

**GAO**

**Testimony**



144841

*For Release  
on Delivery  
Expected at  
9:30 a.m. EDT  
Tuesday  
September 17, 1991*

**AGING AIRCRAFT  
MAINTENANCE**

**Additional FAA Oversight  
Needed**

*Statement by*  
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*Before the*  
Subcommittee on Aviation  
Committee on Public Works and Transportation  
House of Representatives



Mr. Chairman and Members of the Subcommittee:

We appreciate the opportunity to appear before you today to discuss federal oversight of the maintenance and repair of aging aircraft. Last year, the Federal Aviation Administration (FAA) issued a series of rules giving the airline industry about 4 years to guard against structural fatigue in its oldest transport aircraft by taking preventive actions to strengthen airframe structures. Less than a year later, FAA issued additional rules requiring airframe inspections for corrosion. In a separate action, this Subcommittee and the House of Representatives addressed the issue of older aircraft by passing H.R. 172, the Aging Aircraft Safety Act of 1991--now before the Senate--to require an FAA safety inspection and maintenance records review of all airliners over 15 years old.

As FAA was issuing its rules for protecting aging airframes against fatigue, we surveyed airline-owned and independent aircraft repair stations to identify factors that could influence the timely completion of the aging aircraft modifications. We also surveyed airlines' progress toward complying with the new rules and reviewed FAA's oversight activities. We reported our findings to you in May 1991.<sup>1</sup> Our testimony today is based on that report and our further work updating that assessment.

We will make three overall points:

-- First, our May 1991 report concluded that some airlines could have difficulty complying with FAA's aging aircraft rules by the end of the 4-year compliance period. Based on our 1990 survey and the economic conditions at the time, we found that the demand for airframe maintenance during this period would be

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<sup>1</sup>Aircraft Maintenance: Additional FAA Oversight Needed of Aging Aircraft Repairs (GAO)/RCED-91-91A&B, May 24, 1991)

greater than FAA initially believed when it gave air carriers 4 years to comply. For example, FAA created an additional maintenance workload when it issued corrosion rules several months after the structural ones. About 2,600 aircraft--twice that affected by the structural rules--would now require repairs. Our survey, which was taken when demand for air travel was increasing, also found that maintenance resources, such as replacement parts, hangar space, and skilled mechanics were in short supply.

-- Second, since our initial survey in 1990, the economic situation has become very fluid. Although many airlines are making plans to repair their aging aircraft, some may be deferring the work until late in the compliance period. As of April 1991, repairs had been completed on only 28 of the over 1,300 aging aircraft operated by 17 U.S. air carriers we surveyed. This short-term postponement may be explained by the war with Iraq and the recession, which in turn resulted in lower demand for air travel and less pressure to repair aircraft. Also, a large portion of the airline industry is now in financial trouble or bankruptcy. We found that these firms operate a significant proportion of aging aircraft, and they could be deferring maintenance until they are more certain that their older planes will continue in service. A final factor is the timing and strength of an economic recovery. A recovery that brings high air travel demand could result in all airworthy aircraft--no matter how old--being pressed into service.

-- Our final point is that, regardless of the economic situation, FAA needs to play a more active role than it traditionally has in monitoring the maintenance status of the U.S. fleet. Although FAA has recently obtained some current fleet repair information, only a few months ago agency officials could not tell us the extent of airline compliance with the new aging

aircraft requirements. If many airlines defer repairs to their aging aircraft--which are a quarter to a half of most major carriers' fleets--the repair station industry may not be able to accommodate an overabundance of demand late in the compliance period. FAA officials told us that they intend to ground noncompliant aircraft until maintenance is performed.

### BACKGROUND

The events that led to the Subcommittee's concern over the safety of aging aircraft--planes that have passed certain use thresholds or are older than about 20 years--are well-known by now. They started with the April 1988 Aloha accident that occurred in part because of over-reliance on inspection. After that, FAA called an aging aircraft conference which resulted in an industry-FAA task force to determine how airlines' maintenance programs should be changed to reflect the aging of the fleet. The task force concluded that the system of ensuring the structural integrity of aircraft should not rely so heavily on inspections but must require preventive repairs or modifications at certain intervals regardless of what inspections reveal.

