DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 121, 125, and 129

[Docket No.: FAA–2001–10910; Amendment Nos. 121–286, 125–41, and 129–37]

RIN 2120—AG90

Collision Avoidance Systems

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: The FAA is revising the applicability of certain collision avoidance system requirements for airplanes. The current rules are based on passenger seating configuration and therefore exclude all-cargo airplanes. This final rule will use airplane weight and performance characteristics as the basis for collision avoidance system requirements to capture cargo airplanes weighing more than 33,000 pounds (lbs.) maximum certificated takeoff weight (MCTOW). This final rule is intended to reduce the risk of a mid-air collision involving a cargo airplane, which will increase safety for cargo crewmembers, the public on the ground, and occupants of airplanes that already have collision avoidance systems.

DATES: Effective May 1, 2003, except for the revisions of §§ 121.356, 125.224, and 129.18 which are effective January 1, 2005.

FOR FURTHER INFORMATION CONTACT: Alberta Brown, Air Carrier Operations Branch, Flight Standards Service, AFS–220, Federal Aviation Administration, 800 Independence Avenue, SW., Washington, DC 20591, telephone (202) 267–8321.

SUPPLEMENTARY INFORMATION:

Availability of Rulemaking Documents

You can get an electronic copy using the Internet by:

(1) Searching the Department of Transportation's electronic Docket Management System (DMS) web page *(http://dms.dot.gov/search);*

(2) Visiting the Office of Rulemaking's web page at *http://www.faa.gov/avr/arm/index.cfm;* or

(3) Accessing the Government Printing Office's web page at *http://www.access.gpo.gov/su_docs/aces/aces140.html.*

You can also get a copy by submitting a request to the Federal Aviation Administration, Office of Rulemaking, ARM–1, 800 Independence Avenue SW., Washington, DC 20591, or by calling (202) 267–9680. Make sure to identify the amendment number or docket number of this rulemaking.

Anyone is able to search the electronic form of all comments received into any of our dockets by the name of the individual submitting the comment (or signing the comment, if submitted on behalf of an association, business, labor union, etc.). You may review DOT's complete Privacy Act statement in the **Federal Register** published on April 11, 2000 (Volume 65, Number 70; Pages 19477–19478) or you may visit *http://dms.dot.gov.*

Small Business Regulatory Enforcement Fairness Act

The Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996 requires FAA to comply with small entity requests for information or advice about compliance with statutes and regulations within its jurisdiction. Therefore, any small entity that has a question regarding this document may contact SBREFA. You can find out more about SBREFA on the Internet at our site, *http://www.faa.gov/avr/arm/sbrefa.htm.* For more information on SBREFA, e-mail us at *9–AWA–SBREFA@faa.gov.*

Background

Statement of the Problem

Current FAA rules do not require collision avoidance systems on all-cargo airplanes. When the FAA issued the traffic alert and collision avoidance system (TCAS) rules for passenger airplanes in 1987, the overnight cargo industry expansion was in its infancy, it operated few airplanes and those were primarily at night. Congress, in its legislation directing installation of TCAS in passenger airplanes, determined that those cargo airplanes did not represent a significant risk to passenger-carrying airplanes, which operated primarily during the day.

In promulgating the rules the FAA recognized that those few cargo airplanes would benefit some from the TCAS requirement for passenger airplanes because transponder-equipped cargo airplanes are displayed to pilots of TCAS-equipped passenger airplanes. Cargo airplanes also benefit because of the large number of passenger airplanes that are equipped with TCAS. In addition, the FAA determined that the cost/benefit analysis and risk level at that time did not support requiring cargo operators to equip their airplanes with TCAS.

Since those early days of TCAS, cargo operations have grown significantly and we now believe the increase in traffic presents an increased risk of a mid-air collision involving a cargo airplane. We are issuing this amendment to use airplane weight and performance characteristics to encompass cargo as well as passenger airplanes and to standardize and clarify the collision avoidance rules in parts 121, 125, and 129. The FAA believes this would reduce the risk of midair collisions, increasing public safety in the air and on the ground.

History

On April 5, 2000, the Wendell H. Ford Aviation Investment and Reform Act (AIR–21) was enacted (Pub. L. 106–181) and later codified at 49 U.S.C. 44716(g). That section directs the FAA to require all cargo airplanes of more than 15,000 kilograms (kg.) MCTOW to be equipped with collision avoidance equipment by December 31, 2002. It also provides for an extension of up to 2 years for safety or public interest reasons.

Section 44716(g) defines collision avoidance equipment as ''equipment that provides protection from mid-air collisions using technology that provides cockpit-based detection and conflict resolution guidance, including display of traffic; and a margin of safety of at least the same level as provided by the collision avoidance system known as TCAS II.''

Before Congress passed AIR–21, the FAA had been working on a proposal to require collision avoidance systems on cargo airplanes. The justification for that effort was:

- The large increases in all-cargo traffic volume (night and day operations),
- Two near mid-air collisions (NMACs) involving cargo airplanes,
- A petition for rulemaking to put TCAS on cargo airplanes from the Independent Pilots' Association (representing United Parcel Service pilots),
- The International Civil Aviation Organization (ICAO)'s recommendation to equip all airplanes with an airborne collision avoidance system (ACAS), which is equivalent to TCAS II, version 7.0, and
- The National Transportation Safety Board (NTSB)'s recommendation urging the FAA to require TCAS II and a Mode S transponder on certain airplanes.

The Proposed Rule

On November 1, 2001, the FAA published Notice of Proposed Rulemaking (NPRM) No. 01–12 (66 FR 55506) ''Collision Avoidance Systems.'' That document proposed collision avoidance requirements for part 121, 125, and 129 operators of certain airplanes. Specifically, turbine-powered airplanes of more than 33,000 lbs. (15,000 kg.) MCTOW operated under part 121, 125, or 129 would be required to be equipped with TCAS II, or equivalent. Turbine-powered airplanes of 33,000 lbs. or less MCTOW operated under part 121, 125, or 129 would be required to be equipped with at least TCAS I, or equivalent. All piston-powered airplanes, regardless of weight, conducting operations under part 121 or 125 would be required to be equipped with at least TCAS I, or equivalent.

Discussion of Comments

The comment period for notice No. 01–12 ended on December 31, 2001. In response to that notice we received 465 comments. The overwhelming majority of commenters were strongly in support of the proposal. Cargo pilots from United Parcel Service (UPS) comprised the largest group of commenters, accounting for 238 comments in favor of the proposal. Other air cargo pilots from DHL, Fed Ex, Kittyhawk Aircargo, and Polar Air Cargo added approximately 100 more comments in favor of the proposal. Passenger carrier pilots, military pilots, and general aviation pilots also commented in favor. Other commenters represent pilot labor unions, pilot associations, air carriers, air carrier associations, an avionics manufacturer, a civil aviation authority, the NTSB, and many nonaffiliated individuals. The FAA reviewed and considered all comments during deliberations of this final rule.

We received approximately 280 comments, half of which were nearly identical in content, expressing very general support of the proposal. Most of these comments did not address specific issues except indicating that the rule would enhance safety for cargo pilots, for persons on the ground, and in the national airspace system. One person in this group of commenters states that there should be no distinction between cargo and passenger aircraft regarding the collision avoidance systems installed. Another commenter feels there is no equipment that exceeds the value of TCAS. One commenter adds that requiring consistent TCAS rules across all fleets just makes good sense. Several commenters echoed that sentiment citing the need for ‘‘one level of safety’’ for passenger and cargo airplanes, regardless of how many occupants are carried. Many of these commenters urge the FAA to issue the final rule as soon as possible and indicate that this rule is long overdue.

Nearly all commenters were supportive of the general concepts of the proposal; however, some included specific concerns related to: (1) The compliance period, (2) the requirement for TCAS II, version 7.0, (3) alternative systems to TCAS, (4) transponder requirements, (5) aircraft performance capability to respond to resolution alerts (RAs), and (6) the cost of the rule. The strongest criticism of the proposed rule came from four supporters of automatic dependent surveillance-broadcast (ADS-B) and from those who believe the rule is not necessary for some piston-powered airplanes. Some commenters urge us to seriously consider the capabilities of ADS-B as an alternative to TCAS. One commenter states the proposal would not improve safety in the national airspace system because the rule’s restrictive nature could prevent the development of new and improved systems.

Below is the summary of the more specific comments. We introduce each topic with what the NPRM proposed, followed by a discussion of the comments and our response to those comments. Our response includes the FAA’s decision to leave the rule as proposed or to change it.

Compliance Date

Proposed Rule

In notice No. 01–12, the FAA proposed that all airplanes without TCAS and weighing over 33,000 lbs. MCTOW install a collision avoidance system by October 31, 2003. Section 44716(g) of 49 U.S.C. directs the FAA to require collision avoidance equipment that has a margin of safety of at least the same level as provided by TCAS II by December 31, 2002, and allows a 2-year extension for public interest or safety. In the proposal, we felt that a compliance date of October 31, 2003, would provide adequate time for air carriers to schedule the installation of collision avoidance during a major C or D check.

Comments

Several commenters, all representing cargo carriers, disapproved of the compliance period and recommended that we extend it. We received an equivalent number of comments requesting that we not extend it. For example, the FedEx Pilots Association (FPA) recommended adopting Congress’s earlier compliance date of December 31, 2002, and the NTSB, and various pilots requested that we not extend the compliance date beyond the proposed October 31, 2003. The NTSB strongly encourages the FAA to adhere to the equipment requirements and schedule contained in the proposed regulatory amendments and to expedite the implementation of these important rules.

Nearly 140 commenters (submitting similar form letters), representing the Coalition of Airline Pilots and primarily UPS pilots, believe the earlier Congressionally mandated date—December 31, 2002—is reasonable. They state that the December 2002 date coincides with ICAO recommendations, the hardware is readily available, most aircraft have approved installation procedures for TCAS, and many are prewired for TCAS. They suggest an extension to October 1, 2003, only in extenuating circumstances.

However, we heard from many air carriers indicating that the compliance schedule we proposed would be too difficult to comply with. Among the reasons cited were the schedules of individual carriers’ C and D maintenance checks and various proposed Mode S modifications. FedEx Express, Supplemental Air Operations states that it would not complete a C or D check on its entire fleet before October 31, 2003, even without the collision avoidance rule. It states that the short compliance period does not allow time for operators to bid, select, engineer, schedule, and perform the work required for the installation of collision avoidance. It suggests a compliance date of March 29, 2005, to coincide with the terrain awareness warning system/enhanced ground proximity warning system (TAWS/EGPWS) compliance date and minimize disruptions to operations.

The Air Transport Association (ATA) recommends that we establish a compliance date when we issue the final rule to ensure the date coordinates with other regulatory initiatives, namely domestic and international transponder modifications. Its recommendation, echoed by Airborne Express and Northern Air Cargo, Inc., is to allow 24 months after the publication date of the rule for installation of collision avoidance. According to Airborne Express, the percentage of aircraft without collision avoidance during the last year of the compliance period would be small, which would have an insignificant effect on safety. Airborne Express also supports its request to extend the compliance date because it will have to install Mode S transponders on many of its airplanes.

FedEx Express, Air Operations Division (FedEx) also commented on the compliance date, stating that the short period would impose special down time with considerable operational impact to install collision avoidance on an estimated 41 airplanes that do not already have TCAS. Also, FedEx notes that security-related requirements for transponder system modifications will affect the TCAS-related Mode S transponder. It believes that incorporating those requirements into the collision avoidance transponder requirements would avoid future retrofitting. FedEx recommends a compliance date of December 31, 2004, for those reasons.

Several other air carriers suggest a 24-month compliance period to install collision avoidance. The Cargo Airline Association (CAA) and UPS recommend December 31, 2004, but UPS earmarks the extension to allow the certification and orderly installation of ADS-B. The CAA also suggests that the FAA consider a phase-in compliance period, with a certain percentage of airplanes equipped with collision avoidance by October 31, 2003, and 100 percent compliance by December 31, 2004. One individual recommends a compliance date of December 31, 2004, but gives no reason for the extension. The Aerospace Industries Association (AIA) recommends 3 years to coincide with reduced vertical separation minimum (RVSM) operations, and USA Jet Airlines, Inc., recommends a 5-year compliance period to coincide with TAWS and RVSM. Evergreen International Airlines, Inc., recommends that the compliance date coincide with any hijack-mode modifications to transponders.

FAA's Response

When Congress mandated the FAA to require collision avoidance systems for cargo airplanes by December 31, 2002, it also allowed an extension of the compliance date to December 31, 2004. That extension is marked for ''a safe and orderly transition to the operation of a fleet of cargo aircraft equipped with collision avoidance equipment; or other safety or public interest.'' Based on public comments and FAA's rulemaking experience, we have determined that an extension is needed for orderly installation and training associated with this new equipment. This extension meets the intent of Congress. Any suggested compliance date beyond December 31, 2004, is not allowed in the Congressional mandate.

This final rule will require affected operators to install a collision avoidance system on affected airplanes by December 31, 2004. The compliance date is 1 year and 2 months later than the proposed date of October 31, 2003.

As CAA suggested, we did consider a phase-in approach for collision avoidance system compliance, which we have used with other rulemaking projects. We used a phase-in compliance period, for example, the original TCAS rule, and the digital flight data recorder rule. We found that such a compliance mechanism is labor intensive and difficult to implement. The FAA believes that a phase-in approach is impractical in this case because this rule covers passenger-carrying and cargo airplanes. It is better to allow operators to schedule their own installations.

Grandfathering/Early Compliance

Proposed Rule

In the NPRM, we proposed to allow those operators that had installed TCAS II version 6.04A Enhanced before December 3, 2001 (which has been required for passenger-carrying airplanes for years), to continue operating with that system until it can no longer meet the TCAS II version 6.04A Enhanced technical standard order (TSO C–119a) (''grandfathering''). However, installation of TCAS II for the first time after December 3, 2001 (30 days after the publication date of the NPRM), would have to be TCAS II version 7.0 (''early compliance'').

