142972 FAA-01-10910-3 Docket # 01-10910

INITIAL REGULATORY EVALUATION, INITIAL 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.

September 24, 2001

TABLE OF CONTENTS

EXECUTIVE SUMMARY

This regulatory evaluation examines the economic impacts of a notice of proposed rulemaking to require part 121 and 125 operators to install and use a collision avoidance system by October 31, 2003, on certain airplanes. In addition, this proposal would require that all affected airplanes manufactured after the date of this NPRM and required by this proposed 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 proposed rule applies to part 129 carriers, the economic impacts on part 129 carriers are not studied because part 129 applies to foreign carriers and the FAA does not perform economic assessments on 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 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 proposed rule. Over a 20-year horizon the present value total cost of the proposed rule is projected to be $176 million.

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

	TCAS II	TCAS I	Total
Part 121	$156.8	$12.5	$169.3
Part 125	$ 2.8	$ 4.0	$ 6.8
Total	$159.6	$16.5	$176.1

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 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 $2.7 million, the value of a fatality avoided used in FAA analyses. The cost, estimated in this manner, is $1.1 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 proposed rule is expected to have a significant impact on a substantial number of small entities. This proposed rule would not constitute a barrier to international trade nor constitute an unfunded mandate.

The FAA solicits comments on any or all parts of this analysis. Please include substantive information, for example, actual cost or benefits data, with your comments.

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 and a Saudi Boeing 747 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 collision avoidance device, such as TCAS (Traffic Collision and 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 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 Regulatory Evaluation considers the benefits (risk reduction) and costs of this proposed rule that would require the installation and use of a collision avoidance

---

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

system on airplanes used primarily to transport cargo operating under 14 CFR parts 121, 125, and 129. In addition, this proposal would affect passenger and cargo airplanes manufactured after the date of this NPRM, 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 proposed 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 and the FAA does not perform economic assessments on foreign carriers. This regulatory evaluation only estimates the benefits and costs of TCAS because TCAS is the only collision avoidance system currently available and FAA approved.

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 proposing this action to minimize the possibility of midair collisions involving cargo airplanes.

The FAA proposes 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 October 31, 2003. This proposal 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 proposal would require that all affected airplanes manufactured after the publication date of this NPRM, and required by this proposed 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)[2], 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

[2] 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 Proposed Rule

A. Purpose of the Proposed Rule

The purpose of the proposed rule is to further reduce the risk of midair collisions. The proposed rule would primarily reduce the risk of midair collisions between all-cargo airplanes and would also 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 air cargo industry operated approximately 375 airplanes. Today, cargo air carriers operate approximately 1,150 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.

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, 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 support 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 NPRM, proposing to require the installation and use of TCAS on cargo airplanes, although broader than the IPA's proposal, 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 references the two near midair collisions that occurred earlier this year involving airplanes that were not required to have TCAS II equipment installed. The NTSB specifically recommends 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 proposal generally incorporates the NTSB's regulatory recommendation. 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. The FAA's proposal also would require TCAS I on certain airplanes weighing 33,000 pounds or less MCTOW, which is not included in the NTSB's recommendation. 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 has issued legislation (Wendell H. Ford Aviation and Investment and Reform Act ("Air 21") that directs the FAA Administrator to require, in part, that certain cargo airplanes be equipped with collision avoidance technology by December 31, 2002. The statute provides for an extension of up to 2 years.

F. Other Countries and Organizations Requiring Collision Avoidance Systems for All-Cargo Airplanes

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:

- Japan: 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.

- Eurocontrol Member Countries: 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 specifies 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.

- India: 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.

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

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

- ICAO: 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 Currently Proposed Rule

The FAA is proposing to amend §§ 121.356, 125.224, and 129.18 by changing the applicability criteria for collision avoidance requirements. Rather than using the current passenger-seating configuration criteria to determine applicability, which excludes all-cargo airplanes, the FAA would implement a weight criteria. As such, this proposed rule would standardize the requirements for airplanes of similar size, operating environment, and performance capability.

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

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 be required to be equipped with TCAS I.

Operators may elect to install an approved equivalent collision avoidance system to TCAS I or TCAS II, as appropriate. Any alternative system to TCAS must provide equivalent functions and must be interoperable with TCAS to comply with these requirements.

IV. Benefits of the Proposed Rule

A. Introduction

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 sometimes erode. In some instances, separation between aircraft is lost. Many different factors apply in such cases. These could include a pilot's lack of awareness of nearby traffic, a navigational error, or confusion concerning the intentions of other traffic or the parameters of the pilot's own clearance. 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 may fail. At present, TCAS is required in passenger airplanes and has also been voluntarily installed on a small fraction of military transport and on some General Aviation (primarily business) aircraft. In addition, the all-cargo airlines FedEx and Polar Air Cargo 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.

Numerous reports have been filed attesting 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. 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 pilots 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.

Another 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 mostly 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 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 important, 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 traffic display.