To reduce industry reliance on inspecting for fatigue damage, the task force recommended permanent structural changes to hundreds of aircraft in the U.S. fleet and the development of a program for addressing the problem of corrosion. The structural repairs included, for example, replacing fuselage rivets and sections of the aircraft skin. In response, during 1990 FAA issued airworthiness directives mandating changes within 4 years to maintenance programs affecting the oldest Boeing 727s, 737s, and 747s; and Douglas DC-8s, 9s, 10s, and MD-80s.

If enacted, the Aging Aircraft Safety Act of 1991 would require FAA to determine if each aging aircraft is in safe overall condition and properly maintained. FAA would be required to

accomplish this for each aircraft with 15 years of service by making inspections and records reviews during the aircraft's next scheduled major maintenance check.

In addition to these requirements for the inspection and repair of older aircraft, the Congress passed legislation in late 1990 requiring that carriers' fleets also become quieter by meeting stage 3 noise rules--the quietest compared with the first two stages--by the end of the century. Coupled with the cost to repair, the costs to quiet an aging aircraft can be significant and will figure prominently in airlines' decisions to retain, replace, or retire older aircraft.<sup>2</sup>

IN FACE OF ADDITIONAL MAINTENANCE REQUIREMENTS,  
POTENTIAL RESOURCE SHORTAGES EXIST

Our May 1991 report stated that aircraft maintenance demand during the 1990-1994 compliance period would increase because of new FAA-mandated requirements for structural repairs and corrosion inspections. We also said that FAA's estimates of the increase in maintenance time and costs that airlines would incur as a result of the new structural rules were understated compared with airlines' experiences. We concluded that the 4 years FAA gave carriers to comply with the structural requirements may present compliance problems to some carriers, especially in light of repair station industry reports that the availability of key resources--parts, labor, and hangar space--to accomplish this work was marginal.

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<sup>2</sup>Aviation Noise: Costs of Phasing Out Noisy Aircraft (GAO/RCED-91-128, July 2, 1991).

## Requirements for Structural Modifications

FAA's new rules to enhance the safety of aging aircraft mean additional maintenance workload for carriers within a specified period of time. In general, the airlines we surveyed did not question the need to guard against structural fatigue; however, many believed that FAA underestimated the time that the work would take. They said that three factors contributed to FAA's underestimation: (1) the estimates that FAA obtained from the aircraft manufacturers were based on ideal rather than actual conditions for making the repairs; (2) unexpected damage is often discovered when performing mandated repairs, creating a greater-than-anticipated workload; and (3) an additional maintenance workload is being created by the new corrosion rules--issued only months after the structural rules.

When developing the new structural requirements, the industry and FAA used time and cost estimates taken from aircraft manufacturers' service bulletins. Airlines told us that actual repair conditions are usually much different from those on which manufacturers base service bulletin estimates. For example, a service bulletin, according to one airline, estimated that a modification to brace the airframe on a Boeing 727 should take 728 man-hours. However, the airline found that it needed an average of 1,200 man-hours to complete the work.

Air carrier maintenance officials told us that unplanned "collateral" damage is often found while doing the mandated structural work and is most efficiently repaired at that time. While this damage would have to be repaired eventually, it presents an unexpected source of work which impairs a carrier's ability to complete the mandated work on time. For example, one carrier found that collateral damage more than doubled the work--from about 2,500 to about 5,500 man-hours--that had to be done to complete lap joint work on its Boeing 737s. Carrier officials

believe that the time to repair collateral damage was not factored into FAA's overall decision process when the agency set the 4-year time limit on completing the aging aircraft repairs.

FAA has issued corrosion rules that are adding substantially to the industry's current demand for maintenance. These rules require air carriers to inspect, for example, all their aircraft and repair damage that exceeds predetermined levels before the aircraft is returned to service. Many air carriers plan to accomplish both structural and corrosion work on a plane during its next scheduled major maintenance visit. Industry experts told us that because the corrosion inspection and repair, if needed, will occur over an aircraft's lifetime, it will take even more time and money than the one-time preventive maintenance visit for the structural work.

#### Shortages of Parts, Mechanics, and Hangar Space May Affect Timely Compliance

With this recent emphasis on the safety of older aircraft, more requirements now exist for airlines to maintain their fleets. And for many older aircraft, these requirements must be met within the next several years. This means more overall demand for repair services. However, as we reported in May and based on our survey data obtained during 1990, the size of the industry that specializes in maintaining heavy, commercial airframes is limited to 24 domestic air carriers and about 38 independent repair stations. These are the entities that have the hangar capacity and technical capability to repair these airframes.

