had procured more than 350 ASOS units by May 1995, few had been commissioned by the end of that year because of technical difficulties. For example, we reported in April 1995 that six of the eight sensors in the system did not meet key contract specifications for accuracy or performance. Furthermore, the system's overall reliability during testing was only about one-half or less of the required levels.[5]
- The Air Route Surveillance Radar-4 (ARSR-4) is designed to track aircraft and weather. Persistent technical problems—most recently, difficulties in

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[5]ASOS' problems are explained in Weather Forecasting: Unmet Needs and Unknown Costs Warrant Reassessment of Observing System Plans (GAO/AIMD-95-81, Apr. 21, 1995) and Air Traffic Control: Status of FAA's Modernization Program (GAO/RCED-95-175FS, May 26, 1995).

developing software and integrating this radar with other ATC systems—have delayed its implementation for years.

- The Mode Select (Mode S) radar is designed to (1) identify, locate, and track aircraft by using radar signals to obtain information from up to 700 individual aircraft at a time and (2) provide users with a communications channel between aircraft and ground facilities. Although FAA awarded a production contract in 1984, technical difficulties prevented FAA from fielding a full-performance radar until this past year.

Problems Are Caused Largely by Technical Difficulties and Managerial Weaknesses

Our work over the years has pointed to technical difficulties and weaknesses in FAA's management of the acquisition process as primary causes for FAA's recurring cost, schedule, and performance problems. In terms of technical difficulties, FAA has underestimated the complexity of developing systems, especially highly ambitious ones that involved extensive software development, such as AAS. FAA's difficulties in developing software have caused cost overruns and schedule delays for numerous acquisitions of major systems.

We have also reported recurring weaknesses in FAA's management of the acquisition process. FAA did not historically manage its acquisitions of major systems in accordance with the business-like principles embodied in Office of Management and Budget Circular A-109 and FAA's own acquisition policies. For example, FAA did not analyze its mission needs and performed flawed or limited analyses of alternative approaches for achieving those needs. FAA also did not perform realistic testing before proceeding into full production of systems and found out later that the systems did not meet the agency's specifications. Other managerial weaknesses include inadequate oversight of contractors' performance, difficulties in resolving issues related to requirements for FAA's various systems, and problems with securing sites to install equipment.

Prior GAO Reviews of Federal Acquisition Management Have Analyzed the Influence of Organizational Culture

Organizational culture is one managerial factor we have examined in reviews of acquisition management at other federal agencies but not at FAA. We have defined organizational culture as the underlying assumptions, beliefs, values, attitudes, and expectations shared by an organization's members that affect their behavior and the behavior of the organization as a whole.

In our 1992 report on the acquisition of weapon systems at the Department of Defense, we found that the Department's organizational culture

contributed to cost increases, schedule delays, and performance shortfalls.[6] In our view, individuals acted in response to incentives related to their careers, jobs, program support, organizational influence, and budget levels. Collectively, these incentives created an environment that encouraged "selling" and starting new programs and pushing existing programs ahead despite development, production, and implementation problems.

In our 1992 report on the Department of Energy, we concluded that the Department's contract management problems would require a change in its business philosophy and that its efforts to instill a new organizational culture were an acknowledgement of the systemic nature of the problems.[7] Similarly, we reported that the National Aeronautics and Space Administration would have to change its organizational culture in order for its contract management improvement efforts to succeed.[8] Since then, our preliminary work in evaluating the implementation of the Government Performance and Results Act of 1993 has shown that effective implementation of this act will require fundamental changes in the culture of government management—changing management's focus from what federal employees are doing to what they are accomplishing.[9]

Constructive Organizational Cultures Have Similar Characteristics

Organizational theory and behavioral science describe an interdependent relationship between employees' beliefs, values, and attitudes and their individual and collective behaviors. Moreover, these beliefs, values, attitudes, and behaviors do not operate in a vacuum but are affected by forces both within and outside of an organization. Internal forces include policies and procedures, an organization's structure and incentive systems, and leadership exercised by top management. External forces include the needs of customers and, in the case of government agencies, congressional committees and Members of Congress.

Organizational theory and research show that an organization's culture is more constructive when employees' underlying values, attitudes, and beliefs cause individuals and the organization as a whole to behave more often in ways that have desirable results—both for the organization and its

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[6]Weapons Acquisition: A Rare Opportunity for Lasting Change (GAO/NSIAD-93-15, Dec. 1992).

[7]High Risk Series: Department of Energy Contract Management (GAO/HR-93-9, Dec. 1992).

[8]High Risk Series: NASA Contract Management (GAO/HR-93-11, Dec. 1992).

[9]Results-Oriented Management: A Manual for Evaluating Implementation of the Government Performance and Results Act, Operating Draft (GAO/GGD, Dec. 2, 1994).

customers. Employees in these organizations demonstrate a stronger commitment in the following four areas: mission focus, accountability, coordination, and adaptability.[10]

- Mission focus refers to the employees' pursuit of goals that define the best course of action for an organization. An agency's mission provides the agency with purpose and meaning and promotes short- and long-term commitment by its employees. In a more constructive culture, employees are more likely to think ahead and plan, emphasize quality over quantity, and subordinate their own needs to the agency's overall mission.
- Accountability refers to the value an organization places on involvement, participation, and ownership among its members. A greater sense of commitment to the organization fosters the employees' willingness to be held accountable for decisions and actions. In a more constructive culture, employees are more likely to take responsibility and work to achieve self-set goals, give positive rewards to others, and help others to think for themselves.
- Coordination refers to the consistency of behavior and the sharing of beliefs and values by individuals and groups within an organization. Such consistency facilitates the exchange of information and fosters coordinated efforts. In a more constructive culture, employees are more likely to involve others in decisions affecting them, openly share information, resolve differences collaboratively, cooperate with others in the organization, and pursue common purposes.
- Adaptability refers to the employees' capacity to respond positively to changing demands and opportunities posed from within and outside the organization. Adaptability enables an organization to adopt new behaviors and processes (e.g., in response to emerging technologies and the changing needs of its customers). In a more constructive culture, employees are more likely to resist conformity, think in unique and independent ways, explore alternatives before acting, learn from mistakes, and be receptive to change.

When an organization and its employees demonstrate a strong, balanced commitment in these four areas, research shows that the employees are more likely to be satisfied and the organization will perform better. Conversely, an organization is less effective when its employees, both individually and collectively, are less focused on the agency's overall

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[10]Our description of the attributes of a constructive culture is based on the theories and research of Dr. Robert A. Cooke, presented in Organizational Culture Inventory Leader's Guide. Our description of the four areas is based on the work of Dr. Daniel R. Denison in Corporate Culture and Organizational Effectiveness.

goals, are held less accountable, coordinate their actions less effectively, and are more resistant to change.

Objectives, Scope, and Methodology

In light of FAA's persistent acquisition problems and our work at other federal agencies that highlighted a need to change organizational culture, the Chairman, Subcommittee on Transportation and Related Agencies, House Committee on Appropriations, asked us to examine FAA's management of its ATC modernization program to (1) determine whether FAA's organizational culture has contributed to the agency's continuing cost, schedule, and technical problems and (2) identify steps that FAA could take to improve its acquisition management through changing its organizational culture if that is a contributing factor.

To accomplish the first objective, we reviewed reports focused specifically on FAA's acquisitions as well as selected studies and research on organizational culture. We drew upon analyses of FAA by other organizations and analyzed the results of FAA employee surveys. We also discussed these analyses with employees involved in acquisitions, including members of the integrated product teams, and with other FAA acquisition stakeholders. We used common theories of research on organizational culture to link the behaviors of FAA employees to long-standing problems in its acquisition process. To document these problems, in reviewing our past reports and testimonies on FAA's acquisition of ATC systems we concentrated on reports that had been issued since FAA announced its ATC modernization program in 1981. A detailed description of key studies and employee surveys is provided in appendix I.

The body of research on organizational culture is extensive. Theories describe the behaviors and problems promoted by different types of organizational cultures and the elements that are essential for organizational performance and effectiveness. We primarily used the organizational research results of Dr. Daniel R. Denison, professor at the University of Michigan's School of Business Administration; Dr. Robert A. Cooke, consultant for Human Synergistics/Center for Applied Research, Inc.; and Dr. Joseph Coffee, Director of National Education Programs at the Department of Treasury's Bureau of Alcohol, Tobacco, and Firearms. These studies were particularly useful because they provided us with a framework for assessing FAA's culture. A description of these studies is presented in appendix II.

To achieve the second objective, we reviewed a wide range of ways to manage organizational change, including approaches for reengineering and applying best practices, that were explained in our past reports and testimonies and approaches promoted by (1) private consulting firms, such as Ernst & Young and Coopers & Lybrand; (2) individual researchers and writers on organizational culture; and (3) national management organizations, such as the Federal Quality Institute (FQI),[11] the National Academy of Public Administration, the Defense Department's Systems Management College, the Association for Quality and Participation, the American Society for Quality Control, and the National Performance Review.

We then developed a strategy for successful cultural change by synthesizing common components of major studies and asked a variety of individuals involved in federal management issues and research on organizational culture and theory to review and comment on our strategy. We then compared FAA's reform effort for changing its organizational culture with our strategy for managing organizational change. Specifically, we reviewed FAA's effort to determine if it contains the components that are essential for successful change. A list of the individuals we contacted is provided in appendix III.

