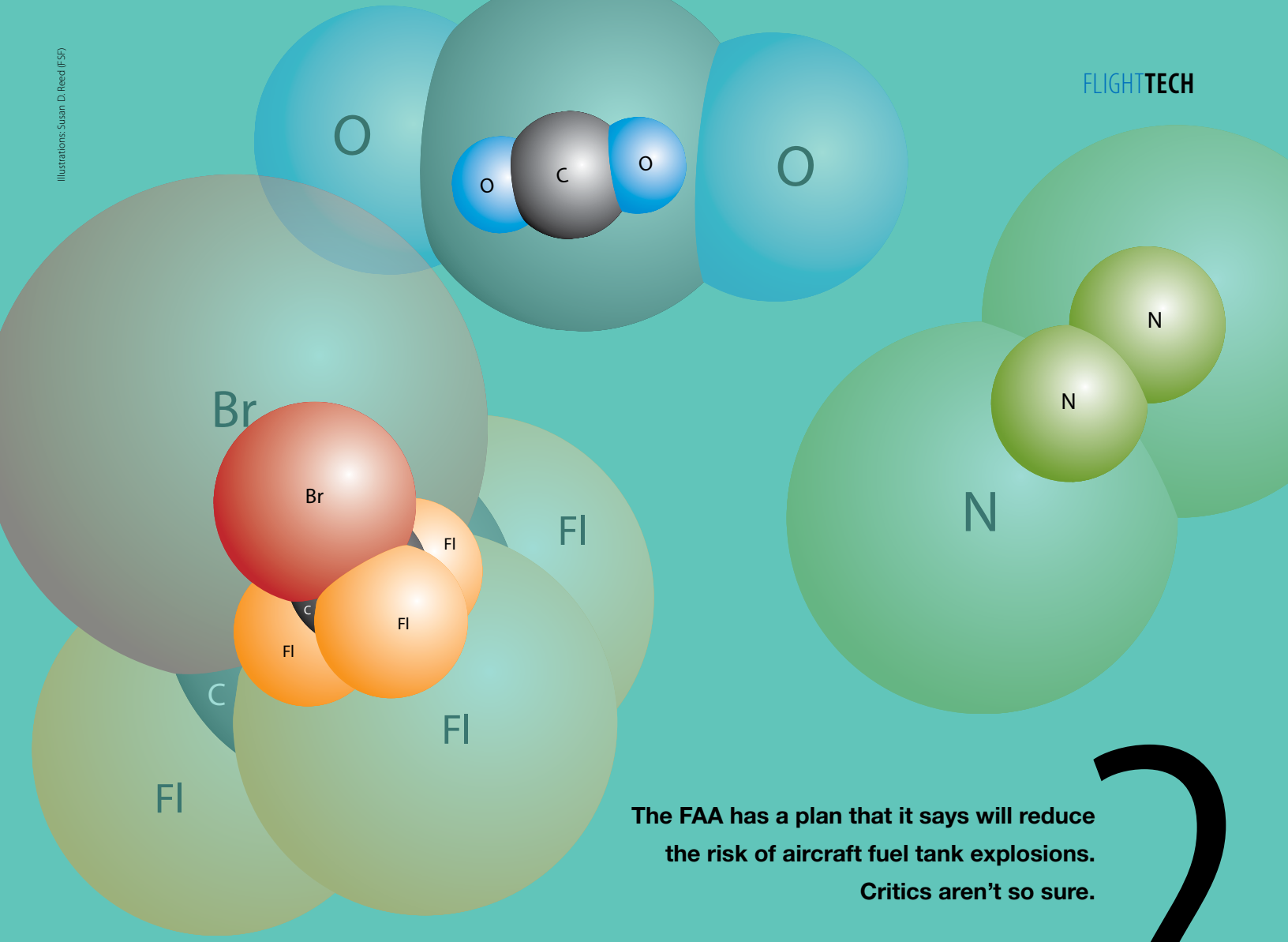


Illustrations: Susan D. Reed (FSF)

The FAA has a plan that it says will reduce the risk of aircraft fuel tank explosions. Critics aren't so sure.

BY LINDA WERFELMAN

Blast-Free Fuel Tanks?