Our survey found that the resources needed to repair aircraft, including parts, skilled mechanics, and hangar space, were in short supply at the time we obtained the data. To combat the supply problem, the industry was taking or planning to take several actions. For example, the major U.S. aircraft manufacturers were

rationing scarce parts to the most needy aircraft. In addition, the repair industry was planning to increase the number of airframe mechanics by 35 percent and the amount of hangar space by almost 50 percent, or 7 million square feet, by 1994. Although we concluded that by the end of 1992 the industry should make good progress in all three areas, we cautioned that the recession could cause repair stations to defer plans to expand capacity.

SOME AIRLINES POSTPONED REPAIRS  
TO AGING AIRCRAFT

On the basis of survey responses from 48 airlines and personal visits with 17 of these 48, we reported in May 1991 that about two-thirds of these airlines were making preparations to repair their aging aircraft in compliance with FAA's new rules. We found that of the 17 carriers, 13 had written compliance plans, 12 had secured hangar space, 10 had secured needed mechanics, and 7 had ordered parts. Six of the 17 carriers, however, had taken 2 or fewer of the above actions. We also found that as of April 1991--1 year into the 4-year compliance period--only 28 aircraft out of over 1,300 owned by these carriers and needing aging aircraft repairs had been fully repaired and 705 had been partially repaired. As we discuss below, the slow response by some carriers to repair their aging aircraft is probably because (1) some airlines are in poor financial health and therefore are uncertain about keeping their aging aircraft in service and (2) airlines faced difficult economic conditions during the war with Iraq and the economic recession which has led to a period of flat demand for air travel. Airlines' actions from this point on will depend on which of several economic scenarios comes to pass.



Financial Health of Airlines  
May Be Hindering Compliance

We found indications that an airline's financial health is related to the extent of its actions toward complying with the aging aircraft repairs. This is not surprising given the high cost to repair an older aircraft, especially when the costs to inspect for corrosion and meet stage 3 noise rules are included. This cost could range from several million dollars for a narrow body jet to over \$20 million for a wide-body jet, depending on the extent of work needed to repair structural fatigue, corrosion, and other incidental damage.

Using a July 1990 Salomon Brothers ranking of the financial health of 10 of the 17 airlines we visited, we found that the highest ranked airlines were generally the most prepared to repair their aging aircraft. The top three airlines from a financial standpoint had taken all four actions (written compliance plan, ordered parts, secured mechanics, and secured hangar space) to prepare for the repairs. On the other hand, while about half of the lower ranked airlines had written plans, most had not ordered parts or secured hangar space.

Compounding the pressure on financially troubled airlines to comply with FAA's structural modification rules is the fact that they also tend to operate older aircraft and face the added burden of repairing more planes. As shown in the table below, our analysis found that several financially troubled airlines operate aircraft that, on average, are older than the industry's aircraft overall. If additional carriers go out of business, some of their aircraft will be purchased by other passenger and cargo airlines, some will be returned to lessors, but other aircraft probably will be retired.

Table 1: Age of Major Carriers' Fleets<sup>a</sup>

<u>Airline</u>	<u>Average age (in years)</u>	<u>Percentage of fleet 20 years or older</u>
Trans World	17.06	43
Pan American	16.44	47
Northwest	15.88	43
Continental	14.05	28
U.S. Fleet	13.92	34
Fed Ex	12.17	29
United	11.96	24
USAir	9.64	16
American	9.59	15
Delta	8.79	6

<sup>a</sup>Airlines with 150 or more aircraft in their fleets as of July 19, 1991)