We conducted audit work from August 1995 through June 1996 in accordance with generally accepted government auditing standards.

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[11]FQI was formed in 1988 as a joint effort of the Office of Management and Budget, the President's Council on Management Improvement, and the Office of Personnel Management to act as a catalyst for quality improvement in the U.S. government.

Organizational Culture Is an Underlying Cause of FAA's Longstanding Acquisition Problems

FAA's organizational culture has been an underlying cause of the persistent cost overruns, schedule delays, and performance shortfalls in the agency's acquisitions of major ATC systems. Weaknesses in ATC acquisitions stem from recurring shortcomings in the agency's mission focus, accountability, internal coordination, and adaptability.

Multiple forces within an organization—such as its policies, processes, structure, incentive systems, and leadership exercised by top management—affect employees' beliefs, values, attitudes, and behaviors. Each section in this chapter cites various studies and the results of FAA's employee surveys to illustrate the effects of these internal forces. While the complexity of the interrelationships among these internal forces as well as their interdependence with external forces allows for a variety of interpretations, our analysis reflects what we found to be common themes in the information sources available to us.

Insufficient Mission Focus Has Impaired Acquisitions

Ultimately, the goal of any acquisition program is to acquire only essential equipment and field it within agreed-to cost, schedule, and performance parameters. In organizations with more constructive cultures, employees are more customer-focused and more actively pursue goals that define the best course of action for the organization.

The effectiveness of FAA's management of the acquisition process was reduced by employees in the various divisions who did not focus on the agency's mission to acquire ATC equipment or consider the long-term, agencywide effects of their decisions and actions. Program officials took such actions as establishing unrealistic cost and schedule estimates and rushing acquisitions prematurely into the production phase. Studies and surveys indicate that these actions were driven by organizational incentives that did not support a focus on FAA's mission.

FAA's Actions Did Not Reflect a Mission Focus

In reviewing problematic acquisitions, we found that FAA officials acted in ways that did not reflect a strong commitment to the agency's acquisition mission. Over the years, program officials did not perform mission needs analyses; set unrealistic program cost and schedule estimates; suppressed bad news; and began system production before completing development, testing, and evaluation. Although enabling projects to get started and proceed with minimal interruption, these actions did not foster the agency's mission of undertaking only essential ATC acquisitions and completing them within budget and on schedule.

Program officials pushed ahead with acquisitions without demonstrating the importance of those acquisitions to achieving the agency's mission. In 1993, we reported that many of the mission need statements we examined—documents that identified the need for FAA to invest an additional $5 billion to fix deficiencies in the ATC system—were not based on the results of any documented mission analysis.[12] Despite the lack of substantial support for these acquisitions, FAA's top management approved the statements. As a result, FAA has acquired systems that do not meet the agency's needs. For example, as we noted in that report, FAA spent $46 million on the Real Time Weather Processor to provide controllers with current accurate weather information. However, the new equipment operated as much as six times more slowly than the existing system, and in 1991, FAA suspended this program indefinitely and began to redefine controllers' needs.

Program officials established unrealistic schedule estimates. The result was "unexpected" schedule delays. For example, according to our 1989 report on the Voice Switching and Control System (VSCS) project, FAA's project schedule was more optimistic than that of the system engineering and integration contractor who was hired to provide technical and programmatic support to FAA in managing the modernization program.[13] FAA officials explained that they preferred their schedule over the contractor's whose "safe" dates did not require as much effort to meet. The contractor, however, said that FAA's schedule was unrealistic because it did not allow any extra time to absorb unanticipated difficulties. By 1991, FAA's estimated date to implement the VSCS at the first-site had slipped from May 1992 to June 1994.

Program officials also established unrealistic cost estimates. The total estimated cost of the AAS project tripled from the original estimate of $2.5 billion to $7.6 billion. On a per-unit basis, the estimated cost of the VSCS project increased from the original estimate of about $10 million to about $63 million or an increase of 511 percent; the estimated cost of the Integrated Terminal Weather System project increased from about $3 million to almost $7 million or an increase of 129 percent. The magnitude of these increases indicates that FAA managers were not being realistic in estimating the costs of various ATC systems.

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[12]Air Traffic Control: Justifications for Capital Investments Need Strengthening (GAO/RCED-93-55, Jan. 14, 1993).

[13]Air Traffic Control: Voice Communications System Continues to Encounter Difficulties (GAO/IMTEC-89-39, June 1, 1989).

Program officials have suppressed bad news. For example, officials managing the ARSR-4 project reported in 1989 that the first implementation of this radar would occur in September 1992. Since 1989, despite their consistent indications that the radar was almost operational, they reported delays in 5 of the following 6 years. In 1995, program officials said the radar system would be up and running in September 1995; however, the first ARSR-4 radar was operational in April 1996. In recent years, the reasons for schedule slippages cited by program officials included software errors that surfaced while integrating software with hardware, production delays, problems with preparing sites, and integration problems between ARSR-4 radars and other ATC systems. While a certain level of technical problems in implementing a complex radar system like ARSR-4 is normal, the consistent pattern of reporting that this system was almost ready, followed by annual schedule delays, indicates that program officials were not disclosing the full extent of difficulties they encountered.

FAA officials have rushed into production of ATC systems. Over the years, cost, schedule, and performance problems have resulted from excessive concurrency—beginning system production before completing development, testing, or evaluation programs. FAA has proceeded with producing numerous systems, including the Microwave Landing System (MLS), Mode S radar, and Oceanic Display and Planning System (ODAPS), before their critical performance requirements had been met. The decision to proceed into the production phase of these projects proved to be a mistake. After years of delays, the MLS contractors did not meet established performance requirements. As of May 1995, the ODAPS contractor had not met a key operational requirement—11 years after the contract was awarded.[14] Although FAA awarded a production contract for Mode S radar in 1984, the agency implemented its first full-performance Mode S radar in February 1995.

Mission Focus Not Supported by Organizational Incentives

Employees at all levels have described FAA's shortcomings in mission focus. Furthermore, internal and external reviews of FAA's ATC acquisitions show that incentives in its acquisition process did not promote management decisions and program outcomes that reflected this mission focus.

According to the current FAA Administrator and his Deputy, "the FAA needs long-haul piloting, but it's been getting short-hop management." Similarly,

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[14]Air Traffic Control: Status of FAA's Modernization Program (GAO/RCED-95-175FS, May 26, 1995).

an analysis of responses to a 1993 FAA survey of acquisition employees concluded that they believed they must devote considerable energy to organizational survival instead of using that energy to be proactive and focused on accomplishing the agency's mission.[15] In a 1995 survey,[16] these employees continued to indicate their focus on survival, rather than mission accomplishment, in responses, such as the following;

- A majority of the respondents (62 percent) agreed that employees are often hesitant to say what they really think for fear of retaliation.
- More than half (53 percent) disagreed that management supports employees who raise difficult or controversial issues in open meetings.
- Half disagreed that management helped employees stay focused on what really matters.
- Nearly half (45 percent) disagreed that pointing out when promised deadlines or deliverables are not realistic would not be held against them.

In discussions with FAA employees and in reviewing studies and reports on its acquisition process, we found further evidence of a link between FAA's insufficient mission focus and the agency's incentives. For example, the Associate Administrator for Research and Acquisitions described a "grow-your-own" development process at FAA. He said that a group of programs has emerged that does not reflect a unified approach to achieving the acquisition mission because program managers are rewarded for starting individual programs and getting them to advance, regardless of the long-term consequences.

A 1995 internal FAA study on the use of support services contracts revealed incentives for focusing on short-term results. The study noted that (1) funding for program officials to pursue new projects appeared to be given a higher priority than funding for users to install purchased equipment and (2) a backlog in the installation and implementation of field equipment had risen to an equivalent of an estimated 1,300 staff years. According to this study, new equipment would likely continue to be backlogged and stored in warehouses unless the agency's Airway Facilities

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[15]What We Already Know About the New AXA Organization: 1993 Job Satisfaction Survey Results, (summer, 1993).

[16]In the ARA Culture Baseline Survey Report, (fall 1995) directions for responding were listed as strongly agree—almost always describes the way people think and act; agree—frequently; unsure—about half the time or lack experience to comment; disagree—seldom; and strongly disagree—rarely. The results of items must be interpreted cautiously because 1) the survey instructions appear only on the first page of the survey, 2) the unsure category has two possible interpretations, and 3) there are high proportions of "unsure" responses on many items. Items reported in this chapter range from 16 to 41 percent for responses of "unsure." For discussion purposes, we present responses in terms of "agreed, disagreed, or were unsure."

division received increased resources for installation.[17] In our view, this allocation of resources reflects a short-term emphasis on beginning new programs without considering the long-term implications for existing systems.