Comments

Some commenters disagree with using the NPRM publication date as a compliance date because it constitutes retroactive compliance. FedEx believes that it contradicts the spirit of due process and effectively reduces the rate of TCAS II installations. It states that some operators planning on installing TCAS II version 6.04A Enhanced on their aircraft may now have to defer installation based on the availability of version 7.0—working against the goal of early equipage. FedEx adds that this requirement would not affect them because they have been installing version 7.0 since December 1, 2001. The CAA also believes that requiring ''early compliance'' for version 7.0 goes against the interests of early equipage and enhanced safety. It adds that this requirement would cause TCAS II installations to stop or would cause version 6.04A Enhanced to become obsolete at a later date. It states that this compliance requirement would result in fewer TCAS-equipped airplanes in the short run and would disrupt carefully constructed industry compliance schedules.

Eurocontrol takes another point of view in its concern that TCAS II version 6.04A Enhanced units currently in service will not be upgraded on the compliance date or any defined schedule. Its position is that version 7.0 offers important safety and air traffic control (ATC) operational compatibility advantages. It also believes that all airplanes subject to the Congressional mandate should be required to install version 7.0 and that we should encourage passenger-carrying operators with airplanes already fitted with version 6.04A Enhanced to upgrade to version 7.0.

The Airline Pilots Association (ALPA) strongly supports the proposal to require version 7.0 for first-time installations and to include the early compliance date, crediting the operational improvements gained between version 6.04A Enhanced and 7.0.

AIA interprets the proposal to mean that all airplanes delivered after the publication date of the NPRM must be operated with TCAS II version 7.0. It indicates that Boeing is still delivering TCAS II version 6.04A Enhanced units to domestic carriers that have opted not to upgrade to TCAS II version 7.0. AIA recommends we delete early compliance and encourage operators to convert to version 7.0 as soon as practicable.

FAA's Response

We drafted the proposal so that no operator—passenger or cargo—would be required to retrofit its TCAS II unit to version 7.0 if version 6.04A Enhanced was installed before December 3, 2001. We included the ''grandfathering'' provision in the proposal as a compromise to requiring a retrofit to version 7.0 for all airplanes requiring TCAS II and have maintained it in the final rule.

The FAA included the ''early compliance'' provision to prevent new installations of older TCAS equipment, *i.e.*, allow new installations of version 6.04A Enhanced, instead of version 7.0 after the NPRM was published. Although the FAA concerns had validity, commenters have convinced us that the proposed date for early compliance is inappropriate. Consequently, we have amended that provision in the final rule. We believe that realistically, most airplanes will be equipped with version 7.0 before the final compliance date of this rule, even though grandfathering continues to be allowed. This is because many flights are in countries that require TCAS II version 7.0. Operators may also elect to conduct RVSM operations, which requires version 7.0 if the airplane has TCAS II installed.

Some commenters were concerned that the FAA was in effect writing a final rule in the NPRM by using a retroactive installation date for TCAS II version 7.0. We feel that because a newer, improved version is available, all first-time installations should be version 7.0. TCAS II version 7.0 includes a number of upgrades that improve the quality of TCAS II. Version 7.0 has the advantage of harmonizing with ICAO, improving ATC efficiency, accuracy, and RVSM capability. We believe that it will not be a burden for cargo carriers to buy version 7.0, rather than version 6.04 since they will have to buy one or the other. We researched availability of version 7.0 and are convinced that supplies are sufficient to support this rule.

Based on the comments, the FAA has decided to allow installation of version 6.04A Enhanced until 30 days after the publication of the final rule instead of the proposed 30 days after publication of the NPRM. This provision applies to operators that buy, sell, or lease airplanes with TCAS II version 6.04A Enhanced.

In response to AIA's comment regarding a manufacturer that continues to deliver airplanes with version 6.04A, the rule language only refers to the date the equipment is installed, not when it is delivered. Operators would be responsible for ensuring that its collision avoidance systems were installed before the required compliance date.

Alternative Collision Avoidance Systems and Other Equipment Issues

Proposed Rule

To accommodate any future technology that may be equivalent to TCAS I or II, we provided for alternatives in lieu of TCAS I or II in the proposal. An alternative system must be approved by the FAA.

Comments on ADS–B

One of the most popular issues that commenters addressed was comparing TCAS to ADS–B. Over 135 commenters (most via form letters from cargo pilots) believe that ADS–B eventually will be a ''commendable'' system, but until it is fully proven, TCAS should be the required collision avoidance system. Approximately 12 commenters indicate that ADS–B is not equivalent to TCAS. Three of those commenters, including Eurocontrol, indicate that this is because ADS–B does not provide conflict resolution capability. ALPA echoes those sentiments stating that ''* * * other technologies are under development but lack the potential to operate independently in any part of the world. Any potential equivalent system must function independently from ground-based systems, demonstrate TCAS II capabilities, be interoperable with TCAS and assure the redundancy to perform as the pilots' last resort safety assurance system.''

Eurocontrol supports allowing a truly equivalent system that is interoperable with TCAS. It believes ICAO is the appropriate forum to agree on equivalence at the international level; however, it is concerned that there does not currently exist an agreement among aviation authorities as to what constitutes equivalence.

Eurocontrol believes the FAA is overemphasizing the potential of ADS–B and finds FAA's description misleading and confusing. According to Eurocontrol, ADS–B, like Secondary Surveillance Radar (SSR), supports the surveillance infrastructure, which it indicates is more importantly used for separation rather than collision avoidance. Eurocontrol maintains that it is critical to keep distinct and separate the concepts of separation and collision avoidance. Eurocontrol indicates that the ''primary use of ADS–B data should be for the provision of separation, and the system employing the data should be constructed to a level of performance and integrity, which would make collision avoidance virtually unnecessary.''

Finally, Eurocontrol states that TCAS II provides collision avoidance protection based on an independent measurement of range and ADS–B does not.

ALPA supports the FAA's decision that any potential equivalent system must: (1) Function independently from ground-based systems, (2) demonstrate TCAS II capabilities, (3) be interoperable with TCAS, and (4) assure the redundancy to perform as the pilots' last resort safety assurance system. It adds that the FAA should proceed with a known, proven product.

On the other end of the spectrum are four supporters of ADS–B's potential. They believe that ADS–B is misrepresented in the NPRM and made suggestions for improvement. Many of the criticisms of the proposal stem from perceptions that the rule imposes onerous restrictions on non-TCAS systems, well beyond what Congress mandated.

The CAA states that AIR–21 requires an equivalent level of safety to TCAS II but does not necessarily require interoperability or coordinated maneuvers between any new system and TCAS. It concludes that the legislation was not technology-specific, which opens the door for alternative systems that do not have to be interoperable with TCAS. According to the CAA, the FAA's apparent prejudice against ADS–B violates the spirit of AIR–21.

The CAA asserts that the FAA provides no relevant analysis on the safety implications of the need for interoperability. It adds that RTCA SC–186, Working Group 1 has studied the issue and has provided alternatives to the ''coordinated maneuvers'' requirement.

The CAA argues that the FAA does not seriously consider the possibility of an alternative system based on ADS–B technology. It contends that the analysis contains inaccuracies and omissions that could preclude the certification of a system that is more accurate and could provide a significantly safer air transportation system than TCAS. It states that the FAA ignores the potential use of traffic information service-broadcast (TIS–B), which it indicates would allow ADS–B to ''see'' TCAS-equipped aircraft. The CAA recommends we delete and reexamine our analysis of the potential use of ADS–B to meet Congress's intent of encouraging, not discouraging, innovative solutions to the collision avoidance question.

United Parcel Service Airlines (UPS) supports the deployment of ADS–B as an alternative collision avoidance system and believes that it could address many shortcomings of TCAS. According to UPS, TCAS provides no information regarding target identification, speed, heading, type, or intent, whereas ADS–B does. In addition, it maintains that:

- ADS–B provides accurate target information below 1,000 feet above ground level (AGL) and on the ground,
- ADS–B derives altitude from GPS, thereby making vertical conflict resolution more reliable and less prone to error than TCAS,
- ADS–B displays range greater than 120 miles, whereas TCAS is typically 12 miles, and
- The bearing accuracy of ADS–B can support horizontal conflict resolution, which TCAS cannot.

UPS criticizes the collision avoidance proposal because it believes that it imposes restrictions on non-TCAS systems that prevent an applicant from pursuing an alternative technology. It lists examples of purported errors from the proposed rule that it believes support its claim that the FAA implicitly is requiring only TCAS as a collision avoidance system.

UPS also criticizes the FAA for not outlining standards to measure potential equivalent collision avoidance systems. It adds that the FAA must perform the necessary analysis to produce a uniform measurement of safety. This will allow the comparison of benefits provided by TCAS II and other collision avoidance technologies. UPS argues that in PL 106–181, Congress intended for the FAA to create the yardstick to evaluate the margin of safety of TCAS alternatives. UPS further contends that, because PL 100–223 calls for the FAA to implement horizontal guidance and PL 106–181 requires conflict resolution guidance, Congress likely required the deployment of an ADS–B-based collision avoidance system. UPS states that TCAS has neither of these capabilities.

Finally, UPS makes suggestions to amend the proposed regulatory text. It recommends that we eliminate the requirement that an equivalent system be capable of coordinating with TCAS units. It suggests instead that an equivalent system reduce the risk of collision to a level equivalent to the reduction provided by a TCAS II that meets TSO C–119a. It also recommends that we add the requirement that any collision avoidance system used must comply with PL 100–223 and provide horizontal resolution.

One commenter believes the rule will not improve safety in the national airspace system (NAS), because its restrictive nature could prevent new and improved systems from being developed. More specifically, he contends that the rule will stifle the development of ADS–B's pertinent application, Airborne Conflict Management (ACM), which he says will improve safety and increase capacity in the NAS.

The commenter adds that TCAS does not resolve all potential collision encounters, but that ADS–B contains more information content, resulting in more effective collision avoidance maneuvers in both the horizontal and vertical planes. He believes that ADS–B can be used to develop a more effective collision avoidance system and traffic management system than TCAS. The commenter argues that TCAS is not totally independent from the ground-based secondary surveillance radar system because it shares the transponder and altimeter in the aircraft. According to the commenter, the altimeter is a common point of failure that can result in false TCAS resolution advisories.

The commenter disagrees with our proposal to require maneuver coordination for any equivalent system used in lieu of TCAS. He states that the ACM sub-group of RTCA–186 has been working on a system that could overcome some of the limitations of TCAS and has determined that coordination is not necessary. He concludes his comment with recommendations to change the regulatory text. He suggests that we eliminate the provisions that an equivalent system be capable of coordinating with TCAS units. In place of it, the commenter suggests adding that equivalent systems reduce the risk of collision to a level equivalent to the reduction provided by TCAS.

Another commenter also supports the potential of ADS–B as an equivalent system to TCAS. He believes that TCAS was the correct system for collision avoidance before the development of global positioning systems (GPS). However, according to the commenter, the FAA made two mistakes implementing TCAS requirements: (1) Not recognizing the contribution GPS would eventually make to traffic conflict and collision prevention, and (2) using Air Traffic Control Radar Beacon System (ATCRBS) Mode S as the vehicle for TCAS. He believes that these two mistakes caused collision avoidance to cost 10–100 times what it should and that it still experiences false alarms. According to the commenter, pilots ignore half of all TCAS resolution alerts (RAs) because they feel that although TCAS has prevented some collisions, it will eventually cause one.

The commenter argues that the Capstone project in Alaska shows that ADS–B is a mature system, capable of providing collision avoidance functions. (The Capstone project is an FAA-funded evaluation, in which ADS–B is installed on certain airplanes under controlled conditions. The Capstone project is further explained in the FAA's response to this comment below.) He states that the accuracy and integrity of ADS–B nearly eliminates the need for collision avoidance. He adds that the susceptibility of ADS–B to the loss of GPS will be eliminated when the FAA and other agencies adopt the existing Loran-C as the back-up navigation source.

The commenter makes suggestions to amend the proposed regulatory text. He recommends, identical to UPS, that we eliminate the requirement that an equivalent system be capable of coordinating with TCAS units. He suggests instead that an equivalent system reduce the risk of collision to a level equivalent to the reduction provided by a TCAS II that meets TSO C–119a. He also adds that the proposed rule document has too many errors to list and that RTCA would address those issues.

FAA's Response to ADS–B Comments

The FAA supports the development of ADS–B. The intent of the rule is to provide the opportunity for future equipment to be certified to either meet or exceed the collision avoidance function of the current TCAS system. The burden to show equivalence is on the applicant. The developers of ADS–B have not requested that FAA approve ADS–B as equivalent to TCAS. Some commenters referred to systems being studied by RTCA; however, the FAA did not receive comments from RTCA.

While the FAA has set out the elements it considers to be part of a TCAS equivalent such as interoperability, it is not appropriate in this rule to set specific technical standards for individual equipment. It is not the intent of the FAA to approve or disapprove equipment as equivalent to TCAS through this regulation. If, in the future, a collision avoidance system is presented to the FAA for certification and approval, we will examine the applicant's data to determine if the system is equivalent.

The FAA agrees with Eurocontrol that it would be beneficial for there to be agreement between Authorities as to what would constitute equivalence, and that ICAO would be the appropriate forum. An international agreement on equivalence could open the door for new technologies. The FAA, however, must have its own standard for findings of equivalency. It is our intent to then make every effort to harmonize these standards.

It is our position that an equivalent system to TCAS II must be interoperable with TCAS II, provide protection against the same population addressed by TCAS II, and coordinate with currently approved devices meeting the requirements of §§ 121.356, 125.224, and 129.18. This is what we interpret Congress to mean when it defined in 49 U.S.C. 44716(g)(3) collision avoidance equipment as "equipment that provides protection from mid-air collisions using technology that provides'a margin of safety of at least that same level as provided by the collision avoidance system known as TCAS II." While Congress did not specifically use the term "interoperability," the FAA has determined that without interoperability, another alternative collision avoidance system would not be equivalent to TCAS.

Although commenters suggest that an alternative system to TCAS need only provide an equivalent reduction in collision risk, we are responding to a Congressional direction that requires more than just a reduction in collision risk. Congress mandated "collision avoidance equipment that provides protection from mid-air collisions using technology that provides cockpit-based collision detection and conflict resolution guidance, including display of traffic; * * *" Congress has defined collision avoidance equipment as technology equivalent to TCAS. At this time there is no system equivalent to TCAS.