More than 10 years after a Trans World Airlines (TWA) Boeing 747 crashed into the Atlantic Ocean following takeoff from New York's Kennedy International Airport — an accident blamed on an explosion in the center wing fuel tank[1] — the U.S. Federal Aviation Administration (FAA) is reviewing comments on a proposed rule that FAA officials say would substantially reduce the risk of similar accidents.

However, some critics, including major airplane manufacturers and a number of airlines, call the proposed rule unnecessary. Others, including the U.S. National Transportation Safety Board (NTSB), say that the rule — which would apply only to center wing fuel tanks and only to passenger airplanes — would not go far enough.

The proposed rule would require more than 3,200 existing passenger jets, as well as some new jets, to have "acceptable levels of flammability exposure in tanks most prone to explosion or require the installation of an ignition-mitigation means in an affected fuel tank."[2]

FAA says that the best method of meeting the requirement is fuel tank inerting — a

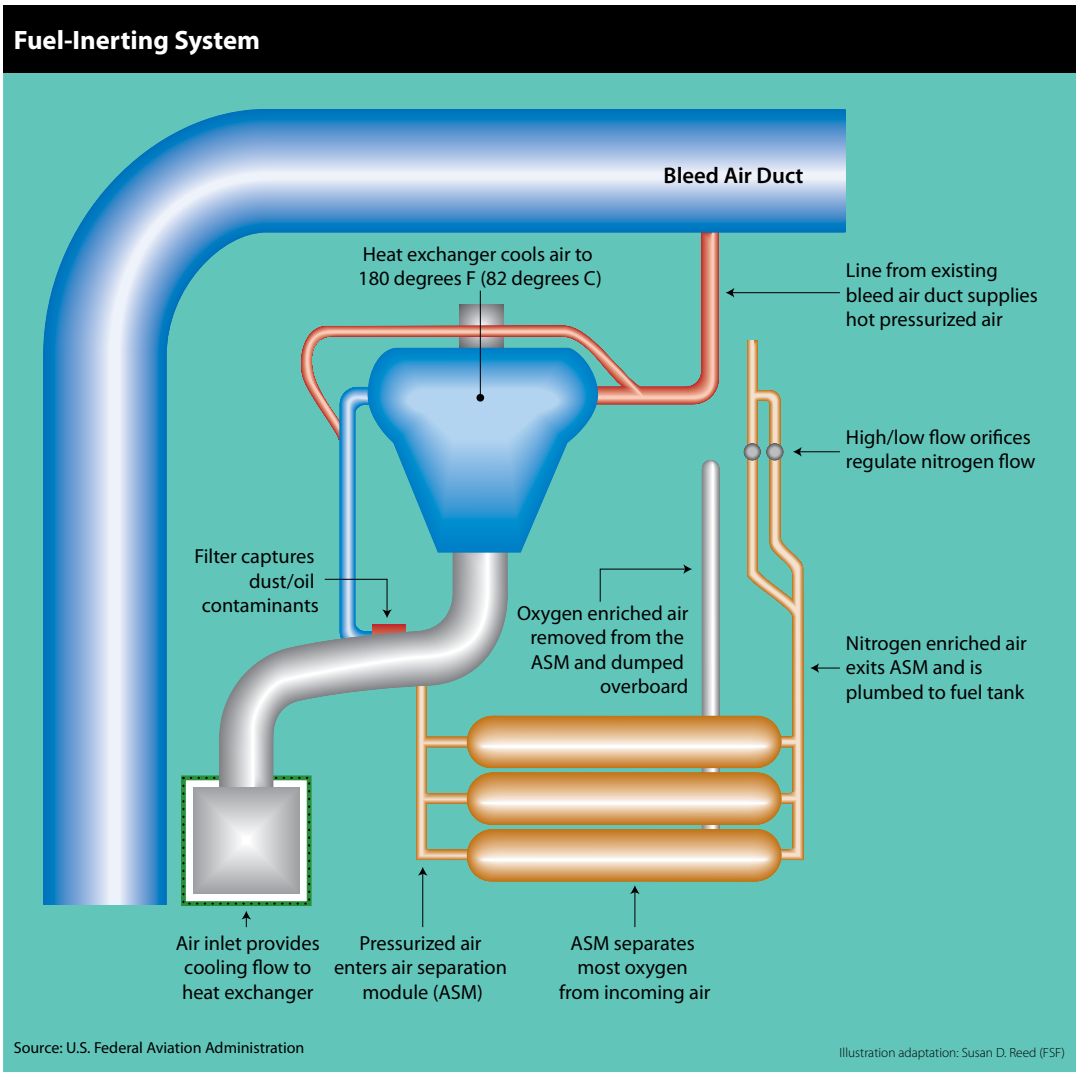
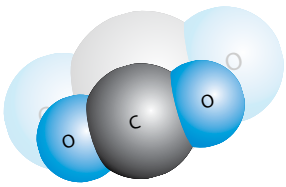