A 1994 report on the AAS program by the Center for Naval Analyses (CNA) discussed organizational incentives that did not promote a strategic focus on FAA's mission. According to CNA, FAA's culture discouraged program officials from reporting news of cost increases, schedule delays, and performance problems with the AAS project. This suppression of bad news prevented top management from taking early action.[18] Similarly, in a 1993 internal study of its process to determine system requirements, an FAA team reported that the agency did not reward employees for how well they met customers' needs; instead, job standards reflected how a process was performed without regard to the effect on the agency's overall performance or budget.[19]

In our 1992 review of the Defense Department's management of acquisitions of major weapon systems, we found that the Department's organizational culture allowed the needs of the participants in the acquisition process to create incentives for pushing programs and encouraging undue optimism, parochialism, and other compromises of good judgment. Consequently, problems persisted not because they were overlooked or underregulated but because they enabled more programs to survive and thus more participants' needs to be met. For example, because the success of program managers depended on getting results (e.g., meeting the next major milestone), their strongest motivation was to keep the programs moving and to protect them from interruption.[20]

It is easy to understand why participants in the federal acquisition process, including FAA officials, are driven by these incentives. By analyzing mission needs, they risk raising questions about the need for "their" projects. By establishing realistic cost estimates, they may endanger the approval of near-term funding. By surfacing problems, they may expose their projects to heightened managerial and congressional oversight and risk criticism for their decisions and actions. By insisting on full testing before moving

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[17]Study of Support Services Contracts Within the Federal Aviation Administration, FAA Task Force (Feb. 1995).

[18]FAA Advanced Automation System Program Assessment, CAB94-30.10 (Apr. 1994).

[19]Report of the Operational Requirements Team, (Nov. 22, 1993).

[20]Weapons Acquisition: A Rare Opportunity for Lasting Change (GAO/NSIAD-93-15, Dec. 1992).

to production, they may delay a project's schedule and cause it to receive reduced funding. Thus, employees are motivated to push ahead expeditiously with acquisitions.

Weak Accountability Has Hampered Acquisitions

In organizations with more constructive cultures, employees feel more empowered and are more willing to be held accountable for decisions and actions. In a January 1996 memorandum to the FAA Administrator, the Department of Transportation's Inspector General described an "environment for abuse" at FAA caused by the lack of accountability that reflected "a mind set within FAA that managers are not held accountable for decisions that reflect poor judgment." We found that FAA's acquisitions were impaired when officials were not held accountable for making decisions on system requirements and for exercising proper oversight of contracts. Both problems were commonly cited as reasons for the drastic restructuring of the AAS program. Because responsibility was diffused among many stakeholders in the acquisition process, establishing accountability for management decisions and actions was difficult. FAA's multiple layers of management in its hierarchical structure have contributed to diffused responsibility and weak accountability.

Responsibility for Decisions on System Requirements Has Been Diffused

FAA program officials have not been held accountable for making and sustaining decisions on requirements for acquisitions of major systems. In 1993, an FAA internal review team reported that FAA's process for making and documenting decisions on requirements lacked discipline and accountability: "No one person or organization has accountability for meeting mission requirements in a cost-effective manner." As a result of this weak accountability, multiple changes in systems' requirements have increased costs and delayed program schedules. For example, the program manager for the ARSR-4 project said that the schedule for making the first radar operational, planned for February 29, 1996, was delayed by the addition of two new requirements that necessitated more operational testing. These requirements were added within a day of putting the first radar into operation.

In the case of AAS, we reported that FAA's failure to resolve issues related to basic requirements contributed to this system's problems and the need for extensive restructuring. CNA reached similar conclusions in its April 1994 review of AAS:

"The systemic cultural problems of the FAA of diffusing responsibility plus an inability to hold firm on requirements has resulted in cost growth and schedule slips in the AAS program."

FAA's difficulties in resolving requirements continued after the restructuring of its AAS project. The Department of Transportation's Office of the Inspector General reported in October 1995 that FAA negotiated the contract for the Display System Replacement without including all known requirements in its specification document that was used as the basis for the negotiation.

FAA's acquisition of the Airport Movement Area Safety System (AMASS), designed to monitor aircraft movements on the ground and alert air traffic controllers to potential conflicts, illustrates how weak accountability for determining a system's requirements limited the agency's ability to improve aviation safety. In 1995, the National Transportation Safety Board reported that FAA's difficulties in getting internal stakeholders to agree on AMASS' operational and performance requirements delayed implementing the system.[21] After investigating the collision between a TWA MD-80 and a Cessna aircraft at the St. Louis airport in November 1994, the Safety Board concluded that if this system had been operational, the accident might have been prevented. The Safety Board said that progress in implementing the system was

". . . effectively paralyzed as a result of a succession of changes in operational specifications imposed from within the FAA's Air Traffic Service . . . Ironically, most of the modifications were not associated with issues of increasing safety. . . . Some requirement changes went against the basic objective of the AMASS program."

If FAA officials had been held accountable for weighing the costs and benefits of requirement changes proposed by different stakeholders and limiting additions to the system's performance requirements, the system might have been implemented in time to prevent this accident.

Officials Have Not Been Held Accountable for Contract Administration

FAA has identified contract administration as a material weakness in its acquisitions of major systems. The agency reported that senior management had not adequately focused on problems occurring when significant changes were made after a contract's award and cited long delays between a problem's recognition and correction. FAA concluded that because accountability for contract administration was not

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[21]National Transportation Safety Board Safety Recommendation to the Federal Aviation Administration Administrator (Feb. 28, 1995).

well-defined or enforced, program officials were not encouraged to
exercise strong oversight of contractors. Over the years, poor oversight of
contractors has caused acquisition problems in such projects as ODAPS,
Mode S, and AAS.

- In 1990, we reported that FAA's management actions to address
  development problems with Mode S were ineffective. We concluded that
  internal controls in the Mode S project were not adequate to ensure that
  appropriate action was taken when contract problems arose. At that time,
  the delivery of the first system had been delayed by 5 years.[22]
- In 1992, we reported that program officials managing the ODAPS program
  were slow to address serious development problems with the system and
  failed to plan essential activities to ensure the program's success. At that
  time, the system was 3 years behind schedule and had no projected
  completion date.[23]
- In 1993, we reported that FAA's inadequate oversight of the contractor
  responsible for developing AAS software was a major cause of the system's
  cost increases and schedule delays.[24] An FAA-contracted review of the AAS
  project reached similar conclusions in April 1994. CNA reported that FAA
  managers did not enforce such normal contract management procedures
  as continually monitoring expenditures, milestones, and deliverables.

Accountability Has Been Reduced by Hierarchy

Past reviews of FAA and responses from employee surveys reflect an
environment of control fostered by the agency's hierarchical structure. In
this environment, employees are not empowered to make needed
management decisions. This lack of empowerment decreases their sense
of ownership and responsibility, which in turns makes them more
reluctant to be held accountable for their decisions and actions.

In 1991, the NRC described FAA's culture as a rigid hierarchy in which
"upward communication is weak and personnel are expected to do what
they are told without challenge."[25] These sentiments were echoed in a 1993
FAA employee survey in which a large percentage of employees involved in
acquisitions responded that decisions were not being made at the most

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[22]Air Traffic Control: Ineffective Management Plagues $1.7-Billion Radar Program (GAO/IMTEC-90-37,
May 31, 1990).

[23]Air Traffic Control: FAA Needs to Justify Further Investment in Its Oceanic Display System
(GAO/IMTEC-92-80, Sept. 30, 1992).

[24]Air Traffic Control: Advanced Automation System Problems Need to Be Addressed
(GAO/T-RCED-93-15, Mar. 10, 1993).

[25]Winds of Change: Domestic Air Transport Since Deregulation, National Research Council (1991).

appropriate level and that they had problems with approvals they
perceived to be unnecessary. Fewer than half reported that they had
enough authority to make day-to-day decisions about day-to-day work
problems.

Results from the 1995 survey of these employees also showed a
relationship between hierarchy, empowerment, and accountability. First,
they identified the hierarchical structure as a concern.

- Most respondents (80 percent) reported that four or more layers of
management review were between them and the head of their
organization.
- More than half (52 percent) disagreed that any employee could easily
access the head of their organization directly.

Responses to this survey also showed they perceived a lack of
empowerment and access to needed information.

- More than half (54 percent) of the respondents disagreed that employees
knew that management listens because things changed as a result of their
input.
- More than half (52 percent) disagreed that needed information flowed up
and down freely in the acquisition organization.

These difficulties with hierarchy and empowerment were also reflected in
their attitudes regarding accountability.

- Nearly half (45 percent) disagreed that people who repeat mistakes are
held accountable for their poor judgement; only a fifth (21 percent) agreed
with the statement, and the remainder (34 percent) were unsure.
- A significant portion of the respondents (42 percent) agreed that it is
difficult to hold individuals accountable because the way things are
structured diffuses responsibility; a third disagreed; and the remainder
(26 percent) were unsure.

We have identified the need to change outdated hierarchical structures
throughout the federal government. As we reported in March 1993, the
centralized bureaucracies of the federal government—with their reliance
on control through rules, regulations, and hierarchical chains of command
designed in the 1930s and 1940s—simply do not function well in the
rapidly changing society and economy of the 1990s, which are
technology-driven and knowledge-intensive. We have also identified the

need for broad changes to improve federal management by establishing accountability for achieving program results and emphasizing a long-term focus.[26]

Poor Internal Coordination Has Impeded Acquisitions

In organizations with more constructive cultures, employees are more likely to involve others in decisions affecting them, openly share information, and resolve differences collaboratively. In FAA, ineffective coordination has caused the agency to acquire systems that cost more than anticipated and took longer to implement. One major factor deterring employees from working together is FAA's organization of key players in the acquisition process into different divisions whose stovepipes or upward lines of authority and communications are separate and distinct.