A benefit of the TCAS equipment is that it is carried onboard the airplane, and thus is completely independent of ATC intervention, acting immediately when required. 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 Federal Express McDonnell Douglas DC-10 had departed from Portland, Oregon, and was enroute to Memphis, Tennessee. The other airplane was an American International Airways Lockheed L-1011 which had departed from Los Angeles, California, and was proceeding to Indianapolis, 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 are not currently required to be equipped with TCAS, or any other form of collision avoidance system.

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.[3]

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.

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 if this proposed rule were to be implemented.

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

[3] 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.

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

- 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 that cargo airplane midair collisions (MACs) may occur. In principle, this risk is the expected number of cargo airplane MACs with another cargo airplane, a passenger airplane, or a general aviation aircraft. 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, there were two near midair collisions (NMAC) with cargo airplanes this year. 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 they are not equipped with a collision avoidance device.

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 increases 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.[4] 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, 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 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.

[4] 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.

The above methodologies provide a range from 0.1 to 0.6 accidents for a cargo airplane MAC 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 events 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.

For the purpose of the analysis that follows, the FAA uses the 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 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 – 0.35)/.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 shows the MITRE derived pair probabilities conditioned on encounters involving at least one passenger airplane.

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 (0.058 – 0.070)/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 would reduce the risk of all-cargo airplane NMACs by 94 percent. This would 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 would experience approximately a 17 percent risk reduction, or the risk factor for passenger airplanes would 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 would be a 40 percent chance that one or more midair collisions involving a cargo airplane would occur in the U.S. airspace within the next 20 years. On the other hand, this rule would 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 would experience approximately a 17 percent risk reduction, or the risk factor for passenger airplanes would 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 would result from this rule. The rule would 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 proposed 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 would 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 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 IV-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 IV-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 IV-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 proposed 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 IV-1) by equipment results in the expected number of accidents by equipment. Thus the expected number of cargo airplane MAC accidents without this proposed rule equals 0.298 with another cargo airplane; 0.160 with a general aviation airplane; and 0.043 with a passenger airplane.

3. Accidents: Expected Costs

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 would 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 $2.7 million. Cargo airplanes are valued here at $5 million each with 2 crew for each airplane resulting in an estimated benefit of $20.8 million per averted MAC. An averted cargo airplane MAC with a general aviation airplane is valued at $21.7, 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 $360.4 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 $25 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 $26 million over twenty years.

4. General Discussion of Benefits

Without CAS on all-cargo airplanes, the approximated MAC rate is 0.5 per 20-year period, or a 40 percent chance of one or more midair collisions involving a cargo airplane in the same time period. If this rule is implemented MITRE estimates that passenger airplanes would experience approximately a 17 percent risk reduction. The MAC risk was dramatized by a near mid-air collision with two cargo airplanes, a DC-10 and an L-1011, over Salina, Kansas on March 2, 1999.

The estimated expected dollar benefit of this proposed rule is $26 million over 20 years.

The expected benefit estimate is a weighted probability estimate. If the low probability event of a cargo airplane colliding in air with a passenger airplane occurs, then the losses will be real, not estimated. A cargo airplane MAC can easily exceed the cost of a collision avoidance system installed in cargo airplanes. The estimated cost of a MAC involving a cargo airplane and a 150-passenger airplane is $360 million without collateral damage. While the expected number of MAC accidents prevented is 0.5 over twenty years, there is a 40 percent chance of one or more mid-air collisions with a cargo airplane without a collision avoidance system. As has been discussed above and with the recent DC-10, L1011 air cargo airplanes near mid-air collision over Kansas, this proposed rule would reduce the real risk of an all-air-cargo airplane mid-air collision with another airplane.

Table IV-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	Pass Aircraft have TCAS (Table 4-11)	1.000	1.000	0.092	
3	Adjusted risk for Conditional Pair and	0.324	0.174	0.046	0.544
4	TCAS 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	$10,800,000			
17	**Total**	**$20,800,000**	**0.298**	**$6,190,977**	
18					
19	GA aircraft = $500,000	$500,000			
20	GA-Pilot = 1, Pass = 3	$10,800,000			
21	Cargo Aircraft = 1 @ $5mill	$5,000,000			
22	Cargo Pilots = 2	$5,400,000			
23	**Total**	**$21,700,000**	**0.160**	**$3,468,645**	
24					
25	Pass. Aircraft = 1 @ $30 mill	$30,000,000			
26	Pass + Crew= (150*.75) + 6	$319,950,000			
27	Cargo Aircraft 1 @ $5mill	$5,000,000			
28	Cargo Crew = 2	$5,400,000			
29	**Total**	**$360,350,000**	**0.043**	**$15,319,026**	
30	**Totals**	**$402,850,000**		**$24,978,647**	
31	**Total Expected Accident Loss**			**$24,978,647**	
32					
33	**4. Accidents: Collateral Damage - Low Estimate**			**$1,000,000**	
34					
35	**5. Total Expected Loss**			**$25,978,647**	
36					
					09/24/2001

V. Part 121/125 All-Cargo Fleet

A. Introduction

An estimate of the affected fleet from the proposed rule depends on several factors. First, due to different TCAS requirements, the affected fleet for TCAS II and TCAS I must be separately determined.

