FINAL REGULATORY EVALUATION, FINAL REGULATORYFLEXIBILITY DETERMINATION, AND TRADE IMPACT ASSESSMENT

COLLISION AVOIDANCE SYSTEMS FOR CARGO AND ALL NEWLY MANUFACTURED AIRPLANES

(TITLE 14 CFR PARTS 121, 125, AND 129)

OFFICE OF AVIATION POLICY AND PLANS
REGULATORY ANALYSIS DIVISION

GEORGE A. EURING, JR.

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EXECUTIVE SUMMARY

This regulatory evaluation examines the economic impacts of a notice of final rulemaking to require part 121 and 125 operators to install and use a collision avoidance system by December 31, 2004, on certain airplanes. In addition, this rule requires that all affected airplanes manufactured after the compliance date of the Final Rule and required by this Final Rule to be operated with TCAS II, must be operated with TCAS II, meeting TSO (Technical Standard Order) C-119b (Version 7.0), or equivalent. Although the final rule applies to part 129 carriers, the economic impacts on part 129 carriers are not studied because part 129 applies to foreign carriers.

The expected benefit of this rule is a reduction in the risk of midair collisions involving at least one airplane primarily used to transport cargo. Fortunately, the risk of midair collisions for part 121, part 125 and part 129 operators is very small; not one has occurred, in U.S. airspace, since the issuance of the 1989 original rule requiring TCAS in passenger air carrier airplanes. Unfortunately, the risk of a midair collision involving cargo airplanes is higher than that of commercial passenger airplanes and such a collision could involve a passenger airplane.

Operators of existing and newly manufactured all-cargo airplanes would incur the cost of the final rule. Over a 20-year horizon the present value total cost of the final rule is projected to be $118 million.

The costs are broken down as follows in millions of dollars:

	TCAS II	TCAS I	Total
Part 121	$102.3	$4.3	$106.6
Part 125	$ 7.8	$ 3.6	$ 11.4
Total	$110.1	$7.9	$118.0

A midair collision involving a cargo airplane can result in accident values from under $10 million to potentially 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. In the event of midair collisions over Los Angeles, San Diego, and other metropolitan areas, significant collateral damage can easily exceed hundreds of millions of dollars – just a collision with a large passenger airplane can result in costs in excess of $100 million. MITRE estimated that slightly more than 50 percent of all midair collisions are expected to occur over the suburbs or cities.

A recent incident over Mainland China illustrates the potential costs of midair collisions. On June 28, 1999, a British Airways (BA) B-747 carrying 400 passengers to Hong Kong came within 200 meters of a Korean Air B-747 freighter. The BA aircraft received a TCAS Resolution Advisory (RA), the flight crew responded to it, and a collision was avoided.

If such a collision had occurred, the costs of the accident would have been extremely high. A rough estimate of the potential costs of such an accident can be prepared by multiplying the number of people involved (about 420 counting the passengers and the crews of each airplane) by $3.0 million, the value of a fatality avoided used in FAA analyses. The cost, estimated in this manner, is $1.3 billion. If the value of the airplane and any collateral damage on the ground were added to this estimate, the cost would be considerably higher. In this case, the TCAS very likely averted an accident that could have had a total cost well in excess of $1 billion.

The FAA believes the reduction in the risk of midair collisions justifies the cost of this rulemaking.

The final rule is expected to have a significant impact on a substantial number of small entities. This final rule will not constitute a barrier to international trade nor constitute an unfunded mandate.

I. Introduction

"We were in the clear (VMC)(Visual Meteorological Conditions) when a cloud to our 2 o'clock position lit up. The light was orange in color and its intensity continued to increase. As the cloud lighted up, it was about 20-40 miles from us, about 20-30 miles in length in a line about even with, or slightly below our altitude." He reported the C-141's flight level at an estimated 12,000-14,000 feet.

"The plume of fire came out of the cloud on the right, followed shortly after by one on the left. The direction of movement was hard to determine, and we were trying to identify what we were witnessing. I remarked, "That's not a missile, is it?" I think this was just about the same time the second plume appeared. Finally, the glow of the cloud diminished, and the two plumes reached the ground, continuing to burn as two distinct fires."

The above passage is an eyewitness account of the fatal midair collision of a Kazakh IL-76 cargo airplane and a Saudi Boeing 747 passenger airplane that occurred near Indira Gandhi International Airport in New Delhi, India in November of 1996. The description was provided by U.S. Air Force Captain Timothy J. Palace who was in the jump seat of a C-141 flying near the two accident aircraft. [1]

Fortunately, mid-air collisions are rare. However, they are always tragic when they occur. A more recent midair collision occurred on July 2, 2002, when a DHL 757 Freighter and a Bashkirian Airlines TU-154 collided over southern Germany. This midair collision resulted in the loss of 71 lives on the two airplanes, the loss of both airplanes, and collateral damage on the ground. [2]

A collision avoidance device, such as TCAS (Traffic Alert and Collision Avoidance System), can vastly reduce the chances of a midair collision occurring. In the United States, TCAS II is required for all large part 121 and part 125 airplanes with more

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[1] ________________, *Safe News* – July, 1997; http: www.aviationweek.com/safety/nz_jul97.htm

than 30 seats, and all turbine-powered part 129 airplanes with more than 30 passenger seats. However, TCAS II is not required for similarly sized part 121, 125, or 129 all-cargo airplanes.

This Final Regulatory Evaluation considers the benefits (risk reduction) and costs of this final rule that requires the installation and use of a collision avoidance system on airplanes used primarily to transport cargo operating under 14 CFR parts 121, 125, and 129. In addition, this rule will affect passenger and cargo airplanes manufactured after the date of this Final Rule, used by part 121, 125, or 129 air carriers, by requiring the installation of TCAS II, Version 7 or equivalent.

This regulatory evaluation examines the economic impact of the final rule on cargo airplanes for part 121 and 125 operators only. The FAA expects that all other non-cargo airplanes operating under part 125 are already equipped with collision avoidance systems under the present rule. The economic impacts on part 129 carriers are not studied because part 129 applies to foreign carriers. This regulatory evaluation only estimates the benefits and costs of TCAS because TCAS is the only FAA approved collision avoidance system currently available.

This final regulatory evaluation revises the initial regulatory evaluation based on the comments received during the public comment period that started on November 1, 2001 and ended on December 31, 2001. In addition, the airline fleet data and cost data from the initial regulatory evaluation is reviewed and adjusted where appropriate.

In the past, cargo air carriers operated few airplanes and conducted their operations primarily at night. However, the air cargo industry has experienced rapid growth and cargo airplanes concentrate at certain hubs. Therefore, the FAA is taking this action to minimize the possibility of midair collisions involving cargo airplanes.

The FAA requires that affected airplanes be equipped with the traffic alert and collision avoidance system known as TCAS II Version 7, or another approved traffic alert and collision avoidance system, as appropriate, by no later than December 31, 2004.

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[2] Higgins, Alexander G., Associated Press Staff Writer, *Air Collision Over Germany Kills 71*, http://www.washingtonpost.com/wp-dyn/articles/A12497-2002Jul2.html

This rule applies to certain airplanes currently operated under parts 121, 125, and 129 that do not have traffic alert and collision avoidance systems installed. In addition, this rule requires that all affected airplanes manufactured after the publication date of this final rule, and required by this final rule to be operated with TCAS II, must install a TCAS II that meets TSO C-119b (Version 7.0), or equivalent.

Both TCAS I and TCAS II units provide a display of traffic in the vicinity of an airplane, known as Traffic Advisories or TAs. A TCAS II unit also provides Resolution Advisories or RAs. The RAs direct the pilot to climb or descend to avoid a collision. If both airplanes are equipped with TCAS II, the RAs are coordinated and instruct one airplane pilot to climb and the other to descend.

II. Background and History

A. Regulatory Background

The first proposal to require the installation and use of TCAS occurred when the FAA issued Notice No. 87-8, (52 FR 32268, August 26, 1987), concerning certain airplanes operating under parts 121, 125, 129 and 135.

On January 5, 1989, the FAA issued the "Traffic Alert and Collision Avoidance System; Final Rule" (54 FR 940, January 10, 1989), which required installation and use of TCAS on passenger airplanes operated under parts 121, 125, 129, and 135. The final rule required part 121 and 125 operators of large airplanes (airplanes of more than 12,500 pounds, maximum certificated takeoff weight)[3], with more than 30 passenger seats, to have TCAS II installed and operational by December 30, 1991. Part 129 operators and part 135 operators of turbine-powered airplanes with 10-30 passenger seats were required to install at least TCAS I by February 9, 1995. Part 121 operators of combination cargo/passenger airplanes with 10-30 passenger seats also were required to install at least TCAS I by February 9, 1995.

All-cargo airplanes were excluded from the requirement for the installation and use of a collision avoidance system during this rulemaking. The reasons given for excluding all-cargo airplanes at that time included:

1. The primary concern was enhancing passenger safety.

2. All-cargo airplanes operated primarily at night and therefore did not represent a risk to passenger airplanes that operated primarily during the day.

3. There were relatively few all-cargo airplanes operating in the same airspace at the same time as passenger airplanes.

4. All-cargo airplanes benefited from the TCAS requirements for passenger airplanes because the transponder-equipped cargo airplanes were displayed

[3] 14 CFR, part 1, 1.1 General definitions.

to pilots of the TCAS-equipped passenger airplanes.

5. The FAA determined that the benefit/cost analysis and risk level at that time did not support requiring cargo operators to equip their airplanes with TCAS I or TCAS II.

B. Current Requirements

Traffic Alert and Collision Avoidance System (TCAS) is a general term for a family of airborne devices that function independently of the ground-based air traffic control (ATC) system and provide collision avoidance protection for a broad spectrum of aircraft types. It is designed to serve as a safety backup to the ATC system.

TCAS transmits interrogations that elicit replies from radar beacon transponders in nearby aircraft. The level of protection provided by TCAS depends on the type of transponder the intruding aircraft is carrying. For example, nearby aircraft equipped with a Mode A transponder will provide only range and azimuth information to the TCAS equipped aircraft; whereas, an aircraft equipped with a Mode C or Mode S transponder will provide range, azimuth, and altitude information to the TCAS-equipped aircraft. TCAS provides protection only from aircraft with an operating transponder.

TCAS I provides proximity warnings to pilots in the form of traffic advisories (TAs), which display the intruding transponder-equipped traffic relative to the TCAS equipped aircraft. Traffic advisories generally include the range, altitude, and bearing of the intruding aircraft but do not provide the pilot with Resolution Advisories (RAs) which provide information to climb or descend to avoid the conflict.

TCAS II provides both RAs and TAs. Resolution advisories provide pilots with information to change a flight path or prevent a maneuver that could cause insufficient separation between aircraft. In addition, TCAS II coordinates RAs between two aircraft equipped with TCAS II (i.e., each pilot would receive an RA that would not conflict with the other RA).

Current rules require TCAS I or better on:

(1) passenger or combination cargo/passenger (combi) airplanes with 10-30

passenger seats operated under part 121,

and

(2) turbine powered airplanes with 10-30 passenger seats operated under part 129.

Current rules require TCAS II on:

(1) large airplanes with more than 30 passenger seats operated under part 121 or 125,

and

(2) turbine powered airplanes with more than 30 passenger seats operated in the United States under part 129.

The current TCAS requirements for parts 121, 125, and 129 are summarized in the table below:

14 CFR	Classification	Equipment Requirements
121.356(a)	Large airplane, more than 30 passenger seats, excluding any pilot seat.	TCAS II and a Mode S transponder.
121.356(b)	Passenger or combi airplane, 10-30 passenger seats, excluding any pilot seat.	Approved traffic alert and collision avoidance system (TCAS I); if TCAS II is installed, it must coordinate with TCAS units that meet specifications of TSO C-119.
125.224(a)	Large airplane, more than 30 passenger seats, excluding any pilot seat.	TCAS II and a Mode S transponder.
129.18(a)(1)	Turbine-powered airplane, more than 30 passenger seats, excluding any pilot seat.	TCAS II and a Mode S transponder.
129.18(b)	Turbine-powered airplane, 10-30 passenger seats, excluding any pilot seat.	Approved traffic alert and collision avoidance system (TCAS I); if TCAS II is installed, it must coordinate with TCAS units that meet specifications of TSO C-119.

III. The Final rule

A. Purpose of the Final rule

The purpose of the final rule is to further reduce the risk of midair collisions. The final rule would primarily reduce the risk of midair collisions between all-cargo airplanes and would also further reduce the risk of a midair collision between an all-cargo airplane and a passenger airplane.

In 1987, before the issuance of the TCAS rule, the U.S. air cargo industry operated approximately 375 airplanes. Today, U.S. cargo air carriers operate approximately 1,140 airplanes and the demand for air cargo services is expected to continue growing at a rate of 5-6 percent per year over the next 10 - 20 years. The FAA believes that because the U.S. air cargo industry has grown rapidly and because of increasing daytime cargo operations into high-density hubs, an increased risk of near midair collisions (NMAC's) involving cargo and passenger airplanes exists. Furthermore, increases in total traffic volume and complexity within the National Airspace System (NAS) increase the challenge of maintaining safe separation between aircraft.

On February 6, 1999, a cargo airplane and a passenger airplane were involved in a hazardous situation, they passed within 1-mile horizontally and 600 feet vertically from each other. The passenger airplane was equipped with TCAS and its pilot took action to avoid the cargo airplane.

On March 2, 1999, a NMAC occurred involving two cargo airplanes over Salina, Kansas. Neither airplane was equipped with TCAS and the airplanes came within an estimated one half mile horizontal and 0 feet vertical separation of each other.

These incidents illustrate the potential of a collision occurring between cargo airplanes and between cargo airplanes and passenger airplanes in the United States.

According to FAA data, the number of pilot-reported NMACs during the period since the installation of TCAS began dropped from 454 reports in 1990 to an all-time low of 194 in 1996. The NTSB believes that TCAS use has played a major role in reducing reported NMACs. According to the FAA's database, for the 5-years from January 1, 1994, to January 1, 1999, pilots flying cargo airplanes filed four NMAC reports. Two incidents involved Federal Express airplanes, one involved an Empire Airlines, Inc., airplane, and one involved an Airborne Express, Inc., airplane.

Despite the fact that no midair collisions involving large all-cargo transport airplanes have yet occurred, in the United States, the FAA believes the potential exists for a midair collision involving a cargo airplane. By requiring part 121, 125, and 129 operators to install TCAS on cargo airplanes, the FAA believes that the risk of midair collisions involving cargo airplanes would be reduced, thereby increasing public safety in the air and on the ground.

B. Petition for Rulemaking

The Independent Pilots Association (IPA), representing pilots from United Parcel Service, petitioned the FAA in September 1996 to amend § 121.356 to require TCAS II on transport category airplanes flown in all-cargo, part 121 operations. According to IPA, requiring transport category cargo airplanes to be equipped with TCAS II may prevent collisions between cargo airplanes and between cargo and passenger airplanes operating in the same airspace. IPA also states that this requirement will reduce the risk of death and serious injury to pilots, passengers of other aircraft, and persons on the ground. IPA argues that TCAS has a proven track record in reducing the risk of midair collisions and that the FAA has routinely stated in Reports to Congress that TCAS operation is providing an additional margin of safety against midair collisions.

The FAA published a summary of the IPA's petition for rulemaking in the Federal Register on October 25, 1996 (61 FR 55230). The FAA received 350 comments in support of the petition, and none opposing it. Commenters included the Air Line Pilots Association (ALPA), Allied Pilots Association (APA), Air Traffic Control Association, Inc. (ATCA), International Brotherhood of Teamsters (IBT), and Airline Professionals

Association Teamsters Local 1224 (APAT). The FAA also received comments from 3 individual pilots, 314 pilots employed by Airborne Express, and 28 pilots employed by DHL Airways, Inc. (DHL). In addition, two comments were received from members of Congress, who forwarded correspondence from their constituents. The commenters generally supported TCAS installation on cargo airplanes as discussed in more detail in the Preamble.

A copy of the petition for rulemaking and comments received in response to the petition have been placed in the docket. The FAA believes that the final rule, requiring the installation and use of TCAS on cargo airplanes, incorporates the IPA's intent in its petition for rulemaking. Including airplanes operating under parts 121, 125, and 129 in this proposal would ensure further that airplanes of similar weight, operating characteristics, and operating environment would be required to be equipped with TCAS. This action will serve as the FAA's response to the petitioner's request to amend § 121.356.

C. Congressional Hearing

The House Committee on Transportation and Infrastructure, Subcommittee on Aviation held a hearing on February 26, 1997, to discuss a proposal to require TCAS II on cargo airplanes. Individuals from the FAA, NTSB, United States Air Force (USAF), United States Navy (USN), ALPA, Nation Air Express, Inc., IPA, International Teamsters Airline Division, Air Freight Association, UPS, Airborne Express, and National Air Transportation Association (NATA) testified at the hearing.

The International Teamsters Airline Division, ALPA, and IPA recommended that TCAS II be required on cargo airplanes. The NTSB supported TCAS equipage on cargo airplanes, but felt legislative action should be a last resort, and the transportation industry should take much needed safety action voluntarily.

The Air Freight Association, UPS, and NATA recommended that Congress not mandate TCAS II equipage on cargo airplanes. The reason they gave included the development of new collision avoidance technology [ADS-B], and minimal benefits comparative to costs.

