The Problem of Aging Aircraft: Is Mandatory Retirement the Answer

Elizabeth Brannen

Follow this and additional works at: https://scholar.smu.edu/jalc

Recommended Citation
https://scholar.smu.edu/jalc/vol57/iss2/4
THE PROBLEM OF AGING AIRCRAFT: IS MANDATORY RETIREMENT THE ANSWER?

ELIZABETH BRANNEN

I. INTRODUCTION

The United States air fleet currently faces an impending crisis. American aircraft are getting older, and as the fleet continues to age, the problems resulting from aging aircraft will become increasingly more urgent. Most airlines continue to fly planes as they age, and many of these aircraft have already exceeded their economic design goals. Experience proves that high-cycle planes, even those that are well-constructed and kept in good repair, are vulnerable to structural fatigue as they age. Additionally, corrosion problems often occur in older aircraft. Corrosion


2 Katherine Rodeghier, Maintenance, not Age, Key to Plane Safety, CRAIN’S CHI. BUS., June 25, 1990, at T5.

3 “The ‘economic design goal’ of an [aircraft] is typically considered to be the period of service, after which a substantial increase in the maintenance costs is expected to take place in order to assure continued operational safety.” 54 Fed. Reg. 22,300, 22,301 (1989) (to be codified at 14 C.F.R. pt. 39) (proposed May 23, 1989).

4 A high-cycle aircraft is one that has gone through a high number of pressurization cycles. A complete cycle is composed of “one take-off, pressurization, depressurization, and landing,” since these activities place the most stress on an aircraft. Senate Hearing, supra note 1, at 10 (statement of Anthony Broderick, Associate Administrator for Regulation and Certification, Federal Aviation Administration (FAA)).

and structural fatigue have been factors in at least 36 accidents since 1983.\textsuperscript{6} As the air fleet ages, these age-related incidents may become commonplace and result in the tragedy of human lives unnecessarily lost.

Complicating the issue is the fact that demand for air travel has increased dramatically since deregulation of the airline industry, and production cannot keep up with the increasing demand for new planes.\textsuperscript{7} Increased competition and the high cost of replacing older planes encourage airlines to cut costs by continuing to use aging aircraft.\textsuperscript{8} Even with continued use of these older planes, manufacturers operating at full capacity cannot immediately meet the needs of the growing industry.\textsuperscript{9} These factors force airlines to provide an increased number of flights with an aging fleet of planes, thus expanding the possibility of future age-related accidents. Adequate maintenance procedures for aging aircraft are crucial if airlines are to continue to meet the public demand.

In April 1988, the crash of an Aloha Airlines Boeing 737 highlighted the problem of aging aircraft and triggered an immediate response in the aviation community.\textsuperscript{10} When the post-accident investigation revealed that a structural failure in the "relatively old and heavily used aircraft"\textsuperscript{11} had caused the plane to crash, the implications

---

\textsuperscript{6} See Senate Hearing, \textit{supra} note 1, at 1 (statement of Mr. Ford).
\textsuperscript{7} Rodeghier, \textit{supra} note 2, at T5.
\textsuperscript{8} \textit{Id.} Completely overhauling an airliner ranges in cost from $2,000,000 to $20,000,000. An average new airliner costs $55,000,000. \textit{GAO says FAA Still Lacks a Strategy for Airworthiness of Older Airliners,} \textit{Air Safety Wk.}, Oct. 16, 1989, at 3, 4 [hereinafter \textit{GAO]}.
\textsuperscript{9} \textit{Boom or Bust, FLIGHT INT'L,} July 4, 1990 (unpaged).
\textsuperscript{11} \textit{Assuring the Safety of the Aging Airline Fleet: Hearings Before the Subcomm. on Aviation of the House Comm. on Public Works and Transportation,} 101st Cong., 1st Sess. v (1989) (summary of subject matter) [hereinafter \textit{Assuring the Safety}].
of the widespread use of older aircraft became evident to the industry and the public alike.\textsuperscript{12}

The Aloha accident received a considerable amount of media attention. In the face of heightened public concern regarding the safety of older aircraft, the industry began to explore the numerous issues raised by the incident. The government joined this effort as well. In fact, the crash caused a "wholesale reassessment on the government level of airline maintenance and the quality of inspection programs for aging aircraft."\textsuperscript{13} The Federal Aviation Administration (FAA) sponsored an industry-wide conference on aging aircraft,\textsuperscript{14} and as a result, two industry task forces were formed to study the issue.\textsuperscript{15} The House of Representatives proposed a new strategy involving stricter inspection of older planes and better training of FAA inspectors and engineers,\textsuperscript{16} while the FAA proposed new airworthiness directives which broadened the requirements for inspection and maintenance of aging aircraft.\textsuperscript{17}

This comment addresses whether it is possible to reach a level of maintenance and repair that will allow a properly cared for aircraft to fly virtually forever, or whether there is a point at which an airliner should just be "taken out to the boneyard and put out of its misery."\textsuperscript{18} It discusses the crash of the Aloha Airlines plane, which first raised many of the aging aircraft questions, and addresses the various problems associated with the issue of aging aircraft. This comment evaluates the maintenance and in-

\begin{footnotesize}
\begin{itemize}
\item 12 James Ott & Richard G. O'Lone, 737 Fuselage Separation Spurs Review of Safeguards, Av. Wk. & Sp. Tech., May 9, 1988, at 92.
\item 13 O'Lone, supra note 10, at 16.
\item 14 Assuring the Safety, supra note 11, at ix.
\item 16 Ott & O'Lone, supra note 12, at 92.
\end{itemize}
\end{footnotesize}
spection schedules proposed by the FAA for those aircraft that have served beyond their economic design goals. It will examine the inspection procedures previously used by the FAA, contrast them with the inspection policies recently proposed and implemented by that agency, and consider whether these new techniques are sufficient to maintain an acceptable level of safety in the aging fleet. This comment will then explore the alternative position taken by the House of Representatives that retirement of those planes is the better solution. Finally, after considering whether forced retirement constitutes a taking of property under the Fifth Amendment, it will show that the new maintenance procedures, if properly implemented and enforced, are the best solution to the growing problem of aging aircraft.

II. THE ALOHA AIRLINES ACCIDENT

A. What Happened?

On April 28, 1988, a Boeing 737 operated by Aloha Airlines experienced “an explosive decompression and structural failure” when 18 feet of the plane’s skin peeled away from the aircraft during flight. The flight crew performed an emergency descent, landing safely on Maui, but not before the air, which escaped during decompression, sucked a stewardess out of the plane to her death and seriously injured eight others. The damaged aircraft was over 19 years old, and it had logged almost 90,000 flights. The inspections, made by authorities

---

19 The economic design goal does not necessarily reflect the technical limitations on the life of an aircraft; maintenance costs on these older planes, however, are substantially higher. Aging Aircraft Safety Act of 1990, Report to Accompany H.R. 3774, 101st Cong., 2d Sess. 4 (1989) [hereinafter House Report].
20 NTSB Safety Recommendation, A-89-53 to -69 (July 21, 1989) at 1 [hereinafter NTSB Report]. The plane, flying at 24,000 feet, was en route from Hilo to Honolulu, Hawaii, when “skin and structure aft of the cabin entrance door and above the passenger floorline separated from the airplane during flight.” Id.
21 Walter Shapiro, The Plane Was Disintegrating, Time, May 9, 1988, at 38.
22 Assuring the Safety, supra note 11, at v.
23 Evans, supra note 10, at C6. According to William Hendricks, director of ac-
who investigated the cause of the crash, revealed extensive fatigue, cracking and corrosion on two other high-cycle planes. In response, the airline immediately took these planes out of service.\(^{24}\)

B. Causes of the Accident

The National Transportation Safety Board (NTSB) determined that the accident sequence began with the structural separation of the pressurized fuselage skin, which caused the decompression within the plane.\(^{25}\) Since a search did not recover the portion of the fuselage in which the structural failure originated, investigators analyzed the crash based on a detailed examination of the remaining structure and a study of the airworthiness history of the aircraft.\(^{26}\) Multiple site damage (MSD)\(^{27}\) analysis revealed numerous fatigue cracks in the lap joint along stringer S-10L,\(^{28}\) the probable point of the failure, and in other parts of the fuselage skin.\(^{29}\) According to the NTSB,

It is probable that numerous small fatigue cracks in the lap

\(^{24}\) O'Lone, supra note 10, at 16. According to one Aloha official, the airline retired the aircraft not because they were unsafe, but because of the attention focused on the issue of aging aircraft, which could make passengers uneasy. \textit{Id.} “An Aloha aircraft was involved. . . . We don't want our passengers to wonder about the aircraft they are in.” \textit{Id.} See 54 Fed. Reg. 22,300 (1989) (to be codified at 14 C.F.R. pt. 39) (proposed May 23, 1989).

\(^{25}\) NTSB Report, supra note 20, at 1. “Pressurizing an aircraft for high-altitude flight and depressurizing it for a landing can be analogized to inflating and deflating a balloon. [E]ventually, the fuselage of the plane, like the surface of the balloon, is apt to give way.” Shapiro, supra note 21, at 38.

\(^{26}\) NTSB Report, supra note 20, at 1.

\(^{27}\) Multiple site damage occurs when “small cracks which start beneath fasteners . . . suddenly link up to produce the type of failure we saw in the Aloha tragedy.” Senate Hearing, supra note 1, at 6 (statement of Anthony Broderick, Associate Administrator for Regulation and Certification, FAA).

\(^{28}\) Stringers are longitudinal “stiffeners” that run the length of the fuselage. They are spaced about 10 inches apart, and numbered from the top down. O'Lone, supra note 10, at 18. Investigators found six cracks around rivets in the lap joint by stringer 10 left, and similar cracks around rivets on other stringers. \textit{Id.}

\(^{29}\) NTSB Report, supra note 20, at 1, 2.
joint along S-10L joined to form a large crack (or cracks) ... At the time of the accident, numerous fatigue cracks in the fuselage skin lap joint along S-10L linked up quickly to cause catastrophic failure of a large section of the fuselage.\textsuperscript{30}

The NTSB urged Aloha to initiate maintenance, inspection, and overhaul procedures that contemplate the age and rapid accumulation of flight cycles in its aircraft.\textsuperscript{31} In analyzing the Aloha Airlines incident, the NTSB report also took into account human error, noting that incorrect repair techniques that appear harmless can lead to catastrophic results.\textsuperscript{32} For instance, there is evidence that a required eddy current inspection\textsuperscript{33} was not conducted on the plane involved in the Aloha air disaster.\textsuperscript{34} Other factors that contributed to the accident included Aloha's failure to supervise its maintenance crews adequately and the FAA's failure to evaluate the maintenance program properly or require certain inspections recommended by the

\textsuperscript{30} Id. at 2. "Cracks on the 737 fuselage skin usually travel 30-40 [inches] longitudinally before stresses change to make the crack turn and run circumferentially, limiting the size of the damage. However, if other cracks exist ahead of the propagating crack, they can delay turning of the crack, much like perforated paper." Michael A. Dornheim, Boeing Methodology Faulted in Assessing Aircraft Corrosion, Av. WK. & Sp. Tech., July 18, 1988, at 91, 93.