This final rule provides the opportunity for future developments without requiring more rulemaking. It is not intended to discourage private-sector, on-going efforts. However, at this time, neither the FAA nor other regulatory authorities are sponsoring programs to develop alternatives to TCAS II/ACAS II (the international equivalent to TCAS II version 7.0) to meet U.S. or international requirements. Allowing for an equivalent system is meant to be helpful to affected parties.

The FAA is responding to Congress and cannot delay this rulemaking for future development. We have extended the compliance date as discussed; however, we cannot extend beyond the date imposed by Congress. It is not the FAA's intent to delay or cancel incentives for new development of systems. The FAA has established a commitment to the development of the ADS–B technologies and works in the international forum with ICAO, Eurocontrol, and others to further this promising technology.

In regard to the comment about Capstone, the FAA is very familiar with ADS–B use in Alaska under the Capstone program. FAA funds were used to equip certain airplanes in Bethel, Alaska, with ADS–B. So far there are approximately 150 participating airplanes. Other than the Cessna 208, which is turbine, all of the airplanes are piston-powered. Most are operated in accordance with part 135, which this rule does not address. Capstone is a demonstration under very controlled conditions where every airplane involved has the necessary equipment. Capstone has demonstrated the utility of an avionics suite containing GPS receivers, moving map display, terrain awareness feature and ADS–B. In Alaska, ADS–B has been approved for provision of radar like services by Air Traffic Control. The Capstone program is entering a second phase which will utilize the Wide Area Augmentation System (WAAS) to provide more precise and robust navigation capabilities and allow for new routes previously unavailable to operators and will continue to develop ADS–B capabilities.

In the lower 48 states, the Safe Flight 21 program office has entered into a joint government-industry effort to develop ADS–B applications that will provide an impetus for widespread equipage by commercial and general aviation operators in the United States. There are numerous applications of ADS–B that, when implemented, could improve safety through greatly enhanced situational awareness. ADS–B installations have been approved in transport category aircraft utilizing the 1090 MHz (transponder) data link. Installations in the Capstone program have utilized the Universal Access Transceiver (UAT) as the data link for ADS–B transmissions. We currently do not have sufficient evidence showing that ADS–B would be a substitute for TCAS.

One commenter's reference to non-compliance to RAs ignores data analysis that shows such non-compliance occurs when pilots acquire the other aircraft visually and determine that a threat does not exist. In other words, there are times when non-compliance with an RA may be appropriate. When the pilot is in instrument meteorological conditions, the only action available to the pilot is to respond to the alert. This same commenter stated that TCAS could cause collisions. However, his statements are unsupported and contrary to the numerous airline pilots' comments received and FAA's experience. The commenter did not provide any data to support his claim that nuisance or unnecessary alerts are costly.

Comments on Other Equipment

In addition to the system alternative issues, three commenters addressed Mode S transponder issues. One commenter indicates that a Mode S is sufficient for collision avoidance without TCAS because it can continuously provide a "squitter" of barometric and GPS position with heading and speed, giving all aircraft and ground listeners the opportunity to locate and avoid the transmitter. He says British Airways has implemented this technology on an experimental basis. According to the commenter, adding a Mode S squitter would increase receiver-equipped aircraft four-fold within 6 years. He believes military and public aircraft without transponders could listen to position reports using the low-cost, uncertified receivers. He requests that all future mandates for collision avoidance systems include Mode S squittering of altitude, latitude, and longitude.

For clarification, the term "squitter" refers to a system designed to transmit and receive signals from a transponder, without active interrogation of the transponder. It also refers to a signal transmitted by the system. TCAS II requires a Mode S transponder, which is interrogated by other TCAS II equipment and replies to that equipment. A squitter system would be able to transmit and receive any information from the transponders, but it would not actively interrogate other aircraft as a TCAS II would.

Ryan International Corporation (Ryan) suggests we include traffic advisory system (TAS) Class A as a less expensive equivalent alternative to TCAS I. It makes this suggestion on the basis of the high cost to install a Mode S transponder. Another commenter agrees with Ryan in that we should include a less expensive form of TAS in lieu of TCAS I. That commenter believes that while TCAS provides a very useful tool to improve the safety of our airways, it is also very costly.

Ryan also inquires as to whether Mode S is required for TCAS I installations. It states that that does not seem to be the case in the preamble of the proposal, but in the proposed regulatory text, it appears that Mode S is required for TCAS I, or equivalent.

FAA's Response Regarding Other Equipment

In response to Ryan's inquiry regarding whether Mode S is required for TCAS I, Mode S is not required for those airplanes that need only a TCAS I. It is not our intent to mandate Mode S in this rule for TCAS I installations because it is not an integral part of the TCAS I installation. The commenter's confusion may have resulted from the appearance of the table in the **Federal Register**.

It should be noted that there are Mode S requirements described in existing §§ 121.345(c)(2), 125.224(a), and 129.18(a)(2). In addition, an appropriate class of Mode S is required to be installed as a part of a TCAS II installation, which is consistent with the existing rule and the proposed rule. In the final rule, the Mode S reference will remain in §§ 121.356, 125.224, and 129.18 because it is a required element in a TCAS II system.

We did make one change to the Mode S reference from the proposed rule. We inserted, for clarification, that the Modes S must be an appropriate class. This is similar language to the existing TCAS II rule. There are multiple classes of Mode S transponders within TSO C–112 and currently TCAS II functions only with at least a class 2 Mode S transponder. At the time of the issuance of this final rule, there is still no system found to be equivalent to TCAS.

Exceptions/Applicability

Proposed Rule

The FAA proposed that part 121, 125, and 129 turbine-powered airplanes that weigh more than 33,000 lbs. MCTOW would require TCAS II, or equivalent. We proposed that part 121 and 125 turbine-powered airplanes weighing 33,000 lbs. MCTOW or less, and all 121 and 125 piston-powered airplanes would require at least a TCAS I, or equivalent. We proposed that part 129 turbine-powered airplanes weighing 33,000 lbs. MCTOW or less would require TCAS I, or equivalent.

Comments

Two commenters request that we except some airplanes from the collision avoidance rule. According to one of these commenters, older, piston-powered, large aircraft conducting all-cargo operations do not have the performance necessary for rapid climbs. He states that passenger aircraft already equipped with TCAS can more safely maneuver to avoid an aircraft in steady-state flight. He states that this rule is not in the public interest and will put small air cargo operators with these airplanes out of business.

The second commenter, Northern Air Cargo, agrees that its B727–100 aircraft should be TCAS II-equipped, but it requests that we except ADS–B-equipped DC–6 aircraft operating under the Capstone project within the State of Alaska. The commenter states that its DC–6 aircraft cruise at much lower altitudes and airspeeds and do not fly among other TCAS-equipped aircraft during most phases of flight. It adds that most of its DC–6 aircraft are Capstone-equipped and operate solely within the State of Alaska and, occasionally, into remote areas of Canada and the lower 48 states.

ALPA, on the other hand, suggests that the proposal could be more restrictive. It asserts that some turbine-powered airplanes weighing less than 33,000 lbs. MCTOW, and some piston-powered airplanes, could respond to TCAS II RAs. It does not agree that certain airplanes operated under part 129 are too small to operate practically with collision avoidance. It states that the same type of piston-powered airplanes could be operating in the same airspace under part 121, 125, or 129, but the piston-powered, part 129 airplane would not be required to have TCAS I. It believes that we should use only a performance threshold to capture all airplanes in parts 121, 125, and 129 uniformly.

Eurocontrol provides a preliminary study demonstrating that light airplanes can respond to RAs. Eurocontrol recommends that we require TCAS II version 7.0 for all airplanes, including those that we proposed to use TCAS I, or equivalent.

FAA's Response

The FAA has decided not to include cargo airplanes weighing 33,000 lbs. or less in this final rule. This is a change from the NPRM, in which we proposed collision avoidance requirements for all airplanes weighing 33,000 lbs. MCTOW or less. We made this decision to reduce a burden on the operators of these airplanes. However, the FAA did maintain the proposed TCAS I (or equivalent) requirement for piston-powered airplanes weighing more than 33,000 lbs.

We have already reduced the burden for the older piston-powered airplanes weighing more than 33,000 lbs. MCTOW. We proposed and will require only TCAS I, or equivalent, for those airplanes. Part 129 already excepts piston-powered airplanes from collision avoidance requirements. The FAA proposed to continue that exception and we have decided to adopt the rule as proposed.

The FAA received comments from ALPA and Eurocontrol requesting that we expand the scope of the proposal. The FAA did not propose TCAS II requirements for piston-powered airplanes because of the lack of performance capabilities for those airplanes. Although the commenters contend that there may be piston-powered airplanes that can effectively use TCAS II, they did not provide any specific make and model airplanes that they feel could safely respond to RAs. In further telephone discussion with ALPA, the FAA determined that the primary intent of the comment was to point out inconsistencies between the proposal and the existing passenger-carrying TCAS rule. ALPA wants ''one level of safety.''

The minimum rate of climb required to respond to a TCAS II RA is 1,500 feet per minute (f/m), with the ability to increase the rate to 2,500 f/m. The FAA did not conduct a study on the performance capabilities of piston-powered airplanes. However, the FAA does have extensive knowledge of and experience with piston-powered airplanes currently operating under part 121, weighing more than 33,000 lbs. MCTOW. (Most of those airplanes were manufactured in the 1940's and 1950's.) Based on that information, the FAA determined that those airplanes were not capable of meeting the performance standards to respond to a TCAS II RA under the worst-case situation for climb performance, *i.e.*, maximum gross weight, high temperature, high pressure altitude.

Further, the equipment and labor to install TCAS II can, in some cases, approach the value of the airplane. Most of those piston-powered airplanes are operated by small entities. For example, the conservative value of a DC–6 is approximately $500,000; whereas, the cost of installing TCAS II on that airplane could reach $180,000. That cost does not include down-time and training. This final rule provides a safe and economical solution for piston-powered airplanes weighing more than 33,000 lbs. MCTOW. The FAA has determined that it cannot justify including in this rule installation of TCAS II (or equivalent) on piston-powered cargo airplanes weighing more than 33,000 lbs. MCTOW and has adopted the rule as proposed.

Because the FAA will not include airplanes weighing 33,000 lbs. or less in this rule, we will maintain the existing passenger-seating rule language for any passenger-carrying airplanes other then those with more than 30 seats. As proposed, we updated the collision avoidance requirement for passenger-carrying airplanes to allow for collision avoidance systems equivalent to TCAS.

Eurocontrol advocates TCAS II for all airplanes, but recognizes that there could be operational differences between the United States and Europe that could support a need for TCAS I. In reference to the Eurocontrol study, the FAA appreciates Eurocontrol providing this preliminary study, which is in its beginning stages. We found the study interesting but are not convinced that these airplanes have the performance capability to respond to RAs as necessary. The FAA developed two levels of TCAS (TCAS I and TCAS II) since the 1980's for the sole purpose of relieving small airplanes from purchasing equipment that may not be more useful or safer for them. Many countries do not yet mandate TCAS at all, but those that do require TCAS II and only require it on those airplanes equivalent to our part 121 airplanes with more than 30 seats. In Europe, the first TCAS mandate for their largest airplanes did not occur until the year 2000. The next stage of the mandate occurs in 2005 when airplanes with more than 19 seats will be required to have TCAS II. They have not mandated anything for ''light'' aircraft. They are able to mandate ACAS II (TCAS II, version 7.0) for airplanes with more than 30 passenger seats (2000) and more than 19 passenger seats (2005) without a retrofit because it is the initial mandate in both cases.

Compared to Europe, the United States has a large community of smaller commercial airplanes transporting passengers and cargo. This rule to add cargo airplanes weighing more than

33,000 lbs. also includes the passenger-carrying airplanes because of the switch to weight; however, the seat definition in the current rule is compatible with the proposed weight definition. The decision has already been made to not require a retrofit of TCAS equipment from one version to another. Retrofits are very expensive and, in this case, the FAA does not find the benefit of a retrofit to be worth the cost.

In response to Northern Air Cargo's comment that we should accept all Capstone participants, we note that Capstone currently applies to Alaska only (specifically, Bethel, Alaska). Although the FAA is pleased with the progress made during the Capstone demonstration, ADS–B is not a collision avoidance system and we have not received any application for its FAA approval as a collision avoidance system. Currently, the ADS–B equipment installed for the Capstone project is not equivalent to TCAS I or TCAS II. It currently would not be an acceptable alternative to TCAS under this proposal either inside Alaska or outside Alaska.

Northern Air Cargo's DC–6 weighs more than 33,000 lbs. If the FAA had adopted the existing rule language and simply added cargo airplanes and used the weight threshold, the DC–6 would have needed TCAS II. This rule provides significant relief to operators of large piston-powered airplanes, including those that operate in Alaska by requiring only TCAS I.

Economic/Risk Analysis/Alternatives

Comments

Several commenters specifically address the costs and benefits of the rule, the risk analysis used, and some alternatives to reduce the cost of the rule.

Ryan suggests that our estimated cost of equipage for TCAS I is low, suggesting that the estimate left out the cost of the elements themselves. It also states that if Mode S is required for TCAS I installations, the costs would be even higher, and recommends that we remove the Mode S requirement for TCAS I installations.

The CAA suggests that we overstated the benefits and minimized the costs in our analysis. It quotes from the cost section of the NPRM that we did not include the cost of air carriers that have voluntarily equipped their fleets with TCAS or that are equipped with TCAS as required by foreign governments. However, it states that our benefits section assumes that no cargo aircraft are equipped with TCAS. It argues that the numbers used for the benefits section are either drawn from unknown sources or are misinterpretations of other existing documents. It recommends that we task MITRE Corporation to review the proposed rule and to submit comments on the benefits that the proposal might generate.

Another commenter indicates that the cost of installing TCAS on older piston-powered cargo aircraft is cost prohibitive. He believes this rule will ground these aircraft, putting small cargo aircraft companies out of business, depriving the public of much needed cargo service. He argues that these aircraft typically fly only a few hundred hours a year and are in their last 10 years' of service life.