USAF and USN personnel testified concerning NMACs involving military and passenger carrying aircraft, but neither testimony addressed the proposal to equip cargo airplanes with TCAS. Their testimonies focused primarily on incidents involving civil and military airplanes and the measures that their respective branches have taken in response to those NMACs. A transcript of the hearing and written testimonies submitted by the witnesses are in the public docket.

D. NTSB Recommendation

On September 9, 1999, the NTSB recommended to the FAA Administrator that the FAA amend 14 CFR 121.356, 125.224, and 129.18. The NTSB referenced the two near midair collisions that had occurred earlier in 1999 that involved airplanes that were not required to have TCAS II equipment installed. The NTSB specifically recommended that the FAA require all aircraft of 15,000 kilograms (33,000 pounds) or greater Maximum Certificated Takeoff Weight (MCTOW), or more than 30 passenger seats be equipped with TCAS II and an appropriate Mode S transponder.

This rule generally incorporates the NTSB's regulatory recommendations. However, the FAA has specifically excluded piston-powered airplanes of more than 15,000 kilograms (33,000 pounds) MCTOW from these proposed TCAS II requirements. The FAA has determined that TCAS I is more appropriate for those airplanes, considering their operating environment and performance capabilities. Finally, the FAA notes that TCAS II and an appropriate Mode S transponder already are required for airplanes with more than 30 passenger seats and many of these airplanes weigh more than 33,000 pounds MCTOW.

E. Legislation

The 106th Congress issued legislation, Pub. L. 106-181, that directed the FAA Administrator to require, in part, that certain cargo airplanes be equipped with collision avoidance technology by December 31, 2002. The statute provided for an extension of up to 2 years.

F. <u>Other Countries and Organizations Requiring Collision Avoidance Systems for All-Cargo Airplanes</u>

This section briefly discusses the actions of other countries in setting requirements for TCAS on airplanes, including cargo airplanes, operating in their airspace. Some international aviation authorities have taken, or are taking, regulatory action to require some form of collision avoidance system for cargo airplanes:

- <u>Japan</u>: TCAS was mandated within its airspace effective January 1, 2001, for all Japanese-registered airplanes with more than 30 passenger seats or with a maximum certificated take-off weight of more than 15,000 kilograms. Equipage of other airplanes desiring to fly in Japanese airspace will be achieved through regional agreements.

- <u>Eurocontrol Member Countries</u>: The Eurocontrol Airborne Collision Avoidance System Policy Task Force completed a unified policy for the implementation, in European airspace, of ACAS II, which is equivalent to TCAS II version 7. This policy specified that ACAS II requirements be implemented in the airspace of certain European countries, effective January 1, 2000. France, Germany, and the United Kingdom have issued regulations implementing this policy with the provision that a petitioner may request relief from the rule until March 31, 2001, and the reason for the request is unavailability of ACAS II equipment. The policy requires the implementation of ACAS II by all air carriers operating airplanes with more than 30 passenger seats, or weighing more than 15,000 kilograms (33,000 pounds). This policy requires cargo airplanes to be equipped with TCAS II/ACAS II and applies to any operator entering Eurocontrol-member countries airspace.

- <u>India</u>: After a Saudi Air B-747 collided with a Kazakh IL-76 with a resultant loss of 346 lives, India mandated that all airplanes with more than 30 passenger seats or with a maximum certificated take-off weight of more than 15,000 kilograms have TCAS II in order to operate in its airspace, effective on January 1,1999.

- <u>Australia</u>: has issued regulations requiring TCAS II equipage no later than January 1, 2000.

- <u>Canada</u>: currently has rulemaking in progress that contains provisions for installation of TCAS on passenger and cargo airplanes.

- <u>ICAO</u>: The International Civil Aviation Organization (ICAO) Standards and Recommended Practices (SARPs) recommends ACAS II on all turbine-engined airplanes with more than 30 passengers or with a maximum certificated take-off weight greater than 15,000 kilograms by January 1, 2003. It has also recommended, in Annex 6, the installation of ACAS II on all turbine-engine airplanes with more than 19 passengers or a maximum certificated take-off weight greater than 5,700 kilograms (about 12,500 pounds) by January 1, 2005.

G. The NPRM

The FAA published a collision avoidance system for cargo airplanes NPRM on November 1, 2001. The public comment period ended on December 31, 2001. The NPRM proposed to amend §§ 121.356, 125.224, and 129.18 by changing the applicability criteria for collision avoidance requirements. Rather than using the then current passenger-seating configuration criteria to determine applicability, which excluded all-cargo airplanes, the FAA proposed to implement a weight criteria. As such, the rule standardized the collision avoidance requirements for airplanes of similar size, operating environment, and performance capability.

The NPRM required that any turbine-powered airplane of more than 33,000 pounds MCTOW conducting operations under part 121, 125, or 129 would have to be equipped with TCAS II or equivalent and an appropriate Mode S transponder. In addition, the NPRM required that all affected airplanes manufactured after (November 1, 2001) and required by this final rule to be operated with TCAS II, must install TCAS II, TSO C-119b (Version 7.0), or equivalent.

The NPRM required that turbine-powered airplanes of 33,000 pounds or less MCTOW and piston-powered airplanes, regardless of weight, conducting operations under part 121 or 125 would have to be equipped with TCAS I.

The NPRM allowed Operators to install an approved equivalent collision avoidance system to TCAS I or TCAS II, as appropriate. Any alternative system to TCAS had to provide equivalent functions to and be interoperable with TCAS to comply with those requirements.

H. Changes from the NPRM to the Final Rule

The FAA received almost 500 comments on the NPRM. The vast majority of these comments were from cargo airplane pilots who strongly supported the proposed rule and recommended that it be implemented at the earliest possible time.

Several air cargo operators said that it would be impossible to comply with the compliance date in the NPRM. They said that they would normally have to install a TCAS during a C or D check. The normal intervals for C & D checks did not match the compliance date in the NPRM. The operators also pointed out that they were already mandated to install TAWS (Terrain Awareness and Warning System) by March 29, 2005 and that it would be very helpful to be able to have a common compliance date for TCAS and TAWS.

The FAA agrees that this was a reasonable request. Therefore, the compliance date for Collision Avoidance Systems was changed from the NPRM compliance date of October 31, 2003 to coincide with the Congressionally mandated date of December 31, 2004.

The FAA also eliminated the requirements in the NPRM that certain airplanes with a MCTOW less than 33,000 pounds be required to have a TCAS I. The original intent of including the lighter cargo airplanes was to have a TCAS rule with parallel requirements for cargo and passenger airplanes. However, the Congressional Mandate was only for cargo aircraft with a MCTOW above 33,000 pounds. Therefore, the NPRM exceeded the Congressional Mandate. The Final Rule is in accordance with the Congressional Mandate.

I. <u>The Final Rule</u>

The final rule is reproduced below.

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, 44901, 44903-44904, 44912, 46105.

2. In § 121.356, revise the section heading and add paragraph (d) to read as follows, effective on [insert date 30 days after publication of the final rule]:

§ 121.356 Collision avoidance system.

* * * * *

(d) Effective [insert 30 days after the publication date of the final rule], if TCAS II is installed in an airplane for the first time after [insert 29 days after the publication date of the final rule] 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. Amend § 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 a later version. (ii) TCAS II that meets TSO C-119a (version 6.04A Enhanced) that was installed in that airplane before [insert 30 days after publication of the final rule]. 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 TSO C-118, or a later version, or* *(3) A collision avoidance system and Mode S transponder that meet paragraph (a)(1) of this*

Collision Avoidance Systems

If you operate any—	then you must operate that airplane with—
	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 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 [insert date 30 days after publication of the final rule]:

§ 125.224 Collision avoidance system.

* * * * *

(c) Effective [insert 30 days after the publication date of the final rule], if TCAS II is installed in an airplane for the first time after [insert 29 days after the publication date of the final rule] 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. Amend § 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 [insert 30 days after publication of the final rule]. 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 [insert date 30 days after publication of the final rule]:

§ 129.18 Collision avoidance system.

* * * * *

(c) Effective [insert 30 days after the publication date of the final rule], if TCAS II is installed in an airplane for the first time after [insert 29 days after the publication date of the final rule] 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. Amend § 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 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 [insert 30 days after publication of the final rule]. 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

Collision Avoidance Systems

If you operate in the United States any...	then you must operate that airplane with:
	version.
(b) Turbine-powered airplane with a passenger-seat configuration, excluding any pilot seat, of 10-30 seats,	*(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* *(3) A collision avoidance system and Mode S transponder that meet paragraph (a)(1) of this section.*

Issued in Washington, DC, on .

[Administrator's Name]

Administrator

IV. Part 121/125 All-Cargo Fleet

A. Introduction

The Final Rule will affect some of the airplanes of the fleet. Therefore, it is necessary to estimate the number of airplanes in the fleet that will be affected. An estimate of the fleet affected by the final rule depends on several factors. First, due to different TCAS requirements, the fleet affected by TCAS II and TCAS I must be separately determined.

Secondly, the fleet affected is reduced by those airplanes that will be required to install TCAS by pending international requirements. Similarly, some U.S. carriers intend to voluntarily install TCAS or have already voluntarily installed TCAS. Voluntary compliance reduces the potentially affected fleet. The affected fleet must also account for airplanes that will be added to the existing fleet in the future. Because all-cargo airplanes tend to be older than passenger airplanes, have fewer operating hours, and as operators tend to keep these airplanes in service longer, the FAA takes the very conservative position that these airplanes will not be retired in the forecast period. Thus the total affected fleet equals the current affected fleet, minus airplanes which must meet international TCAS regulations, minus airplanes under voluntary compliance, plus newly manufactured all-cargo airplanes.

The final rule requires the installation of TCAS II, or equivalent, on turbine-powered all-cargo airplanes of more than 33,000 pounds MCTOW (Maximum Certificated Takeoff Weight) which are operated by part 121, 125 or 129 operators. The final rule also requires the installation of TCAS I, or equivalent, on piston-powered all-cargo airplanes of more than 33,000 pounds MCTOW operated by part 121and 125 operators.

B. Existing Fleet

The fleet of U.S. Cargo Airplanes, as determined in the NPRM, was reviewed to see if any major changes had occurred. The fleet has been separated into five categories, as shown in Appendices IV-1 through IV-5.

The five categories and the number of airplanes in each category are shown below.

1. Part 121 Operators (**NPRM**: 44; **Final Rule**: 37) of part 121 all-cargo, turbine airplanes over 33,000 pounds MCTOW (**NPRM**: 1,048 airplanes; **Final Rule**: 1,062 airplanes, an increase of 14 airplanes).

2. Lessors and Brokers (**NPRM**: 19; **Final Rule**: 12) of part 121 airplanes who have possession of all-cargo turbine airplanes that were not leased to an operator (**NPRM**: 33 airplanes; **Final Rule**: 25 airplanes, a decrease of 8 airplanes).

3. Part 121 Operators (**NPRM**=18) of part 121 all-cargo turbine airplanes of 33,000 pounds or less MCTOW and all piston airplanes (**NPRM**=96 airplanes); **Final Rule**: (7 Operators of 26 Airplanes; a decrease of 70 airplanes) of part 121 piston-powered airplanes greater than 33,000 pounds.

4. Part 125 commercial operators (**NPRM:** 3; **Final Rule**: 7) of all-cargo turbine-powered airplanes 33,000 pounds or more (MCTOW) (**NPRM:** 10 airplanes; **Final Rule**: 25 airplanes, an increase of 15 airplanes).

5. Part 125 commercial operators (**NPRM**=19) of all-cargo turbine airplanes 33,000 pounds or less (MCTOW) and all piston powered airplanes (**NPRM**=31 airplanes); **Final Rule**: (14 operators of 27 airplanes; a decrease of 4 airplanes) of part 125 piston-powered airplanes greater than 33,000 pounds.

The complete number of U.S. registered cargo airplanes by operator/owner is shown in Appendices IV-1 and IV-3 through IV-5. These appendices follow the last chapter of the text of this document.

C. Fleet Operating Internationally

Several recent and anticipated international regulatory actions require or will soon require U.S. registered cargo airplanes operating outside U.S. airspace to be operated with TCAS II. Some of these regulations started in the year 2000. This final rule did not impose economic costs on operators of all-cargo airplanes that already had TCAS II installed to comply with international requirements.

The FAA assumes that long-range airplanes are the most likely to be used internationally. These airplanes include the B-747, B-767, L-1011, MD-11, MD-10, DC-10, DC-8, A-300, and the A-310. The FAA conservatively assumes that the B-757 will be operated as a domestic airplane. These airplanes (except the B-757) are expected to have TCAS II/ACAS II installed even if this rule were not to be implemented.

D. Operator's Voluntarily Installing TCAS II

Airplanes are also excluded from the costs of the rule when an operator voluntarily installs TCAS II. FedEx has announced that it will voluntarily equip its fleet with TCAS II. FedEx started with its international fleet and is proceeding to equip its entire fleet. Airborne Express is also voluntarily equipping its fleet with TCAS II. Polar Air Cargo's fleet and Northwest's air cargo fleet have already been voluntarily equipped with TCAS II. The Airborne Express, FedEx, Northwest, and Polar Air Cargo fleets are excluded from the costs of the rule.

After subtracting airplanes which must meet international TCASII/ACASII requirements and subtracting those airplanes whose operators are voluntarily installing TCAS II, there remains a total of 317 cargo airplanes in the existing U.S. part 121 > 33,000 pounds MCTOW turbine fleet that are affected by this final rule. This compares to a total of 417 of these airplanes that were affected by the NPRM, a reduction of 100 airplanes. (See Appendix IV-2). It should be noted that these numbers do not include the airplanes in the hands of brokers, lessors, etc. This is because it is possible that these airplanes may not be leased or sold to U.S. airlines when they are disposed of by their current owners.

E. Forecasted Fleet

Fleet forecasts depend on expected demand and utilization. Several entities, including the FAA, prepare forecasts of air cargo demand. The Boeing Company provides a biennial forecast of air cargo demand and all-cargo airplanes.

The Boeing Company's 1998 air cargo forecast for turbine airplanes >33,000 pounds MCTOW was used in the preparation of the NPRM. Between the NPRM and the final rule, Boeing issued its 2000 air cargo forecast. This forecast was examined and found to be substantially similar to the 1988 air-cargo forecast. The tragic events of September 11, 2001 also occurred between the preparation of the NPRM and the final rule. Therefore, the FAA decided to use the same forecasting procedure for the final rule that it used for the NPRM.

The Boeing Company's 1998 air cargo forecasts estimates that 70 percent of the all-cargo airplanes added to the all-cargo fleet in the next 20 years will be converted from passenger airplanes. The remaining 30 percent will come from newly manufactured airplanes.

Passenger airplanes converted to all-cargo use will almost certainly contain a TCAS. Therefore, the final rule will not cause any costs in passenger airplanes that are converted to all-cargo airplanes. Therefore, the final rule will only affect newly manufactured cargo airplanes.

As a result, the FAA forecasts an annual need for 35 airplanes converted from passenger service and 15 newly manufactured all-cargo airplanes over the 20 year forecast period. Therefore, the FAA forecasts that 15 newly manufactured freighters will be added to the existing fleet requiring TCAS installation for each of the next 20 years. The FAA also assumes that in the absence of this rule that the current voluntary TCAS installation rate of 70% would continue. This results in a fleet requiring TCAS, as a result of this rule, of the existing fleet of 317 airplanes plus 80 newly manufactured freighters or a total of 397 airplanes requiring TCAS at the end of the twenty-year analysis period. The forecast of these airplanes is shown in Table IV-1.

The FAA estimates that the number of: (1) part 125 turbine-and piston-powered all-cargo airplanes used by commercial operators, (2) part 121 piston-powered airplanes, and (3) part 121 turbine-powered airplanes of 33,000 pounds or less (MCTOW) will remain constant during the 20-year forecast period. The numbers of these aircraft are shown in Tables IV-2 through IV-4.

Table IV - 1

Forecast of Part 121 All Cargo Turbine > 33,000 Pounds MCTOW Fleet And TCAS II Requirements

Year	Existing Freighter Fleet			Forecasted Additions To Freighter Fleet			Total Fleet Size			TCAS Requirements		
	Total Freighters	Would Not Require TCAS II Because of Proposed Rule	Would Require TCAS II Because of Proposed Rule	Total Freighters	Passenger Conversions	Newly Manufactured Freighters	Total Freighters	Airplanes With TCAS II Retrofits	Newly Manufactured Freighters With TCAS II	Would Not Require TCAS II Because of Proposed Rule (70.0%)	Would Require TCAS II Because of Proposed Rule (30.0%)	Total TCAS Required By Rule
N (A)	1,062	746	317	N.A.	N.A.	N.A.	1,062	N.A.	N.A.			
N+1			158	50	35	15	1,112	158	15	11	4	162
N+2			159	50	35	15	1,162	159	15	11	4	163
N+3				50	35	15	1,212		15	11	4	4
N+4				50	35	15	1,262		15	11	4	4
N+5				50	35	15	1,312		15	11	4	4
N+6				50	35	15	1,362		15	11	4	4
N+7				50	35	15	1,412		15	11	4	4
N+8				50	35	15	1,462		15	11	4	4
N+9				50	35	15	1,512		15	11	4	4
N+10				50	35	15	1,562		15	11	4	4
N+11				50	35	15	1,612		15	11	4	4
N+12				50	35	15	1,662		15	11	4	4
N+13				50	35	15	1,712		15	11	4	4
N+14				50	35	15	1,762		15	11	4	4
N+15				50	35	15	1,812		15	11	4	4
N+16				50	35	15	1,862		15	11	4	4
N+17				50	35	15	1,912		15	11	4	4
N+18				50	35	15	1,962		15	11	4	4
N+19				50	35	15	2,012		15	11	4	4
N+20				50	35	15	2,062		15	11	4	4
Total	1,062	745	317	1,000	700	300	2,062	317	300	210	80	397

Notes:

(A) N is the base year. It is assumed that the rule would be passed at the end of the base year and would allow two years for the existing fleet to comply.