\textsuperscript{31} NTSB Report, supra note 20, at 2.

\textsuperscript{32} Id. at 6. "The condition of high-cycle B-737s in the Aloha Airlines fleet with respect to lap joint corrosion, multiple repairs, and detection of fatigue cracking is an example of what can occur in the absence of regular and knowledgeable evaluations of aircraft condition by qualified engineering staff." Id.; see also NTSB Says Incorrect Repair Techniques Can Seem Harmless and Be Catastrophic, Air Safety WK., Aug. 21, 1989, at 3.

\textsuperscript{33} An eddy current or high speed air inspection is a high-frequency electronic inspection designed to discover evidence of cracking and corrosion. Ott & O'Lon, supra note 12, at 92.

\textsuperscript{34} NTSB Probes Aloha 737's Maintenance Records, Av. WK. & Sp. Tech., Sept. 11, 1989, at 131. FAA regulations require that aircraft operators perform a "close visual inspection" of the lap joints on all planes, and, if cracks are discovered, they must also perform an eddy current inspection. Id. Aloha records reflect that the visual inspection was completed, but does not indicate that the required eddy current inspection was accomplished. Id. The cracks which caused the severe decompression of the plane in the Aloha accident "would have been present at the time of other repairs in fall 1987, and would have been detectable by required eddy current inspections." James Ott, NTSB Raps Aloha, Aviation System for Fuselage Failure, Av. WK. & Sp. Tech., May 29, 1989, at 24, 25.
The Aloha Airlines accident brought the aging aircraft issue before the entire industry. Although Aloha flies some of the hardest-working planes in the United States’ fleet, the tragedy brought to light a number of issues of concern to the industry with respect to all aging aircraft. The Aloha incident is not an isolated event; a number of structural failures in older planes have forced the industry to reevaluate its policies for maintaining aircraft as they age to ensure their safety.

Several recent structural failures in older aircraft have placed the issue of aging aircraft in the spotlight, and the Aloha accident raised the issue to a new level of urgency. The Aloha crash was tragic, but it had one positive effect: the aircraft industry no longer believes that a plane main-

---

35 House Report, supra note 19, at 3. A required repair was never made in a particular structural joint identified by Boeing. Id. As a matter of fact, two weeks before the April crash, Boeing presented Aloha with an estimate that “predicted the timing of a potential decompression with ‘uncanny’ accuracy. . . . The estimate predicted the major failure at between 87,000 and 91,000 total cycles; the Aloha accident occurred at 89,680 cycles.” Dornheim, supra note 30, at 91. Compliance with the Service Bulletins issued by manufacturers, which may involve either special inspections or specific modifications to the aircraft, varies among airlines. Compliance figures range from a low of 20% to a high of 80%. Senate Hearing, supra note 1, at 74 (statement of Benjamin A. Cosgrove, Vice President, Engineering Division, Boeing).

36 Evans, supra note 10, at C6. “The industry was really frightened by Aloha.” Erik Calonius, The FAA’s Loose Grip on Air Safety, FORTUNE, Oct. 8, 1990, at 85, 96. According to William Hendricks, Director of Accident Investigations for the FAA, “[I]n retrospect it will be looked on as a landmark.” Evans, supra note 10, at C6 (quoting William Hendricks). Therefore it will join “the list of air tragedies that spurred the FAA to develop collision avoidance systems and advanced radars.” Id.

37 Peter Cary & Brian Duffy, When to Junk Geriatric Jets, U.S. NEWS & WORLD REP., May 16, 1988, at 16, 17. Because its inter-island flights in Hawaii average only 20 minutes each, Aloha planes go through significantly more pressurization and depressurization cycles than other planes. Furthermore, because they fly predominantly over salt water, corrosion is a greater hazard for Aloha planes. Id.

tained under the then-existing standards can be flown virtually forever. Prior to the Aloha incident, the government and at least one manufacturer, Boeing, had expressed concerns about the aging process; after the accident, it became clear that new repair procedures to prolong the lives of planes would be necessary if older aircraft were to continue to fly safely. Recognition of this important fact was the first step in a new wave of improvements in aircraft maintenance and safety.

III. THE AGING OF THE CURRENT FLEET

The American air fleet is aging rapidly. The average age of the US air fleet in 1990 was 12.7 years, a figure which is expected to increase. Twenty percent of the fleet is currently between 15 and 20 years old, and 31.5% of the planes in the American fleet are over 20 years old and past their projected life spans.

No single criteria identifies aircraft as "old." The "age" of a plane actually depends on many factors. Measuring chronological age is one means of establishing the "age" of an aircraft. Considering the number of flight cycles a plane has accumulated is equally important in determining the wear on a plane because it is the pressurization and depressurization that a plane experiences in flight that places the most stress on the skin of the aircraft. Repeated pressurizations cause expansion and contraction over time of the metal that forms the plane's skin. These cycles result in fatigue and cracking. Consequently, to obtain a true picture of the "age" of an aircraft, both the number of years and the number of cycles

---

40 Evans, supra note 10, at C6.
42 Id. GAO statistics show that at present 31.5% of the US fleet is over 20 years old, and the GAO predicts 64% will be in that category in 2000. Thirty-one percent of the current fleet has exceeded its economic design life. GAO, supra note 8, at 4.
43 House Report, supra note 19, at 3.
44 Id.
that a plane has flown are relevant factors. As aircraft age and cycles accumulate, cracks will inevitably occur and expand. The need for inspection and maintenance increases in importance as aircraft grow older.

The economic design life of a typical aircraft is 20 years or 60,000 cycles. This figure is based primarily on economic considerations, which assume regular replacement of certain critical parts. Because of economic trends in the industry, the number of planes operating beyond their design life will increase dramatically in the next ten years, as will their proportion to the total fleet. While aircraft over 20 years old comprised 28% of the world fleet in 1988, it is projected that over 40% of the fleet will fall within this category by the year 2000. Unless airlines begin to retire their older planes, this aging trend will continue, resulting in operation of aircraft well beyond their economic design life goals. As the fleet ages, safety concerns will become more and more pressing.

Anticipated growth trends in the air transport industry further heightened concerns about the aging fleet. On the heels of deregulation, airlines lowered fares in the face of fierce competition for the increasing number of

---

45 Senate Hearing, supra note 1, at 41 (statement of Clyde R. Kizer, Vice President, Engineering and Maintenance, Air Transport Association of America). Additionally, "the operating environment, specifically temperature and humidity" must be considered as part of the plane's "age". Id. True "age" appears to be an "intangible yardstick," even among planes with "similar high-cycle, high daily utilization rates." Parrish, supra note 18, at 78.

46 House Report, supra note 19, at 3.

47 Id. at 4. Foreign research indicates, however, that "[t]he loads are generally less than designed." Evans, supra note 10, at C6 (quoting Ben DeJonge, research director in the Netherlands). In other words, actual stresses on old airplanes are less than the manufacturers anticipated because of longer flights, which results in fewer pressurization cycles, and lower flight altitudes, which reduces the cabin pressure. Id. If the same proves true of the American fleet, it is "good news for old planes." Id.

48 Cary & Duffy, supra note 37, at 16.


50 Id. Marketplace considerations generally drive aircraft retirement decisions, not design characteristics. Id. Airlines consider factors such as operating costs, performance, fuel costs, technology, and noise constraints. Id. Excessive costs or noncompetitive results may result in retirement for the plane. Id.

51 Id. at 3.
passengers. Experts suggest that increased competition necessitated cost-cutting policies, which were often manifested by reduced maintenance programs. In fact, a study by the Department of Transportation (DOT) shows that airlines cut maintenance costs by 30% in the first six years after deregulation. Some pilots are concerned that many airlines are now "maintaining their planes only at the minimal levels required by the FAA," thus cutting into the margin of safety. This concern is especially valid with regard to older planes, which are more costly to maintain than newer aircraft.

Various factors force airlines beyond their economic design life goals. New aircraft production cannot keep pace with industry growth and probably will not be able to match the demand in the near future. This lag in production has resulted, and will continue to result, in the extended use of numerous aircraft beyond their intended life spans. Due to backlogs in orders for new aircraft, delivery may be delayed for as many as five years after the

---

52 Paul Betts, Aerospace Industry: Prepared for a Rough Ride, FIN. TIMES, Aug. 29, 1990, at vi. "Passenger traffic is expected to grow from the current level of approximately 468 million passengers per year to 760 million in the year 2000." House Report, supra note 19, at 3.

53 Calonius, supra note 36, at 85.

54 Id. at 96.

55 Cary, supra note 37, at 18. See infra notes 99-107 and accompanying text for a discussion of the measures taken by the FAA to increase the "minimal levels" of safety it requires.