USA Jet Airlines, Inc., questions the necessity of so many equipment requirements in the near future. It indicates that in the next 3 years, a DC–9 and Falcon operator will pay $250,000 per aircraft for TCAS II, $125,000 per aircraft for TAWS and a significant sum for the domestic RVSM system. It agrees that these systems have merit, but believes the cost of all the systems precludes implementation for many carriers.

UPS contends that the FAA misinterpreted the MITRE study, which the NPRM indicated that the risk of a mid-air collision with a passenger airplane in the United States would be reduced 17 percent if cargo airplanes were also equipped with TCAS. According to UPS, the study reported that the risk of a mid-air collision for passenger airplanes in the United States would be reduced by 1 percent. UPS criticizes the study for not calculating the reduction in the risk of passenger airplane runway incursion accidents if cargo airplanes were equipped with ADS–B.

UPS also believes that the benefits are uncorroborated. It believes that because the FAA did not quantify the benefit of TCAS equipage, it is not possible to calculate a cost-benefit. UPS further asserts that the mid-air collision risk over the next 20 years involving a cargo airplane (40 percent) is unsupported. It argues that because there has never been a mid-air collision in the United States involving a cargo airplane, it is difficult to comprehend how this value could have been computed.

FAA's Response

In response to Ryan's assertion that we left out the cost of TCAS I units, the FAA's cost estimate does include estimates for both equipment and installation costs. As noted above, TCAS I equipment does not need a Mode S to function, nor did we propose to require Mode S. Therefore, the cost of Mode S is not considered to be a cost imposed by this rule.

To address the CAA's comments, in the final rule regulatory evaluation, air-cargo carriers' voluntary compliance has now been factored into both the cost and benefit sections. A large percentage of air cargo carriers voluntarily complied with the rule, even before the publication of the NPRM. Both the costs and the benefits are reduced by the extent of voluntary compliance. The FAA finds it unnecessary to task MITRE Corporation since we have made the corrections.

In response to the individual operating older piston-powered cargo airplanes, as previously discussed, the FAA has reduced the burden for those airplanes from TCAS II to TCAS I as much as we can. In response to USA Jet Airlines, Inc., the FAA realizes there is a cumulative effect of rules; however, in this case, the FAA is required by Congressional mandate to issue this rule.

UPS questioned the validity of a 40-percent chance of at least one mid-air collision involving a cargo aircraft in the next 20 years. That probability refers to the value in the Poisson distribution table when the mean of the distribution is 0.5. The Poisson distribution is an accepted probability distribution for rare events. Just because a collision has not occurred does not mean that the probability of a collision occurring is zero. The economic evaluation discusses the impact of near-miss situations on the FAA's analysis.

The 17-percent and 1-percent reduction in risk estimates, as mentioned in the full regulatory evaluation, are both correct. The MITRE study, which is in the docket, reports (pages 49 and 50), ''If cargo aircraft were TCAS-equipped this relative risk would drop to 0.058 (as compared to the pre-TCAS baseline situation when no aircraft was TCAS-equipped). This corresponds to a Risk Ratio of 0.058/0.070 = 0.828, which roughly corresponds to a 17-percent reduction compared to the current risk. The small proportion of encounters involving one passenger and one cargo aircraft means that equipping cargo aircraft with TCAS would only reduce the risk to the passenger aircraft by another one percent.''

In response to UPS's assertion that the benefits of the rule are uncorroborated, the FAA sponsored a MITRE study to assist in the risk assessment of a mid-air collision. That report provided the basis of the safety benefits for collision avoidance for cargo aircraft. We made that study available in the docket, we provided a risk assessment, and we presented a reasoned determination that the benefits justified the costs. It was not MITRE's task at the time of the study to address ADS–B.

Commenters responding to this rule have criticized us for not having enough accident data to justify the rule. In issuing this collision avoidance systems rule, we are being proactive about preventing accidents, rather than waiting for comprehensive mid-air collision data to give us overwhelming justification for this rule. Since the NPRM was published, a mid-air collision occurred in Germany on July 1, 2002, involving a DHL cargo Boeing B–757 and a passenger-carrying Tupelov Tu–154. Both aircraft were equipped with ACAS II (TCAS II version 7.0). German authorities also reported that data from the aircraft Cockpit Voice Recorders (CVR) and Flight Data Recorders (FDR) indicated that both ACAS II systems alerted the flight crews and displayed coordinated RAs. The B–757 descended in response to its RA, but the Tu–154 did not climb in response to its RA. Rather, it descended in response to air traffic control instructions. The accident is under investigation and the probable cause is unknown at this time.

Paperwork Reduction Act

Information collection requirements in the amendment to parts 121, 125, and 129 previously have been approved by the Office of Management and Budget (OMB) under the provisions of the Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)) and have been assigned OMB control Nos. 2120–0008 and 2120–0085. The potential paperwork burden is any recordkeeping required to maintain the list of those pilots who have completed training and are certified as to their proficiency on the collision avoidance system operation. These recordkeeping requirements already are covered under the Paperwork Reduction Reports entitled ''Operating Requirements; Domestic, Flag, and Supplemental Operations'' and ''Certification and operations: Airplanes having a seating capacity of 20 or more passengers or a maximum payload capacity of 6,000 lbs. or more; and rules governing persons on board such aircraft.''

An agency may not conduct or sponsor and a person is not required to respond to a collection of information unless it displays a currently valid Office of Management and Budget (OMB) control number.

International Compatibility

International Standards and Recommended Practices (SARPs), Annex 6 to the Convention on International Civil Aviation, Part I, seventh edition, July 1998 has the following four recommendations addressing collision avoidance systems:

6.18 Aeroplanes Required to be Equipped with an Airborne Collision Avoidance System (ACAS II).

6.18.1 From 1 January 2003, all turbine-engined aeroplanes of a maximum certificated take-off mass in excess of 15,000 kg. or authorized to carry more than 30 passengers shall be equipped with an airborne collision avoidance system (ACAS II).

6.18.2 From 1 January 2005, all turbine-engined aeroplanes of a maximum certificated take-off mass in excess of 5,700 kg. or authorized to carry more than 19 passengers shall be equipped with an airborne collision avoidance system (ACAS II).

6.18.3 Recommendation.-All aeroplanes should be equipped with an airborne collision avoidance system (ACAS II).

6.18.4 An airborne collision avoidance system shall operate in accordance with the relevant provisions of Annex 10, Volume IV.

FAA Discussion of ICAO SARPs

In keeping with U.S. obligations under the Convention on International Civil Aviation, it is FAA policy to comply with ICAO SARPs to the maximum extent practicable. The FAA has reviewed the corresponding ICAO Standards and Recommended Practices and has identified the following differences.

The FAA agrees that ICAO should actively encourage the use of ACAS II, which is equivalent to TCAS II version 7.0, and agrees in principle with the SARPs. However, the FAA is concerned that some aspects of the SARPs may be unrealistic. ACAS II is appropriate for large, transport category airliners, which have been successfully using TCAS II version 6.04A Enhanced in the United States for several years. However, some small airplanes lack the performance capability to respond to RAs provided by ACAS II (TCAS II version 7.0) and therefore would receive no benefit from the recommendation. The FAA believes that this rule provides a reasonable alternative for those airplanes for which ACAS II would be inappropriate. The FAA has considered the aerodynamic capability of certain airplanes and does not agree that ACAS II/TCAS II is the appropriate level for smaller airplanes. The FAA currently mandates TCAS I for airplanes with 10–30 passenger seats and has done so for more than a decade. Many of the 10–30 passenger-seat airplanes currently equipped with TCAS I weigh less than 5,700 kg. (12,500 lbs.). The FAA also has considered the cost of installing equipment that cannot be fully utilized by certain airplane operators.

The FAA desires that all TCAS II/ACAS II users have the latest version (version 7.0) and the FAA believes that TCAS II version 7.0 has additional benefits. However, many airplanes currently required to have TCAS II have had version 6.04A Enhanced installed for several years. The purpose of this rule is to capture cargo airplanes for the first time, not to create retrofits for passenger airplanes. This rule allows airplanes that already are equipped with TCAS II version 6.04A Enhanced to continue using that version until those particular units can no longer be repaired to TSO C–119a standards. Air carriers that are installing TCAS II for the first time must equip their applicable airplanes with TCAS II version 7.0. Eventually, airplanes operating under parts 121, 125, and 129 that are required to have TCAS II would be required to be equipped with TCAS II version 7.0. This is because operators will need to replace version 6.04A Enhanced units when old units wear out, or they will choose to operate in RVSM airspace or in foreign countries that require version 7.0.

Economic Evaluation, Regulatory Flexibility Determination, Trade Impact Assessment, and Unfunded Mandates Assessment

Changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs each Federal agency proposing or adopting a regulation to first make a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Trade Agreement Act prohibits agencies from setting standards that create unnecessary obstacles to the foreign commerce of the United States. In developing U.S. standards, this act requires agencies to consider international standards, and use them where appropriate as the basis of U.S. standards. Fourth, the Unfunded Mandates Reform Act of 1995 requires agencies to prepare a written assessment of the costs and benefits and other effects of proposed and final rules. An assessment must be prepared only for rules that impose a Federal mandate on State, local or tribal governments, or on the private sector, likely to result in a total expenditure of $100 million or more in any one year (adjusted for inflation.)

In conducting these analyses, the FAA has determined:

(1) This rule has benefits that justify its costs. This rulemaking does not impose costs sufficient to be considered ''significant'' under the economic standards for significance under Executive Order 12866 or under DOT's Regulatory Policies and Procedures. Due to public interest, however, it is considered significant under the Executive Order and DOT policy.

(2) This rule will have a significant impact on a substantial number of small entities.

(3) This rule is in accord with the Trade Agreement Act.

(4) This rule does not impose an unfunded mandate on state, local, or tribal governments, or on the private sector.

The FAA placed these analyses in the docket and summarizes them below.

Benefits of the Final Rule

Introduction

The implementation of this rule contributes to a long-standing effort by the Congress, the FAA, international aviation authorities, and industry to increase the use of Collision Avoidance Systems (CAS). Specifically, the expected benefit of this rule is a reduction in the risk of midair collisions involving at least one cargo airplane.

There are many levels of safety built into the Air Traffic Control System that guard against the risk of midair collision. However, when human errors by pilots or controllers, or equipment failures occur, safety margins erode. In some instances, separation between aircraft is lost. Many different factors apply in such cases. There are such a variety of circumstances that it appears no single measure can entirely eliminate the risk of midair collision.

Traffic Alert and Collision Avoidance System (TCAS) has been proven effective in providing additional protection against collision. TCAS was designed to supplement the safety margins of the ATC system by providing protection when other means fail. At present, TCAS is required in certain passenger-carrying airplanes and has also been voluntarily installed on some general aviation (primarily business) aircraft. In addition to the United States requirements, Europe, India and, recently China require collision avoidance systems. Within the air cargo industry, Northwest Airlines and Polar Air Cargo have already equipped their cargo airplanes with TCAS II and the all-cargo airlines Airborne Express and FedEx are voluntarily equipping their fleets with TCAS II. This voluntary compliance reduces the benefits of this final rule from those cited in the NPRM.

Commenters' reports, Near Midair Collision (NMAC) filings, and the National Transportation Safety Board (NTSB) recommendations attest to occasions where safety benefits improved by using TCAS equipment. Often, these reports suggest that TCAS served as the final safety net that prevented an accident. A pilot's and a controller's view of a situation may differ, particularly in the degree of imminent danger associated with a loss of separation.

The potential benefits of TCAS II have been studied by extensive computer simulations and validated by tens of millions of hours of operational experience. These safety benefits have been recognized by the International Civil Aviation Organization (ICAO) in its worldwide recommendation for TCAS II installation, which affects both passenger and cargo carriers.

The worst midair collision occurred between a cargo airplane and a passenger airplane in India with nearly 350 fatalities. At the time of this writing another midair collision occurred with a cargo airplane and a passenger airplane in Europe. This most recent accident is a painful reminder that such accidents do occur.

A Look at the Environment

Although no passenger air carrier airplanes have been involved in a midair collision since they were required to carry TCAS II, other types of airplanes continue to experience midair collisions. During the period 1994–1997, 61 midair collisions in the U.S. airspace have occurred resulting in 92 fatalities and 26 injuries. No collision involving a cargo airplane (which would be affected by this rule) occurred, but the following describes a recent near miss.

Two U. S. cargo airline airplanes nearly collided at flight level 330 over Kansas on March 2, 1999. A McDonnell Douglas cargo DC–10 had departed from Portland, Oregon, and was enroute to Tennessee. The other airplane was a cargo Lockheed L–1011 that had departed from Los Angeles, California, and was proceeding to Indiana. The minimum distance between the two airplanes at the time of the near-collision was reported as a quarter-mile (ATC recorded radar data) or 50–100 feet (crewmember estimate). The DC–10 captain reported that he never saw the L–1011 approaching. The L–1011 crewmembers saw the DC–10 to the left and slightly behind them at nearly the same altitude and took evasive action to avoid a collision.

The (NTSB)'s investigation of the NMAC determined that air traffic controllers in two different air route traffic control centers failed to properly transfer control and radio communications for each airplane to the next sector that the flights would fly through according to their flight plans. As a result, both airplanes were not on the proper radio frequency (were under no one's control) as their flight paths converged at the same altitude over Kansas. While ATC was aware of the pending conflict, the controllers were unable to issue control instructions to separate the two airplanes, because they could not communicate with the flight crews on the proper radio frequency.

The NMAC also highlighted a difference in the TCAS requirements between passenger and cargo airplanes. Currently, regulations require passenger carrying airplanes with more than 30 passenger seats operating in U. S. airspace to be equipped with TCAS II which alerts flight crews of potential conflicts and, if necessary, instructs them to climb or descend to resolve the conflict. Cargo airplanes receive no TCAS information because they are not currently required to be equipped with TCAS. This could cause a potential safety hazard because a cargo pilot without the advantage of a TCAS RA may inadvertently select the same response as the RA provided to the passenger airplane pilot.