(B) It is also assumed that 30.0% of the existing fleet would be equipped with TCAS II (or equivalent) for each of those two years.

Last Revised: 06/24/2002

Table IV-2

Forecast of Part 121 > 33,000 Pounds MCTOW Piston-Powered Fleet And TCAS I Requirements

	Existing Fleet		Forecasted Additions To Fleet			Total Fleet Size		
Year	Total	Would Require TCAS I Because of Proposed Rule	Total Aircraft	Passenger Conversions	Newly Manufactured Freighters	Total Airplanes	Airplanes With TCAS I Retrofits	Newly Manufactured Airplanes With TCAS I
N (A)	26	26	N.A.	N.A.	N.A.	26	N.A.	N.A.
N+1		13	0	0	0	26	13	0
N+2		13	0	0	0	26	13	0
N+3			0	0	0	26		0
N+4			0	0	0	26		0
N+5			0	0	0	26		0
N+6			0	0	0	26		0
N+7			0	0	0	26		0
N+8			0	0	0	26		0
N+9			0	0	0	26		0
N+10			0	0	0	26		0
N+11			0	0	0	26		0
N+12			0	0	0	26		0
N+13			0	0	0	26		0
N+14			0	0	0	26		0
N+15			0	0	0	26		0
N+16			0	0	0	26		0
N+17			0	0	0	26		0
N+18			0	0	0	26		0
N+19			0	0	0	26		0
N+20			0	0	0	26		0
Total	26	26	0	0	0	26	26	0

Notes:

(A) N is the base year. It is assumed that the rule would be passed at the end of the base year and would allow two years for the existing fleet to comply.

Last Revision: 07/03/2002

Table IV-3

Forecast of Part 125 > 33,000 Pounds MCTOW Turbine Commercial Operator Fleet And TCAS II Requirements

	Existing Fleet		Forecasted Additions To Fleet			Total Fleet Size		
Year	Total	Would Require TCAS II Because of Proposed Rule	Total Aircraft	Passenger Conversions	Newly Manufactured Freighters	Total Airplanes	Airplanes With TCAS II Retrofits	Newly Manufactured Airplanes With TCAS II
N (A)	25	25	N.A.	N.A.	N.A.	25	N.A.	N.A.
N+1		12	0	0	0	25	12	0
N+2		13	0	0	0	25	13	0
N+3			0	0	0	25		0
N+4			0	0	0	25		0
N+5			0	0	0	25		0
N+6			0	0	0	25		0
N+7			0	0	0	25		0
N+8			0	0	0	25		0
N+9			0	0	0	25		0
N+10			0	0	0	25		0
N+11			0	0	0	25		0
N+12			0	0	0	25		0
N+13			0	0	0	25		0
N+14			0	0	0	25		0
N+15			0	0	0	25		0
N+16			0	0	0	25		0
N+17			0	0	0	25		0
N+18			0	0	0	25		0
N+19			0	0	0	25		0
N+20			0	0	0	25		0
Total	**25**	**25**	**0**	**0**	**0**	**25**	**25**	**0**

Notes:

(A) N is the base year. It is assumed that the rule would be passed at the end of the base year and would allow two years for the existing fleet to comply.

Last Revision: 07/03/2002

Table IV-4

Forecast of Part 125 > 33,000 Pounds MCTOW Piston-Powered Commercial Operator Fleet

And TCAS I Requirements

Year	Existing Fleet		Forecasted Additions To Fleet			Total Fleet Size		
	Total	Would Require TCAS I Because of Proposed Rule	Total Aircraft	Passenger Conversions	Newly Manufactured Freighters	Total Airplanes	Airplanes With TCAS I Retrofits	Newly Manufactured Airplanes With TCAS I
N (A)	27	27	N.A.	N.A.	N.A.	27	N.A.	N.A.
N+1		13	0	0	0	27	13	0
N+2		14	0	0	0	27	14	0
N+3			0	0	0	27		0
N+4			0	0	0	27		0
N+5			0	0	0	27		0
N+6			0	0	0	27		0
N+7			0	0	0	27		0
N+8			0	0	0	27		0
N+9			0	0	0	27		0
N+10			0	0	0	27		0
N+11			0	0	0	27		0
N+12			0	0	0	27		0
N+13			0	0	0	27		0
N+14			0	0	0	27		0
N+15			0	0	0	27		0
N+16			0	0	0	27		0
N+17			0	0	0	27		0
N+18			0	0	0	27		0
N+19			0	0	0	27		0
N+20			0	0	0	27		0
Total	27	27	0	0	0	27	27	0

Notes:

(A) N is the base year. It is assumed that the rule would be passed at the end of the base year and would allow two years for the existing fleet to comply.

Last Revision: 07/03/2002

V. Benefits of the Final rule

A. 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. 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.

Nevertheless, 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 military transport airplanes and on some General Aviation (primarily business) airplanes. Within the all-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. As discussed previously, all cargo airlines operating in certain airspaces are, or soon will be, required to equip their airplanes with TCAS II or equivalent.

Reports from commenters, NMAC filings, and the NTSB recommendations, attest to occasions where safety benefits were gained by using TCAS equipment. Often, these reports suggest that TCAS served as the final safety net that prevented an accident. Reports also disclose that a pilot's and a controller's view of a situation may differ in various ways, 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 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 a passenger airplane in Europe. This most recent accident is a painful reminder that such accidents do occur.

In 1989, the FAA issued a final rule requiring air carriers to install TCAS II on certain passenger-carrying airplanes. The carriers reached that equipage by the end of 1993 on airplanes with more than 30 passenger seats. There have been no midair collisions involving TCAS-equipped airplanes in the United States.

B. How TCAS Reduces the Risk of Midair Collisions

B.1. Collision Risk Factors to Traffic in General

Air traffic control (ATC) is organized into widely varying regimes, but always with great attention toward minimizing the risk of midair collision. In controlled airspace, which comprises the great majority of flight hours for passenger carriers, ATC specialists monitor positions and issue clearances designed to preserve separation.

The controllers are aided by radar in nearly all domestic airspace; but even where radar is unavailable, they maintain order through their clearance structure and by monitoring flight progress. Flight over the oceans is a prime example of an orderly flow conducted without the benefit of ATC radar.

Uncontrolled airspace, which is typical of much recreational flying, relies heavily upon a pilot see-and-avoid discipline, because the aircraft have less structured routes than aircraft operating in controlled airspace. However, see-and-avoid cannot be considered a highly reliable means of protection because of great variations in meteorological conditions and aircraft visibility, as well as a variety of closing speeds that is inherent as aircraft approach one another from various directions. Adding to the unreliability is the presence of pilots who may have limited experience in their current aircraft or may be in unfamiliar locales, and may, therefore, more frequently suffer distractions and confusion. Though the latter factors could also affect airline pilots, their risk is minimized by the use of two or more person crews and disciplined flight procedures.

Small airports are often uncontrolled. The pilot's see-and-avoid discipline is supplemented by the protocols of announcing their operations on a common radio channel, and entering airport landing patterns in a uniform manner.

Collision risk occurs when an inexperienced pilot strays into controlled airspace without permission, and sometimes without the safety equipment required in that airspace. In areas surrounding the largest airports, where traffic tends to be dense and arrival/departure throughput has great economic consequences, the ATC system has imposed strict "Terminal Control Area" boundaries and rules. These require, among other things, that all aircraft fly under ATC control and carry transponders, allowing them to be tracked by ATC radar as well as by TCAS.

Another collision risk results from the failure of ATC equipment (e.g., radar, communications).

Finally, another collision risk results, from time to time, when there are controller errors leading to losses of separation.

B.2. Collision Risk Factors for All-Cargo Air Carriers

Cargo carriers experience many of the same risk factors as other types of air traffic. They fly similar airplane types compared to passenger carriers, and their crews have generally the same characteristics and skills. The factors of situational awareness, workload, and human error apply to them to the same extent as those factors apply to passenger carriers.

Although all-cargo flights operate at all hours of the day and night, a difference in risk exposure to all-cargo airlines may be hypothesized because the cargo carriers tend to concentrate their flying at night, and use hub operations that are sometimes separate in location from the passenger hubs. Of course, the nature of cargo traffic requires that all-cargo airplanes fly throughout the airspace, conducting some operations at most major hubs. Also, in nighttime flying, the tasks of visual acquisition and identification of traffic differ in some ways from daylight operations, and have unique failure modes.

B.3. TCAS Functions

Many near midair collision (NMAC) reports cite the pilot's lack of awareness of the conflicting traffic. TCAS provides a Traffic Display, which shows the pilot nearby transponder-equipped aircraft in a graphical, plan-view display, with numerical tags indicating each target's altitude relative to the pilot's airplane. Pilots have found this display to be a natural adjunct to their visual awareness, as well as a supplement to radio communications.

Other problems observed in NMAC reports concern confusion regarding nearby traffic's intentions, or mistaking one airplane for another, because visual discrimination can be challenging. Pilots also have difficulty in visually determining and projecting relative altitudes and speed, and cannot consistently detect an impending collision threat in time to select and execute an evasive maneuver.

The use of TCAS equipment aids in the detection and resolution of these problems. The TCAS traffic display shows all the nearby traffic, overcoming the risk of visually focusing on one target while ignoring others. The display changes colors of traffic symbols to indicate the most threatening traffic. Most importantly, when a target appears to be an imminent collision threat, TCAS II issues a Resolution Advisory (RA), containing explicit vertical maneuver guidance, accompanied by an aural alert.

When both airplanes in an encounter are equipped with TCAS II, their respective systems automatically coordinate RAs to ensure compatibility (e.g., one issues "Climb" and the other "Descend.") Protection is still provided against a target that is not TCAS-equipped; simulations show that over the entire range of conflicts, nearly as much protection is afforded in this case. However, if both airplanes are not equipped with TCAS II, the equipped airplane may follow its' RA, for example to climb, only to find that the other airplane is also climbing. This situation could result in a MAC. TCAS merely needs a target to be equipped with an altitude-reporting transponder to enable its avoidance functions. Also, even a non-altitude reporting transponder will enable the target to appear on the TCAS traffic display.

A benefit of the TCAS equipment is that it is carried onboard the airplane, and thus is completely independent of ATC intervention, allowing pilots to safely respond to TCAS RAs without becoming a burden to ATC. The TCAS equipment travels with its airplane throughout all airspaces worldwide, and operates usefully wherever traffic carries the international standard transponder.

B.4. A Look At The Record

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 which 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.

An 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.

C. Risk Assessment

C.1. Introduction

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.[4]

The scant data available 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 have 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.

[4] 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.

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

C.2. Assumptions and Definitions

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.

Definitions

- Accident (Collision) Rates: - The number of accidents (collisions) occurring within a certain time period.

- Base Period – The period before any airplanes were required to use TCAS.

- MAC – Mid-air collision
- NMAC – Near Mid-air collision

- Pair Probabilities – Relative exposure factors

- Pairs – Cargo-Cargo; Cargo-Passenger; Cargo-GA(General Aviation)

- Risk: - The possibility of a MAC or NMAC.

- Risk Ratios (Risk Reduction Factors): – The fraction by which the risk of a MAC is expected to be reduced when the Resolution Advisories provided by TCAS II are correctly followed. Technically speaking, the risk ratios derived by Mitre, as well as in the successive safety analyses of TCAS II, refer to the risk of a NMAC, as opposed to the risk of a MAC. This choice simply acknowledges the fact that most of the statistical models used in studying the safety of TCAS II were derived from close encounter data and NMAC data, not from MAC data. However, it has been a common practice to treat these risk ratios as providing a strong indication of the expected reduction in the MAC risk. While from a statistical point of view, the relationship between NMAC rates and MAC rates has never been formally established, a reduction in the former is considered to reflect a proportional reduction in the latter for this analysis.

C3. Methodology

The reduction in NMAC risk that a cargo or a passenger flight would experience if cargo aircraft were to equip with TCAS II was estimated by multiplying the relative pair probabilities by the risk ratios that were documented in the Safety Analysis of TCAS II Version 7.

The results of the analysis are provided in the form of risk ratios or risk reduction factors. This approach is consistent with that adopted in the successive safety analyses of TCAS and avoids, at least in a first step, the difficulty of deriving a statistical model of midair collision rates.

C.4. Pre-TCAS II Accident Rates

Part 121 Cargo-Carrying Airplanes

This section discusses the risk of cargo airplane midair collisions (MAC)s. In principle, this risk is the expected number of cargo air carrier airplane MACs with another cargo air carrier airplane, a passenger air carrier 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.[5] 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) is 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

[5] 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.

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.

C.5. Risk Reduction - Cargo Airplane Perspective

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

C.6. 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/ cargo	Passenger/ GA	Passenger/ passenger	Passenger/ unspecified
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 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.

C.7. 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 X 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.

C.8. 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.

D. Quantifiable Benefits of Collision Avoidance Systems for Air Cargo Airplanes

1. 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.

2. 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).

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). 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). 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) 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.

3. 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).

4. 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.

5. Number of Near Mid Air Collisions (NMAC's)

Unfortunately, the risk of a MAC as measured by NMACs has not declined. Table V-2 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.

E. 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.

Table V-1					
Expected Loss Without the Rule by Equipment					
		Column			
		1	**2**	**3**	**4**
		Cargo/ Cargo	**Cargo/ GA**	**Cargo/ Passenger**	**Total**
Row	**1. Accident: Risk**				
1	Conditional Pair Probability (Table 4-11)	0.324	0.174	0.503	1.001
2	Risk When Cargo is Not TCAS Equipped (MITRE Table 4-11)	1.000	1.000	0.092	0.544
3	Adjusted risk for Conditional Pair and TCAS	0.324	0.174	0.046	0.544
4	equippage (= Row 1 * Row 2)				
5	Percentage of risk by equipment	59.53%	31.97%	8.50%	100.00%
6					
7	**2. Accidents: Expected Number**				
8	Expected Accidents without rule = .5				
9					
10	**Expected Accidents by equipment**	**0.298**	**0.160**	**0.043**	**0.500**
11	(=(Percent * .5))	2 Cargo	1 Cargo/	1 Cargo/	
12			1 GA	1 Pass	
13	**3. Accidents: Costs**				
14		**Est. Value**	**Probability**	**Expected Loss**	
15	Cargo Aircraft = 2 @ $5 mill	$10,000,000			
16	Pilots = 4	$12,000,000			
17	**Total**	**$22,000,000**	**0.298**	**$6,548,148**	
18					
19	GA aircraft = $500,000	$500,000			
20	GA-Pilot = 1, Pass = 3	$12,000,000			
21	Cargo Aircraft = 1 @ $5mill	$5,000,000			
22	Cargo Pilots = 2	$6,000,000			
23	**Total**	**$23,500,000**	**0.160**	**$3,756,366**	
24					
25	Pass. Aircraft = 1 @ $30 mill	$30,000,000			
26	Pass + Crew= (150*.75) + 6	$355,500,000			
27	Cargo Aircraft 1 @ $5mill	$5,000,000			
28	Cargo Crew = 2	$6,000,000			
29	**Total**	**$396,500,000**	**0.043**	**$16,855,818**	
30	**Totals**	**$442,000,000**		**$27,160,332**	
31	**Total Expected Accident Loss**			**$27,160,332**	
32					
33	**4. Accidents: Collateral Damage - Low Estimate**			**$1,000,000**	
34					
35	**5. Total Expected Loss**			**$28,160,332**	
36					
					03/03/2003

Table V-2

NMAC's Involving At Least One Cargo Airplane 1992-2001

Year	NMAC's (A) Critical (B)	NMAC's (A) Potential (C)	NMAC's (A) No Hazard (D)	NMAC's (A) Total	NMAC's - Cargo VS Passenger	NMAC's - Cargo VS Cargo	NMAC's - Cargo VS Other	NMAC's - Cargo VS Total
1992	0	4	1	**5**	2	0	3	**5**
1993	0	0	0	**0**	0	0	0	**0**
1994	0	0	1	**1**	0	0	1	**1**
1995	0	0	0	**0**	0	0	0	**0**
1996	0	0	1	**1**	0	0	1	**1**
1997	1	1	1	**3**	0	0	3	**3**
1998	0	1	4	**5**	3	0	2	**5**
1999	1	2	0	**3**	1	1	1	**3**
2000	0	2	2	**4**	1	1	2	**4**
2001	1	2	2	**5**	1	1	4	**6**
Totals	**3**	**12**	**12**	**27**	**8**	**3**	**17**	**28**
Annual Average	**0.3**	**1.2**	**1.2**	**2.7**	**0.8**	**0.3**	**1.7**	**2.8**

Notes:

(A) Data not available to classify one NMAC in 2001.

