

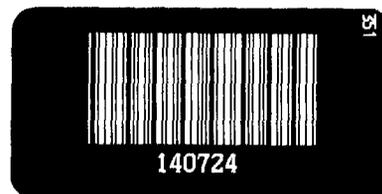
GAO

Report to the Chairmen, Subcommittee  
on Surface Transportation and  
Subcommittee on Aviation, Committee  
on Public Works and Transportation,  
House of Representatives

February 1990

# AVIATION SAFETY

## Management Improvement Needed in FAA's Airworthiness Directive Program



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

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February 16, 1990

The Honorable Norman Y. Mineta  
Chairman, Subcommittee on Surface  
Transportation  
Committee on Public Works and Transportation  
House of Representatives

The Honorable James L. Oberstar  
Chairman, Subcommittee on Aviation  
Committee on Public Works and Transportation  
House of Representatives

This report responds to an October 11, 1988, request that we explore, through several assignments, the Federal Aviation Administration's (FAA) ability to provide meaningful oversight of aviation safety. Pursuant to your request we previously reported on FAA's removal procedures for pilot examiners,<sup>1</sup> the agency's inspection management system,<sup>2</sup> and changes under consideration regarding aviation medical standards.<sup>3</sup> As agreed with both subcommittee staffs, this report focuses on FAA's oversight of the airworthiness directive (AD) program because ADs are key elements of FAA's safety responsibility. ADs are rules that FAA issues requiring airlines to correct conditions in their aircraft, such as cracking and corrosion, that can jeopardize safety. Because of the AD program's critical nature, we agreed to examine whether (1) FAA's oversight is adequate to determine airline compliance with AD requirements and (2) safety-related information maintained by FAA could be used to improve the program's effectiveness. Our review focused on FAA's oversight of the AD process, not on the merits or validity of individual ADs.

**Results in Brief**

FAA's oversight of the AD program is inadequate to determine whether the airlines are complying with ADs. The National Transportation Safety Board's (NTSB) investigation of the widely publicized April 28, 1988, Aloha accident, in which the aircraft lost the upper portion of its cabin

<sup>1</sup>Aviation Safety: FAA Has Improved Its Removal Procedures for Pilot Examiners (GAO/RCED-89-199, Sept. 8, 1989).

<sup>2</sup>Aviation Safety: FAA's Safety Inspection Management System Lacks Adequate Oversight (GAO/RCED-90-36, Nov. 13, 1989).

<sup>3</sup>Aviation Safety: FAA Is Considering Changes to Aviation Medical Standards (GAO/RCED-90-68FS, Jan. 9, 1990).

while in flight, and other FAA special inspections have documented several important examples of AD noncompliance. FAA does not know the extent of AD compliance throughout the airline industry because FAA inspectors do not, and are not required to, verify AD compliance during each inspection. In addition, when AD compliance is checked, current guidance requires inspectors to report only noncompliance. As a result, FAA does not have information on the extent to which airlines are in compliance with ADS. FAA needs to measure the extent of noncompliance and decide what actions it should take to ensure AD compliance throughout the airline industry.

FAA inspection guidelines are very broad, in that they allow inspectors to decide whether to check for AD compliance, which ADS to include in their check, and which aircraft to inspect. FAA inspectors do not routinely check for AD compliance during airline inspections. For example, during our review we accompanied FAA inspectors on 10 routine surveillance inspections and noted that AD compliance was checked in only 2 instances because the inspector decided to emphasize non-AD-related items.

In addition to obtaining more complete and comprehensive information from its safety inspectors, FAA should better use its existing safety data bases. Use of such data could help focus airline inspections on problem areas, thereby improving the effectiveness and efficiency of FAA's limited inspector work force.

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## Background

The Federal Aviation Act of 1958, as amended (P.L. 85-726), established the safe travel of U.S. air passengers—about 492 million in 1988—as a joint responsibility of FAA and the airlines. FAA promotes aviation safety by issuing regulations that stipulate certain requirements that airlines must meet to operate commercial aircraft. FAA's aviation inspectors then monitor to ensure that airlines comply with these safety requirements. When airline accidents do occur, mechanical failures—such as in landing gear and aircraft structural components—are factors in 40 percent of the accidents. FAA's AD program addresses such unsafe conditions and is a key element of FAA's safety responsibility.

