considerations, the SAFER Committee made the following regulatory recommendations to the FAA:

1. Amend 14 CFR part 25 to require fuel tank vent protection from ground fires by adding a new  $\S 25.975(a)(7)$  to read: "Each vent to atmosphere must be designed to minimize the possibility of external ground fires being propagated through the vent line to the tank vapor space, providing that the tank and vent structure remain intact."

2. Amend part 25 to require design practices that maximize the probability of engine fuel supply shutoff in potential fire situations.

To implement the SAFER propulsion system recommendations, preliminary rulemaking action was initiated. Advance Notice of Proposed Rulemaking (ANPRM) No. 84-17 was published in the Federal Register (49 FR 38078, September 26, 1984) for the purpose of obtaining public comments, information, and data relative to adding new airworthiness standards applicable to transport category airplane fuel systems. The objective of the rulemaking proposed in Notice 84-17 was to develop airworthiness standards that would provide protection against fuel tank explosions following a postcrash ground fire, and that would assure engine and auxiliary power unit fuel supply shutoff to reduce the fire hazard from spilled fuel.

Comments were received from the general public, airplane manufacturers, and other interested organizations in the United States and Europe. Eight of the commenters, including the Airline Pilots Association (ALPA), Aerospace Industries Association of America (AIAA), and the Air Transport Association of America (ATA), support the proposed rule change regarding fuel system vent fire protection, whereas five commenters object to the proposal. The ATA response indicates that while comments received from their member airlines generally support the "aircraft design enhancements" discussed in the ANPRM, some remain unconvinced that the specific proposals will produce the desired results. They state, however, that even with minimal justification for such changes, it appears sufficiently promising to proceed with a more detailed cost-benefit analysis.

In general, commenters opposing the proposal argue that the added cost and complexity of the installed fuel system vent fire protection would exceed the very small safety benefits that might accrue from the installation. Further, they express concern that the critical vent system performance might be compromised by the installation of a flame arrestor. They believe the costs

would not be commensurate with the benefits, although they submitted no facts or figures to support their contention. One commenter states that the occurrence of only two incidents in a 20-year period, only one of which would have been mitigated if the airplane had met the proposed fire protection standards, is not sufficient justification for requiring new standards. As discussed below, the FAA concludes that the projected benefits from this proposal are sufficient to warrant further action. Further, the costs and risks to vent performance are expected to be relatively small, since the majority of transport category airplanes currently incorporate flame arrestors in the fuel system vents. Many of these arrestor installations were expressly designed to provide protection from ground fires and have demonstrated the ability to safeguard vent system performance.

A preliminary regulatory evaluation was completed in November 1985. Although the analysis showed that the costs exceeded the benefits, it was noted that the analysis did not properly account for the potential magnitude of a hazardous situation created by a postcrash ground fire and a fuel tank explosion. As discussed below, to address these factors a new regulatory evaluation was completed that demonstrates that the benefits exceed the costs. Therefore, in light of the comments received in response to Notice 84–17, the SAFER Committee conclusions and recommendations, and the fact that public safety would be enhanced, the FAA finds the proposed changes to 14 CFR parts 25, 121, 125, and 135 are in the interest of public safety and should be promulgated. Nevertheless, the comments received in response to the advance notice were considered during the development of the regulatory evaluation for this notice.

While the regulatory evaluation for this notice was being prepared, Congress enacted Public Law 100–591, "Aviation Safety Research Act of 1988." Section 9(a) of that Act resulted in the FAA publication of Advance Notice of Proposed Rulemaking (ANPRM) No. 89-11 (54 FR 18824, May 2, 1989). Notice 89-11 requested new information on the feasibility of installing "crashworthy fuel systems." The comments received indicate that although additional information is needed, improvements in fuel system crashworthiness beyond those envisioned by the SAFER committee recommendation on fuel feed shutoff are feasible. Therefore, the fuel feed shutoff provisions of Notice 84-17 are being incorporated into the regulatory evaluation prepared for the

proposed rulemaking resulting from Notice 89–11, which the FAA anticipates will more completely address the threat from fuel leakage following a survivable crashlanding.

## Discussion

To minimize the possibility of propagation of external ground fires through the vent system, it would be necessary to design a flame arrestor or flame suppression device or system to prevent flame penetration and propagation through the airplane fuel tank vent system for a finite period of time. This time period should be no less than the time required for an external fire to heat fuel and vapors in a wing tank to its auto ignition temperature, or for an external fire to penetrate the undersurface of an empty wing tank, whichever is greater. Typically, this tank material is at least fire resistant; therefore, a period of protection of five (5) minutes is considered consistent with the currently accepted criteria for fire resistant materials. The FAA proposes to adopt a new § 25.975(a)(7) to require that each fuel tank be designed to prevent the propagation of flames from external fires through the fuel tank vents and any other external openings to fuel tank vapor spaces for a minimum of five minutes after a survivable crash landing when the fuel tank and the vent system remain intact.

In order to maximize the net potential benefits by increasing safety during survivable post-crash evacuations, the FAA considers it appropriate to require that the proposed changes to part 25 be incorporated in all transport category airplanes that are used in air carrier, air taxi, or commercial service under the provisions of 14 CFR parts 121, 125, or 135 as soon as practicable. Currently, about 75 percent of the fleet have a flame arrestor device that may comply with proposed § 25.975(a)(7). For airplanes manufactured after the effective date of the rule, compliance would be required within one year. For all other airplanes in operation, compliance would be required within two years. The FAA considers this timeframe to be sufficient to allow manufacturers and operators to design and install a fuel vapor flame suppression device that meets the new requirements. Parts 121, 125, and 135 would be revised accordingly.

## **Regulatory Evaluation**

This section summarizes the full regulatory evaluation prepared by the FAA that provides more detailed estimates of the economic consequences of this proposed regulatory action. This summary and the full evaluation