Risk Assessment

The above discussion outlines in general terms the benefits of equipping airplanes with TCAS II. In an effort to place these benefits in a more quantified context, the FAA performed the following risk assessment based on a study performed by MITRE.[1]

The scant air cargo airplane data in the United States on midair collisions and NMACs does not allow a definitive analysis of the numbers of accidents likely to be avoided by installing TCAS on cargo airplanes. Fortunately, there has been no actual midair collisions in U.S. airspace involving cargo airplanes affected by this rulemaking action. However, it does not follow from this circumstance that the risk of a midair collision involving a cargo airplane is zero.

The following risk assessment attempts to arrive at a reasonable approximation of the risk of a MAC

[1] The Mitre study, ''Assessment of Midair Collision Risk and Safety Benefits of TCAS II for Cargo Aircraft'', June, 1999, is available in the public docket for this rulemaking action.

involving at least one cargo airplane under the following circumstances:

1. The current situation—no requirement for collision avoidance systems on cargo airplanes, and

2. The reduction in risk with the implementation of this final rule.

To do this, the FAA combined the risk reduction estimates developed by MITRE, with the FAA's estimate of risks.

Assumptions

The estimates derived by Mitre depend on a number of simplifying assumptions. These assumptions are believed to be consistent with the level of accuracy that can be achieved when estimating the probabilities of such rare events as midair collisions or NMACs.

The two major assumptions are:

1. Exposure to a possible midair or near-midair collision is assumed to be approximately proportional to the number of airplane pairs flying through the same airspace at about the same time. The number of pairs increases in proportion to the square of the number of airplanes.

2. The NMAC risk reduction estimates documented in the Safety Analysis of TCAS II Version 7, which were derived from airplane track data collected at major terminal areas for passenger flights, also apply to cargo airplanes.

Pre-TCAS II Accident Rates

This section discusses the risk of cargo airplane midair collisions (MAC)s. The risk is the expected number of cargo airplane MACs with another cargo airplane, a commercial passenger airplane, or a general aviation airplane. Due to general aviation data limitations and the fact that passenger airplanes are presently equipped with TCAS, this assessment of risk is limited to that of cargo/cargo MAC. While to date there has not been a MAC involving a cargo airplane in the United States, there were two near midair collisions (NMAC) with cargo airplanes in 1999. The FAA believes there is a small, but significant, risk. Several methodologies are presented below which provide an approximation of the number of cargo airplane MACs that may occur in the future if cargo airplanes are not equipped with collision avoidance devices.

Passenger midair accidents have occurred. In the FAA's 1988 regulatory analysis of TCAS on passenger airplanes, it was noted that during the 15 years before the use of TCAS on airplanes, two midair collisions occurred, each of which involved at least one large air carrier passenger airplane. Accordingly, at that time the rate of 2 MACs per 15 years was used as the estimate of future incidence in the absence of TCAS. By extending the time period to 20 years to coincide with the cost-analysis reference period of this analysis, the rate increased to 2.67. Because there are substantially fewer cargo airplanes than passenger airplanes operating in the United States, a rate of 2.67 defines the upper bound as the rate of MAC involving cargo airplanes. The actual rate is probably substantially less than this upper bound. The FAA has used this figure, however, as a basis for several different methods to approximate the actual risk. These methods include a direct ratio of numbers of aircraft, and proportions of pairs of both cargo aircraft and cargo operations. Taken together, the agency believes that the results of these methods define a reasonable approximation of the range of the actual risk.

In the next 15 years the average number of operating cargo airplanes is projected to be about 1,545, or nearly 50 percent of the average number of passenger airplanes (3,230) that operated between 1973 and 1987. If the MAC risk were solely a function of the number of airplanes, then the cargo MAC risk in the next 15 years could be considered to be 1.0 MAC (50 percent of 2.0). This approximation however is likely to overstate the actual risk, as cargo operations per airplane are lower than that of passenger airplanes. If the ratio of cargo to passenger departures-per-airplane remains roughly that of today (between .33 and .40), then multiplying the value of the departure-per-airplane ratios by 1.0 accidents results in range of .33 to .40 MACs for 15 years, or nearly .44 to .53 MACs over 20 years.

From a slightly different perspective, another approximation can be derived from information on the number of airplane pairs (a collision potential). As the number of years, and as the number of airplane pairs increase, the likelihood of a collision increases. The number of pairs can be calculated for the relevant period.[2] Over the 1973 to 1987 time period, the average annual number of in-service passenger airplanes was approximately 3,230. Over the fifteen-year period 2000 through 2014, the average number of cargo airplanes is projected to be about 1,545. Based upon the assumption that risk is a function of the number of aircraft squared, the estimate of a MAC risk to cargo airplanes not equipped with collision avoidance equipment is estimated as $2.0 * (1{,}545)^2/(3{,}230)^2 = 0.45$ accidents in 15 years, or approximately 0.60 accidents in 20 years.

A different application based on numbers of operations provides an effective lower bound of the likely range of risk for a cargo MAC. Total revenue departures summed from 1974 through 1988 (1973 data are not available) are 79.1 million. For a 15-year period from 2000 through 2014 total cargo airplane departures are assumed for this analysis to grow at a 5 percent annual rate on an estimated base of 645,000 departures in 1999. These total cargo departures sum to 14.6 million. Based upon the assumption that risk is a function of the number of operations squared, the estimate of a cargo MAC is approximated as $2.0 * (14.6)^2/(79.1)^2 = 0.07$ accidents in fifteen years. An additional five years raises this risk to nearly 0.1 accidents.

The above methodologies provide a range from 0.1 to 0.6 mid air collision involving a cargo airplane over twenty years. Admittedly, these models are simplified representations of complex interactions of many other excluded factors such as the time of day, weather, airway congestion, hub concentration, and perhaps pilot error or malfunctioning airplanes. It is clear, regardless of methodology that the risk is low, but it is not zero.

The Poisson probability distribution is often used to analyze rare and random events, and may be useful here. If 0.1 is assumed as the mean of a Poisson distribution, there is a 10 percent chance that there will be one or more mid air collisions involving a cargo airplane during the twenty-year period. If the actual risk rate is 0.6 MACs over 20 years, there is nearly a 50 percent probability that there will be at least one MAC, and slightly more than a 10 percent chance there will be two or more. Such a level of risk is unacceptable.

The benefit sensitivity section will show the potential range of outcomes reflecting the above accident rate variation discussion. For the purpose of the analysis and to ease presentation, the FAA uses a single estimated rate of 0.5 MACs involving a cargo airplane over the next 20 years if they are not equipped with collision avoidance devices.

Risk Reduction—Cargo Airplane Perspective

The following table (Table 4–11 of the MITRE report) shows the MITRE

[2] The number of pairs involving airplanes from the same population (cargo/cargo) can be calculated using the formula: $N = n(n - 1)/2$. For large numbers this formula can be approximated by: $N = nn/2$ for comparisons among different assumptions of the number of airplane pairs involved.

derived pair probabilities conditioned on encounters involving at least one cargo airplane as well as the relevant TCAS risk reduction factors.

RISK REDUCTION FOR CARGO AIRPLANES

	Cargo/cargo	Cargo/GA	Cargo/ passenger	Cargo/ unspecified
Conditional pair probability	0.324	0.174	0.503	1.000
Risk—when cargo is *not* TCAS-equipped	1.000	1.000	0.092	0.544
Risk—when cargo *is* TCAS-equipped	0.023	0.092	0.023	0.035

The current risk to cargo airplanes when they are not TCAS equipped and passenger airplanes are equipped with TCAS II is 0.544 (as compared to the pre-TCAS baseline situation when no airplane was TCAS-equipped). This risk reduction occurs because the equipage of passenger airplanes with TCAS II has already reduced the risk to cargo airplanes. Even though the cargo airplanes are not equipped with TCAS II, the passenger airplanes can see the cargo airplanes on their cockpit displays. This reduces the risk to both passenger and cargo airplanes.

If cargo airplanes were to be TCAS II equipped, this remaining relative risk would drop to 0.035 (as compared to the pre-TCAS baseline situation when no airplane was TCAS-equipped). This results in a comparative risk ratio of 0.035/0.544=0.064, which roughly corresponds to a 94 percent reduction (0.544 ‘‘ 0.035)/.544 = .936) compared to the present risk. In other words, cargo airplanes could experience a reduction in their NMAC risk by about 94 percent as compared to the current risk by installing TCAS II.

Risk Reduction—Passenger Airplane Perspective

For passenger airplanes that already have TCAS II, the perspective is considerably different because the cargo airplanes would represent only a small portion of their potential close encounter traffic. The following table (Table 4–12 in the MITRE study) shows the MITRE derived pair probabilities conditioned on encounters involving at least one passenger airplane as well as the relevant TCAS risk reduction factors.

RISK REDUCTION FOR PASSENGER AIRPLANES

	Passenger/c	Passenger/	Passenger/p	Passenger/u
Conditional pair probability	0.076	0.281	0.643	1.000
Risk—when cargo is not TCAS-equipped	0.092	0.092	0.023	0.070
Risk—when cargo is *not* TCAS-equipped	0.023	0.092	0.023	0.058

Combining these risks in a weighted manner according to the conditional pair probabilities shown in the first row of the above table, the risk to passenger airplanes when cargo airplanes are not TCAS-equipped is reduced by 93 percent to 0.070 (as compared to the pre-TCAS baseline situation when no airplane was TCAS-equipped). If cargo airplanes were to be TCAS-equipped this relative risk would drop to 0.058 (as compared to the pre-TCAS baseline situation when no airplane was TCAS-equipped). This corresponds to a Risk Ratio of 0.058/0.070=0.828, which roughly corresponds to a 17 percent reduction (0.070 ‘‘ 0.058)/0.070 = 0.171) compared to the current risk to passenger airplanes.

The small proportion of encounters involving one passenger and one cargo airplane means that equipping cargo airplanes with TCAS would only reduce the risk to the passenger airplanes by another one percent (reducing the 0.070 risk by 17 percent) beyond the 93 percent already enjoyed through their TCAS equipage. Therefore, the total risk reduction for passenger airplanes from the installation of TCAS II on both passenger and cargo airplanes would be approximately 94%. Coincidentally, this is the same reduction as the risk reduction to cargo aircraft going to TCAS from no TCAS protection. This should be kept in mind to avoid confusion in understanding the following analyses.

Post-TCAS II On Cargo Airplanes Accident Rates

Without TCAS II on all-cargo airplanes, the approximated MAC rate adopted in the previous section, for this analysis, was 0.5 MACs per 20-year period for all-cargo airplanes. The above analysis indicated that the installation of TCAS II on all-cargo airplanes will reduce the risk of all-cargo airplane NMACs by 94 percent. This will reduce the MAC rate for all-cargo airplanes to 0.06×0.5 or 0.03 per 20-year period.

If this rule were implemented, MITRE estimates that passenger airplanes will experience approximately a 17 percent risk reduction, or the risk factor for passenger airplanes will be reduced from 0.07 to 0.058.

One way to make these probabilities more meaningful is through the use of a Poisson probability distribution, a statistical tool often employed to describe rare events. If the factors for cargo airplane midair collisions (0.5 for the cargo fleet without TCAS and 0.03 for the cargo fleet with TCAS) are assumed to be the mean values of the Poisson probability distribution, then those distributions imply that in the absence of this rule there will be a 40 percent chance that one or more midair collisions involving a cargo airplane will occur in the U.S. airspace within the next 20 years. On the other hand, this rule will reduce that likelihood of a midair collision involving cargo airplanes to a 1 percent chance.

If this rule were implemented, MITRE estimates that passenger airplanes will experience approximately a 17 percent risk reduction, or the risk factor for passenger airplanes will be reduced from 0.07 to 0.058. This small reduction in the risk of a passenger and cargo airplane colliding is a direct result of passenger airplanes already being equipped with collision avoidance systems (TCAS II) and because the cargo fleet is much smaller than the passenger fleet. None-the-less, a real reduction in the risk to passenger airplanes occurs when cargo airplanes are equipped with collision avoidance systems.

Risk Assessment Summary

The above calculations are probabilistic estimates and are not precise calculations. These estimates are intended to convey a sense of the reduced MAC risk that will result from this rule. The rule will result in reduced collision risk to all types of airplanes with the greatest risk reduction benefiting cargo airplanes.

Quantifiable Benefits of Collision Avoidance Systems for Air Cargo Airplanes

Introduction

This section quantifies, to the extent possible, the expected dollar benefits of installing CAS on cargo airplanes. The process is to determine the risk of a MAC between different types of airplanes, incorporate the expected number of accidents without the final rule, estimate the cost of potential accidents, and finally estimate the expected loss.

Accidents: Risk

Earlier in the benefits analysis the FAA estimated that the number of cargo airplane MAC's will be 0.5 accidents in a 20 year time period. The risk of a cargo airplane MAC with another airplane depends on the pairs of airplanes present in the same airspace at about the same time and whether such airplanes have a CAS. This section estimates the risk of a cargo airplane MAC with another airplane.

MITRE computes the conditional pair probabilities of three combinations of airplanes that fly in the same U.S. airspace at about the same time. In this case, a conditional pair probability is a pair of airplanes where at least one of the airplanes is a cargo airplane. It is assumed that the risk of a near midair collision (NMAC) is proportional to the pair probabilities. The risk of a NMAC is used rather than the risk of a MAC, because most of the statistical models used in studying the safety of TCAS II were derived from encounter data and not from MAC data. Accordingly, risk reduction estimates from equipping cargo airplanes can be obtained by multiplying the pair probability of each relevant pair by the risk reduction factor associated with collision avoidance equipage.

There are three cargo airplane potential MAC combinations: a cargo airplane and another cargo airplane, a cargo airplane and a general aviation airplane, and a cargo airplane and a passenger airplane. MITRE calculated that the conditional pair probability for two cargo airplanes is 0.324, for a cargo and general aviation airplane, 0.174, and for a cargo and passenger airplane, 0.503 (Row 1 of Table V–1 in the full Regulatory Evaluation).