56 Rodeghier, supra note 2, at T5.

57 House Report, supra note 19, at 4.

58 See Rodeghier, supra note 2, at T5. In 1989, manufacturers booked orders for 1,809 jet airliners, but delivered only 562, according to one Airbus representative. Boom or Bust, supra note 9. The following chart highlights the level of the backlog and explains the slow delivery schedule:

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Backlog</th>
<th>% of Manufacturer's Backlog</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boeing</td>
<td>450</td>
<td>25.6%</td>
</tr>
<tr>
<td>Airbus</td>
<td>216</td>
<td>25.7%</td>
</tr>
<tr>
<td>McDonnell Douglas</td>
<td>86</td>
<td>14.1%</td>
</tr>
<tr>
<td>Fokker</td>
<td>54</td>
<td>30.2%</td>
</tr>
<tr>
<td>Rombac</td>
<td>50</td>
<td>100%</td>
</tr>
</tbody>
</table>

AIRCRAFT LEASING, Aug. 1990, at 12.
order is placed.\textsuperscript{59} Thus, to meet consumer demand, airlines continue to fly aircraft that they expected to retire.\textsuperscript{60} Furthermore, new planes are being used not to replace old aircraft, but to supplement the existing fleets, thus expanding the fleet to match passenger demand.\textsuperscript{61} Until recently, low fuel prices also made it economical to continue to use the older, less fuel-efficient planes rather than retire them.\textsuperscript{62}

The accuracy of industry growth projections is difficult to evaluate. "It is very hard to disagree with most industry observers that global industry traffic will grow in excess of an average rate of 6\% per annum through the year 2000," stated Frederick Bradley, the industry analyst who conducted the DOT study.\textsuperscript{63} While this recent analysis of the future outlook for the industry indicates that the industry is "basically healthy," it still must deal with serious and impending problems.\textsuperscript{64} In addition to aging aircraft, the airline industry must confront other important issues, including congestion and noise regulations.\textsuperscript{65}

In dealing with these important issues, the industry must exercise caution. Eighty percent of the planes on order for United States carriers are for just five airlines, and the increased traffic they were ordered to handle has yet to materialize.\textsuperscript{66} In 1989, domestic air traffic grew by a mere 2\%, and a growth of only 1\% was predicted for 1990.\textsuperscript{67} Airline fares have already begun to climb due to higher fuel prices. When increased fares are coupled with the current recession, a short-term decrease in demand

\textsuperscript{59} House Report, supra note 19, at 4.
\textsuperscript{60} Id.
\textsuperscript{61} Id.
\textsuperscript{62} Id.
\textsuperscript{63} Boom or Bust, supra note 9. In fact, Bradley argued that 6\% is probably a conservative figure. Id.
\textsuperscript{64} Id. Citibank Senior Vice President Frederick Bradley provided this analysis. Id.
\textsuperscript{65} Id. See infra notes 238-248 and accompanying text for a discussion of these issues as they relate to aircraft retirement.
\textsuperscript{66} Id.
\textsuperscript{67} Id.
for air travel is not surprising.  

While operating earnings for domestic airlines have been forced down considerably, and with a further drop predicted, airline debt is increasing due to investment in new equipment and the costs associated with repairing aging planes or replacing them with newer, more fuel-efficient aircraft. Labor costs are also rising steadily. According to Bradley, "The US industry should shake out in the next few years... reducing the survivors to five or six relatively stable airlines." No longer will lower fuel prices cushion weak airlines with older fleets, and the unification of the European Common Market in 1992 is expected to increase competition through an "open skies" policy.

The effect of fuel cost fluctuations, increased competition, and limited demand growth on capital expenditure decisions by the airline industry is uncertain. Airlines must reconsider various aspects of their investment spending plans, with two possible effects. On the one hand, airlines may choose to curtail their expenses by buying fewer new planes than anticipated, resulting in a higher percentage of older planes left in use. On the other hand, increased fuel prices may encourage airlines to retire their older planes in favor of new fuel-efficient aircraft.

The industry seems to be heading toward continued use of aging planes, so maintenance becomes a critical issue. Despite the rise in fuel prices, deregulation has prevented significant fare increases; fares still fall below the regulated levels of ten years ago. This factor leans toward

---

68 Betts, supra note 52, at vi.
69 Boom or Bust, supra note 9; Betts, supra note 52, at vi.
70 Betts, supra note 52, at vi.
71 Boom or Bust, supra note 9.
72 Betts, supra note 52, at vi.
73 Id.
74 Id.
76 Betts, supra note 52, at vi.
continued policies of repair, rather than retirement of aging aircraft. Assuming the continued presence of older aircraft in the American fleet, the question becomes not "whether to replace them, but how to anticipate structural weaknesses, and to repair them before they become a safety hazard."77

Based on all of the factors discussed above, each airline must decide either to repair or to replace older planes. Because of the high volume of older planes in the fleet, airlines will frequently face decisions on whether to sell or maintain older planes.78 Such decisions involve a comparison of the cost and the time involved in acquiring new aircraft with the cost of maintaining older aircraft.79 The average new airliner costs approximately $55,000,000.80 The overhaul of existing planes is substantially less expensive, even with new, more expensive FAA requirements.81 As long as it costs less to repair an older aircraft than to buy a new one, and as long as the older airplanes have sound airframes that will last several more years, airlines are most likely to invest in maintenance.82 The current shortage of new planes makes this response even more probable.83 Given these circumstances, it appears that aging aircraft will continue to be operated in large numbers.84

The FAA has announced new methods of inspection and maintenance to ensure the continued safety of the aging fleet.85 As airlines understand the full impact of the opportunity costs of restricted fleet growth due to poor maintenance techniques, perhaps they will begin to place more of an emphasis on this crucial area.

---

77 Rodeghier, supra note 2, at T5.
78 GAO, supra note 8, at 4.
79 Id.
80 Id.
81 Id.
82 Rodeghier, supra note 2, at T5.
83 Id.
84 Id.
85 Senate Hearing, supra note 1, at 13 (Statement of Anthony Broderick, FAA Administrator).
IV. Changes at the FAA

The challenge of maintaining aircraft as they age is multifaceted; actual repair is one aspect, while predicting fatigue and cracking and preventing corrosion are other important factors. All three participants in the current air transportation system—the manufacturers, the airlines, and the FAA—play important roles in assuring the safety of US aircraft. The duties of the FAA are essential, for they affect the actions of both of the other branches of the system. The manufacturers design and build aircraft, but their designs must be approved by the FAA. It is the responsibility of the airlines to inspect and maintain the aircraft in airworthy condition pursuant to rules and regulations established by the FAA. The FAA also approves maintenance plans and monitors airline maintenance performance.

A. Pre-Aloha Inspection Procedures

In the past, the FAA utilized a “damage tolerance” approach to aircraft maintenance, which concentrated on identifying parts of aircraft that were likely to crack and estimating when such cracks were likely to develop. Based on these predictions, maintenance inspections were scheduled early enough to detect any cracks. When a crack was found, the FAA monitored its growth, but it delayed repair until the crack reached a certain size. Problems existed with this approach, including the tedi-
ousness of the inspection process, which usually entailed a visual inspection of hundreds of individual rivets and had little built-in redundancy as an extra safety measure. The procedure failed to recognize fully the danger that even small cracks in the fuselage skin present. The cabin of an airplane flying at cruise altitude is pumped full of air, which creates enormous pressures on the plane, as the Aloha incident made clear. Cracks in vulnerable areas of the fuselage can cause the highly pressurized air to rush out with potentially devastating results.

The Aloha crash revealed that existing FAA maintenance procedures and regulations did not adequately assure the airworthiness of the aging fleet. The NTSB reported that "the current surveillance system can lead to 'rubber stamp' approvals and endorsement of an air carrier's operations and maintenance programs." According to Anthony Broderick, FAA Associate Administrator for Regulation and Certification, the Aloha tragedy showed that the FAA maintenance philosophy required adjustment.

B. New FAA Policies

1. The First Step

The Aloha accident motivated the FAA to re-think its approach and to implement a program that relies less on the inspection process. FAA officials immediately began a study of the problems, which resulted in a series of proposed directives to combat the aging aircraft dilemma. These directives, most of which have been implemented,

---

94 Id. at 3. In other words, the inspection process did not include adequate procedures for double-checking the results to be sure of catching any damage that was present.
95 Cary & Duffy, supra note 37, at 16. Air in the cabin may cause pressures of "up to 10 tons on a plane's exit door." Id.
96 Id.
97 NTSB Report, supra note 20, at 9.
98 Senate Hearing, supra note 1, at 6 (statement of Anthony Broderick).
99 House Report, supra note 19, at 3.
100 Evans, supra note 10, at C6.
form a completely new approach to aircraft maintenance. They entail extensive structural strengthening of older aircraft.\textsuperscript{101}

The new program utilizes a system of “supplemental inspection” based on an analysis that assumes the existence of crack damage at each critical point on the plane, determines its rate of growth, and estimates the point in time at which it will become unsafe.\textsuperscript{102} The new approach mandates repair or modification at specified intervals, regardless of what inspections reveal.\textsuperscript{103} Additionally, the FAA plans to exercise more “hands-on” involvement during heavy maintenance checks and to develop new techniques in the areas of structural testing and repair.\textsuperscript{104} A program of mandatory modification for planes that have exceeded their economic design life is also intended to reduce the possibility of structural failure.\textsuperscript{105} In effect, the FAA has established life limits on aircraft component parts, rather than on the aircraft as a whole.\textsuperscript{106} The life limits vary among the structural elements, and the span assigned to each part depends on a combination of several factors, including the number of flight cycles, chronological age, or actual hours of operation.\textsuperscript{107}

This new maintenance scheme represents a fundamen-

\textsuperscript{101} Witkin, supra note 39, at A1.
\textsuperscript{102} Senate Hearing, supra note 1, at 12 (statement of Anthony Broderick). This approach, the “Supplemental Structural Inspection Documents” program, was finalized in 1981. Id.
\textsuperscript{103} House Report, supra note 19, at 3. This maintenance plan “could conceivably result in an aircraft that contained none of its original structure.” Henry Lefer, Getting Old But Not Ready To Retire; Maintenance of Aging Airline Fleets, AIR TRANSPORT WORLD, Nov. 1989, at 59.
\textsuperscript{104} Assuring the Safety, supra note 11, at 12-13 (statement of Anthony Broderick).
\textsuperscript{105} 54 Fed. Reg. 22,300 (1989) (to be codified at 14 C.F.R. pt. 39) (proposed May 23, 1989). This program has been implemented through a series of Airworthiness Directives (AD’s) issued by the FAA. Senate Hearing, supra note 1, at 6 (statement of Anthony Broderick).
\textsuperscript{106} Senate Hearing, supra note 1, at 24-25 (statement of Anthony Broderick).
\textsuperscript{107} Id. at 25. Opponents of the new FAA scheme argue that the procedure does not place enough emphasis on the number of completed flight cycles, making the inspection and repair intervals too long to maintain high-cycle planes adequately. Id. at 74 (statement of Benjamin A. Cosgrove, Vice President, Engineering Division, Boeing).
tal shift in perspective for the FAA. It is intended to prevent planes from deteriorating until they reach the dangerous condition of the Aloha plane by repairing design weaknesses rather than inspecting for damage. For example, one proposed directive, issued on October 27, 1988, calls for the replacement of approximately 8000 trouble-prone rivets located on the fuselage of 100 or more older 737s. This directive addresses a specific problem that the Aloha aircraft experienced. As the panels of the fuselage of a 737 begin to pull apart due to flight pressure, the rivets holding them in place experience an increased level of stress, and the knife-like edges of the rivets cause cracks to form around them. The FAA directive calls for replacement of the flush rivets with "buttonhead" rivets to avoid this problem.