Although FAA certifies new aircraft models as safe before they are used in commercial service, it also issues ADS to address unsafe mechanical conditions that surface after the aircraft has been in use. ADS are requirements that FAA issues for the airlines to identify and correct unsafe aircraft conditions that have occurred, or are likely to occur, in

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other aircraft of the same design. ADs also prescribe corrective actions that airlines must take to correct identified problems in their aircraft. For example, a 1988 AD identified several incidents involving Boeing 737s in which an engine bolt failed. In one case, the engine separated from the aircraft. The AD required airlines to add a secondary engine mount support, install a failure indicator for the bolt, and periodically inspect the indicator.

FAA becomes aware of most unsafe aircraft conditions through communications with aircraft manufacturers or reports of significant incidents or accidents. Using engineering judgment, FAA decides if these conditions warrant an AD. If needed, FAA engineers work with the aircraft manufacturer to develop the AD. The manufacturer usually prescribes the procedures needed to monitor and correct the unsafe condition, and FAA reviews and approves these procedures. FAA also establishes the time allowed for the airlines to comply with the AD. In determining the compliance time frames, which can range from immediate action to several years, FAA engineers consider factors such as the severity of the unsafe condition, the availability of parts needed to correct the condition, and the potential economic impact the AD will have on the aviation industry. In addition, some ADs require a one-time repair of an unsafe condition, while others require a combination of repetitive inspections, monitoring, and eventual repair.

FAA issues about 200 ADs each year for large commercial aircraft. At any one time, a particular aircraft type may have many ADs requiring recurrent inspections or repairs.

After issuing an AD, FAA monitors compliance through its airline inspection program. When FAA inspectors find AD noncompliance, the airlines must comply with the AD before operating the aircraft again. Inspectors may also recommend that FAA impose a civil penalty or take other administrative action against the airline.

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## FAA's Management and Oversight of AD Compliance Needs Improvement

Recent accident investigations and special inspections by the NTSB and FAA found instances in which airlines have not complied with ADs. Because FAA's guidelines allow aircraft inspectors discretion in deciding when, what ADs, and how many aircraft to inspect for AD compliance, the inspectors do not always verify compliance during their routine inspections. In addition, FAA does not know the industry-wide extent of AD noncompliance because it does not receive information about the

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number of ADS inspected for or the number of airlines found in compliance.

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## Incidents of AD Noncompliance

Recent NTSB accident investigations and special inspections by FAA found that several airlines were not complying with ADS. For example, FAA issued an AD in October 1987 that addressed deterioration in the Boeing 737 fuselage, the aircraft type that was later involved in the Aloha accident. The AD required airlines to conduct visual inspections for cracking; and if cracks were found, the AD required airlines to perform additional technical inspections. According to NTSB's accident report, Aloha's records neither documented these required additional inspections nor accurately reflected the condition of the aircraft. Further, FAA records showed no evidence that its inspector had verified AD compliance. NTSB concluded that Aloha Airline's maintenance program and FAA's oversight of the airline's flight operations were inadequate. NTSB therefore recommended that FAA's inspection program place greater emphasis on evaluating the actual condition of each aircraft and the airlines' compliance with specific ADS.

FAA's own experience with direct inspection of airline operations has also found instances of serious AD noncompliance. In 1986, as a result of an Eastern Airline aircraft accident, FAA conducted an in-depth review of the company's adherence to FAA regulations. This effort combined records reviews and direct aircraft inspections. FAA found, among other problems, that Eastern had flown two aircraft for almost 5 years without complying with an AD pertaining to the landing gear and without FAA inspectors' detecting the noncompliance. One aircraft made over 10,000 flights while not in AD compliance. The aircraft was damaged when the landing gear—which was the subject of the AD—failed. Another aircraft flew more than 8,900 flights while not in compliance with the same AD. Furthermore, during one 6-day period, Eastern operated 37 aircraft on over 1,100 flights without properly complying with an AD that required recurrent inspections for cracks. On the basis of this review, FAA imposed a \$9.5 million fine for a variety of violations, including AD noncompliance. Also, FAA's 1987 "white glove" inspection of 8 airlines found 26 instances of AD violations.

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## Monitoring AD Compliance

When issuing an AD, FAA relies on the airlines to comply with its requirements but does not require them to report compliance. Instead, FAA relies on its aircraft inspectors to monitor airlines' compliance during routine surveillance inspections. However, FAA's guidelines are too discretionary

## Inspection Guidance Does Not Require Verification of AD Compliance

to ensure that critical safety areas, such as AD compliance, are adequately covered during inspections. We also found that FAA does not have information on the number of ADS checked by inspectors or the extent to which airlines comply with ADS.