Figure 1

process in which an inert gas such as nitrogen is introduced into a fuel tank to replace oxygen (Figure 1). The process is effective because, unlike oxygen, which accelerates fire, inert gases are fire suppressants.



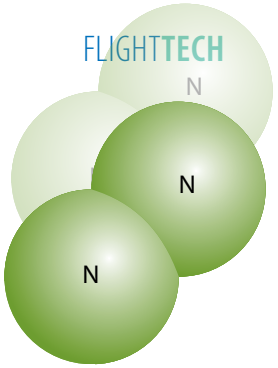
"Fuel tank inerting, originally thought to be prohibitively expensive, can now be accomplished in a reasonably cost-effective fashion and protect the public from future calamities, which, we have concluded, are otherwise virtually certain to occur," the proposed rule says. FAA estimates the cost of retrofitting existing airplanes at US$313 million — or about $140,000 to $225,000 per plane. The total cost for the U.S. fleet probably will total $808 million over 49 years, FAA said.

The proposed rule "should greatly reduce the chances of a catastrophic fuel tank explosion," FAA said in its notice of proposed rulemaking. In the past, fuel tank explosions have been a "constant threat," FAA said, citing data that show that, from 1960 through November 2005, there were 17 accidents in which airplanes were destroyed by fuel tank explosions, including the TWA accident that prompted the proposal (see "Related Accidents," page 16). Without remedial measures, nine similar accidents involving transport category airplanes would be likely in the next 50 years, FAA said.

"We believe at least eight of these explosions are preventable if we adopt a comprehensive safety regime to reduce both the incidence of ignition and the likelihood of an explosion following ignition," FAA said. Of the eight, four could be prevented through implementation of the proposed rule, FAA said.

Four others could be prevented through the implementation of Special Federal Aviation Regulation (SFAR) 88, which was adopted in 2001 to minimize ignition sources — an action that resulted in the identification of more than 200 potential sources.

"While the work accomplished by the industry to comply with SFAR 88 has certainly improved safety, the FAA believes that the added safety net of reducing the flammability of the tank is also necessary," FAA said.



NTSB Chairman Mark V. Rosenker agreed but said that progress toward adopting new safeguards is slow and the proposed rule does not do enough to reduce fuel tank flammability risks.

"Ten years after the TWA accident, fuel tank inerting systems are not in place on our airliners, and flammability exposure is largely unchanged," Rosenker said. "And proposed rule changes do not include the majority of fuel tanks, which are in the wings of transport airplanes, nor this country's large fleet of cargo aircraft."

Elimination of flammable fuel/air vapors in all the fuel tanks of transport category aircraft — an item recommended by NTSB in its final report on the TWA accident — has been on the board's list of "most-wanted transportation safety improvements" since 2002.

Military Beginnings

The inerting process has been used for decades in military aircraft. Inerting systems first were used during World War II to reduce the risk of fuel tank explosions during combat. Initially, engine exhaust was used to produce the inert gas; the use of nitrogen is a more recent development.

The inerting systems used by the military have long been considered too heavy, too complex and too expensive to function well in commercial airplanes. In addition, the military systems were designed to be used for relatively short periods — not for the lengthy flying days that are typical for many passenger jets.

FAA researchers — working with their counterparts at Boeing — spent years developing a more practical system for commercial airliners, and in 2002, six years after the TWA accident, they tested a prototype, on-board inerting system that relies on engine bleed air, weighs far less than the systems used by the military and is less complex and less expensive. The researchers determined that, if a properly sized inerting system were operated during flight, the fuel tank would remain inert after landing and there would be no need for ground operation of the inerting system.