The FAA proposed a timetable for implementation of this regulation, calling for modification of the most-used planes first. For example, aircraft that have logged more than 70,000 cycles must be repaired within 6 months, while those aircraft with less than 40,000 cycles must be repaired within 36 months. For aircraft with a number of cycles in between these two ranges, the table sets reasonable time limits for implementation.

---

108 Witkin, supra note 39, at A1. Two other Aloha planes were taken out of service after the crash when fatigue cracking and corrosion were discovered in subsequent inspections. 54 Fed. Reg. 22,302. Furthermore, in September 1988, workers on a Continental Boeing 737 found 30 cracks, similar to those on the Aloha plane that crashed, some of which were more than a foot long. Anne Belli, FAA Safety Directives Issued for Boeing 737s, DALLAS MORNING NEWS, Oct. 28, 1988, at A1.

109 53 Fed. Reg. 44,163 (1988) (proposed Nov. 1, 1988); see also Witkin, supra note 39, at A1. Older rivets probably cause small cracks, which may grow as the plane continues to experience stress from pressurization cycles. Belli, supra note 108, at A12. The FAA projects that these modifications will require 2016 man-hours. At $40 per hour per mechanic, the FAA estimates a cost in excess of $80,000 per plane. Airlines predict that, coupled with other repairs, and the lost revenue from a reduced number of flights while planes are being repaired, the cost will be much greater than the FAA's estimate. Witkin, supra note 39, at B5.

110 Witkin, supra note 39, at B5.

111 Id.

112 Belli, supra note 108, at A12.

113 Id.

In addition to repair directives like the one described above, the FAA finalized directives of a slightly different nature, again primarily as a result of the Aloha incident. These directives imposed an altitude restriction on 737s that have completed more than 40,000 flights. Since altitude is a factor that affects stress levels, these aircraft are not allowed to fly above 26,000 feet until they have passed a rigorous inspection.

The FAA system of preventative maintenance is expected to be highly successful.

2. Continued Study

Since issuing its first directives in October 1988, which affected only Boeing 737s, the FAA has continued to study the problems associated with aging aircraft. Numerous directives, affecting all Boeing as well as most McDonnell Douglas aircraft, now impose much stricter inspection and maintenance procedures on the airlines than those the industry had become accustomed to in the past. As the FAA continues to study the issue, it will issue even more directives in an attempt to make the aging fleet a safe fleet.

Early in 1989, the FAA proposed a $35 million program involving the modification of approximately 623 Boeing 727s and finalized a rule requiring increased inspection of McDonnell Douglas DC-9s. The Boeing 727 proposal urges both visual and eddy current inspections of planes built using a cold-bonding method.

Belli, supra note 108, at A12. These altitude restrictions were designed to reduce the stress that aircraft experience in flight as a result of maintaining normal air pressure inside the plane. Id. The airlines would be required to conduct the necessary inspections. Id.


See 53 Fed. Reg. 46,447 (1988)(proposed Nov. 17, 1988). Unlike their Boeing counterparts, the McDonnell Douglas aircraft will not have to undergo complete reworking; certain lap joints in the McDonnell Douglas planes will not require replacement. Christopher P. Fotos, Task Force Outlines Fixes for Aging Douglas Fleet, Av. WK. & Sp. Tech., Sept. 18, 1989, at 122. Beyond this exception, however, the directives aimed at the two manufacturers are almost identical. Id.

FAA Proposes Checks, supra note 117, at 63. In 1971, Boeing recognized an
ment of rivets, as in the 737s, was also proposed for the 727s, although fewer rivets are subject to such replacement. Additionally, the FAA adopted a rule which mandates eddy current inspections of DC-9s in areas over the wings and requires repair of any cracks these inspections reveal. This directive affects 476 DC-9s.

On March 6, 1990, the FAA announced its furthest imperfection in the design of its original planes and, after the 291st plane was built, implemented a structural alteration to change the assembly of the 50 or so panels that comprise the fuselage skin. Witkin, supra note 39, at B5. Older jets were built using a cold-bonding process. In other words, the adhesive bond was made at room temperature. Id. As a plane spent more time in flight, the bonding tended to deteriorate and pull apart. Id. Coupled with "flush" rivets, the cold-bonding may allow the layers to shift and cause cracks, which typically begin at the "fastener countersink hole." 54 Fed. Reg. 1383 (1989); FAA Proposes Checks, supra note 117, at 63. Furthermore, cold-bonding fosters the retention of water droplets, a potential source of corrosion. O'Lone, supra note 10, at 17. Boeing's change to a hot-bonding technique, which drives out any water absorbed in the bonding process and provides a more uniform distribution of adhesive, apparently solved this problem. Belli, supra note 108, at A1. O'Lone, supra note 10, at 18. No significant cracking has been reported in planes produced using this technique. Witkin, supra note 39, at B5.

According to Representative Glickman, former Chairman of the House Subcommittee on Science, Space, and Technology, these structural modifications should extend to "all aircraft which are approaching or have exceeded the use they were designed to handle." O'Lone, supra note 10, at 18. While design differences, such as thickness of the outer skin, make the 727 less vulnerable to cold-bonding failures than the 737, the same inspection procedures and maintenance techniques are necessary to ensure their safety. 54 Fed. Reg. 1383 (1989).

McDonnell Douglas never used the cold-bonding method, choosing instead a mechanical-fastener process. O'Lone, supra note 10, at 18. Nevertheless, the FAA now requires inspection procedures on McDonnell Douglas aircraft similar to those imposed on Boeing jets. Fotos, supra note 118, at 122.

FAA Proposes Checks, supra note 117, at 63. Approximately 4150 rivets on each aircraft will be replaced; with inspections, 1432 man hours per aircraft are projected. The FAA estimates that the cost of implementing this directive will be $56,000 per aircraft. Six hundred twenty-three cold-bonded 727s will be affected, so the total cost of implementing the directive will be nearly $35 million. Id.

This directive differs from prior procedures in that inspections occur at more regular intervals and immediate repairs must be made on all cracks, without an evaluation of when the cracks will become dangerous. See supra notes 91-98 and accompanying text for a discussion of prior inspection procedures.

As proposed, this rule applied only to DC-9s that had logged 55,000 pressurization cycles. When cracks were discovered in 20 aircraft with fewer cycles, the FAA reduced the inspection threshold to 45,000 landings. After the initial inspection, each aircraft must undergo inspection every 5800 landings. Id.
reaching proposal for aging aircraft. Effective April 17, 1990, older Boeing jets became subject to regulations that require repair or replacement of certain parts. Periodic replacement of parts is now mandatory, a significant change from the old system which required replacement only after inspection proved it necessary. Designed to prevent fatigue cracking, this program could cost up to $142 million. The airlines have four years to complete the required changes. The FAA also hopes that these regulations will make mandatory retirement of aircraft unnecessary.

On the same day, the FAA also proposed a limitation on the amount of corrosion permitted on older planes. The task forces on aging aircraft reported that corrosion may be a greater problem than anticipated. Comprehensive maintenance and inspection programs to fight corrosion in Boeing aircraft took effect on December 31, 1990, requiring airlines to monitor approximately 100 components of each plane for flaking, rusting, or contaminated metal. The FAA proposed similar directives for McDonnell Douglas planes. While most airlines regularly monitor for corrosion as part of their normal maintenance procedures, some are more diligent than others.

---

124 FAA Proposes Rules, supra note 123, at 11,476.
126 FAA Proposes Rules, supra note 123, at 11,476. The rule calls for 165 mandatory repairs and replacements of parts. The directive focuses primarily on fuselages, but work is also required on wings, doors, tails, landing gear, and engines. Planes will be scrutinized more closely depending on their age and the number of cycles they have logged. Id.
127 Id. The FAA estimates that many of the repairs mandated in the new directive have already been performed by the airlines. If this is the case, the cost may be far less than the original estimate. Phillips, supra note 125, at A2.
128 FAA Proposes Rules, supra note 123, at 11,476.
129 Id. “The most serious corrosion problems are in fuselage sections underneath aircraft kitchens and lavatories.” Id.
130 Phillips, supra note 125, at A2.
132 Id. at 49,634 (1990) (proposed Nov. 30, 1990).
133 Phillips, supra note 125, at A2.
The new directives require periodic inspection and institution of corrosion-prevention programs.\(^{154}\)

While no accidents have been caused by structural fatigue in McDonnell Douglas aircraft, in September 1989, the FAA announced a preventive program designed to ensure the continued safety of those planes.\(^{155}\) This plan requires modification, inspection, and replacement of suspect parts.\(^{156}\) The industry task force, which is systematically evaluating aging aircraft issues such as maintenance, repair and inspection for all major commercial transports, found many of the same problems in both McDonnell Douglas and Boeing jets.\(^{157}\) Hence the directives for the DC-8, DC-9, and DC-10 are similar to those promulgated for Boeing planes.\(^{158}\) The cost of the required repair that must be done on McDonnell Douglas aircraft will probably total only approximately half of the cost of keeping Boeing planes airworthy.\(^{159}\) The directive will have a greater immediate impact on McDonnell Douglas than Boeing, however, because “fewer Boeing aircraft are near their respective thresholds.”\(^{140}\)

The cost of implementing the new FAA regulations to assure the continued operation of older aircraft is of great concern to the aviation industry.\(^{141}\) The number of jets initially affected by the FAA requirements is relatively

\(^{154}\) Id.


\(^{156}\) Fotos, supra note 118, at 122.

\(^{157}\) Id.

\(^{158}\) Id. “Unlike 727s and 737s, certain lap joints on the Douglas aircraft will not need to be replaced.” Id. Furthermore, according to Patrick S. Murphy, vice president of operations of Avitas, a technical services and appraisal company, Boeing aircraft “tend to have more corrosion problems,” while McDonnell Douglas transports experience more trouble as a result of stress cracks. Id. at 123.

