



Projects to Modernize U.S. Air Traffic Control Experience Delays, Cost Increases

The U.S. Federal Aviation Administration's overhaul of the air traffic system is proceeding despite early snags due to technology problems and poor planning. A U.S. study outlines several problem areas that remain, but says the FAA is now taking important steps to speed project implementation.

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Editorial Staff Report

The U.S. Federal Aviation Administration's (FAA) ambitious program to modernize air traffic control has been plagued with delays and cost overruns, a program review report says.

"Of the 12 major projects that we reviewed in detail, 10 experienced either cost increases or schedule delays," said a report compiled by the U.S. General Accounting Office (GAO), an independent government monitoring agency. "Four of the 12 had both cost increases and schedule delays," the 1992 GAO report said.

The modernization program was known as the National Airspace System (NAS) Plan from 1981 until 1989. It is now called the Aviation System Capital Investment Plan (CIP). The CIP incorporates projects from the original

plan that remain incomplete and more than 150 additional projects of varying cost and complexity.

The CIP is designed to modernize the air traffic control (ATC) system to make air travel safer and more efficient. The program focuses primarily on upgrading ATC facilities, including installation of new radars, computers and communication networks. Because of its commitment to substantial long-term investment and the scale and scope of its improvements, the CIP is being watched closely by non-U.S. aviation authorities as they seek ways to improve global ATC systems.

In 1991 the FAA projected that costs of the modernization project through the year 2000 would likely be \$31.9 billion, more than one-half billion dollars more than ear-

lier estimates, the GAO report said. The report said the majority of the cost increases stem from changes in the original NAS plan. It said that for the fiscal years 1982 through 1992, the U.S. Congress has appropriated about \$13.4 billion of the \$31.9 billion the FAA estimates is needed.

Those estimates are likely to be too low, the GAO report said.

"The FAA's \$31.9 billion estimate may not recognize all modernization funding needed through the year 2000 because it is based on an ATC consolidation plan that is changing."

The GAO said funding estimates are based on the FAA's original plan to consolidate more than 200 facilities into 23. Revised plans now call for more than 50 facilities. "This new plan could require an additional \$2.5 billion, including funds for additional buildings and ATC equipment such as computers and communication systems," the report said.

The GAO said the 12 projects it focused on in its report were important because "they represent 33 percent of the FAA's...(capital improvement) budget estimate and are expected to contribute 57 percent of the long-term cost savings that the FAA believes will accrue from modernization."

According to the GAO report, cost increases for the 12 projects ranged from \$13 million to \$219.2 million. The \$13 million increase was used to integrate a low-level wind shear alert system with terminal doppler weather radar. [The doppler radar's primary purpose is to detect wind shear around airports.]

The \$219.2 million increase, the report said, was for changes in the requirements for the advanced automation system (AAS). This project replaces hardware, software and work stations at air traffic control centers. The report said that overall, (in comparison with original field implementation schedules) "11 of the 12 projects have been delayed, on average, about five years."

The FAA has so far completed 36 projects, the GAO said.

"The FAA's effort to modernize the air traffic control system has expanded over the past decade from a 10-year, \$12 billion program, comprising about 80 projects, into...a continuously evolving program. Currently, this 19-year program...[includes] approximately 200 projects," the GAO report said.

The largest short-term increase in a project's cost estimate was for the voice switching and control system (VSCS) program, the GAO said. The program is designed to replace and improve voice ground-to-ground and air-to-ground communications at ATC facilities. The

cost of the project (between 1990 and 1991) increased by \$507 million, from \$892 million to \$1.3 billion through the year 2000. "The increase was due primarily to additional requirements for design and development work to bring the VSCS prototype into compliance with new FAA requirements."

The ATC system manages the entire spectrum of aircraft operating under instrument flight rules (IFR), which includes virtually all scheduled airline flights. The ATC segments that the modernization program is designed to improve include en route airspace, terminal airspace, flight service and weather information, ground-to-air facilities and equipment, inter-facility communications, and maintenance and operations support. The segments function in the following ways:

- En route projects affect the control of aircraft in flight, i.e., between takeoff and landing;
- Terminal projects affect aircraft approaches, landings, takeoffs and departures from airports;
- Flight service and weather projects provide vital information to pilots about conditions along routes they follow;
- Ground-to-air projects provide the facilities and equipment on the ground that support communication, navigation, landing and the surveillance of aircraft in flight;
- Inter-facility communication projects allow FAA facilities on the ground to communicate with each other; and,
- Maintenance and operations support projects provide the facilities and equipment needed to ensure that the system is well maintained.