In 2005, an inerting system developed by Boeing was certified and is now the subject of an "in-service evaluation" involving two 737s and two 747s. The Boeing system — designed to be installed on new and retrofitted 737s and 747s as early as 2007, and on other Boeing airplanes by 2008 — diverts engine bleed air into an air separation module that separates the nitrogen and pipes the nitrogen into the center wing fuel tanks. The new composite 787 has been designed with inerting systems for all fuel tanks.

In comments on the proposed rule, Boeing suggested revisions to exempt from the retrofitting requirement older airplanes estimated to be within five years of retirement, questioned FAA's contention that cargo airplanes should not be subject to the rule, and challenged FAA's projection that a fuel tank explosion might occur once in every 60 million flight hours. A more realistic projection would be once every 100 million flight hours, Boeing said.

Workplace Hazards

Airbus also challenged FAA's projection, saying that the proposal was developed using faulty data that overstated not only the risk of a fuel tank explosion but also the benefits of the proposed safety improvements.

"Specifically ... the number of future accidents to passenger airplanes that might be prevented in the next 50 years by enacting this proposal is not four, as the FAA estimates, but 0.67 accidents," Airbus said in comments submitted in response to the proposed rule. "FAA estimates that some 546 statistical fatalities would be avoided by enactment of these proposals. Our comments estimate that 31 statistical fatalities would be avoided in the next 50 years."

Airbus also noted that its aircraft were not involved in the accidents cited by FAA in proposing the rule, and said that because there are "significant differences" between fuel tank designs on its airplanes and those of other manufacturers, "each fuel tank should be assessed on an individual basis." Airbus said that a primary difference between its fuel tank

Inerting systems first were used during World War II to reduce the risk of fuel tank explosions during combat.

design and that of the 747 is that, on the 747, environmental control system packs are located "directly beneath the [center wing tank] without any evident means of limiting heat transfer"; on Airbus aircraft, one of two ventilation devices is used to spread heat over a larger area, thereby causing lower peak temperatures and fewer ignition source scenarios. The proposed rule will not affect the new A380, which was designed without a center wing fuel tank.

In addition, Airbus projected that the proposed changes would create "widespread workplace asphyxiation hazards" that would result in between 1.4 and 4.7 workplace fatalities every year. "Workplace hazards could actually result in statistical fatalities that exceed those that would be avoided by enactment of this proposal," Airbus said.

Airbus said that, in the decade since the TWA crash, the aviation industry had worked with regulatory authorities to adopt other rules changes that "significantly reduced the risk of further heated center wing tank explosions."

Other airplane manufacturers also questioned the FAA's proposal to require action by manufacturers other than Boeing.

"FAA notes that none of the previous tank explosions have occurred on Airbus aircraft but then claims the historical data [imply] that tank explosions on Airbus types should have occurred by now," BAE Systems Regional Aircraft said. "The only possible basis for this claim would be if Airbus fuel tanks, fuel system components and adjacent equipment installations (e.g., air conditioning packs) were very similar to their Boeing counterparts. They are not."

Embraer agreed, saying in its response to the proposed rule, "In general ... the flammability concern should be limited to tank designs that have shown an unacceptable service history. The cost associated with applying these standards to conventional wing tanks is not justified by the negligible benefits that will occur."

Several regional airline associations — the Air Transport Association of America (ATA), the Association of European Airlines (AEA) and the Association of Asia Pacific Airlines (AAPA)

Related Accidents

Since the 1996 Trans World Airlines crash, two other accidents involving airplane fuel tank explosions have been reported:

- A Thai Airways Boeing 737-400 was destroyed March 3, 2001, when the center wing fuel tank exploded while the airplane was at the terminal in Bangkok, Thailand, being prepared for a domestic passenger flight. One flight attendant was killed, and six other people received serious injuries. NTSB said that the final report on the accident, issued in April 2005 by the Accident Investigation Committee of Thailand, said that the most likely source of the ignition energy was "an explosion originating at the center wing tank pump as a result of running the pump in the presence of metal shavings and a fuel/air mixture";[1] and,
- Substantial structural damage was reported to the area surrounding the left wing fuel tank of a Transmile Airlines 727-200 on May 4, 2006, when the tank exploded while ground personnel in Bangalore, India, were preparing to tow the airplane after maintenance to repair a fuel leak. No one was injured in the explosion, which remains under investigation. The blast occurred while the airplane's auxiliary power unit was operating; the tow crew felt "a jolt" and observed that a circuit breaker for the left wing fuel-tank boost pump had tripped.[2]

Notes

1. U.S. National Transportation Safety Board (NTSB). Accident report DCA01RA024. March 3, 2001.
2. NTSB. Accident report DCA06RA040. May 4, 2006.