\(^{159}\) Id. at 122. This difference is largely attributable to Boeing’s initial use of the cold-bonding process, which McDonnell Douglas did not employ. Id. Cost estimates vary according to aircraft type as well as how well each aircraft has been maintained by its operator. Id. at 122-23.

\(^{140}\) Id. at 123.

\(^{141}\) FAA Proposes Checks, supra note 117, at 63.
small,142 but as the fleet continues to age the FAA directives will affect more planes and will increase the cost to the industry.143 In spite of this fact, Boeing and the aviation industry as a whole reportedly support the FAA actions.144 For instance, Dale Warren, a vice president of the Douglas Aircraft Company, called the FAA's aging aircraft recommendations “one of the best things that has happened in the aviation industry in the last 30 years.”145 Next to the value of the planes, the repair costs are reasonable, especially in light of the current demand for aircraft.146 In fact, other expenses involved in operating an airline dwarf the costs imposed by these directives.147

C. New Procedures in an Old Environment

1. Problems at the FAA

Despite the enormous cost that the various new inspection and maintenance techniques will impose on the industry, the FAA anticipates favorable results.148 The effectiveness of these new procedures, however, depends on the resolution of problems within the FAA. The Agency does more than establish the basic regulatory re-

142 FAA Orders New Measures to Combat Corrosion in Older Boeing Airliners, AIR SAFETY W.K., Mar. 12, 1990, at 3. The regulations adopted in March, 1990, for example, initially affected only 115 Boeing jets. Id. The new directive applies to all planes over 20 years old, 727s with 60,000 accumulated flights, 737s with 75,000 flights, and 747s with 20,000 flights. Id. The immediate effect on McDonnell Douglas transports will be greater, as virtually all DC-8s and a majority of DC-9s will require repairs as a result of the promulgation of the directive. Fotos, supra note 118, at 123.

143 FAA Proposes Checks, supra note 117, at 68. Approximately 1300 jets will eventually be affected. Id.

144 Phillips, supra note 125, at A2.


146 Fotos, supra note 118, at 123. The repairs should also enhance the aircraft's market value. Id.

147 Cushman, supra note 145, at A16.

148 Senate Hearing, supra note 1, at 18 (statement of Anthony Broderick, Associate Administrator for Regulation and Certification, FAA). “This is a high priority issue with us. We are directing our efforts toward immediate corrective action for problems as they manifest themselves in our aging fleet. We are taking long range action towards the improvement of an airplane's tolerance to fatigue damage and corrosion. . . .” Id.
quirements; it also serves an important surveillance function that insures compliance by the operators and manufacturers. The effectiveness of the regulations and directives depends upon enforcement, but the agency responsible for enforcing them is underfunded, undermanned, and poorly managed.

Since deregulation, the problems of the FAA have become severe; more planes are flying, and a greater percentage of them are older. Under competitive pressures, many airlines are choosing to forego the extra margins of safety they once routinely maintained. Hence, at a time when the FAA is less able to shoulder responsibility for airfleet safety, the agency must play a more crucial role in monitoring maintenance than it has in previous years.

While the FAA identifies the human element as one major factor in the problem of maintaining older aircraft, the agency must address other serious issues as well. One problem is that engineers and inspectors often do not receive the training they need. In fact, FAA training programs for inspectors and engineers have been called both outdated and inadequate.

In 1989, the General Accounting Office (GAO) interviewed seventeen

---

149 Id. at 42 (statement of Anthony Broderick).
150 Calonius, supra note 36, at 85. Three separate federal investigative agencies have confirmed the widespread problems within the FAA. Id. at 96. It is "beyond dispute" that the FAA needs to patrol the airlines more effectively. Id. at 88.
151 See supra notes 51-55 and accompanying text for a discussion of the impact of deregulation on age trends in the fleet.
152 Calonius, supra note 36, at 85.
153 Senate Hearing, supra note 1, at 16-17 (statement of Anthony Broderick). The FAA has taken long range action towards improving "inspection reliability including reducing reliance on inspections as a means of limiting the possibility of human error." Id. at 18.
154 Id. at 25.
155 Calonius, supra note 36, at 92. "Many of the FAA's training courses are appallingly obsolete." Id. For instance, the NTSB reported that at the FAA Academy in Oklahoma City, trainees were required to study topics such as wood airframes. Id. The FAA still has no courses in composite materials used in the skin of aircraft, and most inspectors are not trained in the newest aircraft models. Id.
156 Id.
electronics inspectors and determined that none of them had received even the limited amount of training that they were scheduled to receive.\textsuperscript{157} Nevertheless, these agents performed inspections and worked on aircraft on a regular basis.\textsuperscript{158}

The FAA may have sent these inspectors into the field early to mitigate a second problem - shortage of manpower. The agency admits that it has been experiencing a shortage of inspectors for several years.\textsuperscript{159} The practice of sending inexperienced inspectors into the field, however, results in inadequate inspections, which cannot be tolerated because of the potential for tragic errors. For example, in its report on the Aloha incident, the NTSB stated that if the FAA inspector assigned to the Aloha planes had been properly trained, the accident of April 1988 might never have occurred.\textsuperscript{160} In fact, the Aloha inspector had no training in corrosion control, spotting problems with certain joints in 737s, or the general maintenance of older planes.\textsuperscript{161}

The FAA's method of inspection presents a third major problem. FAA inspectors spend most of their time auditing the record books kept by airline mechanics.\textsuperscript{162} These audits reveal \textit{procedural} errors (assuming the records are accurately kept) but rarely reflect the actual condition of the aircraft.\textsuperscript{163} Manufacturers believe that the agents should actually inspect the airplanes, as well as review the

\textsuperscript{157} Id.
\textsuperscript{158} Id.
\textsuperscript{159} Senate Hearing, supra note 1, at 26-27 (testimony of Anthony Broderick).
\textsuperscript{160} NTSB Report, supra note 20, at 8.
\textsuperscript{161} Calonius, supra note 36, at 92.
\textsuperscript{162} Id.
\textsuperscript{163} Id. In December 1987, the FAA conducted a "special inspection" of Aloha. Most of the examination, however, was of paperwork, and "a ramp inspection of eight aircraft turned up trivial items on three of them, but no finding of corrosion." Dornheim, supra note 30, at 91. If FAA inspectors had actually inspected the Aloha planes perhaps they would have noticed what the NTSB post-accident investigators reported — swelling and bulging skin, pulled and popped rivets, and blistering and flaking paint at many sites along lap joints on most of the planes. Calonius, supra note 36, at 92.
As the FAA expands its role to include more comprehensive surveillance, other problems will inevitably arise. Corrosion detection, for instance, represents a particularly problematic area of inspection. It involves a tedious and mind-numbing process that requires a well-trained person of high intelligence and concentration. The FAA must improve procedures designed to combat human error if inspections are to be more effective.

The FAA's primary problem is its worker shortage. While the inspection staff has grown by almost 75% since 1985, the workload has grown even faster. Staff shortages continue partly because of training backlogs. One result of these shortages is that inspectors are sent out before they are fully trained; another is that inspectors are overworked, substantially limiting their effectiveness. Regional imbalances of inspectors with particular specialties, which may worsen with the new inspection requirements, compound the problem of worker shortage. Because of shortages, the overworked inspectors often do not follow up on critical matters. In the case of the Aloha incident, for example, the NTSB accused the FAA of sending Aloha an incomplete directive; the agency singled out two of twelve parts that Boeing re-

164 Senate Hearing, supra note 1, at 79 (statement of Benjamin A. Cosgrove, Vice President, Engineering Division, Boeing).
165 Calonius, supra note 36, at 96. "They have a little hand-held device that the guy runs across every rivet on the airplane," says the GAO's director of transportation issues. Id.
166 Id. at 92.
168 See supra notes 155-161 and accompanying text.
169 The Aloha inspector, for instance, was also assigned as the Principal Maintenance Inspector for nine other operators and seven repair stations in the Pacific Rim area. Calonius, supra note 36, at 92. "His territory stretched from Hong Kong to Hawaii." Id. The NTSB reported that this inspector was too overworked to be effective. See NTSB Report, supra note 20, at 8.
170 Training Plan, supra note 167, at 513.
171 Calonius, supra note 36, at 92. GAO investigators found that in 8 out of 10 instances, FAA employees did not verify compliance with airworthiness directives. Id.
ported were in need of inspection, ignoring the other ten.\textsuperscript{172}

The FAA is busily working in several areas to deal with the problems they face. In 1989, between 200 and 300 new inspectors joined the FAA.\textsuperscript{173} Over a period of three years, the Agency expects a total increase in staff of 30\%.\textsuperscript{174} In spite of these projections, the Agency anticipates having approximately 250 inspectors short of those needed.\textsuperscript{175} Efforts on all fronts will hopefully enable the FAA to monitor and enforce maintenance standards more effectively,\textsuperscript{176} but funding for the necessary measures continues to be a problem.\textsuperscript{177}

The FAA's attempts to improve the quality of its work and to recruit more inspectors are impeded by the bureaucracy involved, which makes change difficult.\textsuperscript{178} The

\textsuperscript{172} NTSB Report, supra note 20, at 7. "[T]he limited AD requirements imposed by the FAA precluded the continuing airworthiness of the aging B-737s and the reduced inspection criteria is considered a contributing factor to the cause of this accident." \textit{Id}.

\textsuperscript{173} Senate Hearing, supra note 1, at 26 (Statement of Anthony Broderick).

\textsuperscript{174} \textit{Id}.

\textsuperscript{175} \textit{Training Plan, supra} note 167, at 513.

\textsuperscript{176} Senate Hearing, \textit{supra} note 1, at 24 (statement of Anthony Broderick). Mr. Broderick states:

\begin{quote}
[W]e are recruiting and hiring additional inspectors. We are increasing the numbers and types of surveillance our inspectors are required to perform. We are training our inspector work force on what to look for during their on-site visits, especially in the area of structural inspection techniques. We are sending teams of experienced inspectors and FAA structural engineers into the field to visit airlines and study the positive and negative impacts on the structural inspection process, including the areas of corrosion control, nondestructive testing techniques, airworthiness directive compliance, and human factor issues. We hope to fashion improved policy from these studies which will ensure the safety of our aging fleet.
\end{quote}

Id.

\textsuperscript{177} In a confirmation hearing before the Senate Committee on Commerce, Science and Transportation, Samuel K. Skinner stated, "I know the importance of spending money at the FAA across the board," but would not commit to an increased spending level. Michael Mecham, \textit{Senators Press Skinner on Civil Aviation Agenda, Av. Wk. & Sp. Tech.}, Jan. 30, 1989, at 70.