ADS are critical elements in maintaining aviation safety because they require airlines to correct potentially unsafe aircraft conditions. However, FAA cites AD compliance as 1 of more than 20 areas, such as pilot training and emergency equipment, that inspectors may consider including in an inspection. The guidelines do not specify how much emphasis inspectors should place on reviewing each inspection area, nor do they require inspectors to verify AD compliance during each inspection. In addition, the guidelines allow inspectors discretion to determine how often to conduct AD inspections, which ADS to check for compliance, and how many of the airline's aircraft to inspect.

Inspectors do not always verify AD compliance during routine inspections because some discretion in the inspection process is necessary to allocate FAA's limited work force among an increasing number of aircraft and hundreds of ADS. In addition, some types of inspections, such as enroute and ramp inspections,<sup>4</sup> do not lend themselves to inspecting for AD compliance. Other types of inspections, however, such as maintenance records checks and spot checks of aircraft undergoing periodic service, are appropriate for verifying AD compliance. Because ADS prescribe corrective actions that airlines must take to correct known unsafe conditions in their aircraft and because several recent incidents suggest serious weaknesses regarding airline compliance with ADS, FAA needs to require its inspectors to test for AD compliance as part of each inspection.

We accompanied FAA inspectors on 10 routine inspections. In only two instances did the inspector check for compliance with an AD during the inspection—once by reviewing maintenance records and once by comparing maintenance records to work done on the aircraft. In the other eight instances, due to FAA's discretionary inspection policy, the inspector decided to emphasize non-AD-related inspection duties, such as following up on reported mechanical problems during a flight, reviewing maintenance records for current work being performed on an aircraft,

<sup>4</sup>An "enroute" inspection is a check of an aircraft during a flight and includes observing the flight crew's usage of aircraft equipment and the performance of the equipment. A "ramp" inspection is a check of an in-service aircraft and includes observing the refueling of the aircraft, passenger handling, and the condition of the aircraft.

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and reviewing training records for airline personnel, instead of checking for AD compliance.

### FAA Needs More Complete AD Compliance Information

FAA does not know the extent of AD compliance throughout the airline industry because the agency does not have information on the extent to which inspectors check for, or find airlines in compliance with, ADS. Inspectors, in accordance with FAA's procedures, report instances in which they find that airlines are not in compliance; they are not, however, required to report when they observe AD compliance. Requiring inspectors to both verify AD compliance during inspections and report complete inspection results—compliance as well as noncompliance—would provide FAA with (1) a data base to measure the extent of AD noncompliance and (2) a management tool to help administer the program more effectively. Without such data, FAA cannot determine whether it has established appropriate emphasis and policies regarding AD compliance inspections.

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### FAA Can More Actively Use Available Safety Data

FAA can enhance its management of the AD program by using available safety-related information to help focus its inspections and thereby improve the effectiveness of its limited inspector resources. Because FAA relies on inspectors to verify AD compliance, a more effective inspection effort would also help FAA identify where changes should be made in the AD program to further improve aircraft safety. The NTSB and the Airworthiness Assurance Task Force, a technical panel of industry and government aviation experts, both recently concluded that FAA's inspection efforts are largely reviews of paper records with limited hands-on aircraft observation. FAA acknowledges it would prefer more hands-on inspections, but it cites manpower limitations as precluding it from inspecting all aircraft and verifying compliance with all ADS. Therefore, FAA must judiciously allocate its limited resources to achieve the maximum effectiveness from its inspection program.

Analyzing existing safety-related data, such as in FAA's Service Difficulty Report system, could provide this focus by raising warning signals regarding specific aircraft, aircraft types, or airlines that warrant a closer hands-on inspection. FAA uses these data to help focus its special inspections but does not as a matter of course use the data for routine airline surveillance.

FAA has maintained extensive safety information in various data bases. For example, FAA requires airlines to report mechanical problems that occur in aircraft, such as problems with landing gear, identification of

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corrosion and cracking, and engine shutdowns, to its Service Difficulty Report system, which has existed for over 2 decades. In 1988, commercial airlines reported approximately 19,000 mechanical difficulties to the system.