(B) Critical: Refers to a situation in which collision avoidance was due to chance rather an act on the part of the pilot. Less than 100 feet of aircraft would be considered critical.

(C) Potential: Refers to an incident that probably would have resulted in a collision if no action had been taken by either pilot. Closest proximity of less than 500 feet would usually be required in this case.

(D) No Hazard: An Incident in which neither critical nor potential hazard existed.

Last Revised: 06/24/2002

VI Part 121 Carriers - Estimated Incremental Costs Of The Final Rule

A. Introduction

The estimated part 121 costs include equipment, installation, additional maintenance and operating costs, and pilot training costs. The compliance period is felt to be of sufficient length such that the existing fleet can install the required equipment at scheduled C and D checks. The 20-year cost of compliance coincides with the same period as the benefit assessment.

In the IRE, the FAA relied upon several different data sources to estimate the incremental compliance cost of the proposed rule. To determine the individual TCAS equipment costs, the FAA used cost data supplied by 3 manufacturers of TCAS equipment. The FAA has also received cost information from 5 air carriers who have installed TCAS II equipment in their existing airplanes and who have had subsequent experiences with it.

The FAA has used in this cost estimate some revised and updated data from its November, 1988, Final Regulatory Impact Analysis, Regulatory Flexibility Determination, and Trade Impact Assessment for the Final Rule on Traffic Alert and Collision Avoidance Systems (hereinafter referred to as the 1988 Final RIA), which was used for the 1989 TCAS rule. Finally, the FAA has relied on its expertise to provide estimates when other data were not available or could not be obtained.

For the FRE, the FAA reviewed the unit cost data used in the IRE and concluded that the IRE unit cost data was still adequate. However, the affected fleet had changed and the time period for equipping existing airplanes was reduced from three to two years. Therefore, the total cost of the final rule differs from the total cost of rule in the IRE because of the change in the number of airplanes and the reduction in the estimated compliance time for existing airplanes.

B. Elements and Characteristics Of A TCAS II System

A typical TCAS II system consists of the following elements:

- TCAS II Processor Unit
- Dual Mode S Transponders and Antennas
- TCAS II Antenna
- Control Panel
- Traffic Display
- Racks and cabling to mount and connect the processing

The TCAS II unit itself weighs approximately 60 pounds. However, the complete unit can weigh approximately 100 pounds because of the racks and cabling needed to connect the TCAS II unit. The FAA uses 100 pounds for the weight of an installed TCAS II unit for its additional fuel cost calculations.

In addition to the TCAS units used on the airplane, it is necessary to maintain an inventory of spare units in the event of the failure of a unit. The manufacturers recommend that an inventory level of 7 to 10 percent of the total installed TCAS II units be maintained.

C. TCAS II Equipment Costs For Existing Airplanes

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 results 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: the type of unit installed, the number of units ordered, whether or not it was necessary to include a display unit in the purchase price, etc. 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.

In order to calculate the total discounted present value of the compliance costs with the proposed rule, the FAA assumed that, given the 2-year time period to retrofit TCAS II equipment, 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 undiscounted initial costs of installing TCAS II on the existing part 121 turbine-powered cargo fleet with a maximum certificated takeoff weight over 33,000 pounds are shown in Table VI-1. The FAA has, as shown on Table VI-1, estimated that the undiscounted capital initial costs of retrofitting the existing all-cargo fleet with TCAS II would be approximately $67,000,000.

D. TCAS II Equipment Costs For Newly Manufactured Airplanes

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 airplane would be $171,000.

Thus, as seen in Table VI-2, using the previously calculated rates of 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 cargo airplanes would be approximately $14 million.

E. Operating and Maintenance (O&M) Expenses

E.1. Introduction

In addition to the initial costs of the TCAS II units, the air carriers would also incur annual O&M expenses. The FAA estimates that 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 Tables VI-1 and VI-2, the FAA estimates that the total non-discounted O&M expenses for the existing fleet would be approximately $12,000,000 (See Table VI-1) and $2,000,000 for the newly manufactured fleet (See Table VI-2).

E.2 Additional Annual Operating Costs

E2.a. Fuel Penalty from Additional Weight

The TCAS II equipment would increase the airplane's weight and, thereby, would 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 II System would 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 (See Table VI-1) and $605,000 for the newly manufactured fleet (See Table VI-2).

E2.b Pilot Training Requirements

Air cargo flight crewmembers who have not trained on TCAS II would need such training in order 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 would 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 (See

Table VI-1) and $6,000,000 for newly manufactured cargo airplanes (See Table VI-2).

F. Total Estimated TCAS II Costs

In Table VI-1 the FAA has estimated that the total undiscounted TCAS II costs of the proposed rule, for the existing fleet during the 20 year analysis period, would be approximately $127,000,000 and that the discounted present value of the total costs of the proposed rule, for the existing fleet over the next 20 years, would be approximately $92,000,000.

In Table VI-2 the FAA has estimated that the total undiscounted TCAS II costs of the proposed rule, for the newly manufactured fleet during the 20-year analysis period, would be approximately $22,000,000 and that the discounted present value of the total costs of the proposed rule, for the newly manufactured fleet over the next 20 years, would be approximately $11,000,000.

The total TCAS II costs of the proposed rule over the 20-year analysis period are shown in Table VI-3. In Table VI-3 the FAA has estimated that the total undiscounted costs of the proposed rule during the 20 year analysis period would be approximately $149,000,000 and the discounted present value of the total costs of the proposed rule over the next 20 years would be approximately $102,000,000.

There were no comments on the accuracy of the TCAS II cost estimates.

G. TCAS I Equipment Costs For Existing Airplanes

G.1. Introduction

The proposed rule requires the installation of TCAS I, (or equivalent) on all part 121 piston-powered cargo airplanes with a MCTOW greater than 33,000 pounds. This section discusses the costs of TCAS I equipment on existing airplanes.

G.2. Initial Costs of TCAS I

The FAA estimates that the total initial and installation costs of TCAS I on an existing part 121 cargo airplane would be approximately $75,000. This figure is estimated to include the necessary spare parts inventory.

In order to calculate the total discounted present value of the compliance costs with the proposed 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 undiscounted capital initial costs of installing TCAS I on the existing part 121 piston-powered cargo fleet greater than 33,000 pounds MCTOW are shown in Table VI-4. The FAA has, as shown on Table VI-4, estimated that the undiscounted initial costs of retrofitting the existing all-cargo fleet with TCAS I would be approximately $2,000,000.

G.3. Operating and Maintenance (O&M) Expenses

In addition to the capital costs of the TCAS I units, the air carriers would 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, and the fleet flight hours estimated in Table VI-4, the FAA estimates that the total non-discounted O&M expenses for the existing fleet would be approximately $1,000,000

G.4. Additional Annual Operating Costs

G.4.a. Fuel Penalty from Additional Weight

The TCAS I equipment would increase the airplane's weight and, thereby, would 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 would 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 (See Table VI-4).

G.4.b Pilot Training Requirements

Air cargo flight crewmembers who have not trained on TCAS I would 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 would 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.

H. Total Estimated TCAS I Costs

In Table VI-4 the FAA has estimated that the total undiscounted TCAS I costs of the proposed rule, for the existing fleet during the 20-year analysis period, would be approximately $7,000,000 and that the discounted present value of the total costs of the proposed rule, for the existing fleet over the next 20 years, would be approximately $4,000,000.

I. Total Costs of TCAS part 121 Proposed Rules

The total costs of the proposed TCAS rules for the part 121 all-cargo fleet, over the 20-year analysis period, are shown in Table VI-5. The FAA has estimated that the total undiscounted costs of the proposed rule during the 20-year analysis period would be approximately $156,000,000 and the discounted present value of the total costs of the proposed rule over the next 20 years would be approximately $107,000,000.

Table VI-1

Cost Estimate for Equipping The Existing Part 121 Turbine Powered >33,000 Pounds MCTOV All-Cargo Airplane Fleet Vith TCAS II

		Costs													
		Initial Costs		O & M Expenses					Tranining Expenses		Incremental Fuel Costs		Total Costs		
Year	Air-Planes	Unit Cost	Total Cost	Unit Expense (B)	Flight Hours Per Air-plane	Total Air-planes	Fleet Flight Hours	Total O&M Expenses	Unit Expense (C)	Total Training Expenses	Unit Expense (B)	Total Annual Incremental Fuel Expenses	Non-Discounted	Discounted	Discount Factor (20 years @ 7%)
N (A)	317														1.0000
N+1	158	$ 211,000	$ 33,338,000	$ 1	2,000	158	316,000	$ 316,000	$ 7,000	$ 1,106,000	$ 0.36	$ 113,760	$ 34,873,760	$ 32,593,016	0.9346
N+2	159	$ 211,000	$ 33,549,000	$ 1	2,000	317	634,000	$ 634,000	$ 7,000	$ 2,219,000	$ 0.36	$ 228,240	$ 36,630,240	$ 31,992,852	0.8734
N+3	N.A.	N.A.	N.A.	$ 1	2,000	317	634,000	$ 634,000	$ 7,000	$ 2,219,000	$ 0.36	$ 228,240	$ 3,081,240	$ 2,515,216	0.8163
N+4	N.A.	N.A.	N.A.	$ 1	2,000	317	634,000	$ 634,000	$ 7,000	$ 2,219,000	$ 0.36	$ 228,240	$ 3,081,240	$ 2,350,678	0.7629
N+5	N.A.	N.A.	N.A.	$ 1	2,000	317	634,000	$ 634,000	$ 7,000	$ 2,219,000	$ 0.36	$ 228,240	$ 3,081,240	$ 2,196,924	0.7130
N+6	N.A.	N.A.	N.A.	$ 1	2,000	317	634,000	$ 634,000	$ 7,000	$ 2,219,000	$ 0.36	$ 228,240	$ 3,081,240	$ 2,053,030	0.6663
N+7	N.A.	N.A.	N.A.	$ 1	2,000	317	634,000	$ 634,000	$ 7,000	$ 2,219,000	$ 0.36	$ 228,240	$ 3,081,240	$ 1,918,688	0.6227
N+8	N.A.	N.A.	N.A.	$ 1	2,000	317	634,000	$ 634,000	$ 7,000	$ 2,219,000	$ 0.36	$ 228,240	$ 3,081,240	$ 1,793,282	0.5820
N+9	N.A.	N.A.	N.A.	$ 1	2,000	317	634,000	$ 634,000	$ 7,000	$ 2,219,000	$ 0.36	$ 228,240	$ 3,081,240	$ 1,675,886	0.5439
N+10	N.A.	N.A.	N.A.	$ 1	2,000	317	634,000	$ 634,000	$ 7,000	$ 2,219,000	$ 0.36	$ 228,240	$ 3,081,240	$ 1,566,194	0.5083
N+11	N.A.	N.A.	N.A.	$ 1	2,000	317	634,000	$ 634,000	$ 7,000	$ 2,219,000	$ 0.36	$ 228,240	$ 3,081,240	$ 1,463,897	0.4751
N+12	N.A.	N.A.	N.A.	$ 1	2,000	317	634,000	$ 634,000	$ 7,000	$ 2,219,000	$ 0.36	$ 228,240	$ 3,081,240	$ 1,368,071	0.4440
N+13	N.A.	N.A.	N.A.	$ 1	2,000	317	634,000	$ 634,000	$ 7,000	$ 2,219,000	$ 0.36	$ 228,240	$ 3,081,240	$ 1,278,715	0.4150
N+14	N.A.	N.A.	N.A.	$ 1	2,000	317	634,000	$ 634,000	$ 7,000	$ 2,219,000	$ 0.36	$ 228,240	$ 3,081,240	$ 1,194,905	0.3878
N+15	N.A.	N.A.	N.A.	$ 1	2,000	317	634,000	$ 634,000	$ 7,000	$ 2,219,000	$ 0.36	$ 228,240	$ 3,081,240	$ 1,116,641	0.3624
N+16	N.A.	N.A.	N.A.	$ 1	2,000	317	634,000	$ 634,000	$ 7,000	$ 2,219,000	$ 0.36	$ 228,240	$ 3,081,240	$ 1,043,616	0.3387
N+17	N.A.	N.A.	N.A.	$ 1	2,000	317	634,000	$ 634,000	$ 7,000	$ 2,219,000	$ 0.36	$ 228,240	$ 3,081,240	$ 975,521	0.3166
N+18	N.A.	N.A.	N.A.	$ 1	2,000	317	634,000	$ 634,000	$ 7,000	$ 2,219,000	$ 0.36	$ 228,240	$ 3,081,240	$ 911,739	0.2959
N+19	N.A.	N.A.	N.A.	$ 1	2,000	317	634,000	$ 634,000	$ 7,000	$ 2,219,000	$ 0.36	$ 228,240	$ 3,081,240	$ 851,963	0.2765
N+20	N.A.	N.A.	N.A.	$ 1	2,000	317	634,000	$ 634,000	$ 7,000	$ 2,219,000	$ 0.36	$ 228,240	$ 3,081,240	$ 796,192	0.2584
Total	**317**	**N.A.**	**$ 66,887,000**	**N.A.**	**N.A.**	**N.A.**	**12,362,000**	**$ 12,362,000**	**N.A.**	**$ 43,267,000**	**N.A.**	**$ 4,450,320**	**$ 126,966,320**	**$ 91,657,026**	**N.A.**

Notes:

(A) N is the base year. It is assumed that the rule would be passed at the end of the base year and would allow two years for the existing fleet to comply.
It is also assumed that 50.0% of the existing fleet will be equipped with TCAS II (or equivalent) for each of those three years.

(B) In Dollars per Flight Hour

(C) Estimated at 0.05 times capital cost of TCAS II Unit.

Last Revision: 06/17/2002

Table VI-2

Cost Estimate for Equipping Newly Manufactured Part 121 Turbine-Powered >33,000 Pounds MCTOW All-Cargo Airplanes With TCAS II

		Costs													
		Initial Costs		O & M Expenses					Tranining Expenses		Incremental Fuel Costs		Total Costs		
Year	Air-planes	Unit Cost	Total Cost	Unit Expense (B)	Flight Hours Per Air-plane	Total Air-planes	Fleet Flight Hours	Total O&M Expenses	Unit Expense (C)	Total Training Expenses	Unit Expense (B)	Total Annual Incremental Fuel Expenses	Non-Discounted	Discounted	Discount Factor (20 years @ 7%)
N (A)	80														1.0000
N+1	4	$ 171,000	$ 684,000	$ 1	2,000	4	8,000	$ 8,000	$ 7,000	$ 28,000	$ 0.36	$ 2,880	$ 722,880	$ 675,604	0.9346
N+2	4	$ 171,000	$ 684,000	$ 1	2,000	8	16,000	$ 16,000	$ 7,000	$ 56,000	$ 0.36	$ 5,760	$ 761,760	$ 665,321	0.8734
N+3	4	$ 171,000	$ 684,000	$ 1	2,000	12	24,000	$ 24,000	$ 7,000	$ 84,000	$ 0.36	$ 8,640	$ 800,640	$ 653,562	0.8163
N+4	4	$ 171,000	$ 684,000	$ 1	2,000	16	32,000	$ 32,000	$ 7,000	$ 112,000	$ 0.36	$ 11,520	$ 839,520	$ 640,470	0.7629
N+5	4	$ 171,000	$ 684,000	$ 1	2,000	20	40,000	$ 40,000	$ 7,000	$ 140,000	$ 0.36	$ 14,400	$ 878,400	$ 626,299	0.7130
N+6	4	$ 171,000	$ 684,000	$ 1	2,000	24	48,000	$ 48,000	$ 7,000	$ 168,000	$ 0.36	$ 17,280	$ 917,280	$ 611,184	0.6663
N+7	4	$ 171,000	$ 684,000	$ 1	2,000	28	56,000	$ 56,000	$ 7,000	$ 196,000	$ 0.36	$ 20,160	$ 956,160	$ 595,401	0.6227
N+8	4	$ 171,000	$ 684,000	$ 1	2,000	32	64,000	$ 64,000	$ 7,000	$ 224,000	$ 0.36	$ 23,040	$ 995,040	$ 579,113	0.5820
N+9	4	$ 171,000	$ 684,000	$ 1	2,000	36	72,000	$ 72,000	$ 7,000	$ 252,000	$ 0.36	$ 25,920	$ 1,033,920	$ 562,349	0.5439
N+10	4	$ 171,000	$ 684,000	$ 1	2,000	40	80,000	$ 80,000	$ 7,000	$ 280,000	$ 0.36	$ 28,800	$ 1,072,800	$ 545,304	0.5083
N+11	4	$ 171,000	$ 684,000	$ 1	2,000	44	88,000	$ 88,000	$ 7,000	$ 308,000	$ 0.36	$ 31,680	$ 1,111,680	$ 528,159	0.4751
N+12	4	$ 171,000	$ 684,000	$ 1	2,000	48	96,000	$ 96,000	$ 7,000	$ 336,000	$ 0.36	$ 34,560	$ 1,150,560	$ 510,849	0.4440
N+13	4	$ 171,000	$ 684,000	$ 1	2,000	52	104,000	$ 104,000	$ 7,000	$ 364,000	$ 0.36	$ 37,440	$ 1,189,440	$ 493,618	0.4150
N+14	4	$ 171,000	$ 684,000	$ 1	2,000	56	112,000	$ 112,000	$ 7,000	$ 392,000	$ 0.36	$ 40,320	$ 1,228,320	$ 476,342	0.3878
N+15	4	$ 171,000	$ 684,000	$ 1	2,000	60	120,000	$ 120,000	$ 7,000	$ 420,000	$ 0.36	$ 43,200	$ 1,267,200	$ 459,233	0.3624
N+16	4	$ 171,000	$ 684,000	$ 1	2,000	64	128,000	$ 128,000	$ 7,000	$ 448,000	$ 0.36	$ 46,080	$ 1,306,080	$ 442,369	0.3387
N+17	4	$ 171,000	$ 684,000	$ 1	2,000	68	136,000	$ 136,000	$ 7,000	$ 476,000	$ 0.36	$ 48,960	$ 1,344,960	$ 425,814	0.3166
N+18	4	$ 171,000	$ 684,000	$ 1	2,000	72	144,000	$ 144,000	$ 7,000	$ 504,000	$ 0.36	$ 51,840	$ 1,383,840	$ 409,478	0.2959
N+19	4	$ 171,000	$ 684,000	$ 1	2,000	76	152,000	$ 152,000	$ 7,000	$ 532,000	$ 0.36	$ 54,720	$ 1,422,720	$ 393,382	0.2765
N+20	4	$ 171,000	$ 684,000	$ 1	2,000	80	160,000	$ 160,000	$ 7,000	$ 560,000	$ 0.36	$ 57,600	$ 1,461,600	$ 377,677	0.2584
Total	**80**	**N.A.**	**$ 13,680,000**	**N.A.**	**N.A.**	**N.A.**	**1,680,000**	**$ 1,680,000**	**N.A.**	**$ 5,880,000**	**N.A.**	**$ 604,800**	**$ 21,844,800**	**$ 10,671,530**	**N.A.**

Notes:

(A) N is the base year. It is assumed that the rule would be passed at the end of the base year.
(B) In Dollars per Flight Hour
(C) Estimated at 0.05 times capital cost of TCAS II Unit.