In determining how the FAA projects rated in terms of completion projections and costs, the GAO report evaluated progress from 1983 to 1991 (Figure 1, page 3).

"Our analysis shows that...costs for maintenance and operations projects have increased by the largest amount, \$6.4 billion. Costs for en route projects have grown by the second largest amount, \$4.3 billion, and costs for

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inter-facility communication projects have exhibited the smallest increase, \$731 million," the GAO said.

Increases in maintenance and operations costs, the GAO said, reflect costs due to "delays in implementing modernization projects associated with...the Advance Automation System."

The report added that increased cost estimates for en route projects resulted "primarily because of cost increases associated with AAS and VSCS."

The GAO said that the 36 completed projects cost \$900 million, or about three percent of the total estimated cost of the FAA's ATC modernization effort through fiscal year 2000. The remaining 97 percent of the modernization effort includes the most costly projects, the report said. The cost estimate for the AAS is \$4.6 billion, the GAO said, with the microwave landing system (MLS) expected to cost \$2.62 billion. These projects are scheduled for completion in 2001 and 2008, respectively. The MLS system is designed to give electronic guidance to aircraft for precision approaches and landings in any weather conditions.

However, the GAO noted that of 80 projects outlined in the 1983 National Airspace System Plan, only 28 have reached completion. "The FAA has indicated that six of

these delayed projects [were] expected to generate the majority of the benefits for users," the GAO report said. "Delays in these six projects will defer a substantial portion of the \$258 billion in benefits that the FAA estimates these projects will provide for ATC system users."

According to FAA statistics, modernization will [over time] result in \$32 billion in benefits to the FAA and \$226 billion to airway and airspace system users.

The six key projects are:

- Advanced automation system (AAS);
- Automated en route air traffic control;
- Voice switching and control system;
- Mode select (Mode S) radar;
- Central weather processor (CWP); and the
- Microwave landing system (MLS).

The GAO report said that delays in final implementation for these projects range from three years for the Mode S project to nine years for the MLS project (Table 2, page 4).