These conditional pair probabilities are based on cargo airplane proximity with other airplanes. However, passenger airplanes are already equipped with CAS, thereby reducing their risk of a MAC. The cargo/passenger conditional pair probability is multiplied by the MITRE-estimated passenger-equipped CAS risk ratio of 0.092 to obtain the NMAC cargo/passenger conditional risk probability (Row 3 of Table V–1 in the full Regulatory Evaluation). This calculation results in a cargo/passenger NMAC probability of 0.046 and a total NMAC risk of 0.544 for all combinations (Row 3, Column 4 of Table V–1 in the full Regulatory Evaluation). Finally, the percentage of risk by equipment (Row 5) is determined by dividing the conditional pair probabilities (Row 3) by 0.544. Then, given that there is a cargo airplane MAC, approximately 60 percent of these accidents will be with a cargo airplane, 32 percent will be with a general aviation airplane, and 9 percent will be with a passenger airplane.

The expected number of accidents without the final rule has previously been estimated to be 0.5 over the next 20 years. Multiplying this expected number of cargo accidents by the percentage of risk (or probability in Table V–1 in the full Regulatory Evaluation) by equipment results in the expected number of accidents by equipment. Thus the expected number of cargo airplane MAC accidents without this final rule equals 0.298 with another cargo airplane; 0.160 with a general aviation airplane; and 0.043 with a passenger airplane.

Expected Costs of Accidents

The expected costs of a cargo airplane MAC is equal to the probability of such an accident with another airplane multiplied by the value of averted fatalities and equipment, plus the collateral damages. Unlike accidents occurring on an airport, it is assumed that a midair collision will result in fatalities for all passengers and crew, rather than some percentage attributed to various classifications of injuries. The value per averted fatality is estimated to be $3.0 million. This estimate increased from the $2.7 million used in the IRE because the Department of Transportation increased this value for benefit/cost analysis purposes. Cargo airplanes are valued here at $5 million each with 2 crew for each airplane resulting in an estimated benefit of $22 million per averted MAC. An averted cargo airplane MAC with a general aviation airplane is valued at $23.5 million, with the general aviation (GA) airplane valued at $500,000 with one GA pilot and with three GA passengers. Given the wide range of seating for commercial airplanes, herein the FAA uses a representative 150-seat airplane with a 75 percent load factor. With such a passenger airplane valued at $30 million dollars, then an averted midair collision with a cargo airplane is valued at $396.5 million. The expected averted value of a cargo airplane MAC then is the percent of expected accidents by equipment multiplied by the value of the averted accidents, summed for the three possible cases, or approximately $27 million in a 20 year time period.

Collateral damage is the damage on the ground that occurs as a result of a MAC. Collateral damage may be the greatest cost of a MAC. However, the costs of collateral damage are very dependent on where the accident occurs. If the MAC occurs over a relatively unpopulated area, the costs of the collateral damage may be relatively low. However, even in unpopulated areas collateral damage can be serious and costly. For example, collateral damage from a MAC could start a fire with ensuing damage. The FAA assumed a low collateral damage estimate of $1 million, essentially a couple of buildings and no loss of life.

The expected total averted loss equals the sum of expected accident loss by equipment plus the $1 million collateral damage. This estimate is very conservative in not including emergency response and legal/court costs estimated at approximately $120,000 per averted fatality. The total expected loss is approximately $28 million over twenty years. However, operators of approximately 65 percent of the existing cargo fleet have voluntarily equipped their airplanes with TCAS. Therefore, only 35 percent of the fleet will undergo the costs of installing TCAS purely as a result of this rule. Reflecting the voluntary compliance of 65 percent of the air cargo fleet, the total benefit of this rule is reduced to approximately $10 million ($28 million multiplied by .35).

Sensitivity Analysis

The estimated benefit of $10 million is the product of an expected accident rate, the percent of the fleet whose operators have not voluntarily complied, and the expected preventable loss of a midair collision with a cargo airplane and another airplane. As the above discussion just outlined the value of a preventable midair collision is many times greater than $10 million.

This section discusses how sensitive the benefit estimate is to changes in the expected number of accidents.

The above discussion uses a 0.5 expected number of accidents throughout. Earlier in the Pre-TCAS II Accident Rate section the FAA outlined four different methods to establish a reasonable expected number of midair collisions involving a cargo airplane. If the cargo accident rate equaled that of the passenger airplane rate used in the FAA 1988 regulatory analysis of TCAS on passenger airplanes, the expected number of midair collisions involving a cargo airplane was 2.67 accidents over 20 years. The FAA believes that figure is too high, nevertheless 2.67 was the high estimate. The lower bound estimate of 0.1 was based on total cargo departures.

If the accident rate equals 2.67 accidents, instead of 0.5, then the expected benefits increase from $10 million to $53.4 million. On the other hand if the accident rate is 0.1 the expected benefits decrease to $2.0 million.

To further develop the sensitivity range, the expected benefit is based just on a cargo airplane colliding with just one of the three possible airplane types. If the number of expected accidents is 2.67 and the cargo airplane collides with an average passenger airplane, the expected benefit is $370.5 million. If the number of expected accidents are 0.5 and the collision occurs between two cargo airplanes, the expected benefit is $4.9 million. If the expected accidents are 0.1 and the air cargo airplane collides with a general aviation airplane, the expected benefit is $1.1 million.

The sensitivity analysis reveals that various conservative changes to key parameters lower the expected benefits, but these values are relatively close to the base case of $10 million. On the other hand, changing the parameters to the high end of the range results in substantial increases in estimated benefits. Even though the FAA believes the higher estimates are not likely, the decision risk here is not to underestimate key parameters.

Number of Near Mid Air Collisions (NMAC's)

Unfortunately, the risk of a MAC as measured by NMACs has not declined. Table V–2 in the full Regulatory Evaluation shows the reported number of NMAC's involving at least one cargo plane during the ten year period 1992 through 2001. During this period, there has been a total of 28 NMAC's, or about 3 NMAC's per year. The number of NMAC's has ranged from a low of zero in 1993 and 1995 to a high of six in 2001. Six NMAC's is particularly troubling given the most recent MAC and the 1999 NMAC with the DC–10 and L1011 cargo airplanes where an eyewitness said that the airplanes were 50 to 100 feet apart.

Summary of Benefits

This final rule requires that all part 121, 125, and 129 airplanes with a MCTOW greater than 33,000 pounds, operating in the U.S. airspace be equipped with a collision avoidance system. The rule will provide an airspace where virtually all large airplanes are protected by Collision Avoidance Systems which, in turn, reduces the risk of mid-air collisions involving at least one cargo airplane. Further, this reduction in risk could avert an accident with a cost savings many times the greater than the cost of compliance. The recent midair collision in Europe is a sad reminder that reductions in probability and associated benefit estimates pale next to the human and monetary costs of an actual tragedy.

This final rule also responds to a Congressional mandate, responds to the petition for rulemaking from the Independent Pilots Association, responds to NTSB Safety Recommendations, and responds to the hundreds of professional airline pilots who commented on the NPRM requesting that this rule be implemented as soon as possible.

Costs of the Final Rule

Part 121 All-Cargo Operator Costs

The estimated part 121 cargo operator compliance costs include equipment, installation, additional maintenance and operating costs, and pilot training costs. After reviewing the information received from manufacturers and carriers, the FAA concluded that the original unit cost data used in the NPRM are still valid. However, since the NPRM was published, the affected fleet has changed and in the final rule the FAA extended and revised the compliance date from 3 years to an estimated 2 years October 31, 2003, to December 31, 2004. Therefore, the total cost of the final rule differs from that of the NPRM because of the change in the number of affected airplanes and the reduction in the compliance time.

The three TCAS II manufacturers reported that the average cost of TCAS II elements, as described above, for a transport category cargo airplane is between $130,000 and $200,000. One company indicated that if purchased in quantity, the cost of a TCAS II system would be between $80,000 to $145,000 per airplane. The manufacturers also estimated that it would cost between $50,000 and $70,000 (depending upon the specific airplane model) to install a TCAS II unit on an existing airplane. This resulted in a possible range of prices for a TCAS II system installed in an existing airplane of $130,000 to $270,000, or an average of $200,000. The actual price would depend on a number of factors, including: (1) The type of unit installed, (2) the number of units ordered, and (3) whether or not it was necessary to include a display unit in the purchase price. Some airplanes may not need a separate TCAS display unit because the TCAS information can be displayed on an airplane's existing EFIS (Electronic Flight Information Display System).

Based on these reported costs, for cost calculating purposes, the FAA used $211,000 for the initial costs of installing a TCAS II system into an existing airplane. This figure is estimated to include the necessary spare parts inventory.

To calculate the total discounted present value of the compliance costs of this final rule, the FAA assumed that, given a 2-year time period to install TCAS for the first time, the cargo air carrier would minimize its airplane's time out-of-service by installing TCAS II during a regularly scheduled major maintenance (C or D) check. The FAA further assumed that equipping the total existing air cargo fleet would be spread evenly over the entire 2-year compliance period due to potential maintenance scheduling conflicts and potential maintenance personnel overtime if every cargo air carrier were to try to schedule this installation in year 2. The FAA estimates that the undiscounted initial capital costs of retrofitting the existing part 121 turbine-powered all-cargo fleet with TCAS II will be approximately $67,000,000.

The three TCAS II manufacturers reported that the TCAS II element costs would be identical for new and for existing airplanes. The FAA estimates that the initial (equipment plus installation) cost per newly manufactured cargo part 121 turbine-powered airplane will be $171,000.

Based on 80 newly manufactured cargo airplane purchases over the 20-year analysis period, the FAA has estimated that the total non-discounted initial costs for purchasing and installing TCAS II in newly manufactured part 121 turbine-powered cargo airplanes will be approximately $14 million.

In addition to the initial costs of the TCAS II units, the air carriers will also incur annual operation and maintenance (O&M) expenses. The FAA estimates the annual O&M expenses for TCAS II units to be $1 per flight hour. Based on an estimated utilization rate of 2,000 hours per airplane per year, and the fleet flight hours estimated in the Regulatory Evaluation, the FAA estimates that the total non-discounted O&M expenses for the existing fleet will be approximately $12,000,000 and $2,000,000 for the newly manufactured fleet.

The TCAS II equipment will increase the airplane's weight and, thereby, will increase the airplane's annual fuel costs to transport the additional weight. The FAA estimates that the incremental fuel costs resulting in the weight added by the TCAS II system will be approximately $0.36 per flight hour. This results in a total non-discounted incremental fuel cost of approximately $4,000,000 for the existing fleet and $605,000 for the newly manufactured fleet.

Air cargo flight crewmembers who have not trained on TCAS II will need such training to obtain the necessary knowledge, skills, and abilities to safely conduct operations in a TCAS II environment. The FAA estimates that the cost of pilot training will be approximately 0.05 times the cost of the TCAS unit itself. This results in a training cost of approximately $7,000 per unit per year. The total non-discounted cost of pilot training, for the 20-year analysis period, is estimated to be approximately $43,000,000 for the existing fleet and $6,000,000 for newly manufactured cargo airplanes.

The FAA estimates that the total undiscounted TCAS II costs of the final rule, for the existing part 121 turbine-powered all-cargo fleet, during the 20-year analysis period, will be approximately $127,000,000. We also estimate that the discounted present value of the total costs of the final rule, for the existing part 121 turbine-powered all-cargo fleet over the next 20 years, will be approximately $92,000,000.

The FAA estimates that the total undiscounted TCAS II costs of the final rule, for the newly manufactured part 121 turbine-powered all-cargo fleet, during the 20-year analysis period, will be approximately $22,000,000. We also estimate that the discounted present value of the total costs of the final rule, for the newly manufactured fleet over the next 20 years, will be approximately $11,000,000.

Thus, the FAA estimates that the total undiscounted costs of the final rule for the existing and future manufactured part 121 turbine-powered all-cargo fleet, during the 20-year analysis period, will be approximately $149,000,000. The discounted present value of the total costs of this portion of the final rule over the next 20 years will be approximately $102,000,000.

The final rule requires the installation of TCAS I, (or equivalent), on all part 121 piston-powered cargo airplanes with a MCTOW greater than 33,000 lbs. The FAA estimates that the total initial and installation costs of TCAS I on an existing part 121 cargo piston-powered airplane would be approximately $75,000. This figure is estimated to include the necessary spare parts inventory.

To calculate the total discounted present value of the compliance costs of the final rule, the FAA assumed that, given the 2-year time period to retrofit TCAS I equipment, the cargo air carrier would minimize its airplane's time out-of-service by installing TCAS I during a regularly scheduled major maintenance (C or D) check. The FAA further assumed that equipping the total air cargo fleet would be spread evenly over the entire 2-year compliance period due to potential maintenance scheduling conflicts and potential maintenance personnel overtime if every cargo air carrier were to try to schedule this installation in year 2. The FAA estimates that the undiscounted initial costs of retrofitting the existing part 121 piston-powered all-cargo fleet greater than 33,000 lbs. MCTOW with TCAS I will be approximately $2,000,000. In addition to the capital costs of the TCAS I units, the air carriers will also incur annual O&M expenses. The FAA estimates that the annual O&M expenses for TCAS I units to be $1 per flight hour. Based on an estimated utilization rate of 2,000 hours per airplane per year, the FAA estimates that the total non-discounted O&M expenses for the existing fleet will be approximately $1,000,000.

The TCAS I equipment will increase the airplane's weight and, thereby, will increase the airplane's annual fuel costs just to transport the additional weight. The FAA estimates that the incremental fuel costs resulting in the weight added by the TCAS I system will be approximately $0.36 per flight hour, based on the weight of TCAS II. This results in a total non-discounted incremental fuel cost of approximately $365,000 for the existing fleet.

Air cargo flight crewmembers who have not trained on TCAS I will need such training in order to obtain the necessary knowledge, skills, and abilities to safely conduct operations in a TCAS I environment.

The FAA estimates that the cost of pilot training will be approximately 0.05 times the cost of the TCAS unit itself. This results in a training cost of approximately $3,800 per unit per year. The total non-discounted cost of pilot training for the 20-year analysis period is estimated to be approximately $3,500,000 for the existing fleet.

