FLIGHT SAFETY FOUNDATION

CABIN CREW SAFETY

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U.S. Report: Progress Slow in Fireproofing Aircraft Cabins

In 1986 and 1988, the U.S. Federal Aviation Administration upgraded its standards for flammability levels for cabin interiors. The FAA anticipated that 85 percent of the U.S. air carrier fleet would meet the standard by 2000, but current estimates suggest that the number will be 55 percent. The U.S. Government Accounting Office says there is a need to reassess a mandated retrofit.

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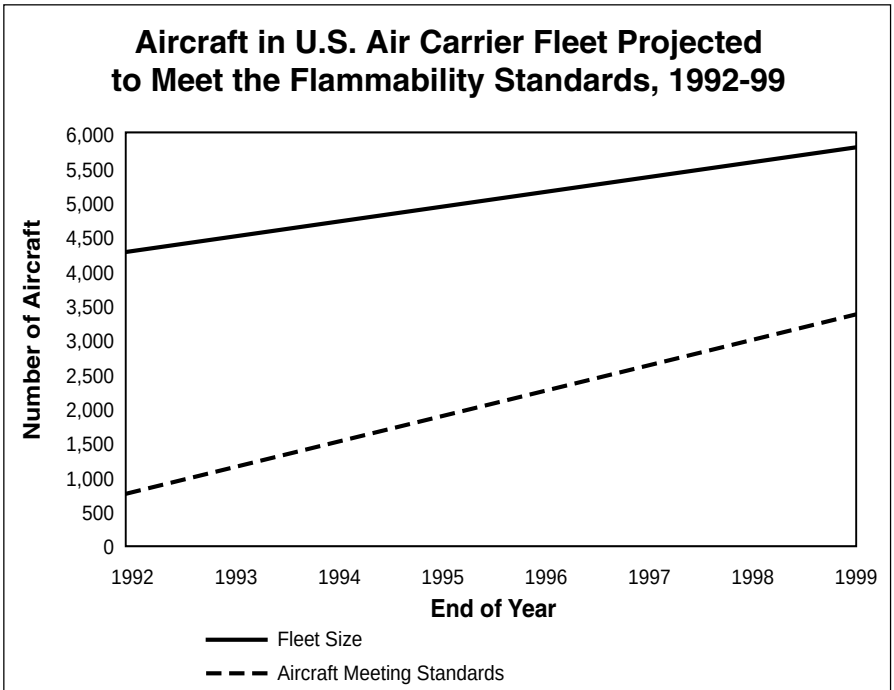
Editorial Staff Report

If the U.S. Federal Aviation Administration (FAA) wants U.S. air carriers to meet the latest cabin material flammability standards before the end of the 1990s, the FAA may have to mandate a deadline, the U.S. General Accounting Office (GAO) said in a January 1993 report.

The GAO, an independent government monitoring agency, recommended that the FAA reconsider whether it should require all U.S. air fleet aircraft to comply with the regulations by a certain date. The report, "Aviation Safety: Slow Progress in Making Aircraft Cabin Interiors Fireproof," said the original timetable to achieve the new flammability standards has fallen significantly behind schedule.

When the cabin regulations were adopted in 1988, the FAA expected 85 percent of the U.S. aircraft fleet to be in compliance with the new standards by the end of this

decade. "In fact, under the current practice of replacing aircraft, the entire fleet is not expected to comply with the stricter flammability standards until 2018," the GAO said (Figure 1).



Source: U.S. General Accounting Office analysis of Air Transport Association and U.S. Federal Aviation Administration data.

Figure 1

"Since 45 percent of the aircraft fleet will likely not meet the flammability standards by the date the FAA anticipated and additional benefits will likely be realized the sooner that all aircraft in the fleet comply, GAO believes that a reassessment of the need to mandate a retrofit is warranted," the report says. The GAO noted that the FAA "indicated that it would consider mandating a retrofit requirement if components not meeting the standards remain in service in a significant number of aircraft and a substantial increase in overall safety could be realized."

FAA officials disagreed. The GAO said FAA officials "did not believe that a reassessment of the flammability standard is warranted."

"FAA officials stated that our findings, as well as an internal FAA cost analysis of refurbishing aircraft cabin interiors, indicate that the costs to retrofit the fleet outweigh the potential safety benefits; therefore, mandating a retrofit requirement would not be cost-effective," the report says.