Latest Revision: 06/17/2002

Table VI-3

Total Cost Estimate For TCAS II For The Total Part 121 Fleet Of All-Cargo Airplanes > 33,000 Pounds MCTOW

	Total Fleet Costs					
	Existing Fleet		Newly Manufactured Fleet		Total Fleet	
Year	Non-Discounted	Discounted	Non-Discounted	Discounted	Non-Discounted	Discounted
N(A)						
N+1	$ 34,873,760	$ 32,593,016	$ 722,880	$ 675,604	$ 35,596,640	$ 33,268,620
N+2	$ 36,630,240	$ 31,992,852	$ 761,760	$ 665,321	$ 37,392,000	$ 32,658,173
N+3	$ 3,081,240	$ 2,515,216	$ 800,640	$ 653,562	$ 3,881,880	$ 3,168,778
N+4	$ 3,081,240	$ 2,350,678	$ 839,520	$ 640,470	$ 3,920,760	$ 2,991,148
N+5	$ 3,081,240	$ 2,196,924	$ 878,400	$ 626,299	$ 3,959,640	$ 2,823,223
N+6	$ 3,081,240	$ 2,053,030	$ 917,280	$ 611,184	$ 3,998,520	$ 2,664,214
N+7	$ 3,081,240	$ 1,918,688	$ 956,160	$ 595,401	$ 4,037,400	$ 2,514,089
N+8	$ 3,081,240	$ 1,793,282	$ 995,040	$ 579,113	$ 4,076,280	$ 2,372,395
N+9	$ 3,081,240	$ 1,675,886	$ 1,033,920	$ 562,349	$ 4,115,160	$ 2,238,235
N+10	$ 3,081,240	$ 1,566,194	$ 1,072,800	$ 545,304	$ 4,154,040	$ 2,111,498
N+11	$ 3,081,240	$ 1,463,897	$ 1,111,680	$ 528,159	$ 4,192,920	$ 1,992,056
N+12	$ 3,081,240	$ 1,368,071	$ 1,150,560	$ 510,849	$ 4,231,800	$ 1,878,920
N+13	$ 3,081,240	$ 1,278,715	$ 1,189,440	$ 493,618	$ 4,270,680	$ 1,772,333
N+14	$ 3,081,240	$ 1,194,905	$ 1,228,320	$ 476,342	$ 4,309,560	$ 1,671,247
N+15	$ 3,081,240	$ 1,116,641	$ 1,267,200	$ 459,233	$ 4,348,440	$ 1,575,874
N+16	$ 3,081,240	$ 1,043,616	$ 1,306,080	$ 442,369	$ 4,387,320	$ 1,485,985
N+17	$ 3,081,240	$ 975,521	$ 1,344,960	$ 425,814	$ 4,426,200	$ 1,401,335
N+18	$ 3,081,240	$ 911,739	$ 1,383,840	$ 409,478	$ 4,465,080	$ 1,321,217
N+19	$ 3,081,240	$ 851,963	$ 1,422,720	$ 393,382	$ 4,503,960	$ 1,245,345
N+20	$ 3,081,240	$ 796,192	$ 1,461,600	$ 377,677	$ 4,542,840	$ 1,173,869
Totals	**$ 126,966,320**	**$ 91,657,026**	**$ 21,844,800**	**$ 10,671,530**	**$ 148,811,120**	**$ 102,328,556**

Notes:

(A) N is the base year. It is assumed that the proposed rule would be passed at the end of the base year.
It is assumed that the proposed rule would allow two years for the existing fleet to comply.

Latest Revision: 06/17/2002

Table VI-4

Cost Estimate for Equipping The Existing Part 121 Piston-Powered > 33,000 Pounds MCTOW All-Cargo Airplane Fleet With TCAS I

		Costs													
		Initial Costs		O & M Expenses					Tranining Expenses		Incremental Fuel Costs		Total Costs		
Year	Air-Planes	Unit Cost	Total Cost	Unit Expense (B)	Flight Hours Per Air-plane	Total Air-planes	Fleet Flight Hours	Total O&M Expenses	Unit Expense (C)	Total Training Expenses	Unit Expense (B)	Total Annual Incremental Fuel Expenses	Non-Discounted	Discounted	Discount Factor (20 years @ 7%)
N (A)	26														1.0000
N+1	13	$ 75,000	$ 975,000	$ 1	2,000	13	26,000	$ 26,000	$ 7,000	$ 91,000	$ 0.36	$ 9,360	$ 1,101,360	$ 1,029,331	0.9346
N+2	13	$ 75,000	$ 975,000	$ 1	2,000	26	52,000	$ 52,000	$ 7,000	$ 182,000	$ 0.36	$ 18,720	$ 1,227,720	$ 1,072,291	0.8734
N+3	N.A.	N.A.	N.A.	$ 1	2,000	26	52,000	$ 52,000	$ 7,000	$ 182,000	$ 0.36	$ 18,720	$ 252,720	$ 206,295	0.8163
N+4	N.A.	N.A.	N.A.	$ 1	2,000	26	52,000	$ 52,000	$ 7,000	$ 182,000	$ 0.36	$ 18,720	$ 252,720	$ 192,800	0.7629
N+5	N.A.	N.A.	N.A.	$ 1	2,000	26	52,000	$ 52,000	$ 7,000	$ 182,000	$ 0.36	$ 18,720	$ 252,720	$ 180,189	0.7130
N+6	N.A.	N.A.	N.A.	$ 1	2,000	26	52,000	$ 52,000	$ 7,000	$ 182,000	$ 0.36	$ 18,720	$ 252,720	$ 168,387	0.6663
N+7	N.A.	N.A.	N.A.	$ 1	2,000	26	52,000	$ 52,000	$ 7,000	$ 182,000	$ 0.36	$ 18,720	$ 252,720	$ 157,369	0.6227
N+8	N.A.	N.A.	N.A.	$ 1	2,000	26	52,000	$ 52,000	$ 7,000	$ 182,000	$ 0.36	$ 18,720	$ 252,720	$ 147,083	0.5820
N+9	N.A.	N.A.	N.A.	$ 1	2,000	26	52,000	$ 52,000	$ 7,000	$ 182,000	$ 0.36	$ 18,720	$ 252,720	$ 137,454	0.5439
N+10	N.A.	N.A.	N.A.	$ 1	2,000	26	52,000	$ 52,000	$ 7,000	$ 182,000	$ 0.36	$ 18,720	$ 252,720	$ 128,458	0.5083
N+11	N.A.	N.A.	N.A.	$ 1	2,000	26	52,000	$ 52,000	$ 7,000	$ 182,000	$ 0.36	$ 18,720	$ 252,720	$ 120,067	0.4751
N+12	N.A.	N.A.	N.A.	$ 1	2,000	26	52,000	$ 52,000	$ 7,000	$ 182,000	$ 0.36	$ 18,720	$ 252,720	$ 112,208	0.4440
N+13	N.A.	N.A.	N.A.	$ 1	2,000	26	52,000	$ 52,000	$ 7,000	$ 182,000	$ 0.36	$ 18,720	$ 252,720	$ 104,879	0.4150
N+14	N.A.	N.A.	N.A.	$ 1	2,000	26	52,000	$ 52,000	$ 7,000	$ 182,000	$ 0.36	$ 18,720	$ 252,720	$ 98,005	0.3878
N+15	N.A.	N.A.	N.A.	$ 1	2,000	26	52,000	$ 52,000	$ 7,000	$ 182,000	$ 0.36	$ 18,720	$ 252,720	$ 91,586	0.3624
N+16	N.A.	N.A.	N.A.	$ 1	2,000	26	52,000	$ 52,000	$ 7,000	$ 182,000	$ 0.36	$ 18,720	$ 252,720	$ 85,596	0.3387
N+17	N.A.	N.A.	N.A.	$ 1	2,000	26	52,000	$ 52,000	$ 7,000	$ 182,000	$ 0.36	$ 18,720	$ 252,720	$ 80,011	0.3166
N+18	N.A.	N.A.	N.A.	$ 1	2,000	26	52,000	$ 52,000	$ 7,000	$ 182,000	$ 0.36	$ 18,720	$ 252,720	$ 74,780	0.2959
N+19	N.A.	N.A.	N.A.	$ 1	2,000	26	52,000	$ 52,000	$ 7,000	$ 182,000	$ 0.36	$ 18,720	$ 252,720	$ 69,877	0.2765
N+20	N.A.	N.A.	N.A.	$ 1	2,000	26	52,000	$ 52,000	$ 7,000	$ 182,000	$ 0.36	$ 18,720	$ 252,720	$ 65,303	0.2584
Total	**26**	**N.A.**	**$ 1,950,000**	**N.A.**	**N.A.**	**N.A.**	**1,014,000**	**$ 1,014,000**	**N.A.**	**$ 3,549,000**	**N.A.**	**$ 365,040**	**$ 6,878,040**	**$ 4,321,969**	**N.A.**

Notes:

(A) N is the base year. It is assumed that the rule would be passed at the end of the base year and would allow two years for the existing fleet to comply.
It is also assumed that 50.0% of the existing fleet will be equipped with TCAS II (or equivalent) for each of those three years.

(B) In Dollars per Flight Hour

(C) Estimated at 0.05 times capital cost of TCAS II Unit.

Last Revision: 07/02/2002

Table VI-5

Total Cost Estimate For Equipping The Total Part 121 All-Cargo Airplane Fleet With TCAS

Year	Total Fleet Costs					
	Turbine > 33,000 Pounds (TCAS II)		Piston > 33,000 Lbs (TCAS I)		Total Fleet	
	Non-Discounted	Discounted	Non-Discounted	Discounted	Non-Discounted	Discounted
N (A)						
N+1	$ 35,596,640	$ 33,268,620	$ 1,101,360	$ 1,029,331	$ 36,698,000	$ 34,297,951
N+2	$ 37,392,000	$ 32,658,173	$ 1,227,720	$ 1,072,291	$ 38,619,720	$ 33,730,464
N+3	$ 3,881,880	$ 3,168,778	$ 252,720	$ 206,295	$ 4,134,600	$ 3,375,073
N+4	$ 3,920,760	$ 2,991,148	$ 252,720	$ 192,800	$ 4,173,480	$ 3,183,948
N+5	$ 3,959,640	$ 2,823,223	$ 252,720	$ 180,189	$ 4,212,360	$ 3,003,412
N+6	$ 3,998,520	$ 2,664,214	$ 252,720	$ 166,387	$ 4,251,240	$ 2,830,601
N+7	$ 4,037,400	$ 2,514,089	$ 252,720	$ 157,369	$ 4,290,120	$ 2,671,458
N+8	$ 4,076,280	$ 2,372,395	$ 252,720	$ 147,083	$ 4,329,000	$ 2,519,478
N+9	$ 4,115,160	$ 2,238,235	$ 252,720	$ 137,454	$ 4,367,880	$ 2,375,689
N+10	$ 4,154,040	$ 2,111,498	$ 252,720	$ 128,458	$ 4,406,760	$ 2,239,956
N+11	$ 4,192,920	$ 1,992,056	$ 252,720	$ 120,067	$ 4,445,640	$ 2,112,123
N+12	$ 4,231,800	$ 1,878,920	$ 252,720	$ 112,208	$ 4,484,520	$ 1,991,128
N+13	$ 4,270,680	$ 1,772,333	$ 252,720	$ 104,879	$ 4,523,400	$ 1,877,212
N+14	$ 4,309,560	$ 1,671,247	$ 252,720	$ 98,005	$ 4,562,280	$ 1,769,252
N+15	$ 4,348,440	$ 1,575,874	$ 252,720	$ 91,586	$ 4,601,160	$ 1,667,460
N+16	$ 4,387,320	$ 1,485,985	$ 252,720	$ 85,596	$ 4,640,040	$ 1,571,581
N+17	$ 4,426,200	$ 1,401,335	$ 252,720	$ 80,011	$ 4,678,920	$ 1,481,346
N+18	$ 4,665,080	$ 1,321,217	$ 252,720	$ 74,780	$ 4,917,800	$ 1,395,997
N+19	$ 4,503,960	$ 1,245,345	$ 252,720	$ 69,877	$ 4,756,680	$ 1,315,222
N+20	$ 4,542,840	$ 1,173,869	$ 252,720	$ 65,303	$ 4,795,560	$ 1,239,172
Total	**$ 148,811,120**	**$ 102,328,556**	**$ 6,878,040**	**$ 4,321,969**	**$ 155,689,160**	**$ 106,650,525**

Notes:

(A) N is the base year. It is assumed that the rule will be passed at the end of the base year and allow two years for the existing fleet to comply.

Latest Revision: 07/02/2002

VII Part 125 Commercial Operators –Estimated Incremental Costs

A. Introduction

If an airplane is included in part 125 it may be operated in one or more of the following ways:

- Operated entirely as a company or personal airplane. In this case the operator has two options. He may operate under the provisions of part 125, or he may request an application for a deviation to operate under part 91, Subpart F. When an airplane is operated entirely as a company or personal airplane there is no operating certificate; no commercial service of any kind is provided; and, for all practical purposes the airplane operates under part 91. However, a deviation is not mandatory. It should also be noted that if an operator utilizes the same airplane as both a deviation holder and a commercial operator and if the provisions of part 125 require equipment that is not required when he/she is operating as a deviation holder, the part 125 equipment cannot be removed when the airplane is operating under part 91. Part 91 deviation holders are not included in these cost estimates.

- Operated as a commercial operation. In this case, the operator has an operating certificate, charges for his services, and operates his business in accordance with the provisions of part 125. In this case, the operator has no option to operate under the provisions of part 91, he must operate under the provisions of part 125.

It should be noted that, in certain cases, the provisions of the proposed rule would apply to airplanes operated for passenger transportation under the provisions of part 125. For example, under the current rule, a DC-9 configured for 14 seats and a B-757 configured for 28 seats would not be required to have a TCAS II. However, the provisions of the proposed rule would require these airplanes to be equipped with a TCAS II because the proposed rule is stated in terms of airplane weight, rather than the number of passenger seats the airplane is configured for. However, if these airplanes are used as private airplanes and they should not want to install TCAS II, they have the option of requesting a deviation and operating under part 91, subpart F. Because the use of TCAS II is not required under part 91, these airplanes would not be required to use a TCAS if they received a deviation to operate under part 91. Therefore, airplanes that are currently operating under part 125, but have the option to request a deviation to operate under part 91 are not included in the cost estimates for this rule.

B. TCAS II Costs On Existing Airplanes

The estimated cost of TCAS II installations to part 125 Commercial Operators is shown in Table VII-1. The unit costs and methodology are the same that were used for developing the cost estimates for Part 121 all-cargo operators that would require TCAS II installation as a result of this proposed rule.

In summary these costs were:

- Initial cost of purchasing and installing a TCAS II System: $211,000
- O&M Expenses: $1 per flight hour
- Training Expenses: .05 times the initial cost of the TCAS System
- Incremental Fuel Costs: $0.36 per flight hour

Table VII-1 shows that the total undiscounted costs of installing TCAS II units on the existing part 125 Commercial Operator Fleet are approximately $10,000,000. The corresponding discounted amount is estimated to be approximately $7,000,000.

It is anticipated that the existing part 125 Commercial Operator Fleet that would require TCAS II installation as a result of this proposed rule would remain at about its current size. Therefore, no forecast of newly manufactured airplanes is provided.