The FAA estimates that the total undiscounted TCAS I costs of the final rule, for the existing part 121 piston-powered all-cargo fleet during the 20-year analysis period, will be approximately $7,000,000. The discounted present value of the total costs of the final rule for the existing fleet over the next 20 years will be approximately $4,000,000.

It is anticipated that the existing part 121 fleet that will require TCAS I installation as a result of this final rule will not change in the study period. Therefore, the FAA does not expect additional costs.

The FAA estimates that the total undiscounted costs of the final rule for the part 121 all-cargo fleet, during the 20-year analysis period, will be approximately $156,000,000. The discounted present value of the total costs of the final rule for part 121 all-cargo carriers over the next 20 years will be approximately $107,000,000.

Part 125 All-Cargo Commercial Operator Costs

Part 125 all-cargo operators compliance costs and methodology are the same as those used to develop the cost estimates for part 121 all-cargo operators. For the 25 part 125 airplanes requiring TCAS II (or equivalent) as a result of this rule, the total estimated cost is approximately $10 million with a present value of approximately $7 million. For the 27 part 125 airplanes requiring TCAS I (or equivalent) as a result of this rule, the total estimated cost is $5 million with a present value cost approximately equal to $4 million.

It is anticipated that no additional newly manufactured airplanes will be produced for part 125 commercial operators in the 20-year study period. Therefore, no additional compliance cost for newly manufactured airplanes is anticipated for part 125 operations.

The total non-discounted compliance costs of collision avoidance system requirements for the part 125 operators are estimated to be approximately $15,000,000. The corresponding present value costs are estimated to be approximately $11,000,000.

Total Incremental Costs of the Final Rule

The total non-discounted estimated compliance costs of collision avoidance system installations on part 121 all-cargo airplanes and part 125 all-cargo commercial operators, over the next 20 years, are estimated to be approximately $172,000,000. The corresponding present value costs are estimated to be approximately $118,000,000.

Benefits and Costs Comparison

The installation and use of TCAS for cargo airplanes is projected to reduce the probability of a cargo airplane MAC by 94% and a cargo/passenger MAC by 17%. To obtain this benefit will cost operators slightly under $118 million in present value terms over 20 years.

A 20 percent chance of a midair collision involving a cargo airplane can result in accident values from under $10 million to hundreds of millions of dollars. In the least costly case, a cargo airplane could have a midair collision with a general aviation airplane with no collateral damage. If a midair collision occurs over Los Angeles, San Diego, and other metropolitan areas, significant collateral damage can easily exceed hundreds of millions of dollars. MITRE estimated slightly more than 50 percent of all midair collisions are expected to occur over the suburbs or cities. With no collateral damage a collision with a large passenger airplane can result in costs well more than $300 million. The worst MAC occurred in 1996 with 349 fatalities. Preventing such an accident is worth over a billion dollars.

The benefits of the final rule of the proposed rule equal approximately $10,000,000. This benefit estimate is based upon avoiding a statistical 0.5 air cargo airplane midair collision with another airplane. If the expected number of accidents is reduced to 0.1 avoided midair collisions, then the estimated benefits decline to $1.1 million. Even though expected benefits are expressed in fractions of a preventable accident, a midair collision involves *two* airplanes with *no* survivors. If an accident does occur the benefits can easily exceed the cost of this rule.

Despite the estimated dollar benefits being less than the estimated costs, the FAA believes the qualitative benefits justify the costs. The facts are that collision avoidance devices have prevented MACs and that midair collisions with cargo airplanes have occurred. This final rule will help to reduce the risk of MACs and NMACs. This risk includes six NMACs in 2001, one NMAC of less than 100 feet in 1999 and now two MACs involving cargo and passenger airplanes. Given these circumstances it is not surprising there is substantial favorable public interest in this rule. This final rule responds to a Congressional mandate, responds to the petition for rulemaking from the Independent Pilots Association, and responds to NTSB safety recommendations. Hundreds of professional airline pilots who commented on the NPRM requested that this rule be implemented as soon as possible. Much of the air cargo fleet is already in compliance with the rule by voluntary action by the carriers and most of the remaining air cargo fleet is scheduled to be in compliance by December 31, 2004.

Therefore, the FAA believes that the benefits of this proposed rulemaking justify the projected costs.

Final Regulatory Flexibility Analysis

Introduction and Purpose of This Analysis

The Regulatory Flexibility Act of 1980 (RFA) establishes ''* * * as a principle of regulatory issuance that agencies shall endeavor, consistent with the objective of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the business, organizations, and governmental jurisdictions subject to regulation.'' To achieve that principle, the RFA requires agencies to solicit and consider flexible regulatory proposals and to explain the rationale for their actions. The RFA covers a wide range of small entities, including small businesses, not-for-profit organizations, and small governmental jurisdictions.

Agencies must perform a review to determine whether a proposed or final rule will have a ''significant economic impact on a substantial number of small entities.'' If the determination is that it will, the agency must prepare a regulatory flexibility analysis as described in the RFA.

The FAA determined that this proposal results in a significant economic impact on a substantial number of small entities. The purpose of this analysis is to ensure that the agency has considered all reasonable regulatory alternatives that will minimize the rule's economic burdens for affected small entities, while achieving its safety objectives.

Reasons for the Rule

The Traffic Alert and Collision Avoidance System (TCAS) was developed to minimize the possibility of a midair collision by providing an on-board safety back-up system that operates independently of the air traffic control (ATC) system. Beginning December 30, 1990, in the United States, a TCAS II system was required in certain part 121, 125 and 129 airplanes with more than 30 passenger seats. After December 31, 1995, a TCAS I system was required in all part 121 airplanes with 10 to 30 passenger seats. Cargo airplanes were not covered.

This rule is being promulgated because the FAA believes that the risk of midair collisions and potential collateral damage after a collision involving a cargo airplane is too high and that this rule, if implemented, will reduce this risk. In addition, the 106th Congress enacted Pub. L. 106–18 that directs the FAA Administrator to require, in part, that certain cargo airplanes be equipped with collision avoidance technology by December 31, 2002. The law provides for an extension of up to 2 years.

Significant Issues Raised by the Public Comments in Response to the IRFA

There were no public comments that directly addressed the IRFA. However, a comment was made by a small entity. This comments is reproduced below.

USA Jet Airlines, said, in part, ''Further, it is our position that a rash of mechanical and software technologies are becoming foisted upon aircraft without regard to fleet size, aircraft age or the existence of satisfactory equipment already on the aircraft. For example, in the next 3 years alone, a DC–9 and Falcon operator will, under proposed rules/regulations and existing rules/regulations pay $250,000 per aircraft for TCAS II, $125,000 per aircraft for the Terrain Awareness Warning System (TAWS) and a significant sum for the Domestic RVSM system being discussed by the FAA. We have not seen any indication of a need for these systems in the all-cargo industry.

While certainly any of these proposals have merit in that they each seek a positive goal, the cost of the implementation of all systems, precludes their very implementation for many carriers.''

Several other individual respondents also expressed a concern about the cost of the proposed regulation. Some small entities expressed a desire for more time to implement the final rule. One of these small entities requested at least a five-year compliance period. Another commenter said this rule will put small firms out of business.

The FAA considers that these comment are reasonable for small firms. However, because the final rule is a Congressional Mandate, the FAA has little flexibility in changing the final rule. However, the FAA did reduce the TCAS requirement from TCAS II to TCAS I for piston-powered airplanes because the FAA does not believe that piston-powered airplanes have the necessary performance to respond to RAs. In addition, the FAA eliminated the requirement, in the NPRM, for TCAS I in turbine-powered airplanes of less than 33,000 pounds MCTOW. The FAA also set the rule's compliance date at the latest date allowed by the Congressional Mandate.

Number and Types of Small Entities Impacted

Under the RFA, the FAA must determine whether or not a final rule significantly affects a substantial number of small entities. This determination is typically based on small entity size and cost thresholds that vary depending on the affected industry. The Small Business Administration (SBA) size standards are shown on their Web site *(http://www.sba.gov)* and are based on the North American Industry Classification (NAICS).

Entities potentially affected by the final rule include: scheduled freight air transportation (NAICS Subsector 481112) and nonscheduled chartered air transportation (NAICS Subsector 481212). The FAA used a guideline of 1,500 employees or less per firm as the criteria for the determination of a small business. This corresponds with the SBA's definition of a small business in these areas. It should be noted that the IRE used the SIC (Standard Industrial Classification) numbers to determine the size of a small business. However, the SIC has been replaced by the NAICS. In spite of this the size of a small business has remained the same, at 1,500 or less employees.

To determine which entities will be affected, the FAA segmented the various types of firms into four groups as follows:

1. Part 121 all-cargo air carriers operating turbine-powered airplanes with a MCTOW greater than 33,000 pounds. This definition was the same in the IRE and the FRE. There are 24 firms in Group 1.

2. Part 121 all-cargo air carriers operating turbine-powered airplanes of 33,000 pounds or less MCTOW and piston-powered airplanes regardless of weight. IRE)

As a result of the change in the rule from the NPRM, the definition of Group 2 changed to: Part 121 all-cargo air carriers operating piston-powered airplanes greater than 33,000 pounds MCTOW in the FRE.

There are 7 firms in Group 2.

3. Part 125 all-cargo commercial operators who fly turbine-powered airplanes with a MCTOW greater than 33,000 pounds. This definition was the same in the IRE and the FRE. There are 7 firms in Group 3.

4. Part 125 all-cargo commercial operators flying turbine-powered airplanes of 33,000 pounds or less MCTOW and piston-powered airplanes regardless of weight. (IRE)

As a result of the change in the rule from the NPRM, the definition of Group 4 changed to: Part 125 all-cargo air carriers operating piston-powered airplanes greater than 33,000 pounds MCTOW in the FRE.

There are 14 firms in Group 4.

For simplicity these entities will be referred to as Group 1, 2, 3, or 4 in the remainder of this study.

It should be noted that Groups 1 and 3 have the same definition in both the IRE and the FRE. However, the rule was modified between the NPRM and the Final Rule. The major change in the rule was the elimination of all airplanes with a MCTOW less than 33,000 pounds. Therefore, the definition of Groups 2 and 4 changed, as shown above. Groups 2 and 4 now contain only piston-powered airplanes with a MCTOW greater than 33,000 pounds. If the number of Group 2 and Group 4 small entities had remained the same between the IRE and the FRE the change in the rule would have eliminated thirteen Group 2 small entities and two Group 4 small entities. In practice, however, the combination of the change in the rule and other factors changed the number of small entities in each group.

Projected Reporting, Recordkeeping and Other Compliance Requirements of the Rule

The final rule does not add any specific projected reporting, record keeping, and other requirements.

Steps the Agency Has Taken To Minimize the Significant Economic Impact on Small Entities

FAA potentially reduced the economic impact on small entities in two ways. First, the FAA eliminated the NPRM TCAS1 requirement for turbine-powered airplanes with a MCTOW less than 33,000 pounds. Second, instead of a TCAS II requirement for piston-powered airplanes with a MCTOW greater than 33,000 pounds, the FAA required the use of TCAS I. The FAA determined that piston-powered airplanes of this weight lacked the performance to respond to TCAC II RAs. TCAS I cost less than TCASII. As small entities tend to be the primary operators of these airplanes, these two FAA actions are expected to benefit small entities.

Finally, the FAA allowed the maximum amount of time for compliance that the Congressional Mandate allowed.

Cost and Affordability for Small Entities

The FAA estimated the financial impact on Group 1 small entities in two steps. First, the FAA multiplied a compliance cost of $223,000 cost per airplane by the operator's fleet size to obtain an operator estimated one-year cost of this rulemaking. Then the FAA calculated an affordability measure by dividing this cost by the operator's 2001 (parent company) revenues. As 2 percent is often less than the annual rate-of-inflation, the FAA believes that a compliance cost of 2 percent or less is affordable.

Group 1 consists of 24 firms that qualify as small entities (see Table XI–1 in the full Regulatory Evaluation). Financial data was available for all but one of these firms. Two of these firms had recently or were emerging from Chapter 11 bankruptcy and were not included in the financial analysis. Seven of the Group 1 firms incur no financial impact because they did not operate aircraft that would be required to have TCAS. The remaining 14 firms 1 had compliance costs as a percentage of revenue ranging from 0.8% to 38.2%. Eleven of these firms are negatively impacted by the rule because their compliance cost as a percentage of revenue is 2 percent or greater. Of the 11 firms with a value above 2% for the ratio the percentage ranges from 2.9 percent to 38.2 percent.

In a similar fashion, the FAA estimated the impact on Group 2 small entities in two steps. In an effort to raise the safety standard and to minimize the impact on small firms, for firms in Group 2, the FAA proposed requirements are expected to be met by an investment of $82,000. For the first step, the FAA multiplied the cost per airplane of $82,000 by the operator's fleet size to obtain the estimated one-year compliance cost of this rulemaking for each operator. This estimated operator compliance cost is then divided by the operator's 2001 (parent company) revenues. This ratio provides a measure of affordability.

Group 2 consists of a total of 7 firms (Table XI–2 in the full Regulatory Evaluation) that qualified as small businesses, based on the criteria of 1,500 employees per firm. Financial data was available for all but one of these firms. The financial data indicated that five of the six firms were adversely impacted by this final rule. The value of this ratio of cost per revenue is 2 percent or less for 1 of the 7 Group 2 firms. For the remaining Group 2 firms the value of this ratio ranged from 2.2 percent to 9.4 percent.

The FAA estimates that for the firm with no public financial data available was also adversely affected by the rule. Therefore, the FAA estimates that six of the Group 2 firms were adversely affected by the final rule.

The FAA estimated the financial impact on Group 3 entities using the same methodology as that for Group 1. Group 3 consists of 7 firms (Table XI–3 in the full Regulatory Evaluation) that qualified as small entities. Financial data was available for two of the seven Group 3 firms. Neither of the two firms had a value of this ratio of less than 2%. The two firms had ratio values ranging from 5.9 percent to 25.5 percent. In both cases the financial data indicated that the firms will be adversely affected by the final rule. Therefore, the FAA estimates that all seven firms will be adversely impacted.