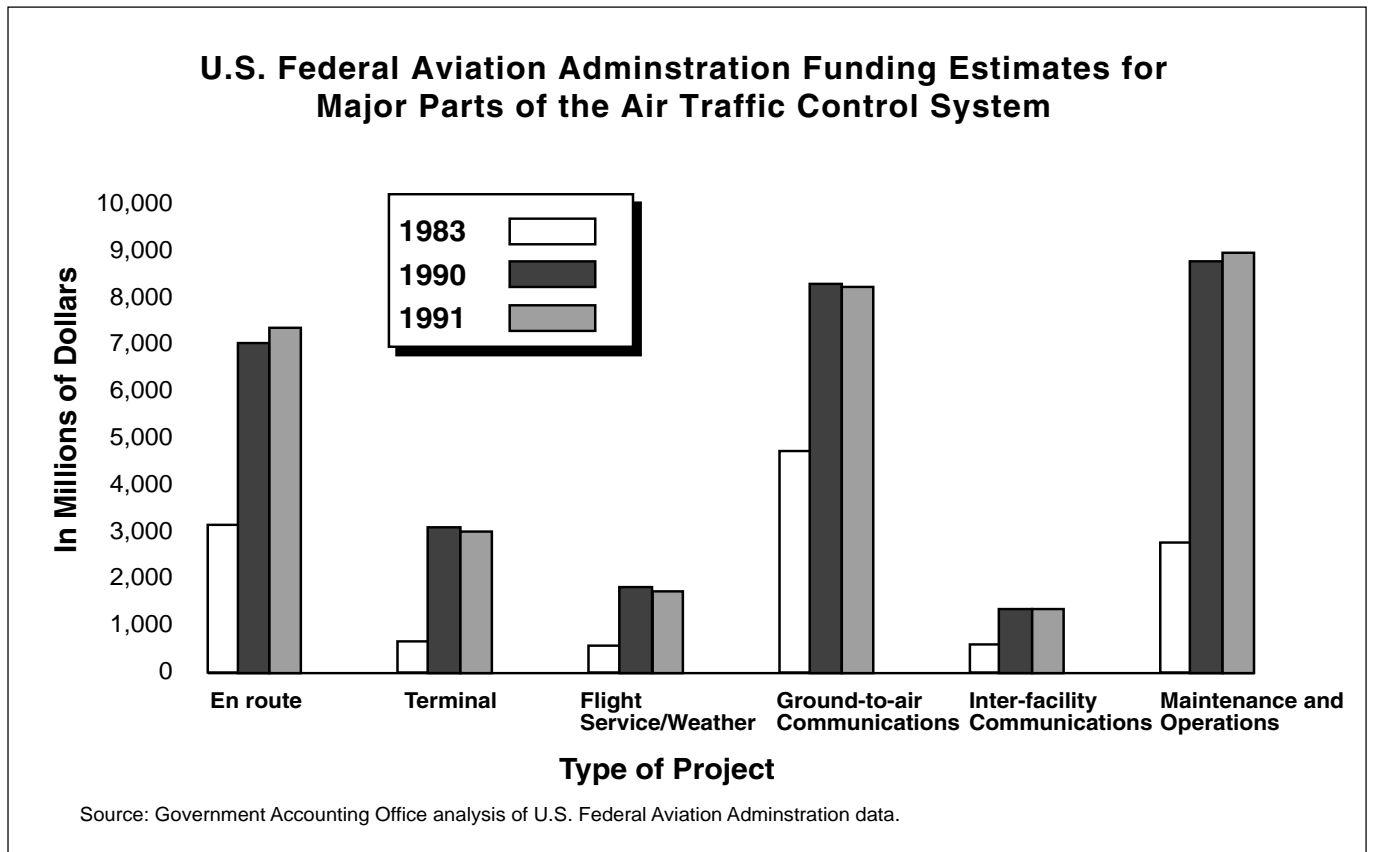


Figure 1

**Table 2
Implementation Milestones for 12 Major
U.S. Federal Aviation Administration Projects**

System	Year of first-site implementation			Years delayed	Year of last-site implementation			Years delayed
	1983 NAS*	1990 CIP**	1991 CIP	1983 NAS-1991 CIP	1983 NAS	1990 CIP	1991 CIP	1983 NAS-1991 CIP
Advanced Automation System	1990	1992	1991	1	1994	2001	2001	7
Air Route Surveillance Radar (ARSR-4)	1985	1993	1993	8	1995	1996	1996	1
Airport Surface Detection Equipment (ASDE-3) Radar	1987	1992	1992	5	1990	1994	1994	4
Airport Surveillance Radar (ASR-9)	1985	1989	1989	4	1992	1992	1993	1
Automated Weather Observing System	1986	1989	1989	3	1990	1994	1997	7
Central Weather Processor	1990	1991	1991	1	1991	1992	1998	7
Flight Service Automation System	1984	1991	1991	7	1989	1995	1995	6
Microwave Landing System	1985	1997	1997	12	1999	2008 ^a	2008 ^a	9
Mode S	1986	1992	1993	7	1993	1996	1996	3
Radar Microwave Link Replacement and Expansion	1985	1986	1986	1	1989	1993	1994	5
Terminal Doppler Weather Radar	b	1993	1993	b	b	1996	1996	b
Voice Switching and Control System	1989	1994	1995	6	1992	1996	1997	5
Average Delay (in years)				6				5

* National Airspace System ** Capital Investment Plan

^a The last-site implementation date is for all 1,280 microwave landing systems.

^b The terminal doppler weather radar project was not included in the 1983 NAS Plan.

Source: Implementation dates for 1983 and 1990 are from FAA's 1983 NAS Plan and 1990 CIP, respectively. Implementation dates for 1991 are from the unpublished 1991 FAA CIP.

"Mode S delays have postponed the FAA's plans to substitute automatic weather and air traffic communications with pilots for voice communications with controllers. Such automatic communications would help reduce controller workload. However, almost eight years after the signing of the production contract, the FAA does not have a working Mode S. First-site implementation of Mode S is now scheduled for 1993 and [final] implementation for 1996," the GAO report said.