Source: AvData, Wichita, KS

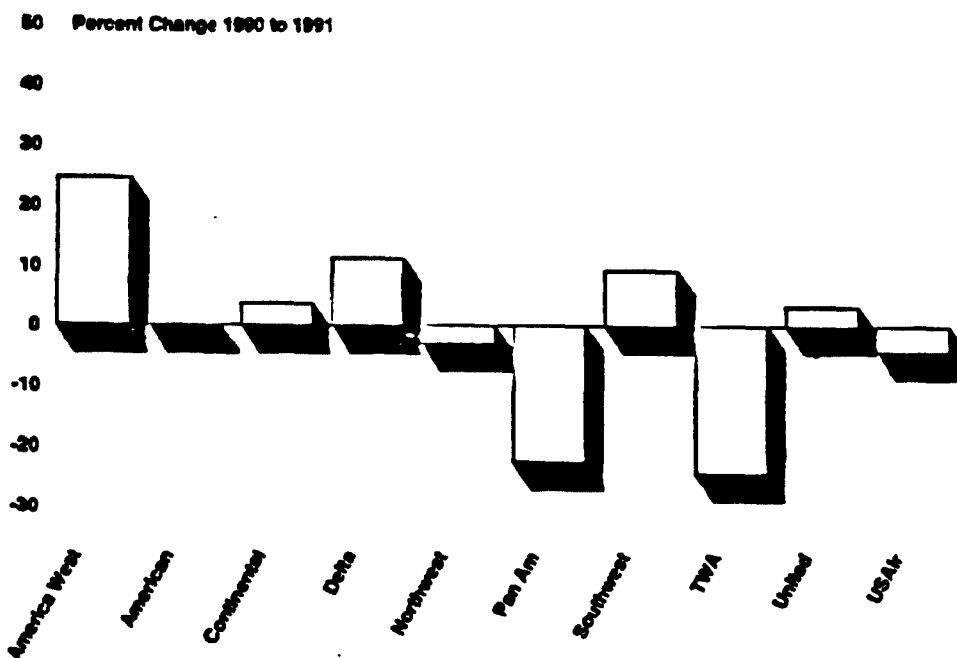
The Nature of the Economy and the Timing  
of its Recovery Will Be Critical

We believe that the strength of the economy will be a major factor in industry compliance with FAA's rules. Under the scenario where the economy is strong, we would expect passenger traffic to meet or exceed forecasted levels, carriers' financial health to improve, carriers to use aging aircraft more frequently, demand for repair services to increase, and airline and independent repair stations to act on their expansion plans. This seemed to be the case at the time that we conducted our survey from April to July 1990. At that time, demand for air travel had not felt the full impact of the war with Iraq and the recession.

However, under the scenario where the economy is weak, we would expect traffic to fall below forecasted levels, carriers financial health to decline, carriers to use aging aircraft less frequently, demand for repair services to decrease, and repair stations to defer action on their expansion plans. And this was more the case by the time we reported in May 1991. Certain factors, such as the recession and war with Iraq, had diminished

air travel demand. This demand, which rose at an average annual rate of 6.6 percent between 1986 and 1990 began to flatten out early in 1991. Over the first 6 months of 1991 compared to the same period of 1990, revenue passenger miles of the 10 major airlines increased by only 0.1 percent. As shown in figure 1, six airlines' revenue passenger miles increased over 1990 levels and four airlines had decreases.<sup>3</sup>

**Figure 1: Percent of Change in Revenue Passenger Miles--First 6 Months of 1991 Compared with the Same Period in 1990**



Source: Aviation Daily, July 1991.

This slack air travel demand has provided a measure of relief to the aircraft repair industry, at least in the short term. The weakened economy and resultant decrease in demand for air travel have reduced pressure on airlines to keep all of their planes in

<sup>3</sup>Eastern Airlines ceased operations in January 1991. If Eastern is included, overall traffic is down about 4 percent in the first half of 1991. In addition, increases in revenue passenger miles do not necessarily reflect profitability--America West with the largest increase in figure 1 recently filed for bankruptcy.

service at all times. Moreover, the first aircraft to be taken out of service are those most costly to operate because of higher fuel and crew costs. These also are the oldest aircraft and the ones needing the most preventive maintenance, especially to comply with FAA's aging aircraft rules. This trend is beginning to have an effect on overall fleet mix. On the basis of Boeing Company data, FAA reports that the number of aircraft in the fleet classified for noise purposes as stage 2--this is also a reasonable indication of aircraft age--had declined from about 60 percent in January 1989 to 54 percent in November 1990.