Coordination Among Divisions Has Been Ineffective

Poor coordination between FAA's program offices and field organizations has caused schedule delays. Although coordination between program offices and field organizations is necessary to ensure that sites suitable for installing ATC systems are acquired and prepared, installations of the Terminal Doppler Weather Radar (TDWR), the Airport Surveillance Radar (ASR-9), and the Airport Surface Detection Equipment (ASDE-3) have all been delayed because of problems with putting these systems in the field. For example, as of March 1996, the implementation of the final 10 ASR-9 radars was being delayed because planned sites were not ready. Similarly, we reported in 1995 that FAA had to postpone TDWR's implementation at 11 locations because of the unavailability of sites and land acquisition problems.[27] FAA's installation of ASDE-3 was also delayed. The system, as designed, was too heavy for many of the existing ATC towers where it was to be installed. In four of five regions, the initial implementation plans were not detailed enough for those regions to know where the towers should be located or how to construct them in time to meet the original schedule.[28]

AAS is an example of how poor coordination between developers and users of systems impaired an acquisition.

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[26]Improving Government: Measuring Performance and Acting on Proposals for Change (GAO/T-GGD-93-14, Mar. 23, 1993).

[27]Air Traffic Control: Status of FAA's Modernization Program (GAO/RCED-95-175FS, May 26, 1995).

[28]Air Traffic Control: FAA's Implementation of Modernization Projects in the Field (GAO/RCED-89-92, June 28, 1989).

- In 1992, about 4 years after awarding the AAS contract, FAA announced that it would incur an additional $150 million in costs for design changes for the system's tower component because the original design did not give controllers enough room to move around or visibility in the tower cab. If controllers and developers had collaborated to resolve these concerns during the original design phase, the additional expense to modify an awarded contract may have been avoided.
- In 1993, recognizing the agency's difficulties in resolving requirements for AAS, FAA designated three top officials from the program office and its Air Traffic and Airway Facilities divisions to make final decisions on requirements. However, this group was unable to resolve important requirements for the system's continuous operations.
- Recent work by the Department of Transportation's Office of the Inspector General found that FAA officials planned to restructure the AAS contract before senior management and users of the system agreed on what was needed.[29]

Structural "Stovepipes" Have Reduced Coordination

A major factor limiting coordination among stakeholders in FAA's acquisitions of major systems has been its organizational structure. Internal and external observers of FAA generally agree that organizational stovepipes have reduced coordination, increased systems' costs, and delayed their implementation.

FAA's senior management has identified the agency's current organizational structure as a problem that impairs ATC acquisitions. In May 1995, the FAA Administrator characterized the problem as a "hierarchical, stovepipe approach that in the past has often resulted in costly inefficiencies and a failure to deliver products in time to meet customer needs." Similarly, in a December 1995 agency newsletter, FAA's Deputy Administrator cited "the bureaucratic structures that have hampered the full utilization of the talent and energy that reside in FAA employees." Earlier, in April 1994, the Assistant Administrator for Information Technology had recognized the effect of these stovepipes and the need to "change our ways of thinking—change our individual and corporate culture and change some of our traditional business practices."

Among the reviews describing the negative effect of FAA's organizational structure on internal coordination during the acquisition process was a 1994 report by the Office of Technology Assessment (OTA) on aviation

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[29]Inspector General Semiannual Report to the Congress, Office of the Secretary of Transportation (Oct. 31, 1995).

research.[30] OTA noted that differences in the organizational culture among FAA's air traffic controllers, equipment technicians, engineers, and divisional managers made communication difficult and limited coordination. Implementing these systems was often delayed because of a tendency for one stakeholder to establish technical requirements without adequately consulting those stakeholders responsible for developing the operational procedures that the systems were designed to support. According to OTA, when system operators were not consulted early in the development process, operational problems remained undetected until after a prototype of the system was developed and tested and procurement was imminent or underway.

Employees involved in acquisitions have also described deficiencies in coordination and cooperation. A March 1992 survey of FAA's research and acquisition staff found that its researchers did not focus adequately on what end-users, such as controllers, need or on how the technology would be deployed and maintained. FAA's 1993 study of its process to establish requirements found that the agency's operations and development sides have not formed a partnership to articulate requirements and devise a range of alternatives to meet them rapidly and cost-effectively. This study reported that the end customer is insufficiently involved in establishing system requirements. As a result, the study concluded that FAA functioned as a classically stovepiped organization in which operators and developers only came together at the Administrator's level. Therefore, disputes regarding system requirements have been forced to a very high level before they can be resolved.

More recently, results of FAA's 1995 survey of acquisition employees showed that the agency has been making progress in promoting cooperation as an organizational value because nearly two-thirds (65 percent) of the respondents agreed that everyone is expected to coordinate with others who have a stake in the outcome of their work. The survey responses, however, indicate the need for FAA to enhance cooperation.

- More than half (53 percent) disagreed that employees value team achievement more than individual achievement.
- More than half (58 percent) disagreed that most tasks are assigned to teams rather than to individuals.

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[30]Federal Research and Technology for Aviation, OTA-ETI-610 (Sept. 1994).

Inadequate Adaptability Has Hampered Acquisitions

In organizations with more constructive cultures, employees are more receptive to change and respond more positively to demands and opportunities posed within and outside that organization. FAA's acquisitions of major ATC systems have been impaired because its employees resisted making needed changes in the agency's approach to both specific acquisitions and its acquisition process as a whole. As a result, FAA has been less able to respond to changes in its internal and external environments. Institutional incentives that foster the status quo and high levels of management turnover are two factors hindering FAA's adaptability.

FAA's Actions Have Not Demonstrated Adaptability

FAA's reluctance to apply federal principles for acquisitions of major systems illustrates how the agency has resisted changing its acquisition process. For the first 10 years of its modernization program, FAA did not follow government acquisition policy and principles established by the Office of Management and Budget's Circular A-109. These principles included analyzing mission needs, considering a full range of alternatives to meet them, and testing new systems operationally before committing to full production. In 1987, we recommended that FAA comply with these principles as a step toward alleviating the cost and schedule problems that had characterized the acquisition process since 1981.[31] In 1991, FAA finally issued a revised order on major acquisitions that better reflected the phases and key decision points of Circular A-109.

The results of an August 1995 internal FAA report summarizing management problems with AAS indicated that the 1991 order was not sufficient to overcome the agency's resistance to changing its acquisition process. On the basis of findings from studies, the majority of which occurred after 1992, FAA's report concluded that management actions concerning the AAS program "deliberately circumvented" the A-109 process.[32]

The MLS was one acquisition in which FAA officials resisted change despite powerful reasons to reconsider their decision. In the 1970s, because of limitations in its ILS and the expected large growth in air traffic operations, FAA decided to replace this system with the MLS. Despite pressure from such user groups as the airlines and general aviation, evidence that the ILS had been improved, lower-than-expected growth in air traffic, and the

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[31]Aviation Acquisition: Improved Process Needs to Be Followed (GAO/RCED-87-8, Mar. 26, 1987).

[32]Responses to Institutional Problems Contributing to AAS Program Failures, Interim Report: Synthesis of Problems Associated with the Advanced Automation System Acquisition (Aug. 1995).

emergence of satellite-based navigation technology, FAA resisted changing its decision to acquire this system until 1993. The agency eventually terminated the MLS project in 1994 because the Global Positioning System (GPS), when enhanced, was expected to support all types of aircraft approaches.[33]

FAA's attempt to implement cross-functional matrix teams responsible for acquisitions of major systems is an example of a new process that was undermined by management's resistance to change.[34] FAA began to implement cross-functional teams in 1990 with the creation of matrix teams, which consisted of staff and resources from various FAA functional divisions working together to develop and implement a project or group of projects. By assigning experts from each functional specialty to a project team, FAA hoped to improve coordination and communication. Although managers of each functional division represented in the matrix teams formally agreed to support them, by March 1992, employee survey results indicated that senior managers' commitment to this concept was weakening and they continued to foster a "stovepipe" approach.

The effects of FAA's resistance to change on the agency's ability to respond to external changes in technology and growth in aviation traffic have been cited by several sources.

- The Aircraft Owners and Pilots Association predicted in 1990 that the United States would have the technology to implement GPS by 1995 but expressed concern that FAA's bureaucracy would slow this system's implementation.
- The National Research Council concluded in its 1991 report that "FAA has not demonstrated the capacity to anticipate or respond to rapid changes in technology or the industry which it serves." According to the Council, FAA's failure to anticipate changes in the aviation industry resulting from deregulation caused delays in responding to the demands posed by increased air traffic. These delays engendered concerns about air safety and service.
- The 1994 Air Traffic Control Corporation Study found that FAA has been struggling to keep up with rapidly evolving technology, such as the use of GPS satellites for navigation purposes, despite its potential to improve safety substantially and reduce the cost of aircraft operations. The study's

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[33]Air Traffic Control: Status of FAA's Modernization Program (GAO/RCED-95-175FS, May 23, 1995).