C. Estimated Costs of TCAS I Installations To Part 125 Commercial Operators

The estimated cost of TCAS I installations to part 125 Commercial Operators is shown in Table VII-2. The unit costs and methodology are the same that were used for the development of the cost estimates for Part 121 all-cargo operators that would require TCAS I installation as a result of this rule.

In summary these costs were:

- Initial cost of purchasing and installing a TCAS I System: $75,000
- O&M Expenses: $1 per flight hour
- Training Expenses: .05 times the initial cost of the TCAS System
- Incremental Fuel Costs: $0.36 per flight hour

Table VII-2 shows that the total undiscounted costs of installing TCAS I units on the existing part 125 Commercial Operator Fleet is approximately $5,000,000. The corresponding discounted amount is estimated to be approximately $4,000,000 million.

It is anticipated that the existing part 125 Commercial Operator Fleet that would require TCAS I installation as a result of this proposed rule would remain at about its current size. Therefore, no forecast of newly manufactured airplanes is provided.

D. Total Costs of TCAS Installations to Part 125 Commercial Operators

The total estimated costs of TCAS II and TCAS I installations on part 125 commercial operators as, a result of this rule, are shown on Table VII-3.

These total non-discounted costs are estimated to be approximately $15,000,000. The corresponding discounted costs are estimated to be approximately $11,000,000.

Table VII-1

Cost Estimate For Equipping The Existing Turbine Powered > 33,000 Pound MCTOW Part 125 Commercial Operator Fleet With TCAS II

		Costs														
		Initial Costs		O & M Expenses					Tranining Expenses		Incremental Fuel Expenses		Total Costs		
Year	Air-planes	Unit Cost	Total Cost	Unit Expense (B)	Flight Hours Per Air-plane	Total Air-planes	Fleet Flight Hours	Total O&M Expenses	Unit Expense (C)	Total Training Expenses	Unit Expense (B)	Total Annual Incremental Fuel Expenses	Non-Discounted	Discounted	Discount Factor (20 years @ 7%)
N (A)	25														1.0000
N+1	12	$ 211,000	$ 2,532,000	$ 1	2,000	12	24,000	$ 24,000	$ 7,000	$ 84,000	$ 0.36	$ 8,640	$ 2,648,640	$ 2,475,419	0.9346
N+2	13	$ 211,000	$ 2,743,000	$ 1	2,000	25	50,000	$ 50,000	$ 7,000	$ 175,000	$ 0.36	$ 18,000	$ 2,986,000	$ 2,607,972	0.8734
N+3	N.A.	N.A.	N.A.	$ 1	2,000	25	50,000	$ 50,000	$ 7,000	$ 175,000	$ 0.36	$ 18,000	$ 243,000	$ 198,361	0.8163
N+4	N.A.	N.A.	N.A.	$ 1	2,000	25	50,000	$ 50,000	$ 7,000	$ 175,000	$ 0.36	$ 18,000	$ 243,000	$ 185,385	0.7629
N+5	N.A.	N.A.	N.A.	$ 1	2,000	25	50,000	$ 50,000	$ 7,000	$ 175,000	$ 0.36	$ 18,000	$ 243,000	$ 173,259	0.7130
N+6	N.A.	N.A.	N.A.	$ 1	2,000	25	50,000	$ 50,000	$ 7,000	$ 175,000	$ 0.36	$ 18,000	$ 243,000	$ 161,911	0.6663
N+7	N.A.	N.A.	N.A.	$ 1	2,000	25	50,000	$ 50,000	$ 7,000	$ 175,000	$ 0.36	$ 18,000	$ 243,000	$ 151,316	0.6227
N+8	N.A.	N.A.	N.A.	$ 1	2,000	25	50,000	$ 50,000	$ 7,000	$ 175,000	$ 0.36	$ 18,000	$ 243,000	$ 141,426	0.5820
N+9	N.A.	N.A.	N.A.	$ 1	2,000	25	50,000	$ 50,000	$ 7,000	$ 175,000	$ 0.36	$ 18,000	$ 243,000	$ 132,168	0.5439
N+10	N.A.	N.A.	N.A.	$ 1	2,000	25	50,000	$ 50,000	$ 7,000	$ 175,000	$ 0.36	$ 18,000	$ 243,000	$ 123,517	0.5083
N+11	N.A.	N.A.	N.A.	$ 1	2,000	25	50,000	$ 50,000	$ 7,000	$ 175,000	$ 0.36	$ 18,000	$ 243,000	$ 115,449	0.4751
N+12	N.A.	N.A.	N.A.	$ 1	2,000	25	50,000	$ 50,000	$ 7,000	$ 175,000	$ 0.36	$ 18,000	$ 243,000	$ 107,892	0.4440
N+13	N.A.	N.A.	N.A.	$ 1	2,000	25	50,000	$ 50,000	$ 7,000	$ 175,000	$ 0.36	$ 18,000	$ 243,000	$ 100,845	0.4150
N+14	N.A.	N.A.	N.A.	$ 1	2,000	25	50,000	$ 50,000	$ 7,000	$ 175,000	$ 0.36	$ 18,000	$ 243,000	$ 94,235	0.3878
N+15	N.A.	N.A.	N.A.	$ 1	2,000	25	50,000	$ 50,000	$ 7,000	$ 175,000	$ 0.36	$ 18,000	$ 243,000	$ 88,063	0.3624
N+16	N.A.	N.A.	N.A.	$ 1	2,000	25	50,000	$ 50,000	$ 7,000	$ 175,000	$ 0.36	$ 18,000	$ 243,000	$ 82,304	0.3387
N+17	N.A.	N.A.	N.A.	$ 1	2,000	25	50,000	$ 50,000	$ 7,000	$ 175,000	$ 0.36	$ 18,000	$ 243,000	$ 76,934	0.3166
N+18	N.A.	N.A.	N.A.	$ 1	2,000	25	50,000	$ 50,000	$ 7,000	$ 175,000	$ 0.36	$ 18,000	$ 243,000	$ 71,904	0.2959
N+19	N.A.	N.A.	N.A.	$ 1	2,000	25	50,000	$ 50,000	$ 7,000	$ 175,000	$ 0.36	$ 18,000	$ 243,000	$ 67,190	0.2765
N+20	N.A.	N.A.	N.A.	$ 1	2,000	25	50,000	$ 50,000	$ 7,000	$ 175,000	$ 0.36	$ 18,000	$ 243,000	$ 62,791	0.2584
Total	**25**	**N.A.**	**$ 5,275,000**	**N.A.**	**N.A.**	**N.A.**	**974,000**	**$ 974,000**	**N.A.**	**$ 3,409,000**	**N.A.**	**$ 350,640**	**$ 10,008,640**	**$ 7,218,341**	**N.A.**

Notes:

(A) N is the base year. It is assumed that the rule would be passed at the end of the base year and would allow two years for the existing fleet to comply.
It is also assumed that 50.0% of the existing fleet will be equipped with TCAS II (or equivalent) for each of those three years.

(B) In Dollars per Flight Hour

(C) Estimated at .05 percent of the initial cost of a TCAS II unit.

Last Revision: 06/18/2002

Table VII-2

Cost Estimate For Equipping The Existing Piston-Powered > 33,000 Pounds MCTOW Part 125 Commercial Operator Fleet With TCAS I

		Costs													
		Initial Costs		O & M Expenses					Tranining Expenses		Incremental Fuel Expense		Total Costs		
Year	Air-planes	Unit Cost	Total Cost	Unit Expense (B)	Flight Hours Per Airplane	Total Air-planes	Fleet Flight Hours	Total O & M Expenses	Unit Expense (C)	Total Training Expense	Unit Expense (B)	Total Annual Fuel Expense	Non-Discounted	Discounted	Discount Factor (20 years @ 7%)
N (A)	27														1.0000
N+1	13	$75,000	$ 975,000	$ 1	2,000	13	26,000	$ 26,000	$ 3,800	$ 49,400	$ 0.36	$ 9,360	$ 1,059,760	$ 990,452	0.9346
N+2	14	$75,000	$ 1,050,000	$ 1	2,000	27	54,000	$ 54,000	$ 3,800	$ 102,600	$ 0.36	$ 19,440	$ 1,226,040	$ 1,070,823	0.8734
N+3	N.A.	N.A.	N.A.	$ 1	2,000	27	54,000	$ 54,000	$ 3,800	$ 102,600	$ 0.36	$ 19,440	$ 176,040	$ 143,701	0.8163
N+4	N.A.	N.A.	N.A.	$ 1	2,000	27	54,000	$ 54,000	$ 3,800	$ 102,600	$ 0.36	$ 19,440	$ 176,040	$ 134,301	0.7629
N+5	N.A.	N.A.	N.A.	$ 1	2,000	27	54,000	$ 54,000	$ 3,800	$ 102,600	$ 0.36	$ 19,440	$ 176,040	$ 125,517	0.7130
N+6	N.A.	N.A.	N.A.	$ 1	2,000	27	54,000	$ 54,000	$ 3,800	$ 102,600	$ 0.36	$ 19,440	$ 176,040	$ 117,295	0.6663
N+7	N.A.	N.A.	N.A.	$ 1	2,000	27	54,000	$ 54,000	$ 3,800	$ 102,600	$ 0.36	$ 19,440	$ 176,040	$ 109,620	0.6227
N+8	N.A.	N.A.	N.A.	$ 1	2,000	27	54,000	$ 54,000	$ 3,800	$ 102,600	$ 0.36	$ 19,440	$ 176,040	$ 102,455	0.5820
N+9	N.A.	N.A.	N.A.	$ 1	2,000	27	54,000	$ 54,000	$ 3,800	$ 102,600	$ 0.36	$ 19,440	$ 176,040	$ 95,748	0.5439
N+10	N.A.	N.A.	N.A.	$ 1	2,000	27	54,000	$ 54,000	$ 3,800	$ 102,600	$ 0.36	$ 19,440	$ 176,040	$ 89,481	0.5083
N+11	N.A.	N.A.	N.A.	$ 1	2,000	27	54,000	$ 54,000	$ 3,800	$ 102,600	$ 0.36	$ 19,440	$ 176,040	$ 83,637	0.4751
N+12	N.A.	N.A.	N.A.	$ 1	2,000	27	54,000	$ 54,000	$ 3,800	$ 102,600	$ 0.36	$ 19,440	$ 176,040	$ 78,162	0.4440
N+13	N.A.	N.A.	N.A.	$ 1	2,000	27	54,000	$ 54,000	$ 3,800	$ 102,600	$ 0.36	$ 19,440	$ 176,040	$ 73,057	0.4150
N+14	N.A.	N.A.	N.A.	$ 1	2,000	27	54,000	$ 54,000	$ 3,800	$ 102,600	$ 0.36	$ 19,440	$ 176,040	$ 68,268	0.3878
N+15	N.A.	N.A.	N.A.	$ 1	2,000	27	54,000	$ 54,000	$ 3,800	$ 102,600	$ 0.36	$ 19,440	$ 176,040	$ 63,797	0.3624
N+16	N.A.	N.A.	N.A.	$ 1	2,000	27	54,000	$ 54,000	$ 3,800	$ 102,600	$ 0.36	$ 19,440	$ 176,040	$ 59,625	0.3387
N+17	N.A.	N.A.	N.A.	$ 1	2,000	27	54,000	$ 54,000	$ 3,800	$ 102,600	$ 0.36	$ 19,440	$ 176,040	$ 55,734	0.3166
N+18	N.A.	N.A.	N.A.	$ 1	2,000	27	54,000	$ 54,000	$ 3,800	$ 102,600	$ 0.36	$ 19,440	$ 176,040	$ 52,090	0.2959
N+19	N.A.	N.A.	N.A.	$ 1	2,000	27	54,000	$ 54,000	$ 3,800	$ 102,600	$ 0.36	$ 19,440	$ 176,040	$ 48,675	0.2765
N+20	N.A.	N.A.	N.A.	$ 1	2,000	27	54,000	$ 54,000	$ 3,800	$ 102,600	$ 0.36	$ 19,440	$ 176,040	$ 45,489	0.2584
Total	**27**	**N.A.**	**$ 2,025,000**	**N.A.**	**N.A.**	**N.A.**	**1,052,000**	**$ 1,052,000**	**N.A.**	**$ 1,998,800**	**N.A.**	**$ 378,720**	**$ 5,454,520**	**$ 3,607,927**	**N.A.**

Notes:

(A) N Is the base year. It is assumed that the rule would be passed at the end of the base year and would allow two years for the existing fleet to comply.
It is also assumed that 50.0% of the existing fleet will be equipped with TCAS I (or equivalent) for each of those three years.

(B) In Dollars per Flight Hour

(C) Estimated at 54 percent of TCAS II training expenses.

Last Revised: 07/05/2002

Table VII-3						
Total Cost Estimate For Equipping The Part 125 Commercial Operator Fleet With TCAS						
	Total Fleet Costs					
	Turbine > 33,000 Pounds (TCAS II)		**Piston > 33,000 Lbs (TCAS I)**		**Total Fleet**	
Year	**Non-Discounted**	**Discounted**	**Non-Discounted**	**Discounted**	**Non-Discounted**	**Discounted**
N(A)						
N+1	$ 2,648,640	$ 2,475,419	$ 1,059,760	$ 990,452	$ 3,708,400	$ 3,465,871
N+2	$ 2,986,000	$ 2,607,972	$ 1,226,040	$ 1,070,823	$ 4,212,040	$ 3,678,795
N+3	$ 243,000	$ 198,361	$ 176,040	$ 143,701	$ 419,040	$ 342,062
N+4	$ 243,000	$ 185,385	$ 176,040	$ 134,301	$ 419,040	$ 319,686
N+5	$ 243,000	$ 173,259	$ 176,040	$ 125,517	$ 419,040	$ 298,776
N+6	$ 243,000	$ 161,911	$ 176,040	$ 117,295	$ 419,040	$ 279,206
N+7	$ 243,000	$ 151,316	$ 176,040	$ 109,620	$ 419,040	$ 260,936
N+8	$ 243,000	$ 141,426	$ 176,040	$ 102,455	$ 419,040	$ 243,881
N+9	$ 243,000	$ 132,168	$ 176,040	$ 95,748	$ 419,040	$ 227,916
N+10	$ 243,000	$ 123,517	$ 176,040	$ 89,481	$ 419,040	$ 212,998
N+11	$ 243,000	$ 115,449	$ 176,040	$ 83,637	$ 419,040	$ 199,086
N+12	$ 243,000	$ 107,892	$ 176,040	$ 78,162	$ 419,040	$ 186,054
N+13	$ 243,000	$ 100,845	$ 176,040	$ 73,057	$ 419,040	$ 173,902
N+14	$ 243,000	$ 94,235	$ 176,040	$ 68,268	$ 419,040	$ 162,503
N+15	$ 243,000	$ 88,063	$ 176,040	$ 63,797	$ 419,040	$ 151,860
N+16	$ 243,000	$ 82,304	$ 176,040	$ 59,625	$ 419,040	$ 141,929
N+17	$ 243,000	$ 76,934	$ 176,040	$ 55,734	$ 419,040	$ 132,668
N+18	$ 243,000	$ 71,904	$ 176,040	$ 52,090	$ 419,040	$ 123,994
N+19	$ 243,000	$ 67,190	$ 176,040	$ 48,675	$ 419,040	$ 115,865
N+20	$ 243,000	$ 62,791	$ 176,040	$ 45,489	$ 419,040	$ 108,280
Total	**$ 10,008,640**	**$ 7,218,341**	**$ 5,454,520**	**$ 3,607,927**	**$ 15,463,160**	**$ 10,826,268**

Notes:

(A) N is the base year. It is assumed that the rule would be passed at the end of the base year and would allow two years for the existing fleet to comply.

Last Revised: 07/02/2002

VIII. Part 121 Newly Manufactured Airplanes > 33,000 Pounds MCTOW

Currently, TCAS II Version 6.04A Enhanced is required on passenger airplanes but there is no such requirement on cargo airplanes. The proposed rule would require that all newly manufactured airplanes be equipped with TCAS II Version 7. The costs of equipping newly manufactured all-cargo airplanes with TCAS II Version 7 have been discussed above.

Discussions with industry contacts indicate that the cost of purchasing a new TCAS II Version 7 would be about $3,000 more than purchasing a new TCAS II Version 6.04A Enhanced. This is approximately 1.5% of the cost of a complete TCAS II Version 7 unit costing approximately $200,000. The $3,000 cost increment for a TCAS II version 7 instead of a version 6.04A Enhanced is about .03 percent of the cost of an airplane selling for $10,000,000.

The installation of a TCAS II Version 7 instead of a Version 6.04A Enhanced would also provide benefits to the airplane's owner. These benefits include the ability to use the airplane in global airspaces including RVSM (Reduced Vertical Separation Minimums). This would increase the value of the airplane on the resale market.

The FAA has not included the costs of the change of TCAS II Version 7 on newly manufactured passenger airplanes in this analysis because of the relatively minor absolute and relative costs of equipping newly manufactured passenger airplanes with TCAS II Version 7, instead of Version 6.04A Enhanced, and the offsetting benefits of equipping with Version 7 instead of Version 6.04A Enhanced.

The proposed rule would allow operation of TCAS 6.04A Enhanced units until they no longer can be repaired to TSO C-119a standards. However, the life expectancy of a TCAS 6.04A Enhanced unit is expected to extend beyond the term of this study. Therefore, no costs are forecasted for the replacement of existing TCAS 6.04A Enhanced units.