The FAA estimated the financial impact on Group 4 entities using the same methodology as that used for Group 2. Group 4 consists of 14 firms (Table XI–4 in the full Regulatory Evaluation) that qualified as small entities. Financial data was available for four of these fourteen 4 firms. One of the four firms had a value of this ratio of less than 2%. The remaining three firms had ratio values ranging from 10.9 percent to 32.8 percent. The FAA estimates that 13 of the 14 Group 4 firms will be adversely affected by the final rule.

Of the 33 firms considered to be small, and for which information was available, over 36 percent are estimated to have costs less than 2 percent of annual revenue. For these firms the FAA believes compliance is affordable. For the remaining 64 percent of the firms the FAA estimates that there will be a significant, negative economic impact.

Competitive Analysis

Nearly all of the firms considered to be small entities and with an affordability measure greater than 2 percent appear to operate in markets with little or no competition. These markets require very specialized service such as remote air delivery service. Of the 31 part 121 only two were headquartered in the same city and most were located in remote locations. All of the part 125 operators, by regulation, provide non-competitive services. Part 125 operators are restricted from offering for-hire services to the public, such as advertising or marketing. To provide for-hire services, these operators must, in effect, have the customer find them. Thus in terms of competition, this rulemaking is expected to have a minimal competitive impact.

Disproportionality Analysis

Relative to larger air cargo operators, smaller air cargo operators are likely to be disproportionately impacted by this rulemaking. Large cargo carriers' cost is a smaller percentage of their annual revenue, than those of the smaller cargo carriers.

Business Closure Analysis

Seven firms have an extremely high compliance cost per annual revenue ratios (compliance cost greater than 10% of annual revenue). Some or even many of these firms could potentially face a business closure due to this final rulemaking. The FAA does not have sufficient information to provide a more refined estimate of the potential business closures.

Analysis of Alternatives

The FAA acknowledges that the rule is likely to have a significant economic impact on a substantial number of small entities. For the final rule the FAA changed the NPRM requirements in way that may benefit small entities. The agency considered various four alternatives for the final rule. These alternatives are:

1. Issue the rule as proposed in the NPRM.
2. Exclude small entities.
3. Extend compliance deadline for small entities.
4. Establish lesser technical requirements for small entities.

Based upon safety considerations the FAA concludes that the option to exclude small entities from all the requirements of the final rule is not justified.

The FAA considered options that will lengthen the compliance period for small operators. The FAA believes that the compliance requirement will place only a modest burden on small entities. Small entities will have 2 years from the effective date of the rule to complete installation work. Further time extensions only provide modest cost savings and leave the system safety at risk. In addition, the Congressional Mandate does not provide for a time extension beyond December 31, 2004.

The FAA considered establishing lesser technical requirements for small entities. However, the FAA believes that this will result in a lower level of safety than will the implementation of the final rule. The FAA believes that the greatest safety benefits will come from a common collision avoidance system for all operators who fly in the same airspace under the same operating environment.

In contrast to the NPRM, the FAA eliminated the CAS requirement for the owners of turbine-powered airplanes weighing less than 33,000 MCTOW. Operators of these airplanes tend to be small entities.

The FAA considered alternatives that would lessen the economic burden to small entities and achieve the needed safety objectives. To that end the FAA removed the CAS requirement for turbine-powered airplanes weighing less than 33,000 MCTOW and the required only TCASI for piston-powered airplanes. Given the real safety concerns and the Congressional mandate, the FAA worked hard to provide additional flexibility to small entities and provide the safe operating environment expected.

International Trade Impact Analysis

The Trade Agreement Act of 1979 prohibits Federal agencies from engaging in any standards or related activities that create unnecessary obstacles to the foreign commerce of the United States. Legitimate domestic objectives, such as safety, are not considered unnecessary obstacles. The statute also requires consideration of international standards and where appropriate, that they be the basis for U.S. standards. In addition, consistent with the Administration's belief in the general superiority and desirability of free trade, it is the policy of the Administration to remove or diminish to the extent feasible, barriers to international trade, including both barriers affecting the export of American goods and services to foreign countries and barriers affecting the import of foreign goods and services into the United States.

In accordance with the above statute and policy, the FAA has assessed the potential affect of this final rule and has determined it uses international standards as the basis for U.S. standards. Thus this final rule is in accord with the Trade Agreement Act.

Unfunded Mandates Assessment

Title II of the Unfunded Mandates Reform Act of 1995 (the Act), codified in 2 U.S.C. 1501–1571, requires each Federal agency, to the extent permitted by law, to prepare a written assessment of the effects of any Federal mandate in a proposed or final agency rule that may result in the expenditure by State, local, and tribal governments, in the aggregate, or by the private sector, of $100 million or more (adjusted annually for inflation) in any one year. Section 204(a) of the Act, 2 U.S.C. 1534(a), requires the

Federal agency to develop an effective process to permit timely input by elected officers (or their designees) of State, local, and tribal governments on a proposed "significant intergovernmental mandate." A "significant intergovernmental mandate" under the Act is any provision in a Federal agency regulation that will impose an enforceable duty upon State, local, and tribal governments, in the aggregate, of $100 million (adjusted annually for inflation) in any one year. Section 203 of the Act, 2 U.S.C. 1533, which supplements section 204(a), provides that before establishing any regulatory requirements that might significantly or uniquely affect small governments, the agency shall have developed a plan that, among other things, provides for notice to potentially affected small governments, if any, and for a meaningful and timely opportunity to provide input in the development of regulatory proposals.

This final rule does not contain a Federal intergovernmental or private sector mandate that exceeds $100 million in any 1 year.

Executive Order 13132, Federalism

The FAA has analyzed this final rule under the principles and criteria of Executive Order 13132, Federalism. We determined that this action will not have a substantial direct effect on the States, or the relationship between the national Government and the States, or on the distribution of power and responsibilities among the various levels of government. Therefore, we determined that this final rule does not have federalism implications.

Environmental Analysis

FAA Order 1050.1D defines FAA actions that may be categorically excluded from preparation of a National Environmental Policy Act (NEPA) environmental impact statement. In accordance with FAA Order 1050.1D, appendix 4, paragraph 4(j), this rulemaking action qualifies for a categorical exclusion.

Energy Impact

The energy impact of this rule has been assessed in accordance with the Energy Policy and Conservation Act (EPCA) Public Law 94–163, as amended (42 U.S.C. 6362) and FAA Order 1053.1. It has been determined that the final rule is not a major regulatory action under the provisions of the EPCA.

List of Subjects

14 CFR Part 121

Air carriers, Aircraft, Airmen, Aviation safety, Charter flights, Reporting and recordkeeping requirements, Safety, Transportation.

14 CFR Part 125

Aircraft, Airmen, Aviation safety, Reporting and recordkeeping requirements.

14 CFR Part 129

Air carriers, Aircraft, Aviation safety, Reporting and recordkeeping requirements, Security measures.

The Amendment

■ In consideration of the foregoing, the Federal Aviation Administration amends Chapter I of Title 14, Code of Federal Regulations as follows:

PART 121—OPERATING REQUIREMENTS: DOMESTIC, FLAG, AND SUPPLEMENTAL OPERATIONS

■ 1. The authority citation for part 121 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 40119, 41706, 44101, 44701–44702, 44705, 44709–44711, 44713, 44716–44717, 44722, 4901, 44903–44904, 44912, 46105.

■ 2. In § 121.356, revise the section heading and add paragraph (d) to read as follows, effective on May 1, 2003:

§ 121.356 Collision avoidance system.

* * * * *

(d) Effective May 1, 2003, if TCAS II is installed in an airplane for the first time after April 30, 2003, and before January 1, 2005, no person may operate that airplane without TCAS II that meets TSO C–119b (version 7.0), or a later version.

■ 3. Revise § 121.356 to read as follows, effective January 1, 2005:

§ 121.356 Collision avoidance system.

Effective January 1, 2005, any airplane you operate under this part must be equipped and operated according to the following table:

COLLISION AVOIDANCE SYSTEMS

If you operate any—	Then you must operate that airplane with—
(a) Turbine-powered airplane of more than 33,000 pounds maximum certificated takeoff weight.	(1) An appropriate class of Mode S transponder that meets Technical Standard Order (TSO) C–112, or a later version, and one of the following approved units: (i) TCAS II that meets TSO C–119b (version 7.0), or takeoff weight a later version. (ii) TCAS II that meets TSO C–119a (version 6.04A Enhanced) that was installed in that airplane before May 1, 2003. If that TCAS II version 6.04A Enhanced no longer can be repaired to TSO C–119a standards, it must be replaced with a TCAS II that meets TSO C–119b (version 7.0), or a later version. (iii) A collision avoidance system equivalent to TSO C–119b (version 7.0), or a later version, capable of coordinating with units that meet TSO C–119a (version 6.04A Enhanced), or a later version.
(b) Passenger or combination cargo/passenger (combi) airplane that has a passenger seat configuration of 10–30 seats.	(1) TCAS I that meets TSO C–118, or a later version, or (2) A collision avoidance system equivalent to has a TSO C–118, or a later version, or (3) A collision avoidance system and Mode S transponder that meet paragraph (a)(1) of this section.
(c) Piston-powered airplane of more than 33,000 pounds maximum certificated takeoff weight.	(1) TCAS I that meets TSO C–118, or a later version, or (2) A collision avoidance system equivalent to maximum TSO C–118, or a later version, or (3) A collision avoidance system and Mode S transponder that meet paragraph (a)(1) of this section.

PART 125—CERTIFICATION AND OPERATIONS: AIRPLANES HAVING A SEATING CAPACITY OF 20 OR MORE PASSENGERS OR A MAXIMUM PAYLOAD CAPACITY OF 6,000 POUNDS OR MORE; AND RULES GOVERNING PERSONS ON BOARD SUCH AIRCRAFT

■ 4. The authority citation for part 125 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701–44702, 44705, 44710–44711, 44713, 44716–44717, 44722.

■ 5. In § 125.224, revise the section heading and add paragraph (c) to read as follows, effective on May 1, 2003:

§ 125.224 Collision avoidance system.

* * * * *

(c) Effective May 1, 2003, if TCAS II is installed in an airplane for the first time after April 30, 2003, and before January 1, 2005, no person may operate that airplane without TCAS II that meets TSO C–119b (version 7.0), or a later version.

■ 6. Revise § 125.224 to read as follows, effective January 1, 2005:

§ 125.224 Collision avoidance system.

Effective January 1, 2005, any airplane you operate under this part 125 must be equipped and operated according to the following table:

COLLISION AVOIDANCE SYSTEMS

If you operate any . . .	Then you must operate that airplane with:
(a) Turbine-powered airplane of more than 33,000 pounds maximum certificated takeoff weight.	(1) An appropriate class of Mode S transponder that meets Technical Standard Order (TSO) C–112, or a later version, and one of the following approved units: (i) TCAS II that meets TSO C–119b (version 7.0), or a later version. (ii) TCAS II that meets TSO C–119a (version 6.04A Enhanced) that was installed in that airplane before May 1, 2003. If that TCAS II version 6.04A Enhanced no longer can be repaired to TSO C–119a standards, it must be replaced with a TCAS II that meets TSO C–119b (version 7.0), or a later version. (iii) A collision avoidance system equivalent to TSO C–119b (version 7.0), or a later version, capable of coordinating with units that meet TSO C–119a (version 6.04A Enhanced), or a later version.
(b) Piston-powered airplane of more than 33,000 pounds maximum certificated takeoff weight.	(1) TCAS I that meets TSO C–118, or a later version, or (2) A collision avoidance system equivalent to TSO C–118, or a later version, or (1)(3) A collision avoidance system and Mode S transponder that meet paragraph (a)(1) of this section.

PART 129—OPERATIONS: FOREIGN AIR CARRIERS AND FOREIGN OPERATORS OF U.S.-REGISTERED AIRCRAFT ENGAGED IN COMMON CARRIAGE

■ 7. The authority citation for part 129 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40104–40105, 40113, 40119, 41706, 44701–44702, 44712, 44716–44717, 44722, 44901–44904, 44906.

■ 8. In § 129.18, revise the section heading and add paragraph (c) to read as follows, effective on May 1, 2003:

§ 129.18 Collision avoidance system.

* * * * *

(c) Effective May 1, 2003, if TCAS II is installed in an airplane for the first time after April 30, 2003, and before January 1, 2005, no foreign air carrier may operate that airplane without TCAS II that meets TSO C–119b (version 7.0), or a later version.

■ 9. Revise § 129.18 to read as follows, effective January 1, 2005:

Effective January 1, 2005, any airplane you, as a foreign air carrier, operate under part 129 must be equipped and operated according to the following table:

COLLISION AVOIDANCE SYSTEMS

If you operate in the United States any . . .	Then you must operate that airplane with:
(a) Turbine-powered airplane of more than 33,000 pounds maximum certificated takeoff weight.	(1) An appropriate class of Mode S transponder that meets Technical Standard Order (TSO) C–112, or a later version, and one of the followign approved units; (i) TCAS II that meets TSO C–119b (version 7.0), or takeoff weight a later version. (ii) TCAS II that meets TSO C–119a (version 6.04A Enhanced) that was installed in that airplane before May 1, 2003. If that TCAS II version 6.04A Enhanced no longer can be repaired to TSO C–119a standards, it must be replaced with a TCAS II that meets TSO C–119b (version 7.0), or a later version. (iii) A collision avoidance system equivalent to TSO C–119b (version 7.0), or a later version, capable of coordinating with units that meet TSO C–119a (version 6.04A Enhanced), or a later version.
(b) Turbine-powered airplane with a passenger-seat configuration, excluding any pilot seat, or 10–30 seats.	(1) TCAS I that meets TSO C–118, or a later version, or (2) A collision avoidance system equivalent to excluding any TSO C–118, or a later version, or (3) A collision avoidance system and Mode S transponder that meet paragraph (a)(1) of this section.

Issued in Washington, DC, on March 24, 2003.

Marion C. Blakey,

Administrator.

[FR Doc. 03–7653 Filed 3–31–03; 8:45 am]

BILLING CODE 4910–13–P