We analyzed Service Difficulty Report data by aircraft type, such as the Boeing 727 and McDonnell Douglas DC-9, to determine whether this information could be used to augment FAA's inspection process. We reviewed a limited sample of reports that airlines had submitted to FAA between January 1983 and June 1989 and noted a wide range in the frequency of problems reported across aircraft type and airlines. For example, in reviewing Service Difficulty Report data for 727s, we noted that one airline reported 37 instances of structural problems involving cracking and corrosion found during inspections of one of its aircraft. All of these problems were found during eight aircraft inspections that began in September 1984 and concluded in January 1988. During the last inspection, the airline found and repaired 28 instances of cracks and corrosion in areas such as floor beams, brackets, and fuselage skin. However, the airline did not submit any additional Service Difficulty Reports to FAA from January 1988, when repairs were made, to June 1989, the ending date of our analysis. If FAA analyzed these safety data, the agency could better focus its inspection efforts by selecting for reinspection this or other aircraft with similar findings to determine whether any additional cracking and corrosion have occurred since the last reported inspection.

FAA could also use Service Difficulty Report information to monitor whether airlines are finding and correcting generic problems, such as cracking and corrosion, that can occur in aircraft. For example, for one type aircraft, we examined six Service Difficulty Reports that airlines had submitted to FAA. Five of the reports stated that the airlines had found and corrected cracks and corrosion in their aircraft. Airlines operating other aircraft makes and models also reported finding these and other types of deterioration.

While this type information cannot be used exclusively to determine problems with specific aircraft, aircraft type, or airlines, FAA can use the data as a warning signal of potential safety problems. FAA inspectors could use these signals, along with their knowledge of other factors—such as aircraft age, utilization, airline maintenance practices, and various types of normally expected deterioration—to determine which specific aircraft, aircraft type, or airline should receive increased inspection emphasis. FAA notes that its reporting system may have some problems

regarding the quality and timeliness of the data. In a separate review, we are currently assessing FAA's Service Difficulty Report system to determine how to make these data more useful.

In 1987, we issued two reports that identified improvements needed in FAA's airline inspection program. In one report, we recommended that FAA use safety data to target its inspector resources toward high-risk conditions.<sup>5</sup> In the other, we recommended that FAA revise its inspection guidance to take into account the need to target airlines displaying characteristics that may indicate safety deficiencies.<sup>6</sup> Consistent with these recommendations, FAA could use the kind of data maintained in the Service Difficulty Report system, as well as other systems and data bases maintained by the agency, to develop indicators of potentially unsafe conditions in aircraft as tools to help target its limited inspection resources.

## Conclusions

Because by their nature ADS address critical safety conditions, airline compliance with AD requirements and FAA's ability to effectively oversee and manage the AD program are vital to aviation safety. Poor implementation of AD requirements can potentially result in aircraft accidents. This is illustrated by the Eastern Airlines incident involving the failed landing gear. Furthermore, the NTSB investigation of the Aloha accident and FAA's special inspection results demonstrate that (1) some airlines are not complying with ADS and (2) AD noncompliance can remain undetected by FAA for long periods of time.

FAA does not compile information on the extent of AD noncompliance because (1) the number of ADS inspected for is left to the discretion of each aviation safety inspector and (2) the inspectors report only when airlines are not in compliance. Consequently, FAA is not aware of the number of ADS inspected for or the number verified as being in compliance. This information is needed, however, to measure the extent of AD compliance throughout the airline industry. The instances of noncompliance discovered by recent accident investigations and special FAA inspections, coupled with the wide discretion given inspectors in verifying ADS and incomplete inspection reporting, indicate a need for FAA to improve its management and oversight of this critical safety program. FAA needs

<sup>5</sup>Department of Transportation: Enhancing Policy and Program Effectiveness Through Improved Management (GAO/RCED-87-3, Apr. 13, 1987).

<sup>6</sup>Aviation Safety: Needed Improvements in FAA's Airline Inspection Program Are Underway (GAO/RCED-87-62, May 19, 1987).

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to know if its inspectors are checking for AD compliance and the extent to which airlines are complying with ADs. With more complete information, FAA would have the management tools needed to determine whether (1) airlines are complying with ADs and (2) additional regulatory action is needed to ensure AD compliance.

Also, FAA can improve the management of its AD process by analyzing existing safety data to help determine where to focus its limited inspection resources. FAA can use this information to identify which aircraft, aircraft type, or airlines warrant additional hands-on inspection emphasis.