[The GAO report examines 100 percent compliance with 1994, 1996 and 1999 as hypothetical deadlines. 1999 was chosen because it is the end of the decade; 1994 and 1996 were chosen to predict trends.]

"GAO estimated that the total cost (in present value) for airlines to replace the cabin interiors for aircraft in the fleet not meeting the standards by the end of 1994 (70 percent of fleet), 1996 (58 percent of fleet) and 1999 (45 percent of fleet) would be US$3.8 billion, $3.1 billion, and $2.5 billion, respectively," the GAO stated.

"By the beginning of 1992, about 470 aircraft had been manufactured to comply with the latest flammability standards, representing about 11 percent of the more than 4,200 aircraft in the fleet," the GAO said. It added that "no airline had completely replaced interior components of even one in-service aircraft to meet the standards."

According to the GAO, airlines plan to retire an estimated 1,300 aircraft between 1992 and 1999, but also intend to retain an estimated 2,500 aircraft, or about 60 percent of the aircraft in service when the new standards went into effect.

The GAO said it expects the proportion of the fleet that meets the new standards will grow each year as new aircraft replace older aircraft. "On the basis of the percentage of aircraft belonging to ATA [Air Transport Association of America] members expected to meet the standards, we estimate that over 1,400 aircraft, or 30 percent of the U.S. fleet, will meet the flammability standards by the end of 1994; about 2,100 aircraft, or 42 percent of the fleet, by the end of 1996; and over 3,000, or 55 percent of the fleet by the end of 1999."

In addition, the GAO expects that wide-body aircraft in compliance by the end of 1999 will outnumber the narrow-bodies in compliance (Figure 2, page 3).

The only U.S. aircraft required to meet the 1988 standards are those manufactured after August 19, 1990. Those manufactured between August 19, 1988, and August 20, 1990, were subject to an interim heat release standard and fall under the same "grandfather" clause as aircraft already in service by August 19, 1990.

According to the new flammability rules, aircraft that were in service before August 1990 need only comply with the new standards if a "substantially complete replacement of cabin interior components is undertaken," the GAO said.

But it said the FAA had not "precisely defined what constitutes a 'substantially complete' replacement of interior components."

The report added: "Almost all aircraft that currently do not meet the flammability standards will undergo some type of routine heavy maintenance inspection by the end of the decade, providing airlines the opportunity to modify cabin interiors. However, airlines infrequently replace entire cabin interiors.

"Although a portion of the interior components is removed during a heavy maintenance inspection, airline officials told GAO that the components not meeting the standards are usually refurbished and reinstalled, rather than replaced with components that meet the standards. Industry practice is to replace a worn-out component with one that meets the standards if it is necessary to purchase a new component. However, this piecemeal replacement of individual components will likely not significantly reduce the hazards posed by a post-crash fire."

Regulations Involved Two-stage Development Process

In 1986, the FAA upgraded fire safety requirements for aircraft manufactured under Part 25 and operated under Parts 121 and 135 of the U.S. Code of Federal Regulations (CFR). These standards included new tests and criteria for heat release rates for cabin materials. The Aerospace Industries Association of America (AIAA), along with the ATA, objected to the changes and petitioned for lower heat-release criteria, a smoke-release test and a three-year delay in compliance. Because of the AIAA/ATA petition, the FAA reopened the public comment period on the standards.

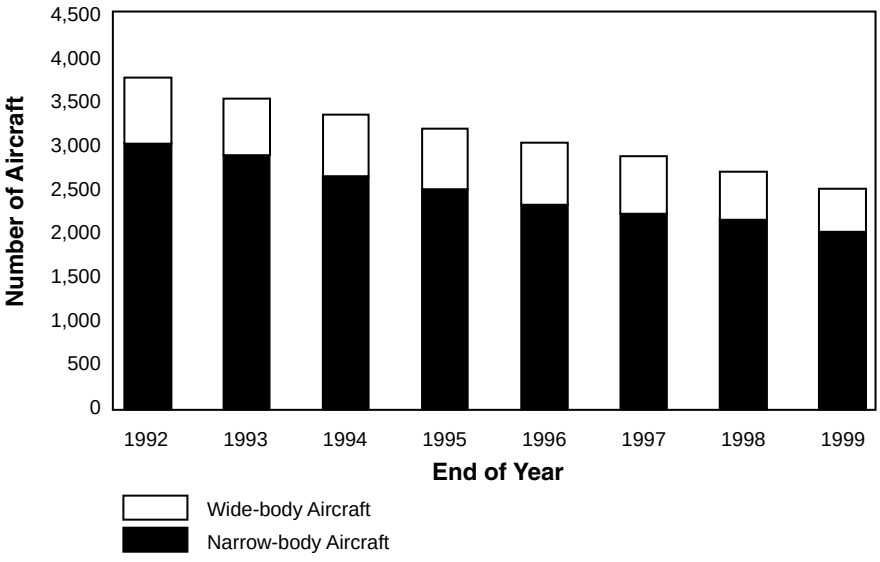
The FAA made additional recommendations in 1988, incorporating some of the 1986 AIAA/ATA suggestions. The rules refined heat-release test procedures; established a new method for testing smoke emissions and determining allowable emission rates; and allowed extra time for certain components to comply with the new standards.