On the other hand, FAA is still forecasting a 4.1-percent annual increase in air travel through the year 2000. But will the repair industry be able to accommodate airlines' needs for maintenance, including structural modifications and corrosion inspections? That will depend in part on whether older aircraft are retained in service or replaced with newly purchased or leased models. Replacing old with new aircraft is limited by the manufacturers' production capacity: only 300 to 400 new transport aircraft are available annually for the U.S. market, and orders are backlogged as much as 2 years. Under conditions of increasing demand for air travel, this production of new aircraft would not be sufficient to replace the aging fleet in the near term. In addition, the repair industry's ability to accommodate maintenance demand also will depend on whether the supply of parts, labor, and space has improved from levels we found during our industry survey.

Timing, of course, will be critical. If air traffic and the industry's financial health do not improve until the latter part of the compliance period (1993-94), repair stations will be trying to act quickly on their expansion plans at the same time that airlines will be pressing their older aircraft into service and demanding added repair services. A severe bottleneck at the repair dock would then occur. FAA would likely be under severe pressure

to accept alternative strategies for complying with the new rules or to relax its deadlines.

TO STAY ABREAST OF INDUSTRY PROGRESS,  
ADDITIONAL OVERSIGHT NEEDED BY FAA

FAA officials acknowledged that until we shared the results of our survey with them, they were not aware of airlines' postponement of repairs. The proposed Aging Aircraft Safety Act of 1991 as well as our recommendations made in May would help ensure that FAA would develop a better awareness of airlines' progress regarding compliance with all of the rules that apply to older model aircraft and that FAA has more complete information on airline actions. The act and our recommendations would also help bring FAA inspectors closer to understanding the airworthiness of each aircraft.

In our May report, we recommended that FAA should require airlines to submit reports that include

- descriptions of critical compliance obstacles, such as the unavailability of parts or labor;
- an implementation schedule for each aging aircraft, including evidence of obtaining sufficient hangar space for the work;
- evidence that replacement parts have been ordered, plans for obtaining remaining parts, and facts relating to compliance that is impaired by parts unavailability; and
- a status report on aircraft that have been (1) brought into compliance, (2) disposed of before doing the repair work, (3) newly acquired and will require repair, and (4) kept in operation and will still need repair.

With reports such as these, we believe that FAA inspectors could determine the potential for widespread noncompliance long before it occurs and facilitate solutions to problems faced by airlines. FAA participated in something like this not long ago when it was part of a task force to investigate ways in which

better distribution of scarce parts could occur throughout the industry. Additional actions of this type might include clearinghouse functions whereby FAA could guide carriers to qualified repair stations with available maintenance space or suggest alternative sources of scarce parts. This could help to reduce the chances of a bottleneck developing at the repair dock during the last 2 years of the compliance period (1993-94).

FAA officials told us that in the 4 months since our report, the agency has mounted an effort to identify airlines' plans to repair their aging aircraft as well as any problems airlines could be having in obtaining resources to complete the work. Although FAA has some information on 41 airlines plans to either repair or dispose of their aging aircraft, gaps exist in the information. Several carriers with large numbers of aging aircraft have not reported their plans or problems to FAA. Carriers not reporting include two large cargo carriers with approximately 200 aging aircraft between them and many charter airlines that we identified and obtained information from during our survey. Of course, FAA needs to obtain the missing information.

In addition to these gaps in reporting coverage, the information that FAA does have is of questionable value if FAA intends to facilitate the industry's compliance with the new airworthiness directives. Of the 41 airlines reporting to FAA, 8 said that they had made no plans to repair their aging aircraft. Also, 19 airlines had not assessed the availability of critical resources with which to accomplish the repairs. Therefore, in addition to this initial effort to identify airline actions, we believe that FAA should followup these reports because they could be the forerunners of possible requests for waivers to the new rules.

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In summary, Mr. Chairman, this Subcommittee and the House of Representatives passed H.R. 172 and FAA issued the new structural repair and corrosion rules because of the public's concerns about aging aircraft and the safety of air travel. We believe additional FAA oversight of the airline industry is needed during the next few years. This oversight would help ensure that reduced air travel demand and some airlines' financial troubles do not jeopardize aviation safety and the industry's ability to comply with FAA's deadlines for completing the work. Although FAA could ground aircraft that do not meet the deadlines, this could affect some air carriers' financial survival. There are other options, including a push to comply fully by the deadline, but they need to be explored and developed on the basis of FAA's full understanding of the condition of the U.S. airline fleet.

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

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