\textsuperscript{178} Calonius, \textit{supra} note 36, at 94. Past administrators are "unsparingly critical" of the red tape. \textit{Id}. According to one administrator "[t]o try to advance a progressive agency with all that bureaucratic baggage is really difficult. You have a lot of bosses." \textit{Id}. A pending Senate bill which "calls for an FAA separate from
involvement of Congress, the hierarchical structure of the agency, and the financial constraints pose hurdles to the objectives of training and maintaining an adequate inspection staff.\textsuperscript{179} Meanwhile, airlines in the United States are becoming bigger and more complex. As planes age, air travel becomes more dangerous.\textsuperscript{180}

2. \textit{Other Obstacles}

The FAA’s troubles are not the only obstacle to effective implementation of the new directives. Manufacturers, operators, and the FAA operate together to ensure airfleet safety. Their relationship can be compared to a three-legged stool, since each body must operate properly for the system to work.\textsuperscript{181} Thus, like the FAA, airlines and manufacturers must address the problems that impede their effectiveness.

One problem facing airlines is the wide variation of inspection and maintenance programs among operators.\textsuperscript{182} To avoid deferral of maintenance beyond the proper time, Benjamin Cosgrove of the Boeing Company suggests the development and enforcement of a minimum industry standard.\textsuperscript{183} Another hurdle the airlines face is the need for proper technical capability, which enables them to use technical information distributed by manufacturers properly.\textsuperscript{184} Such capability might be ensured by sus-
taining adequate engineering and maintenance departments. Finally, since only the airline knows the different stresses that a particular aircraft has experienced, it is best equipped to deal with the aging process. A well-equipped and trained maintenance staff is fundamental to meeting these needs.

Like airlines, manufacturers need to improve their role in the system of assuring the safety of the aging airfleet. Initially, communications with airlines and regulatory agencies must be improved. Manufacturers need to gain a better understanding of the effectiveness of the maintenance programs they recommend. This knowledge may help improve the overall condition of the fleet as manufacturers issue more appropriate recommendations.

V. Government Action

A. The House Bill

Although all three branches of the air transport industry are attempting to eliminate the problems discussed above, these problems overshadow the significant actions by the FAA in the eyes of some critics. In spite of its continuing efforts in the aging aircraft arena, the FAA is “still accused of not doing enough.” As a result, Congress has involved itself in the aging aircraft issue to an extent beyond that of mere supervision of the FAA. In fact, 1990 was expected to be a watershed year for shaping the future of the aviation industry, and some potentially important legislation was introduced that year. While 1989 did not produce landmark legislation in the aviation area, the issues received a good bit of attention in both houses.

---

185 Id. at 79.
186 Id. at 81. "Clarity of the service bulletins, timeliness and emphasis of information provided regarding fleet problems should be improved." Id.
187 Id. at 80.
188 Cary & Duffy, supra note 37, at 18.
of Congress. Specifically, both the Senate and the House of Representatives held hearings on the issues raised by the aging aircraft problem to determine what, if any, action was necessary.

Late in 1989, after the initial Airworthiness Directives (ADs) were finalized by the FAA, Representative James Oberstar, Chairman of the House Public Works and Transportation Committee's Subcommittee on Aviation, stated that while current law gives the FAA broad latitude in this area, including the authority to deal with the aging aircraft problem on its own, he was prepared to legislate a solution if the FAA did not act promptly and satisfactorily.

To assure the flying public that the air transport system in the United States is operating at the highest level of safety, Oberstar advocates an approach that evaluates each aging aircraft as a whole, "not a collection of replaceable parts." Furthermore, since the new maintenance programs focus primarily on flight hours or calendar time, rather than flight cycles, Oberstar argues that the inspection intervals for high-cycle planes are too long to assure adequate safety of these aircraft. Finally,

---

190 Id.; see also Mecham, supra note 177, at 70.
191 See, e.g., Senate Hearing, supra note 1, at 1; Assuring the Safety, supra note 11, at 5.
192 Democrat Minnesota.
194 Id. at 3. Despite Oberstar's comments, the FAA feels that a life limit set on crucial parts of the aircraft's structure is sufficient to ensure safety; the agency presently has no plans to establish a mandatory retirement age for any aircraft. Id. at 3-4. In fact, many experts fear that setting a mandatory retirement age would be nothing more than a knee-jerk reaction to a complex problem. Hearing on Aging Aircraft Questions FAA Maintenance Standards, REGIONAL AV. WKLY., Apr. 14, 1989. "[S]ince aircraft age by use, corrosion, and hard landings, among other factors", more than chronological age should be considered before retiring any plane. Id. Acting chairman of the NTSB, James Kolstad, supports the FAA proposals that require mandatory retirement of aircraft parts, not aircraft. Business Aviation Briefs: James Kolstad, WKLY. OF BUS. AV., Feb. 5, 1990, at 46.
195 Senate Hearing, supra note 1, at 74 (statement of Benjamin Cosgrove, Boeing). The FAA, however, has indicated that it does consider the number of flight cycles in its determination of maintenance schedules. Id. at 11, 12 (statement of Anthony Broderick).
the FAA's decision to give airlines four years to implement its new program is a cause of concern.\(^{196}\) Legislators fear that the delay factor will encourage some airlines to procrastinate, eventually compromising fleet safety.\(^{197}\)

In response to these concerns, in November 1989, Oberstar and Representative William F. Clinger, Jr.\(^{198}\) co-sponsored House Resolution 3774 (H.R. 3774). The bill is designed to amend the Federal Aviation Act of 1958 relating to the suspension of airworthiness certificates at the end of the economic design life of aircraft.\(^{199}\) Essentially, the bill adopts the Navy's "safe-life" concept.\(^{200}\) It requires that the FAA establish a way to accurately determine the design life\(^{201}\) of aircraft and mandate special inspections of aircraft during the last year of the expected design life.\(^{202}\) These inspections would determine whether or not the plane could remain in use in air commerce.\(^{203}\) The individual airlines would have the burden of proving to the FAA that the maintenance of all "age-sensitive parts and components" of the aircraft has been adequate and timely enough to assure a continued high level of safety beyond the plane's design life.\(^{204}\) The bottom-line result of H.R. 3774 would be a suspension of the

\(^{196}\) Allen Li, *Shortage of Facilities May Cause Crisis*, AIRCRAFT LEASING, Aug. 1990, at 28.

\(^{197}\) Id.

\(^{198}\) Republican Pennsylvania. Representative Clinger is the Subcommittee on Aviation's ranking minority member. See *House Bill Would Require the FAA to Set Age Limits for Airliners*, AIR SAFETY WK., Dec. 11, 1989, at 3 [hereinafter *Age Limits*].


\(^{200}\) Senate Hearing, supra note 1, at 2 (statement of Senator Ford, Chairman of the Subcommittee on Aviation). The "safe-life" concept means that "aircraft structures and parts are not operated beyond a limit established by extensive testing. Planes are not repaired beyond a certain point; they are just retired." Id.

\(^{201}\) The design life is not to be confused with the economic design life of an aircraft. The economic design life refers to the point in time when maintenance costs are expected to skyrocket; design life refers to the number of years that a properly maintained plane can safely fly. See H.R. 3774, 101st Cong., 2d Sess. § 3 (1990).

\(^{202}\) Id. See also *House Bill Would Require the FAA to Set Age Limits for Airliners*, supra note 198, at 3.

\(^{203}\) H.R. 3774, 101st Cong. 2d Sess. (1990); see also supra note 198, at 3.

\(^{204}\) H.R. 3774, 101st Cong., 2d Sess. § 2 (1990). The bill does not define "age sensitive parts and components." Id.
AIRWORTHINESS CERTIFICATE ON THE LAST DAY OF A PLANE'S DESIGN LIFE UNTIL THE FAA DETERMINES AFTER INSPECTION THAT THE PLANE CAN SAFELY CONTINUE TO PROVIDE AIR TRANSPORTATION.\textsuperscript{205} THIS REQUIREMENT MAY MEAN THAT AN AIRPLANE COULD BE OUT OF SERVICE FOR AS LONG AS TWO WEEKS WHILE IT UNDERGOES A THOROUGH INSPECTION.\textsuperscript{206}

The House of Representatives passed H.R. 3774 by a voice vote on July 16, 1990.\textsuperscript{207} They requested Senate concurrence and transferred the bill to the Senate Com-

\textsuperscript{205} Age Limits, supra note 198, at 4.

\textsuperscript{206} Li, supra note 196, at 28.

\textsuperscript{207} 136 Cong. Rec. H4741 (daily ed. July 16, 1990); see House Passes Bill Ordering FAA to Write Aircraft Design Life Rule, AIR SAFETY WK., July 30, 1990, at 3 [hereinafter Aircraft Design Life Rule]. The text of H.R. 3774, as approved by the House, reads as follows:

SECTION 1. SHORT TITLE
This Act may be cited as the "Aging Aircraft Safety Act of 1990"

SECTION 2. AGING AIRCRAFT RULEMAKING PROCEEDING
(a) IN GENERAL. - Not later than 180 days after the date of the enactment of this Act, the Administrator shall initiate a rulemaking proceeding for the purpose of issuing a rule to assure the continuing airworthiness of aging aircraft.

(b) INSPECTIONS AND RECORD REVIEWS. -
(1) GENERAL REQUIREMENT. - The rule issued pursuant to this section shall, at a minimum, require the Administrator to make such inspections, and conduct such reviews of maintenance and other records, of each aircraft used by an air carrier to provide air transportation as may be necessary to enable the Administrator to determine that such aircraft is in safe condition and is properly maintained for operation in air transportation.

(2) PART OF HEAVY MAINTENANCE CHECKS. - The inspections and reviews required under paragraph (1) shall be carried out as part of each heavy maintenance check of the aircraft conducted on or after the first day of the 15th year in which the aircraft is in service.

(3) APPLICABILITY OF FEDERAL AVIATION ACT. - The inspections required under paragraph (1) shall be conducted as provided in section 601(a)(3)(C) of the Federal Aviation Act of 1958.

(c) DEMONSTRATION OF STRUCTURAL AND PARTS MAINTENANCE. - The rule issued pursuant to this section shall, at a minimum, require the air carrier to demonstrate to the Administrator, as part of the inspection required by the rule, that maintenance of the aircraft's structure, skin, and other age-sensitive parts and components has been adequate and timely enough to ensure the highest degree of safety.