[34]In commenting on our draft report, acquisition officials said that the failure of the matrix team concept was also caused by an inherent design weakness; specifically, the concept was not based on team-based collaborative decisionmaking, shared accountability, and empowerment.

executive oversight committee, consisting of the FAA Administrator, his Deputy, and other high-ranking aviation industry officials, concluded that "FAA is the weak link in the technological revolution."[35]

Incentives Have Promoted the Status Quo

The link between FAA's organizational resistance to change and its organizational incentives has been cited by various sources within and outside the agency. For example, the Secretary of Transportation stated in July 1994 that "We need to change the whole culture of the ATC system to permit flexibility, ingenuity, and efficiency to come to the fore." In May 1994, the executive oversight committee for the Air Traffic Control Corporation Study described FAA's culture as one that "emphasizes conservatism and conformity, and lacks innovation." The committee concluded that at FAA, "people are not used effectively in an acquisition system that discourages innovation and rewards them for following rules."

Most respondents to FAA's 1993 survey of employees involved in acquisitions were skeptical that FAA would take advantage of opportunities to change. According to the results from FAA's May 1995 survey, half of the respondents disagreed that management is open and responsive to change; and only a fifth of the respondents (21 percent) agreed with the statement that "management takes an active role in promoting innovative ideas proposed by employees;" or that employees are given "soft landings" when innovations result in failure (20 percent).

FAA's 1993 report on its process to determine requirements, which was based on interviews of managers, noted that organizational incentives promoted the status quo. One manager observed that FAA employees are not innovative because they are "beat over the head for identifying problems rather than rewarded for finding something that needs fixing." Another manager noted that employees were not innovative because if "there's a failure, the FAA puts in another rule." Similarly, in 1991, the National Research Council's report described FAA's culture as one that is "resistant to innovation or rapid change and more disposed to avoiding criticism." The report concluded that in order to change its culture, FAA must change its incentive system "from a bureaucratic one which rewards those who 'don't make waves' to one which encourages creative and innovative behavior."

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[35]Air Traffic Control Corporation Study: Report of the Executive Oversight Committee to the Secretary of Transportation (May 1994).

Turnover of Management Has Hindered Adaptability

We have expressed concerns over the years about the instability and uncertainty caused by the frequent turnover of FAA Administrators and observed that greater stability within the agency's top leadership would enable FAA to effectively initiate and sustain corrective actions. Since its modernization program began, the average tenure for the Administrator or Acting Administrator has been less than 18 months. FAA has also experienced a high turnover rate for its most senior acquisition executive, who is charged with overseeing acquisition policy and program execution. Since 1990, five people have held that position.

The frequent turnover of FAA's Administrators has enabled them to focus on the short term and defer making tough decisions. As we reported in March 1993, the frequent turnover of FAA's Administrators contributed to the delay in reaching a decision on the extent to consolidate air traffic facilities for the AAS project. This delay, in turn, contributed to schedule and cost problems and created uncertainty over the future of the project.[36] CNA noted in its April 1994 report on the AAS project that the system's design had never been changed from the original design, which was based on a consolidation plan that had been, for all practical purposes, previously abandoned. As a result, unneeded requirements were carried forward at high cost and technological complexity.

This frequent management turnover has also led employees to believe that new initiatives will be short-lived. According to the 1991 National Research Council report, the short tenure of FAA Administrators has been a problem because it has created a resistance on the part of the bureaucracy to respond to new directions. Because FAA employees have believed that an Administrator is not likely to stay in office long enough to see new initiatives implemented, they have felt that those initiatives would likely be thwarted by bureaucratic inertia.

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[36]Air Traffic Control: Advanced Automation System Problems Need to be Addressed (GAO/T-RCED-93-15, Mar. 10, 1993).

FAA Has Begun Efforts to Change Its Acquisition Culture

Cultural change is a complex and time-consuming undertaking. Recognizing the need to improve its management of acquisitions through cultural change, FAA has developed and begun implementing a reform effort. Much work remains, however, before substantial cultural change is fully incorporated and can be sustained. A particular concern is the difficulties in gaining the strong commitment of all stakeholders throughout the agency. As currently designed, FAA's reform effort does little to identify ways for obtaining this commitment.

Cultural Change Is a Major Undertaking for Organizations

According to organizational theory and research, cultural change is a complex and time-consuming undertaking. Employees' values, attitudes, and beliefs are affected by a wide range of internal and external forces. Dr. Joseph Coffee, who has studied cultural change in federal agencies, concluded that there is a direct relationship between the size of an organization and the number of variables that tend to maintain the status quo and, thus, have to be manipulated to bring about desired changes.[37] Cultural change efforts typically take 5 or more years to fully implement.

Through our management reviews of major federal departments and agencies over the past decade, we have identified diffused accountability and incentives that encourage short-term responses to long-term problems as fundamental challenges to improving an agency's management. Moreover, the lack of coordination promoted by functionally organized divisional structures and institutional resistance to change are weaknesses commonly attributed to the bureaucratic structure that typifies many federal organizations.

Dr. Coffee's research found that federal executives have often focused on reorganizing and initiating new work processes, while paying little attention to culture, as ways to effect change. Many governmental efforts to promote change have emphasized that people should work more effectively across organizational lines. Organizations attempting to encourage more risk-taking and empowerment of lower-level employees while reducing the hierarchy and the number of rules have found their progress frustratingly slow. His study on cultural change in the federal government concluded that many efforts to promote change are not sufficiently comprehensive and do not address the many variables needed for success. For example, the study predicted that as cross-functional work groups are created, desired changes in behavior will less likely be

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[37]A Comparative Study of Organizational Culture Change in Federal Agencies: Success Patterns of Long-Term Efforts, Joseph N. Coffee (Nov. 1993).

produced if traditional functional structures are maintained. When this occurs, the "stovepiping" effect continues, and the values, beliefs, and behaviors of the employees are more likely to remain aligned with their functional division.

From Dr. Coffee's and others' research, we conclude that managing cultural change requires a different set of management techniques and greater management sophistication in planning and implementation. By integrating current theories of effective management improvement initiatives, such as business process reengineering and results-oriented management, with traditional strategic planning precepts, we developed a strategy based on common components for managing organizational change. By focusing on employees' beliefs, values, and attitudes; their behaviors; and the organization's formal and informal structures, incentives, and policies, an organization can apply this comprehensive strategy to change its culture. Included in this strategy are the following components:

- Assess the current situation to determine the root cause of problems.
- Communicate the need to address the root cause of problems.
- Develop and communicate a vision for the future.
- Identify the factors that will impede change.
- Neutralize impediments to change.
- Identify and teach the skills required to make the change successful.
- Develop performance indicators to measure the extent to which the organization has achieved change.
- Implement the strategy for change.
- Use performance data to improve efforts to promote change.

Appendix IV lists supporting actions that organizations could take to apply these nine components to change their culture.

FAA's Reforms Include a Plan for Cultural Change, but Stakeholders' Commitment Has Been Difficult to Obtain

FAA's primary reform effort for cultural change, the Integrated Product Development System (IPDS), began in November 1994. We found that FAA has made some progress in implementing its cultural change effort. A key area of concern is FAA's difficulties in gaining the strong commitment to IPDS agencywide. As currently designed, this new system does little to address how FAA can gain this commitment.

IPDS Aims to Achieve Cultural Change

IPDS is at the core of FAA's effort to improve its management of ATC acquisitions and its ability to provide modern and reliable ATC equipment. Although other initiatives underway elsewhere in the agency will probably affect its organizational culture, this system was designed explicitly to effect cultural change.

A key component of the IPDS is the establishment of integrated product teams (IPT). These teams are designed to be cross-functional and responsible for research, development, and acquisition as well as for ensuring that new equipment is delivered, installed, and working properly. IPT members include systems and specialty engineers, logistics personnel, testing personnel, contract personnel, and lawyers as well as representatives from the organizations responsible for operating and maintaining the ATC equipment. In a complementary action, to mirror the structure of the IPTs, the divisions responsible for operating and maintaining ATC equipment have restructured their units that determine requirements.

IPDS evolved from matrix management teams that FAA established in 1990 to promote cross-functional collaboration. Responsible for developing and implementing projects, matrix teams consisted of staff and resources from various FAA functional divisions. However, FAA's management recognized that the matrix teams had continuing weaknesses, such as the lack of empowerment and accountability as well as the persistence of stovepiping.

FAA managers developed and proposed IPDS to apply the successful parts of matrix teams while addressing their weaknesses. We found three reasons why this new system would likely prove more successful than the former matrix teams. For one, the new system recognizes the need to change the acquisition culture. Secondly, IPDS incorporates many aspects of the model strategy we present in this report. For example, to equip IPT members with the skills required in the new environment, FAA developed a training program for the teams that includes training on working together effectively, collaborative decision-making, and conflict resolution. Similarly, to convey their commitment to cultural change, managers in FAA's Research and Acquisitions division (ARA) piloted a rewards program that recognizes teams as well as individuals for behaviors that lead to desired outputs. Thirdly, FAA developed guiding principles for its new system that address the agency's deficiencies we identified in chapter 2. For instance, the IPDS emphasizes rewarding teamwork, communications, and innovation to address shortcomings in coordination and adaptability

and emphasizes life-cycle management and team responsibility to address weaknesses in mission focus and accountability.