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## Recommendations

To improve FAA's management and oversight of the AD program, we recommend that the Secretary of Transportation direct the Administrator, FAA, to

- require a systematic testing for AD compliance as part of each routine airline inspection,
- require inspectors to report which ADs are tested and the extent of airline compliance found during each inspection, and
- maintain and analyze compliance information to determine the extent of AD noncompliance and any additional actions necessary to ensure that airlines comply with ADs.

We also recommend that the Secretary direct the Administrator, FAA, to analyze and use available aircraft safety data as a management tool to focus FAA's limited inspection work force.

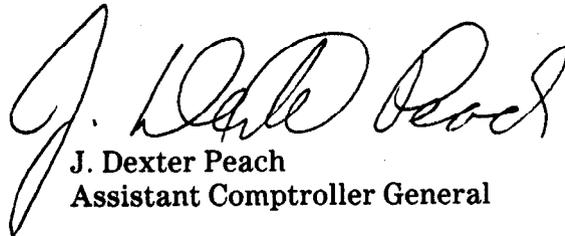
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We discussed the facts presented in this report with cognizant FAA officials. They agreed that the report is accurate. However, as requested by your office, we did not obtain official agency comments. Details on our objectives, scope, and methodology are contained in appendix I.

Unless you publicly announce its contents earlier, we plan no further distribution of this report until 15 days from the date of this letter. At that time, we will send copies to the Secretary of Transportation and the Administrator, FAA, and make copies available to others upon request.

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We performed our work in accordance with generally accepted government auditing standards under the direction of Kenneth M. Mead, Director for Transportation Issues, who can be reached on (202) 275-1000. Other major contributors to this report are listed in appendix II.



J. Dexter Peach  
Assistant Comptroller General



# Objectives, Scope, and Methodology

On October 11, 1988, the then-Chairman of the Subcommittee on Aviation, House Committee on Public Works and Transportation, Norman Mineta, requested that we explore FAA's ability to provide meaningful oversight of aviation safety. This report is one of several assignments responding to the chairman's request.

As agreed with the subcommittee staff, we concentrated this current review on FAA's AD program because ADS are key elements of FAA's safety responsibility and critical to ensuring aviation safety. We reviewed how FAA identifies and addresses unsafe conditions in commercial aircraft and whether (1) FAA's oversight is effective to determine AD compliance and (2) safety-related information maintained by FAA could be used to improve the program's effectiveness. We limited our review to the AD process for commercial aircraft because these aircraft transport 95 percent of all aviation passengers. We did not review the process for smaller, general aviation aircraft. We focused on FAA's management of the AD process and did not assess the merits or validity of individual ADS.

To determine how FAA identifies and addresses unsafe conditions, we (1) interviewed FAA engineers who write ADS in Seattle, Washington; Long Beach, California; and Boston, Massachusetts; (2) reviewed AD documentation and files; and (3) accompanied FAA inspectors on aircraft inspections. In addition, we interviewed engineers from two aircraft manufacturers, the Boeing Aircraft Company and McDonnell Douglas. Also, we interviewed officials from NTSB and the Air Transport Association regarding their roles in the AD development process. We discussed methods that FAA uses to identify unsafe aircraft conditions, the manufacturer's input into the AD process, how an AD is developed, and the engineering judgment used in the process. We reviewed files from 14 major ADS and identified the extent of documentation supporting the judgments and decisions made as the engineers developed the ADS. We also tested to determine whether the files contained evidence of proper internal controls, such as documented levels of review and approvals.

To assess the adequacy of FAA's oversight of AD compliance, we accompanied FAA inspectors on aircraft inspections in Ft. Lauderdale and Miami, Florida, and Atlanta, Georgia, and observed their routine surveillance and AD compliance activities. We supplemented these observations by reviewing inspector guidelines and discussing inspection practices with the field inspectors and with the directors of FAA's Flight Standards in Ft. Lauderdale, Miami, Atlanta, and FAA headquarters. We also reviewed FAA requirements for reporting inspection results. Finally, we

reviewed the NTSB's report on its investigation of the Aloha Airlines accident, FAA's actions taken against Eastern Airlines for AD noncompliance, and the results of FAA's 1987 special inspection program.

To determine whether safety data could be used to improve the AD program, we interviewed FAA officials and analyzed safety-related data reported by airlines to the Service Difficulty Report system in Washington, D.C., and the agency's computer center in Oklahoma City, Oklahoma. We discussed the feasibility of using existing safety-related data as a means to focus inspections and identify unsafe conditions in aircraft.

We conducted our review between February and October 1989 using generally accepted government auditing standards.

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