IX. Total Incremental Costs Of The Proposed Rule

The total estimated costs of TCAS II and TCAS I installations on part 121 all-cargo airplanes and part 125 commercial operators that would be required as a result of this proposed rulemaking are shown on Table IX-1.

These total non-discounted costs, over the next 20 years, are estimated to be approximately $172,000,000. The corresponding discounted costs are estimated to be approximately $118,000,000.

Table IX-1						
Total Cost Estimate For The Proposed Rule						
	Total Rule Costs					
	Part 121		**Part 125**		**Total Rule**	
Year	**Non-Discounted**	**Discounted**	**Non-Discounted**	**Discounted**	**Non-Discounted**	**Discounted**
N(A)						
N+1	$ 36,698,000	$ 34,297,951	$ 3,708,400	$ 3,465,871	$ 40,406,400	$ 37,763,822
N+2	$ 38,619,720	$ 33,730,464	$ 4,212,040	$ 3,678,795	$ 42,831,760	$ 37,409,259
N+3	$ 4,134,600	$ 3,375,073	$ 419,040	$ 342,062	$ 4,553,640	$ 3,717,135
N+4	$ 4,173,480	$ 3,183,948	$ 419,040	$ 319,686	$ 4,592,520	$ 3,503,634
N+5	$ 4,212,360	$ 3,003,412	$ 419,040	$ 298,776	$ 4,631,400	$ 3,302,188
N+6	$ 4,251,240	$ 2,830,601	$ 419,040	$ 279,206	$ 4,670,280	$ 3,109,807
N+7	$ 4,290,120	$ 2,671,458	$ 419,040	$ 260,936	$ 4,709,160	$ 2,932,394
N+8	$ 4,329,000	$ 2,519,478	$ 419,040	$ 243,881	$ 4,748,040	$ 2,763,359
N+9	$ 4,367,880	$ 2,375,689	$ 419,040	$ 227,916	$ 4,786,920	$ 2,603,605
N+10	$ 4,406,760	$ 2,239,956	$ 419,040	$ 212,998	$ 4,825,800	$ 2,452,954
N+11	$ 4,445,640	$ 2,112,123	$ 419,040	$ 199,086	$ 4,864,680	$ 2,311,209
N+12	$ 4,484,520	$ 1,991,128	$ 419,040	$ 186,054	$ 4,903,560	$ 2,177,182
N+13	$ 4,523,400	$ 1,877,212	$ 419,040	$ 173,902	$ 4,942,440	$ 2,051,114
N+14	$ 4,562,280	$ 1,769,252	$ 419,040	$ 162,503	$ 4,981,320	$ 1,931,755
N+15	$ 4,601,160	$ 1,667,460	$ 419,040	$ 151,860	$ 5,020,200	$ 1,819,320
N+16	$ 4,640,040	$ 1,571,581	$ 419,040	$ 141,929	$ 5,059,080	$ 1,713,510
N+17	$ 4,678,920	$ 1,481,346	$ 419,040	$ 132,668	$ 5,097,960	$ 1,614,014
N+18	$ 4,917,800	$ 1,395,997	$ 419,040	$ 123,994	$ 5,336,840	$ 1,519,991
N+19	$ 4,756,680	$ 1,315,222	$ 419,040	$ 115,865	$ 5,175,720	$ 1,431,087
N+20	$ 4,795,560	$ 1,239,172	$ 419,040	$ 108,280	$ 5,214,600	$ 1,347,452
Total	**$ 155,689,160**	**$ 106,650,525**	**$ 15,463,160**	**$10,826,268**	**$171,352,320**	**$117,474,791**
				ABOUT:	**$172,000,000**	**$118,000,000**

Notes:

(A) N is the base year. It is assumed that the rule would be passed at the end of the base year and would allow two years for the existing fleet to comply.

Last Revised: 03/03/2003

X. 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% while costing 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. In the event of midair collisions over Los Angeles, San Diego, and other metropolitan areas, significant collateral damage can easily exceed hundreds of millions of dollars – just a collision with a large passenger airplane can result in costs in excess of $300 million. The worst MAC occurred in 1996 with 349 fatalities. MITRE estimated slightly more than 50 percent of all midair collisions are expected to occur over the suburbs or cities.

The risk reduction study was based upon the U.S. airspace, where no actual MAC with a cargo airplane has occurred. As a consequence of no U.S. MAC accident history, the estimated probabilities of a MAC may be biased low.

A recent incident over mainland China illustrates the potential costs of midair collisions. On June 28, 1999, a British Airways (BA) B-747 carrying 400 passengers to Hong Kong came within 200 meters of a Korean Air B-747 freighter. The BA aircraft received a TCAS Resolution Advisory (RA), the flight crew responded to it, and a collision was avoided. If such a collision had occurred, the costs of the accident would have been extremely high. A rough estimate of the potential costs of such an accident can be prepared by multiplying the number of people involved (about 420 counting the passengers and the crews of each airplane) by $3,000,000, the value of a fatality avoided used in FAA analyses. The cost, estimated in this manner, is $1,260,000,000. If the value of the airplane and any collateral damage on the ground were added to this estimate, the cost would be considerably higher. In this case, the TCAS very likely averted an accident that could have had a total cost well in excess of $1 billion.

The benefits of the final rule of the proposed rule, as estimated in Chapter V equal approximately $10,000,000. This benefit estimate is based upon avoiding a 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, if an accident does occur the benefits can easily exceed the cost of this rule. The costs of the final rule, as estimated in Chapter IX are approximately $118,000,000.

Despite the estimated quantified benefits being less than the estimated costs, the FAA believes that 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 that 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.

XI. 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 Final Regulatory Flexibility Analysis (FRFA) must provide:

1. A succinct statement of the need for, and objectives of the rule;
2. A summary of the significant issues raised by the public comments in response to the IRFA, a summary of the assessment of the agency of such issues, and a statement of any changes made in the proposed rule as a result of such comments;
3. A description of, and an estimate of the number of, small entitities to which the rule will apply or an explanation of why no such estimate is available;
4. A description of the projected reporting, recordkeeping, and other compliance requirements of the rule, including an estimate of the classes of small entities which will be subject to the requirement and the type of professional skills necessary for preparation of the report or record; and

5. A description of the steps the agency has taken to minimize the significant economic impact on small entities consistent with the stated objectives of applicable statutes, including a statement of the factual, policy, and legal reasons for selecting the alternative adopted in the final rule and why each one of the other significant alternatives to the rule considered by the agency which affects the impact on small entities was rejected.

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 Website (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 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 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 three 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 expected safe aviation-operating environment.

Table XI-1									
Group1 - Part 121 All-Cargo Turbine-Powered > 33,000 Pounds MCTOW **Small Business Entities - Employees And Revenues - 2001**									
			Airplanes (A)						
No.	**Operator**	**Employees**	**No.**	**Compliance Cost**		**Operating Revenue 2001 (D)**		**Cost as % of Revenue**	**Affected (E)**
				$ 223,000	**(B)**				
1	Air Transport Int'l LLC	522	0	$ -	(C)	$ 112,254,000		0.0%	
2	Amerijet Int'l Inc	396	4	$ 892,000	(C)	(F)		(F)	
3	Asia Pacific Airlines	34	1	$ 223,000	(C)	$ 1,200,000		18.6%	1
4	Capital Cargo Int'l Airlines Inc	200	13	$ 2,899,000	(C)	$ 48,100,495	(G)	6.0%	2
5	Centurion Air Cargo Inc	60	1	$ 223,000	(C)	$ 24,000,000	(H)	0.9%	
6	Charter America	5	2	$ 446,000	(C)	N.A.		N.A.	
7	Custom Air Transport Inc	67	2	$ 446,000	(C)	$ 10,388,000		4.3%	3
8	Eastwind Airlines	N.A.	5	$ 1,115,000	(C)	$ 22,000,000		5.1%	4
9	Empire Airlines Inc	174	13	$ 2,899,000	(C)	$ 18,000,000		16.1%	5
10	Express One Int'l Inc	500	17	$ 3,791,000	(C)	$ 115,000,000	(G)	3.3%	6
11	Express.Net Airlines LLC	244	3	$ 669,000	(C)	$ 1,750,000		38.2%	7
12	Florida West Int'l Airways Inc	55	0	$ -	(C)	$ 125,000,000		0.0%	
13	Gemini Air Cargo Inc	590	0	$ -	(C)	$ 35,900,000		0.0%	
14	Kalitta Air LLC	120	0	$ -	(C)	$ 7,500,000		0.0%	
15	Kitty Hawk Air Cargo Inc	500	30	$ 6,690,000	(C)	(I)		(I)	
16	Miami Air International Inc	460	3	$ 669,000	(C)	$ 85,700,000		0.8%	
17	Mountain Air Cargo (Air T) Inc	472	20	$ 4,460,000	(C)	$ 70,246,000		6.3%	8
18	Northern Air Cargo Inc	225	3	$ 669,000	(C)	$ 41,568,000		1.6%	
19	Ryan Int'l Airlines Inc	1,200	33	$ 7,359,000	(C)	$ 200,000,000		3.7%	9
20	Southern Air Inc [Ohio USA]	94	0	$ -	(C)	$ 52,400,000		0.0%	
21	Tradewinds Airlines Inc	135	0	$ -	(C)	$ 17,000,000		0.0%	
22	USA Jet Airlines Inc	277	12	$ 2,676,000	(C)	$ 22,000,000		6.4%	10
23	World Airways Inc	589	0	$ -	(C)	$ 317,866,000		0.0%	
24	Zantop Int'l Airlines Inc	150	2	$ 446,000	(C)	$ 15,230,000		2.9%	11
25									
26									
27									
Total		**7,069**	**164**	**$36,572,000**		**$ 1,343,102,495**		**2.7%**	**11**

Notes:	
(A)	Airplanes requiring TCAS II.
(B)	Per Airplane Cost
(C)	Total Operator Cost
(D)	Operating Revenues of the Parent Firm.
(E)	More than 2% of gross revenue.
(F)	Emerged From Chapter 11 Bankruptcy on December 31, 2001.
(G)	2000
(H)	Projected for 2002
(I)	Emerging From Chapter 11 Bankruptcy in 2002.

Sources:	
1	DOT/BTS/OAI -Number of Employees Certificated Carriers Year End Data - 2001
2	Wyvern Air Carrier Information Service--Extended Information - (www.wyvernltd.com)
3	Hoover's Online
4	Dun & Bradstreet Business Locator 07/17/2001
5	World Aviation Directory, Spring/Summer 2002
6	Reference USA, Version 4.1-www.referenceusa.com

Last Revised: 03/03/2003

Table XI-2

Group 2 - Part 121 All-Cargo Piston-Powered > 33,000 Pounds MCTOW Air Carriers
Small Business Entities - Employees And Revenues - 2001

No.	Operator	Employees	Airplanes (A) No.	Compliance Cost		Operating Revenue 2001 (D)		Cost as % of Revenue	Affected (E)
				$ 82,000	(B)				
1	Air Tahoma, Inc.	36	4	$ 328,000	(C)	N.A.		N.A.	1
2	Coastal Air Transport	11	1	$ 82,000	(C)	$ 1,750,000		4.7%	2
3	Northern Air Cargo, Inc.	243	6	$ 492,000	(C)	$ 41,568,000		1.2%	
4	Rhoades Aviation, Inc.	52	4	$ 328,000	(C)	$ 7,500,000		4.4%	3
5	Tatonduk Outfitters, Ltd.	168	8	$ 656,000	(C)	$ 12,000,000		5.5%	4
6	Tol Air Services, Inc.	28	1	$ 82,000	(C)	$ 3,750,000		2.2%	5
7	Trans Florida Airlines, Inc.	7	2	$ 164,000	(C)	$ 1,750,000		9.4%	6
8									
9									
10									
11									
12									
13									
14									
15									
Total		**545**	**26**	**$ 2,132,000**		**$ 68,318,000**		**3.1%**	**6**

Notes:

(A)	Airplanes requiring TCAS I.
(B)	Per Airplane Cost
(C)	Total Operator Cost
(D)	Operating Revenues of the Parent Firm.
(E)	More than 2% of gross revenue.

Sources:

1	DOT/BTS/OAI -Number of Employees Certificated Carriers Year End Data - 2001
2	Wyvern Air Carrier Information Service--Extended Information - (www.wyvernltd.com)
3	Hoover's Online
4	Dun & Bradstreet Business Locator 07/17/2001
5	Reference USA, Version 4.1-www.referenceusa.com

Last Revised: 07/08/2002

Table XI-3									
Group 3 - Part 125 All-Cargo Turbine-Powered > 33,000 Pounds MCTOW Air Carriers **Small Business Entities - Employees And Revenues - 2001**									
			Airplanes (A)						
No.	**Operator**	**Employees**	**No.**	**Compliance Cost**		**Operating Revenue 2001 (D)**		**Cost as % of Revenue**	**Affected (E)**
[illegible]	[illegible]	[illegible]	[illegible]	**$ 223,000**	**(B)**	[illegible]	[illegible]	[illegible]	[illegible]
1	C and M Airways Inc.	27	6	$ 1,338,000	(C)	N.A.		N.A.	1
2	Contract Air Cargo	58	11	$ 2,453,000	(C)	N.A.		N.A.	2
3	Contract Cargo Airlines Inc	2	1	$ 223,000	(C)	N.A.		N.A.	3
4	Murray Air, Inc.	35	2	$ 446,000	(C)	N.A.		N.A.	4
5	Platinum Commercial Air Gruoup	12	1	$ 223,000	(C)	N.A.		N.A.	5
6	Tepper Aviation, Inc.	16	2	$ 446,000	(C)	$ 7,500,000		5.9%	6
7	Traffic Management Corporation	36	2	$ 446,000	(C)	$ 1,750,000		25.5%	7
8									
9									
10									
11									
12									
13									
14									
15									
Total		**186**	**25**	**$ 5,575,000**		**$ 9,250,000**		**60.3%**	**7**
Notes:									
(A)	Airplanes requiring TCAS II.								
(B)	Per Airplane Cost								
(C)	Total Operator Cost								
(D)	Operating Revenues of the Parent Firm.								
(E)	More than 2% of gross revenue.								
Sources:									
1	DOT/BTS/OAI -Number of Employees Certificated Carriers Year End Data - 2001								
2	Wyvern Air Carrier Information Service--Extended Information - (www.wyvernltd.com)								
3	Hoover's Online								
4	Dun & Bradstreet Business Locator 07/17/2001								
5	Reference USA, Version 4.1-www.referenceusa.com								
Last Revised: 07/08/2002									

Table XI-4									
Group 4 - Part 125 Commercial Cargo Operators - Piston-Powered > 33,000 Pounds MCTOW Airplanes									
Small Business Entities - Employees And Revenues -2001									
			Airplanes (A)						
No.	**Operator**	**Employees**	**No.**	**Compliance Cost**		**Operating Revenue 2001 (D)**		**Cost as % of Revenue**	**Affected (E)**
				$82,000	**(B)**				
1	Blumenthal, James R.	3	1	$ 82,000	(C)	N.A.		N.A.	1
2	Brooks Air Transport, Inc.	14	2	$ 164,000	(C)	N.A.		N.A.	2
3	Custom Air Service, Inc.	15	1	$ 82,000	(C)	$ 500,000		16.4%	3
4	Dodita Air Cargo, Inc.	15	2	$ 164,000	(C)	N.A.		N.A.	4
5	Everts Air Fuel	8	4	$ 328,000	(C)	$ 75,000,000		0.4%	
6	Ferreteria E Implementos San Franci	15	3	$ 246,000	(C)	N.A.		N.A.	5
7	Florida Air Transport, Inc.	7	2	$ 164,000	(C)	N.A.		N.A.	6
8	Fresh Air, Inc.	7	2	$ 164,000	(C)	N.A.		N.A.	7
9	Lone Star Contract Air Cargo, Inc.	15	2	$ 164,000		N.A.		N.A.	8
10	Miami Air Lease, Inc.	8	1	$ 82,000	(C)	$ 750,000		10.9%	9
11	Nord Star Airlines, Inc.	5	1	$ 82,000	(C)	N.A.		N.A.	10
12	Northern Air Fuel	7	2	$ 164,000	(C)	$ 500,000		32.8%	11
13	Tiger Contract Cargo	5	1	$ 82,000	(C)	N.A.		N.A.	12
14	Universal Airlines, Inc.	12	3	$ 246,000	(C)	N.A.		N.A.	13
Total		**136**	**27**	**$ 2,214,000**		**$ 76,750,000**		**2.9%**	**13**

Notes

(A)	Airplanes requiring TCAS I
(B)	Per Airplane Cost
(C)	Total Operator Cost
(D)	Operating Revenue of the parent firm
(E)	More than 2% of gross revenue

Sources

(1)	Reference USA, Version 4.1-www.referenceusa.com

Last Revised: 07/08/2002

XII 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.