FAA identifies the IPDS as an "implementing arm" of the new Acquisition Management System, which became effective on April 1, 1996. Provisions of the 1996 Department of Transportation Appropriations Act exempted FAA from most federal procurement and personnel laws and regulations.[38] In response, FAA has announced its new acquisition management and human resource systems to implement provisions of the 1996 Act. The Acquisition Management System consists of three elements:

- The life-cycle acquisition management system is intended to be a more comprehensive, disciplined approach to managing the entire acquisition life cycle, from the analysis of mission needs to the eventual disposal of products.
- The procurement system is intended to allow FAA managers to be innovative and creative in selecting vendors and managing contracts.
- The acquisition work force learning system is intended to increase the capability of ARA employees and align the motivations of individuals with FAA's overall goals.

The concept behind the life-cycle acquisition management system is to improve coordination and mission focus by strengthening the "front-end" of the acquisition process. Specifically, the operators and developers are expected to work together to analyze mission needs and alternatives before senior management makes capital investment decisions and assigns projects to IPTs. The acquisition work force learning system is being designed to improve mission focus and increase empowerment, coordination, and adaptability by strengthening the competencies of employees and developing an environment of continuous learning. The new learning system is linked to the agency's new competency-based human resource system that the agency is developing in response to statutory exemptions from federal personnel laws and regulations.

It is too early to identify results of the new Acquisition Management System. However, by June 1996, some 19 months after beginning its reform effort, only 1 of FAA's 13 IPTs[39] had obtained approval of its team plan, an action FAA considers to be essential to successfully implement the new teams. These plans are important because they outline the team members'

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[38]Public Law 104-50, 109 Stat. 436, 460-61 (1995), 49 U.S.C. Sec. 40110 note.

[39]The IPT with an approved plan is responsible for acquiring oceanic ATC systems.

roles, empowerment boundaries, and team operating approaches and
procedures.

Feedback from FAA employees and internal FAA reports indicate FAA's
difficulty in gaining commitment to the new system. Evidence of this
problem was cited in a September 1995 internal FAA report summarizing
the views of 50 senior and midlevel managers and technical employees
who were interviewed about programs and functions affected by the
formation of IPTs.[40] According to FAA's report, while support for the new
system at the leadership level of the ARA and Air Traffic divisions appeared
strong, interviewees expressed concerns over commitment of staff at the
working level. Several respondents concluded that the Flight Standards
and Airports divisions had not bought into the process.

Our interviews with a cross section of oceanic IPT members revealed that
FAA's weaknesses in mission focus, accountability, coordination, and
adaptability continue to undermine the IPDS initiative to effect
organizational change. For example, comments suggested that some team
members have remained motivated primarily by their functional division's
values and attitudes to the detriment of the team's ability to focus on the
agency mission of ATC acquisitions. Also, because some team members
have not been empowered by midlevel managers who attempt to
circumvent the team's decision-making process, they continue to elevate
disputes through the traditional stovepiped hierarchies. The internal
"lessons learned" paper by the oceanic IPT concluded that

- lack of commitment exists because of doubts over whether empowerment
  had changed or would change;
- not all team members want the responsibility of empowerment, and some
  do not act accountably;
- empowerment supported by top management has been hampered by
  functional managers' resistance;
- collocation is not supported by many functional managers;
- working as a team in a cross-functional manner is difficult for staff to
  understand;
- some functional managers will not conduct business within the new
  structure; and
- staff who do not understand the new integrated product development
  system concept have to be worked around or through.

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[40]Staff Report: A Survey of Programs and Functions Impacted During the ARA Reorganization (Sept.
1995)

Cultural Reform Effort Does Not Address How to Obtain Strong Commitment by Stakeholders

Dr. Coffee's research indicates that targeting a small segment of an organization is less likely to effect substantial change because the existing culture continues to shape the beliefs, values, and behaviors of the majority of the organization. If change is to occur, the different stakeholders have to be integrated into the effort to change so they come to value and support a different vision of their organization. The study concludes that when senior managers throughout the organization are supportive and involved in its efforts to change, the probabilities of sustaining change increase substantially.

Implementation of the IPDS included a formal memorandum of support signed by senior management from the various stakeholder divisions in April 1995. The memorandum states generic roles in the acquisition process and the functional managers' dedication to supporting the new IPTs. For example, ARA will "provide overall program oversight;" the Regulation and Certification division will "provide input to the IPTs on behalf of system users;" Air Traffic Services (ATS) will "initiate mission needs statements on behalf of system users;" and officials from the Airports division will "coordinate with ARA and ATS on functional requirements."

Of course, the memorandum, by itself, does not guarantee commitment. In implementing matrix teams, the predecessor of IPTs, FAA obtained the formal agreement of functional managers, who provided personnel to acquisition project teams, to support their staff in team roles. The results of a March 1992 survey of about 600 research and acquisition staff found, however, that (1) managers had not fully empowered employees, (2) team's decisions had been second-guessed and/or overturned, (3) the commitment of senior mangers to matrix teams was weakening, and (4) senior managers continued to work as individuals, thus fostering a stovepiped approach.

FAA management has recognized the risk for stovepipes to impede change. According to a senior ARA official responsible for planning and implementing the IPTs, the implementation of IPDS has been slowed because the key stakeholder groups have different values and objectives. For example, as a member of the acquisition reform task force studying the issue of life-cycle and workforce competencies, this official found that each division has had different ideas of what characterizes a competent workforce for the life-cycle of an acquisition.

ARA has recognized the implementation difficulties presented by stovepipes. Its draft transition plan for the IPDS concluded that establishing IPTS alone is insufficient to sustain needed cultural changes:

"The team-based performance philosophy of IPDS requires a culture and special organizational focus.... What matters is that the parochial motivations of functional organizations need to give way to true partnerships cutting across 'stovepipes' in an integrative manner. The FAA IPDS model accomplishes this objective from a structure standpoint. What remains is the change in culture and thinking necessary to make it successful."

As designed, however, FAA's reforms are likely to have a limited effect because they focus on IPT members and do little to neutralize the impediments to change. The 750 members of the 13 IPTS include only about 500 of the approximately 2,000 ARA employees and about 250 of the remaining FAA employees, including representatives from the other major stakeholder divisions—namely, the controllers and maintenance technicians who use and maintain the new equipment. The IPDS does little to identify how FAA can influence the beliefs, values, attitudes, and behaviors of FAA employees who are not members of IPTS. A comprehensive strategy would have defined responsibilities, provided performance measures, and described incentives for all stakeholders in the acquisition process to help make the IPDS a success and promote a more constructive culture throughout FAA.

Conclusions

Changing FAA's organizational culture will not occur overnight. Both organizational research and FAA's experience have shown that much work remains before the agency's shortcomings in mission focus, accountability, coordination, and adaptability are ameliorated.

To FAA's credit, the agency has recognized the importance of cultural change, and its Integrated Product Development System is a promising first step. However, FAA will not know whether this system has the potential to create and sustain a more constructive culture unless the agency is able to fully establish the integrated product teams and gain the strong commitment of all stakeholders to the new system. A comprehensive strategy for cultural change is needed that includes the means for obtaining the support throughout FAA.

Recommendation to the Secretary of Transportation

We recommend that the Secretary of Transportation direct the FAA Administrator to develop a comprehensive strategy for cultural change. This strategy should include specific responsibilities and performance measures for all stakeholders throughout the agency and provide the incentives needed to promote the desired behaviors and to achieve agencywide cultural change.
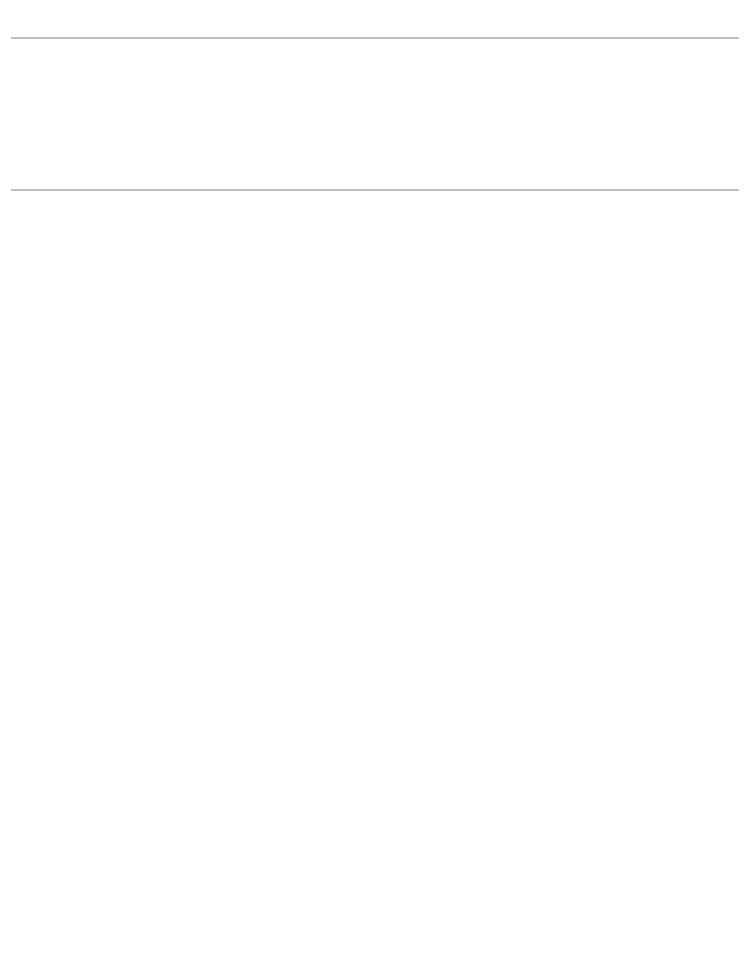
Agency Comments

We provided the Department of Transportation with a draft report for review and comment. We met with FAA officials, including the Director, Office of Acquisitions; the Chief of Staff to the Associate Administrator for Research and Acquisitions; and the Program Directors for Air Traffic Plans and Requirements and Airway Facilities Requirements. These officials generally agreed that our report provided an accurate history of FAA's acquisition problems and correctly identified culture as a contributing factor. In concurring with our conclusions and recommendations, they told us that although FAA has made great strides toward changing its organizational culture, our report is correct in pointing out deficiencies that may prevent FAA from accomplishing such change.