Cost overruns and delays, the GAO said, were caused by the following:

- **Advanced Automation System.** Delays were attributed to software and other design problems. Replaces hardware, software and workstations at ATC facilities. Designed to increase controller productivity, reduce operating costs and increase airway safety and efficiency.
- **Voice Switching and Control System.** Implementation delayed by extension of prototype phase. VSCS replaces and improves ground-to-ground and air-to-ground communications at ATC facilities. It increases controller efficiency and allows safer handling of air traffic increases.
- **Automated Weather Observing System (AWOS).** Delayed by budget cuts and implementation of related systems. The system obtains aviation-critical weather data, including wind velocity, temperature, dew point, altimeter setting, cloud height and visibility.
- **Central Weather Processor.** FAA is reviewing system requirements. It is scheduled for operations funding in 1993. The system collects, synthesizes and distributes weather data, tailoring it to users' needs. Designed to reduce weather-related accidents and air traffic delays.
- **Flight Service Automation System.** More than 25 automated flight service stations are in service. The stations provide pilots with automated weather data and access to the FAA system identifying any airspace system changes. They increase flight service efficiency at lower staff costs.
- **Air Route Surveillance Radar.** Contract disputes delayed the start of the program. The system enables busy airports to monitor ground activity of aircraft and other vehicles under all weather conditions.

- **Airport Surface Detection Equipment.** Design problems and site changes have caused delays and cost increases.
- **Airport Surveillance Radar.** Equipment design faults have delayed installation. The system provides highly accurate monitoring of aircraft movement within a radius of 60 miles from the airport. It increases a busy airport's safety by providing more accurate data on aircraft separation and airport arrivals and departures.
- **Mode S.** Software development problems have caused extensive delays. Mode S is designed to reduce signal interference between aircraft and establishes a clear message channel between aircraft and ground facilities. It improves safety by identifying the location of aircraft more accurately.
- **Terminal Doppler Weather Radar.** Cost increases were attributed to integration requirements and software problems. Implementation proceeding on schedule. The system detects wind shear and microbursts around airports, as well as gust fronts, wind shifts and precipitation.

The FAA is studying several alternative plans, including one that calls for up to 54 facilities instead of the 23 originally proposed in the CIP.

The delays, the GAO said, have resulted in:

- Unrealized gains in FAA work force productivity;
- A growing demand for service in the commercial aviation industry without simultaneous improvement in the effectiveness of the ATC system; and,
- Increased operation and maintenance costs to preserve the aging ATC system.

Three of the major projects could be affected if the FAA modifies its plan for air traffic consolidation, the report said. Costs will also increase if the FAA consolidates fewer facilities, it said.

"The current CIP is based on the FAA's plan to consolidate 202 terminal radar approach

control facilities and en route centers into 23 facilities. For the last several years, however, the FAA has had serious reservations about the operational feasibility of this plan because of the potential impact on the ATC system of a catastrophic failure at any of these consolidated facilities. FAA vulnerability studies indicate that if a consolidated facility failed, adjacent facilities could not adequately manage the airspace. Aircraft delays and the risk of tragic accidents would then increase," the GAO said.

The FAA is studying several alternative plans, including one that calls for up to 54 facilities instead of the 23 originally proposed in the CIP.

According to the GAO, if the FAA determines that more than 23 consolidated ATC facilities are needed, additional AAS, VSCS and CWP systems will be required. It said that VSCS equipment needs could nearly double and that, under such a scenario, the FAA estimates it would need an additional \$2.5 billion in funds during the next decade. In 1988, the FAA estimated that another consolidation plan, which involved 44 sites, would cost an additional \$4 billion.

"We believe that these [consolidation cost] estimates may be low," the GAO said.

Despite the report's critical overview, GAO officials say the FAA has corrected many of the problems that led to cost overruns and delays.

Kenneth Mead, director of the GAO's Transportation Issues Resources, Community, and Economic Development Division, said the CIP "represents one of the largest and most complex civilian procurements this nation has ever undertaken."

"The FAA has initiated major reforms in its modernization program," Mead said in testimony to the U.S. Congress. "When it began the program, the FAA did not fully recognize the enormous complexity of ATC modernization. As a result, it did not follow essential acquisition steps such as determining needs and testing systems before buying them. Cost increases, schedule delays and performance problems were an inevitable result." ♦

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