"Under the new standards, the materials and coverings of all larger interior surface components, including sidewalls, ceilings, bins and partitions, and galley structures, are required not only to be self-extinguishing but also must limit the amount of heat released and smoke emitted when the components are exposed to fire," the report says.

According to the GAO, fire tests conducted by the FAA demonstrated that the stricter standards "could provide up to 17 seconds additional time for occupants to escape a burning aircraft, allowing more passengers to escape."

The GAO estimated that an average of 12.5 lives could be saved each year if all aircraft operated by U.S. air carriers met the 1988 standards. It says that between 1985 and 1991, 22 percent of the fatalities that occurred as a result of an air transport accident involving fire were caused by the effects of fire or smoke.

"Safety benefits [from compliance with the newer standards] would be realized in an unpredictable manner; that is, fatalities could be avoided in accidents occurring relatively soon or 20 years from now. Because aircraft accidents occur infrequently and unpredictably, substantial uncertainty is associated with any estimate of potential fatalities. One or two significant accidents could result in the loss of hundreds of lives," the GAO report says.



Source: U.S. General Accounting Office analysis of Air Transport Association and U.S. Federal Aviation Administration data.

Figure 2

A major concern is preventing "flashover," which happens when products emitted during combustion are trapped

in the upper part of the cabin and ignite spontaneously. FAA tests have indicated that toxic gasses released during airplane fires do not reach hazardous levels unless flashover occurs. "The greatest threat to passenger survival is flashover," the GAO said.

In a test conducted prior to proposing the 1988 upgrade, the FAA found the stricter flammability standards effective in preventing flashover. The GAO report described the results:

"The advanced design panels delayed the onset of flashover for two minutes when the cabin fire was initiated by a fuel fire adjacent to a fuselage rupture. The panels also eliminated flashover when a fuel fire was adjacent to a door opening or when an in-flight fire was started from a seat drenched in gasoline. On the basis of these tests, FAA concluded that advanced interior panels can provide a significant safety improvement during post-crash and in-flight fires."

However, the FAA concluded that the costs outweighed these considerations, the GAO says.

"FAA officials stated that our findings, as well as an internal FAA cost analysis of refurbishing aircraft cabin interiors indicate that the costs to retrofit the fleet outweigh the potential safety benefits; therefore, mandating a retrofit requirement would not be cost-effective."

The GAO admitted that time was an important factor in calculating cost. The time spent replacing a cabin interior is time the plane cannot be used to produce revenue. For wide-body planes, the ATA estimated that replacing cabin components would take between three and four weeks; and two to three weeks for narrow-bodies.

The GAO suggested that these planes could be rotated into the heavy maintenance inspection schedule. If a plane is scheduled to be out of service, the airline has already anticipated a period when that vehicle would produce no revenue. By doing the work within already scheduled maintenance periods, revenue would not be lost by taking a plane out of circulation more than once. Such a plan could help move the U.S. aircraft fleet toward the end-of-decade goal, the GAO said.

"Since a normal heavy maintenance inspection already includes time to refurbish components, an airline would not typically lose revenue to replace components if the modifications are scheduled during the normal maintenance cycle. Therefore, our analysis assumes that an airline would lose revenue from an aircraft's being out of service only when modifications occur outside the normal maintenance schedule," the report says. "Since all aircraft could be modified during a normal maintenance cycle under the 1999 compliance year, airlines would not be expected to lose revenue from aircraft being out of service."

On the basis of discussions with airline officials, the GAO estimated that "75 percent of the labor cost would be the additional cost required to replace interior components. For the aircraft that could be modified under a normal maintenance cycle, our analysis assumes that the additional labor cost required to replace interior components would be about $83,000 for a narrow-body aircraft and $206,000 for a wide-body aircraft."