The Program Director, Air Traffic Plans and Requirements, emphasized that procedural deficiencies, such as weak controls over requirements changes, have been instrumental in causing past acquisition problems. He said that changing procedures could have an immediate, beneficial impact on the agency's ATC acquisitions and that FAA has been making those changes. We agree that procedural deficiencies have caused problems with FAA's acquisitions. Over the years, GAO reports have focused on these deficiencies. However, this review found that FAA's culture is also a cause, and we believe FAA is correct in looking to cultural change as an important part of the solution.

FAA officials also told us that our report should recognize the many structural and procedural initiatives throughout the agency that could improve its organizational culture. They told us, for example, that

- Offices for air traffic and airway facilities requirements were restructured to complement the establishment of IPTs.
- Airway Facilities' business, strategic, and operational plans now address initiatives of the IPDS.
- ATS and ARA also instituted more discipline in the process for establishing and modifying requirements.

It was not within the scope of our review to catalog and evaluate all of FAA's initiatives that could potentially affect its culture. Our review focused instead on the agency's primary reform effort—the IPDS—whose explicit purpose was to improve the acquisition process through cultural change. However, references to some of FAA's initiatives were included, as appropriate, in the text.

Summary of Studies Used to Characterize FAA's Organizational Culture

Air Traffic Control Corporation Study: Report of the Executive Oversight Committee to the Secretary of Transportation, 1994.

Basis for Study: The Secretary of Transportation established the Executive Oversight Committee in September 1993 to study how the air traffic control (ATC) system could be restructured to resolve long-standing problems with acquisition, budget and finance, and personnel. The Committee comprised senior executives from the Federal Aviation Administration (FAA), the Office of the Secretary of Transportation, several organizations within the Executive Office of the President, three other government agencies, and two existing government corporations.

Approach: The Executive Oversight Committee focused its research on 13 prior studies on the subject; other U.S. corporations' experiences; international ATC organizations; the cost and existing use of ATC services, projected financial performance, and the viability of an ATC corporation; and the identification of the best practices in acquisition, budget, management, and personnel that would be possible under corporatization and the limitations of a government agency. The Committee examined a range of approaches to improving the ATC system to evaluate how (1) these alternatives would permit rapid modernization of the ATC system; (2) obstacles to day-to-day operations could be removed; (3) users and employees could change the organization's culture; and (4) aviation safety could be improved.

Significance of Findings: The Executive Oversight Committee concluded that "the FAA acquisition process takes too long, lacks flexibility and accountability, and results in products and services that cost too much." The ability of FAA's current management to be responsive to customer needs and to acquire advanced technology is limited because of "an organizational culture that is not responsive to change, emphasizes conservatism and conformity, and lacks innovation."

FAA Advanced Automation System Program Assessment, the Center for Naval Analyses, CAB94-30.10, Apr. 1994.

Basis for Study: FAA asked the Center for Naval Analyses (CNA) to assess the organizational, management, and financial status of the agency's Advanced Automation System (AAS).

Approach: CNA's panel of 38 senior experts performed a 90-day independent analysis of the AAS program. Team members included

computer hardware and software experts, former program managers and program analysts familiar with complex technology programs, corporate managers, major systems developers, and former legislative staff. The team received briefings from FAA and IBM, visited government and contractor facilities, attended program reviews and technical meetings, interviewed participants in the program, and reviewed records and financial data.

Significance of Findings: The study included a specific focus on the organizational culture that characterized FAA's management of the AAS program. The team's report cited systemic cultural problems at FAA related to such problems in the acquisition of AAS as increased costs and schedule delays. For example, the suppression of bad news prevented FAA's top management from taking early action.

Federal Research and Technology for Aviation, **Office of Technology Assessment, OTA-ETI-610, Sept. 1994.**

Basis for Study: The study was conducted by the Office of Technology Assessment (OTA) in response to a request by the House Committee on Science, Space, and Technology and its Subcommittee on Competitiveness and Technology (now the Subcommittee on Technology, Environment, and Aviation).

Approach: OTA reviewed FAA's technology and regulatory development programs, focusing on, among other things, the ATC system. OTA conducted a series of workshops between June 1992 and February 1993 to obtain the views of officials involved in global aviation issues, including representatives from international aviation-related organizations, airlines, independent and federal research centers, and aircraft manufacturers and contractors.

Significance of Findings: OTA's report focused in part on FAA's difficulties with its acquisitions of major systems. The findings are less than 2 years old and directly address managerial and cultural problems that have delayed development and implementation of ATC technologies. For example, OTA notes that "ATC system development issues are as much cultural as they are managerial." OTA also discusses FAA's shortcomings in analyzing and establishing operational requirements. For example, OTA found that delays in ATC modernization usually stem from inadequately addressing operational issues throughout the stages of system planning and development at FAA.

Report of the Operational Requirements Team, **Federal Aviation Administration, Nov. 22, 1993.**

Basis for Study: In July 1993, the Acting Administrator of FAA assembled a team of employees from Air Traffic, Logistics, System Engineering, Aviation Standards, and the System Capacity Office to investigate FAA's requirements process from an agency's perspective and to make practical recommendations to improve the process.

Approach: The team reviewed past reports related to FAA's process to determine requirements and interviewed 21 individuals from inside and outside FAA to obtain their perspectives on various phases of the requirements process. Interviewees included such high-ranking FAA managers as the Acting Administrator and Deputy Administrator, Associate Administrators, Directors and Executive Directors, and Regional Administrators as well as a contractor senior vice-president.

Significance of Findings: The report was written by FAA employees about FAA problems. It focuses on faulty management practices in the areas of accountability and coordination in the acquisition process and cites FAA's culture as one of four primary areas of deficiency. According to the report, "FAA does not have a culture or rewards system that encourages teamwork, communications, or accountability."

1995 ARA Culture Baseline Survey Report, **Federal Aviation Administration Civil Aeromedical Institute, fall 1995.**

Basis for Study: In May 1995, the Office of the Associate Administrator for Research and Acquisitions (ARA) distributed surveys on organizational culture to all headquarters employees to determine the current state of ARA's culture.

Approach: The survey on organizational culture assessed the following nine dimensions of ARA's culture: customer focus, organizational design, teamwork, innovation, motivation, results management, empowerment, communication, and leadership. FAA's survey was distributed to all ARA employees at their offices. Employees filled out the survey and mailed it back to FAA's Civil Aeromedical Institute (CAMI) in Oklahoma City. The response rate was 47 percent (480 responses out of 1,028 employees).

Significance of Findings: These survey results indicate that ARA has significant problems in its organizational culture. The biggest weaknesses

are in the dimensions of organizational design, which measures the degree to which FAA's structure and infrastructure support quality work and cross-functional collaboration; innovation, which measures the extent to which ARA's culture encourages risk-taking and learning from failure; and leadership, which measures the extent to which ARA's culture encourages management to instill a common vision, lead by example, and help employees focus on quality results.

What We Already Know About the New AXA Organization: 1993 Job Satisfaction Survey Results, Federal Aviation Administration, Civil Aeromedical Institute, 1993.[41]

Basis for Study: In the summer of 1993, FAA's Civil Aeromedical Institute administered a Job Satisfaction Survey (JSS) to 56 randomly selected employees. The survey was intended to measure employee satisfaction with, among other things, managerial practices in employee empowerment and improvement orientation.

Approach: After the new acquisition organization was formed in 1994, the Civil Aeromedical Institute randomly selected 56 headquarters employees responsible for acquisitions who were assigned to the new organization and analyzed their JSS responses.

Significance of Findings: Employees portrayed their acquisition organization as low in empowering them and lacking in openness to the point of making them apprehensive. For example, responses indicated that considerable energy had to be devoted to organizational survival and not doing anything that might "rock the boat."

Acquisition Team Assessment Survey, Federal Aviation Administration Civil Aeromedical Institute, Mar. 1992.

Basis for Study: In the 1992 survey, FAA's Civil Aeromedical Institute asked acquisition employees to respond to questions regarding their attitudes and perceptions of the implementation of matrix teams.

Approach: In March 1992, the Civil Aeromedical Institute sent a series of surveys to solicit responses from approximately 600 acquisition employees (team members and nonteam members) who had played a role in implementing matrix teams.

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[41]AXA was the original designation of the new acquisition organization, which was renamed ARA.

Significance of Findings: The summary of survey results concluded that although cross-functional teams were the right approach, problems continued. For example, acquisition employees said that empowerment was limited and indicated that the commitment of senior managers to the concept of matrix teams was weakening.