XIII. 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.

Appendices

Appendix IV-1, Page 1 of 2					
Comparison of NPRM and Final Rule Air Cargo Fleets, Part 121>33,000 Lbs. MCTOW					
No.	**Operator**	**NPRM Airplanes**	**Final Rule Airplanes**	**Notes** Back Data as of 01/05/2002, unless otherwise noted.	**Change In Fleet**
	Airlines				
1	Airborne Express	114	122	Docket #218	8
2	Air Transport Int'l LLC	11	10		-1
3	Aloha	1	0		-1
4	Alaska Airlines Inc	0	1		1
5	American Int'l Airways	30	0	Merged with Kittyhawk	-30
6	Amerijet Int'l Inc	8	4		-4
7	Arrow Air	9	0		-9
8	Asia Pacific Airlines, Guam	0	1		1
9	Atlas Air	15	32		17
10	Bax Global	18	17		-1
11	Capital Cargo Int'l Airlines Inc	6	13		7
12	Centurion Air Cargo Inc	0	1		1
13	Challenge Air Cargo	5	0		-5
14	Charter America	4	2		-2
15	Continental Micronesia	7	0		-7
16	Custom Air Transport Inc	2	2		0
17	DHL Airways Inc	34	34		0
18	Eagle Airlines	1	0		-1
19	Eastwind Airlines	5	5		0
20	Emery Worldwide	64	0	Fleet grounded, not counted.	-64
21	Empire Airlines Inc	10	13	RAA	3
22	Evergreen Intl'l Inc	19	15		-4
23	Express One Int'l Inc	20	17		-3
24	Express.Net Airlines LLC	0	10		10
25	Falcon Air Express	1	0		-1
26	FedEx Inc	303	333		30
27	Fine Air	10	19		9
28	Florida West Airlines	1	0		-1
29	Florida West Int'l Airways Inc	0	2		2
30	Gemini Air Cargo Inc	8	12		4
31	Kalitta Air LLC	0	7		7
32	Kitty Hawk Air Cargo Inc	38	30		-8
33	Miami Air International Inc	0	3		3
34	Mountain Air Cargo Inc	22	20	FAA	-2
35	Northern Air Cargo Inc	3	3		0
36	Northwest Airlines Inc	8	12		4
37	Polar Air Cargo Inc	12	16		4
38	Purolator	1	0		-1
39	Reliant Airlines Inc	1	0	Ceased Operating in 2002	-1
40	Renown Aviation	5	0		-5
41	Rich Int'l	1	0		-1
42	Ryan Int'l Airlines Inc	9	33		24
43	Sky Trek Int'l Airlines	2	0		-2
44	Southern Air [OH-USA] Inc	0	3		3
45	TMC Airlines	0	5		5
46	Tower Air	1	0		-1
47	Tradewinds Airlines Inc	1	7		6
48	Transcontinental	7	0		-7
49	United Airlines Inc	4	1		-3
50	United Parcel Service	217	238		21
51	USA Jet Airlines Inc	7	12		5
52	World Airways Inc	1	5		4
53	Zantop International Airlines Inc	2	2		0
Total Airlines		**1,048**	**1,062**		**14**
Last Updated: 07/01/2002					

Appendix IV-1 (Page 2 of 2)

Comparison of Lessor, Broker, Etc.Air Cargo Fleets
Part 121, >33,000 Lbs. MCTOW

No.	Lessors, Brokers, Etc.	NPRM Fleet	Final Rule Fleet	(A)	Change In Fleet
1	AirCorp, Inc.	0	1		1
2	Aircraft R Us Corp.	0	1		1
3	Air Trade LSG	1	0		-1
4	Aircraft Investment Assoc.	1	0		-1
5	ALG, Inc.	2	0		-2
6	Babcock & Brown	1	0		-1
7	Bank of NY	1	0		-1
8	BEHC	5	0		-5
9	Boeing	0	1		1
10	Cook Aircraft LSG	1	0		-1
11	Finova Capital	3	3		0
12	First Security Bank	2	0		-2
13	G&B Corp.	1	1		0
14	GATX Leasing	1	0		-1
15	General Avn Tech.	1	0		-1
16	General Electric Cap Corp.	0	4		4
17	Global Aircraft Sales	1	0		-1
18	Int'l Air Leases	5	0		-5
19	Intrepid Aviation Partners LLC	0	4		4
20	Jack Prewitt + Associates	0	2		2
21	Joda LLC	0	3		3
22	Kalitta Equipment LLC	0	2		2
23	Nationsbanc Leasing	1	0		-1
24	Pacific Harbor Capital	1	0		-1
25	Pegasus Capital Corp.	0	2		2
26	Polaris Leasing	3	0		-3
27	Provident Bank	0	1		1
28	Raytheon E-Systems	1	0		-1
29	Trans Pacific LSG	1	0		-1
Total Lessors, Etc.		**33**	**25**		**(8)**
Total Airlines		**1,048**	**1,062**	**(B)**	**14**
Grand Total		**1,081**	**1,087**		**6**
Notes:					

(A) Back Data as of Jan 05, 2002, unless otherwise noted.

(B) From Page 1

Last Updated: 07/01/2002

Appendix IV-2

Comparison of TCAS II Requirements - Air Cargo Fleets Part 121, >33,000 Lbs. MCTOW

		NPRM Fleet		Final Rule Fleet		
No.	Operator	Airplanes	TCAS Rq'd By NPRM	Airplanes	TCAS Rq'd By Final Rule	(A)
1	Airborne Express	114	72	122	0	(B)
2	Air Transport Int'l	11	0	10	0	
3	Aloha	1	1	0	0	
4	Alaska Airlines Inc	0	0	1	1	
5	American Int'l Airways	30	1	0	0	
6	Amerijet Int'l Inc	8	8	4	4	
7	Arrow Air	9	0	0	0	
8	Asia Pacific Airlines, Guam	0	0	1	1	
9	Atlas Air	15	0	32	0	
10	Bax Global	18	2	17	4	
11	Capital Cargo Int'l Airlines Inc	6	6	13	13	
12	Centurion Air Cargo Inc	0	0	1	0	
13	Challenge Air Cargo	5	3	0	0	
14	Charter America	4	4	2	2	
15	Continental Micronesia	7	7	0	0	
16	Custom Air Transport	2	2	2	2	
17	DHL Airways	34	25	34	21	
18	Eagle Airlines	1	1	0	0	
19	Eastwind Airlines	5	5	5	5	
20	Emery Worldwide	64	24	0	0	(C)
21	Empire Airlines Inc	10	10	13	13	
22	Evergreen Intl'l Inc	19	10	15	7	
23	Express One Int'l Inc	20	20	17	17	
24	Express.Net Airlines LLC	0	0	10	3	
25	Falcon Air Express	1	1	0	0	
26	FedEx Inc	303	0	333	0	
27	Fine Air	10	0	19	0	
28	Florida West Airlines	1	0	0	0	
29	Florida West Int'l Airways Inc	0	0	2	0	
30	Gemini Air Cargo Inc	8	0	12	0	
31	Kalitta Air LLC	0	0	7	0	
32	Kitty Hawk Air Cargo Inc	38	38	30	30	
33	Miami Air International Inc	0	0	3	3	
34	Mountain Air Cargo Inc	22	22	20	20	
35	Northern Air Cargo Inc	3	3	3	3	
36	Northwest Airlines Inc	8	0	12	0	
37	Polar Air Cargo Inc	12	0	16	0	
38	Purolator	1	1	0	0	
39	Reliant Airlines Inc	1	1	0	0	(D)
40	Renown Aviation	5	5	0	0	
41	Rich Int'l	1	1	0	0	
42	Ryan Int'l Airlines Inc	9	9	33	33	
43	Sky Trek Int'l Airlines	2	2	0	0	
44	Southern Air [OH-USA] Inc	0	0	3	0	
45	TMC Airlines	0	0	5	5	
46	Tower Air	1	0	0	0	
47	Tradewinds Airlines Inc	1	0	7	0	
48	Transcontinental	7	1	0	0	
49	United Airlines Inc	4	0	1	0	
50	United Parcel Service	217	125	238	116	
51	USA Jet Airlines Inc	7	7	12	12	
52	World Airways Inc	1	0	5	0	
53	Zantop International Airlines Inc	2	0	2	2	
Total Airlines		**1,048**	**417**	**1,062**	**317**	
Total Brokers, Etc.		**33**	**33**	**25**	**8**	**(E)**
Total TCAS II Requirements		**1,081**	**450**	**1,087**	**325**	

Notes:

(A) See Table V-1.

(B) Letter of 21 Dec 2001, Docket # 218.

(C) Emery has grounded its fleet of 37 aircraft. It is not known if this fleet will fly again. Therefore, those airplanes are not counted at this time.

(D) Terminated Operations in 2002.

(E) Approximately 30% of the final rule airline fleet requires TCAS II. It is assumed that this ratio also applies to broker, etc. airplanes.

Last Updated: 07/01/2002

Appendix IV-3

NPRM - Part 121 < 33,000 Pound MCTOW Turbine-Powered And All Piston-Powered Airplanes All-Cargo Fleet

Final Rule - Part 121 > 33,000 Pound MCTOW Piston-Powered Airplanes All-Cargo Fleet

NPRM						Final Rule					
Operator No.	Operator Name	Airplane Type	Engine Type	MCTOW	Total Airplanes	Operator No.	Operator Name	Airplane Type	Engine Type	MCTOW	Total Airplanes
1	Air Alaska Cargo	CV-440	Piston	49,100	1	1	Air Tahoma, Inc.	CV-240-27	Piston	49,100	4
2	Alaska Central Express	B-1900	Turboprop	18,950	4	2	Coastel Air Transport	CV-340-30	Piston	47,000	1
3	Alaska Island Air	DC-3	Piston	26,200	1	3	Northern Air Cargo	DC-6	Piston	106,000	6
4	Arctic Circle Air Service	Skyvan	Turboprop	12,700	3	4	Rhoades Aviation, Inc.	CV-240-27	Piston	49,100	2
5	Arctic Transportation Services, Inc.	CASA 212	Turboprop	16,093	2		" " "	CV-340-340	Piston	47,000	1
6	Bering Air	CASA 212	Turboprop	16,093	1		" " "	CV-440-440	Piston	49,100	1
7	Cape Smythe Air Service	DC-3	Piston	26,200	1		**Subtotal - Rhoades Aviation**				**4**
8	Corporate Air	SD-3-30	Turboprop	22,900	3	5	Tatonduk Outfitters, Ltd.	C-46	Piston	56,000	2
	" " "	SD-3-60	Turboprop	17,350	3		" " "	DC-6	Piston	106,000	6
	" " "	B-1900	Turboprop	16,950	1		**Subtotal - Tatonduk Outfitters**				**8**
	" " "	B-99	Turboprop	10,900	4	6	Tol Air Services, Inc.	CV-240-27	Piston	49,100	1
	" " "	DHC-6	Turboprop	12,500	3	7	Trans Florida Airlines, Inc.	CV-240	Piston	49,100	2
	Subtotal - Corporate Air				**14**						
9	F.S. Air Service	CASA 212	Turboprop	16,093	1						
	" " "	Skyvan	Turboprop	12,700	1						
	Subtotal - F.S. Air Service				**2**						
10	Falcon Air Express Airlines	B-1900	Turboprop	18,950	4						
11	Frontier Flying Service	DC-3	Piston	26,200	1						
12	Great Lakes Aviation, Inc.	B-1900	Turboprop	18,950	4						
13	Merlin Express	Metro	Turboprop	14,500	26						
14	Mountainn Air Cargo, Inc.	SD-3-30	Turboprop	22,900	4						
15	Renown Aviation	CV-440	Piston	49,100	3						
16	Rhoades Aviation, Inc.	CV-240	Piston	49,100	3						
	" " "	CV-340	Piston	47,000	3						
	" " "	CV-440	Piston	49,100	3						
	" " "	DC-3	Piston	26,200	4						
	Subtotal - Rhoades Aviation				**13**						
17	Tatonduk Outfitters	DC-6	Piston	106,000	6						
18	Tol Air Services, Inc.	CV-240	Piston	49,100	1						
	" " "	CV-440	Piston	49,100	2						
	" " "	DC-3	Piston	26,200	4						
	Subtotal - Tol Air Services, Inc.				**7**						
	Total Airplanes				**96**		**Total Airplanes**				**26**

Last Revised: 07/01/2002

Appendix IV-4

Part 125 > 33,000 Pound MCTOW Turbine-Powered Commercial Operator Fleet (1)

NPRM						Final Rule					
Operator						Operator					
No.	Name	Airplane Type	Engine Type	MCTOW (Pounds)	Total Airplanes	No.	Name	Airplane Type	Engine Type	MCTOW (Pounds)	Total Airplanes
1	C and M Airways, Inc	CV-640	Turboprop	57,000	5	1	C and M Airways, Inc.	CV-640-340STD	Turboprop	57,000	5
2	Contract Cargo Airlines, Inc	DC-8F-55	Turbofan	325,000	1		" " "	CV-640-440STD	Turboprop	57,000	1
3	Traffic Management Corp	DC-8F-55	Turbofan	325,000	1		Subtotal - C and M				6
	" " "	L-188-A	Turboprop	116,000	3	2	Contract Air Cargo	B-727-22C	Turbofan	209,500	1
	Subtotal - Trf Mgmt Corp.				4		" " "	CV-340-580STC	Turboprop	58,140	5
							" " "	CV-440-580STC	Turboprop	58,140	5
							Subtotal - Contract Air Cargo				11
						3	Contract Cargo Airlines, Inc	L-188-A	Turboprop	116,000	1
						4	Murray Air, Inc.	DC-8-63F	Turbofan	350,000	2
						5	Platinum Commercial Air Group	B-727-232	Turbofan	209,500	1
						6	Tepper Aviation, Inc	L-382-G	Turboprop	155,000	2
						7	Traffic Management Corp.	L-188-A	Turboprop	116,000	2
	Total Airplanes				10		**Total Airplanes**				25

Notes:

1 Excludes:

1. Deviation Holders
2. Airplanes Configured for > 30 Seats.
3. 10-30 Seat Airplanes

Last Revised: 07/01/2002

Appendix IV-5

NPRM - Part 125 < 33,000 Pound MCTOW Turbine-Powered And All Piston-Powered Commercial Operator Fleet (1)
Final Rule - Part 125 > 33,000 Pound MCTOW Piston-Powered Commercial Operator Fleet

NPRM

Operator No.	Operator Name	Airplane Type	Engine Type	MCTOW (Pounds)	Total Airplanes
1	Airway Transport	DC-3	Piston	28,000	1
2	Blumenthal, James R.	DC-4	Piston	73,000	1
3	Brooks Air Transport, Inc.	DC-4	Piston	73,000	2
4	Cascade Air, Inc	DC-3	Piston	28,000	2
5	Custom Air Service, Inc.	DC-4	Piston	73,000	1
6	Dodita Air Cargo, Inc.	CV-440	Piston	49,700	2
7	Everts Air Fuel	C-46	Piston	56,000	4
	" " "	DC-6	Piston	97,200	2
	Subtotal-Everts Air Fuel				6
8	Ferreteria E Implementos SF	C-46	Piston	56,000	1
	" " "	CV-440	Piston	49,700	2
	Subtotal - Ferreteria				3
9	Florida Air Transport, Inc.	DC-6	Piston	97,200	1
10	Fresh Air, Inc.	CV-440	Piston	49,700	1
11	Miami Air Lease, Inc.	CV-340	Piston	47,000	1
12	Nord Star Airlines, Inc.	DC-6	Piston	97,200	1
13	Northern Air Fuel	DC-6	Piston	97,200	1
14	Piedmont Air Transport, Inc.	DC-6	Piston	97,200	2
15	Powers & Hawkins Enterprizes	C-97	Piston	175,000	1
	" " "	DC-6	Piston	97,200	1
	Subtotal - Powers & Hawkins				2
16	RPG Airlift, Inc.	CV-440	Piston	49,700	1
17	Richard Air of Florida, Inc.	CV-340	Piston	47,000	1
18	Tiger Contract Cargo	CV-340	Piston	47,000	1
19	Woods Air Fuel	DC-6	Piston	97,200	1
	Total Airplanes				31

Final Rule

Operator No.	Operator Name	Airplane Type	Engine Type	MCTOW (Pounds)	Total Airplanes
1	Blumenthal, James R.	DC-4	Piston	73,000	1
2	Brooks Air Transport, Inc.	DC-4	Piston	73,000	2
3	Custom Air Service, Inc.	DC-4	Piston	73,000	1
4	Dodita Air Cargo, Inc.	CV-440	Piston	49,700	2
5	Everts Air Fuel	C-46	Piston	56,000	2
	" " "	DC-6	Piston	97,200	2
	Subtotal-Everts Air Fuel				4
6	Ferreteria E Implementos SF	C-46	Piston	56,000	1
	" " "	CV-440	Piston	49,700	2
	Subtotal - Ferreteria				3
7	Florida Air Transport, Inc.	DC-6-A	Piston	97,200	1
	" " "	DC-7-B	Piston	143,000	1
	Subtotal - Florida Air Transport, Inc.				2
8	Fresh Air, Inc.	CV-440	Piston	49,700	2
9	Lone Star Contract Air Cargo, Inc.	CV-340	Piston	47,000	2
10	Miami Air Lease, Inc.	CV-340	Piston	47,000	1
11	Nord Star Airlines, Inc.	DC-6	Piston	97,200	1
12	Northern Air Fuel	DC-6	Piston	97,200	2
13	Tiger Contract Cargo	CV-340	Piston	47,000	1
14	Universal Airlines, Inc.	DC-6	Piston	97,200	3
	Total Airplanes				27

Notes:

1 Excludes:

1. Deviation Holders
2. Passenger Airplanes.

Last Revised 07/01/2002

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