The cost of compliance for the entire U.S. aircraft fleet will go down over time, the GAO said, because as older aircraft are retired, they will be replaced by newer planes that have been manufactured in accordance with the new standards.

The GAO report said airlines would have to spend 10 times more to buy new interior components than to refurbish old ones, and that airlines are thus more likely to choose the less expensive option. "The airline officials [surveyed for the report] also stated that the interior components that are removed are typically cleaned, repaired or recovered, and reinstalled in the same aircraft," the report added.

When new materials are used, the report said, they will comply with the latest flammability standards. That does not necessarily mean, however, that the part that has been refurbished will comply with the 1988 standards.

"According to ATA and the four airlines ...contacted, individual components, such as a sidewall panel, that have worn out or are beyond refurbishment are replaced by materials meeting the latest flammability standards. In addition, airlines will replace the decorative coverings or tapestries on panels and partitions with materials that meet the new standards. In such cases, however, the backings are not replaced; therefore, the upgraded panels and partitions do not meet the standards. ...Because of this selective replacement of interior materials, the aircraft fleet will contain a mixture of interior components, some of which will and will not meet the latest flammability standards. According to FAA officials, the replacement of individual components on a piecemeal basis would not significantly reduce the risk posed by a post-accident fire."

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aircraft are retired, they will be replaced by newer planes that have been manufactured in accordance with the new standards.

"The number of aircraft that would need to have their cabin interiors replaced declines from about 3,200 under the 1994 alternative to about 2,500 under the 1999 alternative. As a result, total costs to modify the domestic fleet would decline by about $1.3 billion between 1992 and 1999 (Figure 3.)

The report added: "A decision to mandate a specific date when the U.S. aircraft fleet should meet the stricter flammability standards will have to consider the additional costs to the airlines and potential lives saved as a result of mandating compliance. ...However, the decision will not be clear-cut and will have to be weighed against other actions that could improve the overall safety of the U.S. aircraft fleet."

Estimated Total Cost to Modify Aircraft with Cabin Interiors That Meet the Flammability Standards

	Compliance Years		
	1994	**1996**	**1999**
	U.S. Dollars in Millions		
Aircraft Needing Modification	3,200	2,900	2,500
Present Value Cost to Modify Aircraft [a]			
Components [b]	$3,167	$2,744	$2,257
Labor	401	344	241
Lost revenue	217	38	0
Total	**$3,785**	**$3,126**	**$2,498**

[a] Discounted to present value at 7.5 percent.

[b] Cost difference between new components meeting the standards and refurbished components not meeting the standards.

Source: U.S. General Accounting Office analysis of Air Transport Association, U.S. Federal Aviation Administration and airline data.

Figure 3

The GAO report noted that in proposing the standards, the "FAA expected that air carriers would continue to voluntarily replace interiors in aircraft that already came close to meeting the standards. Moreover, FAA expected that many aircraft would be retired from service because of noise restrictions and obsolescence and that air carriers would completely replace the interiors of most of the remaining aircraft for other such reasons as wear or modernization."

But the GAO concluded: "Between 1992 and 2018, an estimated 200 lives could potentially be saved as a result of replacing aircraft that do not meet the standards with new aircraft that meet the standards."

The GAO analysis "demonstrates that the sooner all aircraft in the fleet comply with the flammability standards, the more rapidly the safety benefits will likely be realized."

In recent years, the FAA has issued a number of other rules to make passenger survival during a post-crash fire more probable. Among them were provisions for easier access to emergency exits, flammability requirements for seat cushions and requirements for on-board fire extinguishers and breathing apparatus for flight attendants.

One recent development has been a joint effort of the FAA, U.K. Civil Aviation Authority and Transport Canada to conduct water-spray tests. Onboard water-spray apparatus would increase survivability during a post-crash ground fire by suppressing interior fires and cooling the air in the cabin, making further combustion less likely.

"Here," the report says, "the fire threat is hundreds of gallons of burning jet fuel. The burning fuel radiates intense heat; generates thick, black smoke; and causes aircraft interior materials to ignite, inhibiting or preventing occupants from escaping. The purpose of water spray is for passengers to gain additional time to escape by suppressing the interior fire and cooling the cabin environment." ♦

FLIGHT SAFETY FOUNDATION

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CABIN CREW SAFETY

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