Organizational Theories Used to Analyze FAA's Organizational Culture

Interpreting the Cultural Styles Measured by the Organizational Culture Inventory: Organizational Culture Inventory Leader's Guide, Robert A. Cooke, Ph.D. and Janet L. Szumal, Human Synergistics, Inc. 1989.

Summary of Contents: Dr. Cooke discusses the "Organizational Culture Inventory," an instrument he designed to present a quantitative approach to profile the culture of organizations in terms of behavioral norms and expectations. Using the inventory, Dr. Cooke collected data indicating that outcomes generally valued by organizations (such as members' satisfaction and motivation) are directly related to constructive cultural and behavioral styles. Dr. Cooke's description of constructive (v. defensive) cultural types establishes a framework to classify organizational culture according to (1) the factors that promote it, (2) the behaviors resulting from those factors, and (3) the problems or advantages that result from those behaviors.

GAO's Analysis: Dr. Cooke's theory and descriptions of defensive behaviors, the factors that promote defensive behaviors, and the problems associated with them very closely correspond to independently derived studies of FAA's management by numerous internal and external sources during the last 10 years. By combining Dr. Cooke's theory with Dr. Daniel Denison's conclusions on the correlation between positive management styles and organizational effectiveness, we have established criteria to evaluate FAA's acquisition management culture.

Bringing Corporate Culture to the Bottom Line, Daniel R. Denison, Ph.D. Organizational Dynamics: Special Reports, 1988, and **Corporate Culture and Organizational Effectiveness**, Daniel R. Denison, Ph.D. 1990.

Summary of Contents: Dr. Denison's work presents the results of a study of the perceptions of 43,747 respondents in 6,671 work groups in 34 companies. Data on the 34 companies were drawn from the Survey of Organizations archive at the University of Michigan's Institute for Social Research. The survey instrument was based on organizational theory by Rensis Likert Associates and research conducted at the Institute for Social Research between 1966 and 1981. Data on the organizational cultures of 34 companies were then correlated to financial ratios (used as a measure of performance) from Standard and Poor's COMPUSAT listing. The study supports Dr. Denison's conclusions regarding the correlation between

positive (or constructive) corporate cultures and better performance records.

Dr. Denison describes four elements of organizational culture—involvement, mission, adaptability, and consistency—that form a framework for a model of organizational culture and effectiveness. Dr. Denison's research revealed that companies in the private sector whose employees were empowered to actively participate in decision-making and management, as measured by the four elements of organizational effectiveness, reaped a return on investment that averaged nearly twice as high as those firms with less participatory cultures.

GAO's Analysis: The results of Dr. Denison's study provide evidence that the cultural and behavioral aspects of organizations affect their performance. This study establishes criteria to support FAA's need to change the negative aspects of its acquisition management culture. Denison's description of a participative culture corresponds closely with Dr. Cooke's description of a constructive culture. Dr. Denison's data and correlations relate to private sector organizations. Although using financial ratios as a measure of effectiveness is not directly applicable to nonprofit, government organizations, such as the FAA, because of the movement to improve government by making federal agencies more businesslike and accountable and the universality of Denison's four elements of organizational effectiveness, we believe they are applicable to improving FAA's management of ATC acquisitions.

A Comparative Study of Organizational Culture Change in Federal Agencies: Success Patterns of Long-Term Efforts, Joseph N. Coffee, Ph.D. Nov. 1993.

Summary of Contents: Dr. Coffee's study of 19 federal organizations focuses on the factors that cause cultural change efforts in federal agencies and the factors that enable federal agencies to maintain cultural change. Dr. Coffee's initial premises are that (1) certain preconditions must exist, (2) similar activities begin and initially sustain the effort, (3) change-related activities will be of a similar nature, and (4) major changes in organizational culture take place over a significant period of time.

Dr. Coffee concludes that cultural change efforts in the federal government are driven by external threats or crises; an organization's history is the source of many of the elements that resist change as well as

some that drive a change; reducing hierarchy or autocratic management is not normally seen as a cause of a change effort but as a means of achieving that change; leadership plays a key role in instigating cultural change in an organization; incremental change appears to be the preferred approach to cultural change in the federal government; the type of organization and purpose of a change effort appear to be the key variables affecting the success of a change effort because they influence the amount of resistance to it.

Dr. Coffee describes a "legal-rational" model as the cultural base for federal organizations with the following characteristics and problems it poses for changing organizational culture:

- Organized in clearly defined hierarchy of offices. While cross-functional teams have been established in many agencies, the traditional hierarchy has usually remained side-by-side with the new groups that form a new hierarchy.
- Multitude of rules and procedures to ensure that the interests of the organization are served. As employees find ways around existing rules, more rules and procedures are created. Thus, many strategies for change include an effort to streamline procedures.

Dr. Coffee also describes the life-cycle stages of cultures in federal organizations. His description of the "maturity stage" is particularly applicable to FAA. In the maturity stage

- the culture is a significant constraint on innovation and causes stakeholders to believe that change is unnecessary;
- aspects of the culture cause dysfunctional behavior; and
- functional and mission effectiveness declines.

GAO's Analysis: Dr. Coffee's study describes factors that affect the organizational cultures of federal agencies and their ability to change. These factors are applicable to FAA.

GAO'S SYNTHESIS OF THEORIES: Dr. Cooke's theory of constructive and defensive organizational cultures presents a framework that can be used to analyze the FAA. By overlaying Dr. Denison's theory of the four organizational elements required for effectiveness and performance, we can make a direct link between FAA's ineffective management of acquisitions of major ATC systems and the defensive aspects of its

organizational culture. Dr. Denison's elements of effectiveness correspond closely with Dr. Cooke's descriptions of constructive cultures—the opposite of defensive cultures. Dr. Coffee's assertion that employee involvement is essential corresponds directly with Dr. Denison's premise that involvement is a key element of effectiveness. Dr. Coffee presents research specific to the federal environment regarding the factors associated with achieving successful cultural change.

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Components of a Strategy for Cultural Change

This appendix describes the strategy for cultural change presented in chapter 3 with some explication. It is designed for use by organizations suspecting that culture is an underlying cause of their problems. The components are presented as a series, but they are not sequential in the sense that each must be completed before the next can begin. For instance, an organization can communicate the need for cultural change at the same time it communicates its vision of the future. Similarly, an organization can identify the skills required for the cultural change to succeed as it develops its strategy for change.

We validated our strategy for cultural change by soliciting comments from various experts on cultural and organizational change. These experts generally agreed with our strategy but suggested some clarifications, which we incorporated. For example, several experts suggested that we note the role that politics and the three branches of government play in the agencies' efforts to change. Several experts we consulted also noted the importance of selecting a leadership team to drive agencies' efforts to change. Our strategy for cultural change includes the following components:

1. Assess the current business and political situation to determine the root cause of problems.

- Question management, customers, employees, suppliers, the Congress, et cetera, to identify root causes of problems.
- Conduct an analysis of the organization's strengths and weaknesses, opportunities for and threats to the organization.

2. Communicate the need to change the organization's culture.

- Select a leadership team to drive the cultural change.
- Explain the rationale behind the decision to change the culture.

3. Develop and communicate a vision for the future.

- Build consensus around a new corporate vision at the executive level.
- Define the organization's mission, goals, and objectives.
- Link the new vision to mission requirements and the current and anticipated needs of stakeholders (the workforce, bargaining units, the public and customers, and the three branches of government).
- Promote the new corporate vision to stakeholders by (1) demonstrating how current values no longer serve the organization's mission and

(2) presenting data that assail beliefs inconsistent with the desired corporate environment.

4. Identify factors that may impede cultural change

- Identify stakeholders in the change process (e.g., the workforce, bargaining units, the public and customers, and the three branches of government) that may not support cultural change.
- Identify the key leverage points (e.g., reward systems, structure, and leadership) that may inhibit cultural change.

5. Develop a strategy for cultural change that includes ways to neutralize impediments to change.

- Create ownership by involving stakeholders in planning cultural change.
- Hold all employees accountable for promoting the new vision for change.
- Maintain a standard of cross-organizational coordination.
- Realign reward systems to maintain interest in and motivation to change.
- Decrease the levels of hierarchy in the organization to enable change through empowering the workforce.
- Maintain a continuity of leadership style.

6. Identify and teach the skills required to make the cultural change effort successful.

- Audit and match current skills and abilities to change requirements.
- Identify strategies for improving the readiness of the workforce (e.g., training, education, details, and benchmarking).
- Identify organizational resources that can be used to promote learning new skills and abilities.
- Develop a formal training program to equip managers for implementing change at the local level.
- Develop training that clearly demonstrates how the new, desired culture will benefit the organization and the individuals who promote it.

7. Develop performance indicators to measure the extent to which the organization has achieved cultural change.

- Measure adherence to mission, goals, and objectives.
- Establish a baseline measurement of the current organizational culture (e.g., with a survey).
- Develop a customer feedback system.

- Realign data collection and reporting with new goals and objectives.

8. Implement the strategy for cultural change.

- Widely distribute management's plan for change.
- Begin change with fanfare to create momentum.
- Maintain momentum by keeping the leadership team in the limelight.

9. Use performance data to improve efforts to change the culture.

- Ensure that critical mission-related goals and objectives are tracked and widely reported.
- Meet periodically with the workforce to review performance data and discuss ways to improve.

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