(d) PROCEDURES. - The rule issued pursuant to this section shall
merce, Science and Transportation Committee on July 17, 1990. There has been no significant action in the Senate as of the date of this writing.

B. FAA and Industry Response

Anthony Broderick, Associate Administrator for Regulation and Certification at the FAA, stated that H.R. 3774 presents both philosophical and practical problems for the agency. One practical problem with the program set out by H.R. 3774 is the shortage of FAA inspectors.

---

establish procedures to be followed in carrying out the inspections required by the rule.
(e) AVAILABILITY OF AIRCRAFT.-The rule issued pursuant to this section shall require the air carrier to make available to the Administrator the aircraft and such inspection, maintenance, and other records pertaining to the aircraft as the Administrator may require for carrying out reviews required by the rule.

SECTION 3. AIRCRAFT MAINTENANCE SAFETY PROGRAMS.
Not later than 180 days after the date of the enactment of this Act, the Administrator shall establish-
(1) a program to verify that air carriers are maintaining their aircraft in accordance with maintenance programs approved by the Federal Aviation Administration;
(2) a program-
  (A) to provide inspectors and engineers of the Federal Aviation Administration with training necessary for conducting auditing inspections of aircraft operated by air carriers for corrosion and metal fatigue; and
  (B) to enhance participation of such inspectors and engineers in such inspections; and
(3) a program to ensure that air carriers demonstrate to the Administrator their commitment and technical competence to assure the airworthiness of aircraft operated by such carriers.

SECTION 4. ADMINISTRATOR DEFINED.
As used in this Act, the term "Administrator" means the Administrator of the Federal Aviation Administration.


Senator Ford, Chairman of the Senate Subcommittee on Aviation, is not prepared to call for the mandatory retirement of aircraft, although he commented the "safe life" concept reflected in the House Resolution "seems to make sense." 

Aging Aircraft Hearing Raises Questions for Congress, Av. Daily, Apr. 12, 1989. Other senators fear that a mandatory retirement age is "a simplistic response to a complicated problem." Id.


See supra notes 166-172 and accompanying text for a discussion of the FAA worker shortage.
The bill would require the FAA to furnish inspectors and engineers with training to qualify them to conduct inspections for fatigue and corrosion.\textsuperscript{212} Broderick estimated that it would take at least five years to hire and train those inspectors and called the goal of 1000 inspections in the first year of enactment "unrealistic."\textsuperscript{213} Broderick also argues that the FAA does not want to incur the potential liability inherent in the requirement that the FAA make the final determination of airworthiness based on a review of maintenance records.\textsuperscript{214}

In addition to the FAA's objections to the bill, several industry representatives fear that the bill could have the opposite of its intended effect.\textsuperscript{215} Those individuals expressed concern that emphasizing an age limit or age related compulsory modification might lead to complacency in routine inspections.\textsuperscript{216} Furthermore, manufacturers do not set mandatory retirement dates for aircraft.\textsuperscript{217} Thus, in spite of the House Bill, both the FAA and the industry firmly oppose the proposed mandatory retirement as a solution to the aging aircraft problem.

VI. Is Mandatory Retirement a Good Idea?

The FAA and Congress clearly advocate similar approaches to the aging aircraft problem, but with one important difference. The FAA approach assumes that through the conscientious application of a preventative maintenance program coupled with periodic replacement of parts, an aircraft can be safely flown almost indefinitely.\textsuperscript{218} The government approach, on the other hand,

\textsuperscript{212} See Aircraft Design Life Rule, supra note 207, at 3.
\textsuperscript{213} FAA, Airlines Differ on Aging Aircraft Inspections, supra note 210, at 217. Broderick later revised that time table to three years. Id.
\textsuperscript{214} Id.
\textsuperscript{215} Bill to Subject Older Air Transports to Recertification is Questioned, AIR SAFETY WK., Dec. 18, 1989, at 3.
\textsuperscript{216} Id. Clearly, age becomes a more serious problem when inspections fail to identify its side effects — corrosion and fatigue. Cary & Duffy, supra note 37, at 16.
\textsuperscript{217} Cary & Duffy, supra note 37, at 16.
\textsuperscript{218} Ott & O'Lone, supra note 12, at 94. According to Boeing, the actual lifetime
takes the position that there will eventually come a time when no amount of prevention can assure the structural integrity and reliability of a plane; at that point the plane must be retired.

At present, the precise point at which retirement becomes necessary is difficult to determine, as the problem is relatively new. Aircraft "used to become technologically obsolete" before their age raised safety issues. Today, planes continue to fly safely beyond their design goals.219 Thus, any "age" chosen for mandatory retirement will be arbitrary. Eventually, experience will be the best indicator for assessing the longevity of an airplane, as we will learn what to look for as planes age.220

A. Factors to Consider

1. On the Government Level

Clearly, many factors affect the decision to mandate retirement of aging aircraft. Which factors are most relevant necessarily vary depending on who is making the decision, as government objectives are not precisely the same as airline objectives. From the perspective of Congress and the FAA, it is most important to assure that the aging airline fleet remains safe; industry will invariably focus more attention on the cost factor. Overall cost to the industry is a factor that the government will consider, but it is secondary to safety considerations.

In most respects, the aging aircraft proposal offered by the House of Representatives is similar to the revised policy of the FAA. In fact, the retirement issue is the only real point on which Congress and the FAA disagree. Under the FAA plan, an airline would make the ultimate retirement decision based on economics, for, with supplemental maintenance, the planes should remain safe virtu-

---


220 Id.
ally forever. The government prefers tests which will ask the question, "Is this old airplane safe?" By requiring an affirmative answer to this question before aircraft return to service, the legislature wants to assure the public that planes in the American fleet are safe. This approach takes what is perhaps the more reasonable position that no plane can last forever, no matter how well maintained.

2. Does Mandatory Retirement Constitute a Taking?

The House approach, which may result in mandatory retirement of aircraft as they age, involves a potential constitutional complication in the event such planes are forced to retire. If it does require an airline to retire an aircraft, the government may be subject to an action for inverse condemnation. Under the Due Process Clause of the Fifth Amendment, the government cannot take private property without just compensation. It is clear that a regulation can effect a taking if it denies an owner economically viable use of his property.

No cases have dealt specifically with the takings issue in the context of legislatively mandated retirement of aircraft, which have a public use; however, in a case dealing with regulation of public transportation, the Supreme Court held that although use of railroad property is subject to public regulation, "arbitrary and unreasonable" regulation that infringes on the right of ownership can constitute a taking. The question becomes, then, whether mandatory retirement of aging aircraft is an arbitrary or unreasonable regulation. Such a regulation would clearly be unreasonable if the government set an arbitrary date or age at which all aircraft must be retired. Under the House Resolution, however, no plane would be

---

221 House Report, supra note 19, at 6.
222 Id.
223 U.S. CONST. amend. V.
forced to retire until it has been deemed unsafe and, presumably, beyond repair. Arguably, such a scheme is not unreasonable, for it sets a definite standard and looks to the safety of air passengers.

Since property used for public transportation is subject to the Takings Clause, an analogy can be drawn to cases in which municipalities have required property owners to demolish buildings which were determined to be unsafe. In *Miles v. District of Columbia*,226 for example, the plaintiff owned two buildings which the city condemned. After six years, during which the plaintiff attempted to restore the buildings, the buildings were destroyed.227 Plaintiff brought suit alleging a taking of property without just compensation, and the court granted her petition. The issue of valuation of her interest in the condemned buildings was remanded.228

In *Benenson v. United States*,229 the Court of Claims reached a similar result, holding that government regulations which completely deprived property owners of any right to use their property constituted a taking of their fee interest and required compensation.230 *Miles* and *Benenson* stand for the principle that property owners are entitled to just compensation if government regulations, federal or local, deprive them of the enjoyment of their property for the public good.231 Forcing airlines to retire planes in the interest of safety is clearly such a regulation.

If the court finds mandatory retirement of aged aircraft constitutes a taking, the issue of what compensation is due

---

226 510 F.2d 188 (D.C. Cir. 1975).
227 Id. at 191.
228 Id. at 195.
229 548 F.2d 939 (Ct. Cl. 1977).
230 Id. at 952.
231 In order for just compensation to attach, the taking must be a legitimate exercise of governmental power for the public good. See Keystone Bituminous Coal Ass'n v. DeBenedictis, 480 U.S. 470, 485-86 (1987). "The nature of the State's interest in the regulation is a critical factor in determining whether a taking has occurred." Id. at 488. The government might argue in airline cases that it is preventing a nuisance by requiring retirement of unsafe planes, although that argument would probably not succeed.
arises. Valuation of a party's interest in property that has been deemed unsafe presents a difficult issue. Both cases previously discussed remanded the valuation question.\textsuperscript{232} Just compensation is generally not equal to the replacement cost of the property taken, but rather fair market value at the time of the taking.\textsuperscript{233} In the case of an aircraft that has been declared unsafe, fair market value of the plane would be virtually nothing, and the owner would recover nothing for his lost property interest. In cases such as this, where manifest injustice would result from the fair market approach, a court may look at the facts and consider replacement value in its determination of just compensation.\textsuperscript{234} The potential cost to the government of paying just compensation to airlines if mandatory retirement is characterized as a taking is a factor that Congress must weigh carefully before forcing planes to retire.

3. Airline Perspective

The airline industry has manifested a desire to play a role in deciding the aging aircraft issue. This desire is evident from the overwhelming support of and participation in the various task forces formed shortly after the Aloha incident.\textsuperscript{235} Absent a federal mandate, while airlines must operate within the FAA's regulatory framework, each airline must make its own decision on the retirement issue, but the factors they consider will differ significantly from those discussed above, which apply to decisions made from an out-of-the-market perspective. Airlines must consider the economic effects of these decisions on their business as well as the common good of the industry. Generally, factors the airlines consider include maintenance costs, the status of the used aircraft market, the route system and which planes are best suited to a given route, what new models are available, and the availability

\textsuperscript{232} See Benenson, 548 F.2d at 952; Miles, 510 F.2d at 195.
\textsuperscript{233} Olson v. United States, 292 U.S. 246, 255 (1934).
\textsuperscript{235} Parrish, supra note 18, at 74.
of financing.\textsuperscript{286} While the aggressive FAA inspection and maintenance plan could increase the safe life of an aircraft by replacing, over time, its entire original structure, the question remains whether it would be economical to go that far.\textsuperscript{237}

Recent high fuel prices and noise control regulations may be factors that have an important impact on the airline industry's decision regarding retirement of older aircraft. At present, the industry appears to be on the edge of a sharp decline.\textsuperscript{288} Edmund S. Greenslat, president of ESB Aviation Services, has forecast the retirement of between 100 and 160 aircraft by 1993, with a sharp rise in retirement rates beginning in 1994, resulting in the exodus of approximately 1000 planes from the world fleet by 1996.\textsuperscript{239} Such predictions, however, may be premature and unwise.