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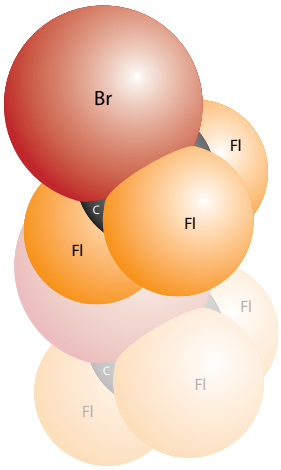

— said in their responses that the actions described in the proposed rule could not be justified, largely because of steps already taken by the industry to address safety issues.

"Existing and planned ignition-prevention improvements will reduce the risk of a catastrophic fuel tank explosion for airplanes that are affected by the [proposed rule] to less than one occurrence in 1 billion flight-hours, which is the FAA's goal," ATA said. "In other words, [ignition-prevention improvements] alone can reduce the risk of catastrophic fuel tank explosion to the point that it is unlikely one will occur during the operational life of any given airplane type."

AEA, which questioned FAA's data on the costs and benefits that would follow adoption of the rule, added that fuel tank explosions "are not a major cause of aviation accidents (statistically, the percentage of both accidents and fatalities due to fuel tank explosions is approximately 1.2 percent over the last 20 years.)"

AEA said that, in addition, European cost estimates are "significantly higher" than FAA's, with "the investment required to achieve the safety benefit promised by this proposal … 23 times higher than the value of the benefit."

AAPA said that it opposes the mandatory retrofitting of airplanes with inerting systems, but if FAA decides to "unilaterally mandate the retrofit of in-service aircraft, it should consider removing the requirement to complete 50 percent of the fleet within four years, as this will impose a tremendous burden on our members to realign their heavy maintenance schedules to meet the deadline."

AAPA said that FAA also should recognize "the disparity of the efforts undertaken by the respective manufacturers" by allowing them more time to develop flammability-reduction systems that meet the requirements of the proposed rule.

'Waited Too Long'

Support for the proposal has come from groups representing airline passengers and pilots.

The National Air Disaster Alliance/Foundation, which represents survivors of more than 100 aviation accidents worldwide and victims' families, asked FAA to approved the proposed rule as soon as possible.

"The public has waited too long for the safest fuel tanks on aircraft to prevent the possibility of explosions, such as TWA [Flight] 800," the organization said.

The Air Line Pilots Association, International (ALPA) said that it supports the intent of the proposal but takes "strong exception to the exclusion of airplanes used in all-cargo operations." ALPA said that excluding all-cargo operations from the requirement is a "totally unacceptable approach to aviation safety."

Safety Modifications

Despite NTSB's criticism of some aspects of the proposed rule, Rosenker said that other steps taken by FAA as a result of the TWA crash resulted in significant safety improvements.

"Fleet-wide inspections and analytical reviews of fuel tank design have resulted in significant measures that have the potential to reduce the likelihood of an ignition event inside a tank," he said, "and … fuel pumps, fuel-quantity indicating systems, in-tank wiring, co-routed wiring and operational procedures have been modified to make fuel systems safer."

The period for receiving public comments on the proposed rule ended in May 2006; final action from FAA is expected late in 2007. ●

Notes

1. U.S. National Transportation Safety Board (NTSB). *Aircraft Accident Report: In-Flight Breakup Over the Atlantic Ocean, Trans World Airlines Flight 800, Boeing 747-131, N93119, Near East Moriches, New York, July 17, 1996.*
2. U.S. Department of Transportation (DOT), Federal Aviation Administration. "Reduction of Fuel Tank Flammability in Transport Category Airplanes; Proposed Rule." *Federal Register*, Nov. 23, 2005. Comments on the proposed rule from airplane manufacturers, airlines, regulatory and investigative authorities, and others can be viewed at <http://dms.dot.gov> by clicking on "simple search" for docket no. 22997.