Noise control regulations may have a substantial effect on the aging aircraft issue. Older aircraft are louder than the newer models.\textsuperscript{240} The timing of new anti-noise requirements, which Congress has asked the FAA to consider, will strongly influence the pace of retirements.\textsuperscript{241} In fact, noise control legislation may be an alternative to mandatory retirement.\textsuperscript{242} According to Greenslat, “[O]nce the Stage 3 requirements are known, the older

\textsuperscript{236} Toni Taylor, \textit{Retirement for Planes?}, L.A. TIMES, Sept. 18, 1988, at 20.

\textsuperscript{237} Lefer, supra note 103, at 59. Some argue that the industry should not worry about the expense. \textit{Err on the Side of Safety}, supra note 5, at 9. While FAA-mandated modifications will cost approximately $600,000 per plane, this amount is not unreasonable, especially since it can be spread across several years. \textit{Id.} U.S. airlines currently spend between $1.5 and $2 million per plane on maintenance each year. \textit{Id.}

\textsuperscript{238} \textit{U.S. Airlines Face Big Losses Due to Rise in Fuel, Other Costs}, Av. Wk. & Sp. TECH., Sept. 3, 1990, at 203 [hereinafter \textit{Big Losses}]. “Traffic is already looking sick and the chance of stretching out aircraft orders, dropping options and parking old airplanes is very real.” \textit{Id.}

\textsuperscript{239} \textit{Id.} This is a conservative estimate; Boeing calculates retirements of more than 300 per year in the beginning of the decade. \textit{Id.}

\textsuperscript{240} David Evans, \textit{Noise Issue is Quiet Ploy to Replace Aging Planes}, CHI. TRIB., Apr. 11, 1989, at C1.

\textsuperscript{241} \textit{Big Losses}, supra note 238, at 203; see also Evans, supra note 240, at C1.

\textsuperscript{242} Evans, supra note 240, at C1.
airplanes will have the sign of death on them." On the other hand, requiring all aircraft to meet these new regulations may simply result in new mufflers, or "hush kits," on old planes. Such a result might have the ironic effect of keeping older planes in service longer. The airline industry hopes to avoid unnecessary complications by keeping the aging aircraft problem separate from the noise issue. If the fleet improvement requirements and the noise issue are linked, however, the airlines might benefit from "one-stop shopping; the fuselage work can get done at the same time planes are pulled out of service for hush kit installation," resulting in a minimum of "down time." In either case, noise control procedures are an additional expense which airlines will certainly consider.

Other questions regarding retired planes, whether retired by force or voluntarily, must be answered. One of the most pressing issues concerns the status of retired planes. Will they be scrapped, sold to companies for use as freighter planes, or sold to foreign countries? It is clear that not all aircraft which are no longer used by commercial airlines will be retired permanently, then sold for scrap metal or parts. Since passenger jets can be converted to freighters with little difficulty, a high demand for older planes exists outside the commercial aviation indus-

---

243 *Big Losses*, supra note 238, at 203. "You have to wonder what [the hush kit] does for you, because you still have old technology. . . . [Y]ou have to wonder whether you aren't better off to buy a new airplane." Henderson, *Impact on Stage III Retrofits?*, AIR TRANSPORT WORLD, Feb. 1989, at 61.

244 Evans, *supra* note 10, at C6.


246 *Id.*

247 *Id.*

248 USAir Launches DC-9 Aging Aircraft Inspection Program, *Av. Daily*, Dec. 15, 1989, at 495-96. The potential costs are "enormous." The current Stage 2 fleet has a market value of approximately $30 billion, while it would cost at least $50 billion to replace it with newer planes. Evans, *supra* note 240, at 10.

249 *New Regulations, Surplus Will Force Narrow-Body Transports Out of Service*, *Av. Wk & Sp. Tech.*, July 2, 1990, at 73, 74 [hereinafter *New Regulations*]. Passenger jets can be converted to freighters, for which there is a high demand. *Id.*

250 *Id.* at 73.
try.251 For example, Federal Express currently buys many older 727s from United Airlines.252 "Retired" planes not purchased for freight use may also be sold or leased to other carriers or even to other countries.253 Finally, if the planes are to be sold, where will the line between the secondhand value of the planes and the cost of modification and repair be drawn?

Even in light of these factors, it is unlikely that airlines will retire their planes willingly after investing enough money in them to meet FAA standards of maintenance and repair.254 In fact, carriers in the midst of complying with the new directives say that the "stringent and standardized" inspection and repair procedures mandated by the FAA are a much better approach to the problem of aging aircraft, despite their cost, than mandatory retirement.255 Major airlines stress the need for uniformity of application, however, to ensure that consistent maintenance requirements are established and met by all carriers.256

B. Overall Effect of Mandatory Retirement

Mandatory retirement of older aircraft would disrupt the United States' air transport system.257 This disruption could trigger a chain of failures among smaller airlines "staffed" primarily with old planes.258 On the other hand, in the current market, most of these smaller airlines are

---

251 Id. at 74. "There will be a number of operators that will always pick up an airplane if it's a good buy and it fits their needs, like Federal Express." Id. at 73.
253 Taylor, supra note 236, at 20.
254 USAir Launches DC-9 Aging Aircraft Inspection Program, supra note 248, at 496.
255 Donna K. Henderson, Airlines, FAA Intensify Old Transport Efforts, AIR TRANSPORT WORLD, Feb. 1989, at 61. "We don't want to be caught up in a retirement regime or mandated maintenance program that has no logic." Id.
256 Id. Currently, there is a big disparity among airlines as to how conscientiously repairs are actually carried out. Id.
257 Err on the Side of Safety, supra note 5, at 9. Mandatory retirement would "increase ticket costs and possibly force some airlines out of business." Id.
258 New Regulations, supra note 249, at 73.
not faring very well.\textsuperscript{259} As long as airlines are able to meet consumer demand only by operating planes beyond their design lives, they will resist retiring planes. Both the long waiting period and the cost of new planes encourage extended use of older aircraft. Mandatory retirement at an arbitrarily set “age” will not achieve significant safety goals; in fact, it might have the effect of grounding planes that are safe at a time when demand for those planes is high. Higher fares to offset the cost of new planes would probably result.\textsuperscript{260} Furthermore, if heightened safety is not the result of retirement, the airline industry will suffer unnecessarily.

VII. Conclusion

This comment has addressed the most significant issues that impact the final decision regarding aging aircraft. Whether mandatory retirement is the best solution to the problem of aging aircraft is a multifaceted question, complicated by the fact that the major parties it affects disagree as to the proper course of action. The industry and the FAA oppose retirement plans, while Congress maintains that such plans are a potentially viable response to the problem that the aging fleet presents. Clearly, there is a general agreement that no arbitrary age for retirement should be set; the FAA leaves the ultimate decision to the industry, while the House Resolution provides for testing of individual aircraft at a predetermined critical date. Under both programs, as long as a plane is deemed safe, it would be allowed to continue to fly.

Safety must be of primary concern, but economics necessarily enters the equation as well. High passenger demand and the cost of new planes, coupled with a five-year manufacturing backlog, means that mandatory retirement will almost certainly result in higher fares and greater inconvenience for passengers. Such sacrifices would, of

\textsuperscript{259} Evans, \textit{supra} note 10, at C6; \textit{Big Losses, supra} note 238, at 203.

\textsuperscript{260} Taylor, \textit{supra} note 236, at 19.
course, be justified if the overall safety of the fleet would be compromised by allowing older planes to fly. Under the new FAA regime, however, such a result is unlikely.

The FAA regulations, if fully and effectively implemented, would allow the airlines to consider both safety and economic factors. The economics of the current market encourages the operation of planes as long as maintenance costs do not exceed revenue generated by the plane. While the government correctly argues that economics alone should not dictate decisions where the safety of air passengers is at stake, the FAA program contains safeguards which will prevent the operation of unsafe aircraft. With its system of periodic maintenance and replacement of parts, the program is designed to ensure that a plane is "repaired" well before an inspection would reveal any structural weaknesses. The safety factor, however, is inextricably linked to the regulatory standards of the FAA, and no regulations, no matter how thorough, will succeed in solving the problem until the difficulties at the FAA are resolved.\textsuperscript{261}

The House Resolution emphasizes the safety element to an even greater extent than the FAA program; it encompasses the FAA regulations and adds testing of planes as they reach their design life goals to ensure that the supplemental inspections and repairs are achieving their desired effect — maximum safety. Coupled with new FAA procedures, this may be the best solution. Unfortunately, the House Resolution, if passed, would aggravate the FAA's current problems. It would require even more inspectors and impose a tremendous financial burden on the agency which it is not capable of meeting. Furthermore, the degree of mandatory testing when an aircraft reaches the end of its design life would keep planes out of

\textsuperscript{261} Evans, supra note 10, at C6. "Until the regulatory holes are plugged, the great number of Americans who fly every day are unwitting guinea pigs in an uncontrolled experiment to see how much longer old airliners can be kept flying without breaking apart." Id.
service for extended periods of time, intensifying the industry's inability to meet consumer demand.

And finally, the House bill does not address continuing inspection needs of aircraft which are certified to fly beyond their design life. Presumably, the FAA approach would apply in these instances, allowing the airlines to make economic decisions. The House Bill calls for retirement as a last resort when a plane is not safe enough to fly and deemed too expensive to repair. It seems clear that mandatory retirement is not the solution to the problem of aging aircraft. Forcing airlines to retire old planes would probably result in smaller airlines going out of business and larger airlines raising fares to cover increased costs. Instead of focusing on retirement, Congress and the FAA need to concentrate on solving the agency's problems. Increased financing of FAA projects is a good place to start. Once the FAA is able to achieve its objectives efficiently and effectively, the "repair and replace" strategy is the best way to keep our planes flying safely.