Secondly, the affected fleet is reduced by those airplanes that would 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 proposed rule would require the installation of TCAS II, or equivalent, only 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 proposed rule would also require the installation of TCAS I, or equivalent, on other all-cargo airplanes operated by part 121and 125 operators. In general, this would include turbine-powered cargo airplanes of 33,000 pounds or less MCTOW and all piston-powered cargo airplanes regardless of weight.

B. Existing Fleet

The of U.S. cargo airplanes that would be affected by the proposed rule have been separated into five categories, as shown in Appendix V-2:

1. Operators (44) of part 121 all-cargo, turbine fleet over 33,000 pounds MCTOW (1,048 airplanes)
2. Lessors and brokers (19) of part 121 who have possession of all-cargo turbine airplanes that were not leased to an operator (33 airplanes);
3. Operators of part 121 all-cargo fleet (18) - all piston and turbine airplanes of 33,000 pounds or less MCTOW (33 airplanes)
4. Part 125 commercial operators (3) turbine fleet more than 33,000 pounds MCTOW (10 airplanes)
5. Part 125 commercial operators (19) piston fleet 33,000 pounds MCTOW or less (31 airplanes)

The FAA estimates that there are 22 commercial part 125 operators using 41 airplanes that might be affected by the proposed rule. Of these 22 commercial operators, three operators fly 10 turbine-powered airplanes that have a MCTOW of more than 33,000 pounds (listed in Appendix V-4). These operators would be required to install and use TCAS II in these airplanes. The remaining 19 commercial operators fly a total of 31 piston powered airplanes that have a MCTOW of 33,000 pounds or less (listed in Appendix V-5). These operators would be required to install and use TCAS I in these airplanes.

The complete number of U.S. registered cargo airplanes by airplane model and operator/owner are shown in Appendices V-1, V-3, and V-4. These appendices follow the last chapter of this document.

C. Fleet Operating Internationally

Several anticipated international regulatory actions will require U.S.-registered cargo airplanes operating outside U.S. airspace to be operated with TCAS II, starting in the year 2000. This proposed rule would not impose economic costs on operators of all-cargo airplanes that must 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-L1011, MD-11, MD-10, DC-

10, DC-8, A300, and the A310. The FAA conservatively assumes that the B-757 will be operated as a domestic airplane. These airplanes (except the B-757) are expected to be required to have TCAS II/ACAS II installed whether or not this proposal becomes a final rule.

D. Operators Voluntarily Installing TCAS II

Airplanes are also excluded from the costs of the proposed rule when an operator voluntarily installs TCAS II. FedEx has announced that it will voluntarily equip its fleet with TCAS II. FedEx will start with its international fleet and then proceed to equip all its fleet. Polar Air Cargo has already voluntarily equipped its fleet with TCAS II. FedEx and Polar Air Cargo's fleets are excluded from the costs of the proposed rule.

After subtracting airplanes which must meet international TCASII/ACASII requirements and subtracting those airplanes whose operators voluntarily are installing TCAS II, there remains a total of 416 cargo airplanes in the existing U.S. part 121 > 33,000 pounds (MCTOW) fleet that would be affected by this proposed rule. (See Appendix V-2)

E. Forecasted Fleet

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

In 1988 Boeing forecasted that the world air cargo fleet would approximately double in the next 20 years. The FAA forecasts the total part 121, turbine >33,000 pound (MCTOW) all-cargo fleet for the next 20 years in Table V-1. The FAA forecasts that this segment of the cargo fleet will increase by 1,000 airplanes in the next 20 years, an approximate doubling of the 1,048 part 121 existing all-cargo fleet. Again, with the FAA conservative assumption of no retirements, the FAA forecasts that there will be 2,048 all-cargo airplanes in 20 years.

The FAA forecasts that the U.S. part 121 all-cargo fleet will grow at a rate of 50 airplanes per year over the next 20 years. The increase in the all-cargo fleet will come from two sources: airplanes converted from passenger service and newly manufactured all-cargo airplanes. Because passenger airplanes converted to cargo service will almost certainly contain a TCAS unit, there will be no costs caused by the proposed rule to all-cargo airplanes that are converted from passenger airplanes. Thus, of the future additional cargo airplanes, the proposed rule would affect only newly manufactured all-cargo airplanes.

The Boeing Company, in its 1998 air cargo forecast, forecasts that 70 percent of the all-cargo airplanes added to the fleet in the next 20 years will be converted from passenger airplanes. The remaining 30 percent would come from newly manufactured airplanes. The FAA uses these Boeing percentages in the forecasts shown in Table V-1. 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.

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 airplanes are shown in Table V-2 for part 121 carriers and in Table V-3 for part 125 commercial operators.

The existing part 121 fleet of > 33,000 pounds MCTOW, as shown in Table V-1, consists of 632 airplanes that would not be affected by the proposed rule and 416 airplanes that would be affected by the proposed rule. It is assumed that the proposed rule allows 3 years for the existing fleet to have TCAS II installed. This length of time should allow these airplanes to have the TCAS installed during a C or D check.

It is assumed that approximately one third of the existing fleet (139 airplanes) would have TCAS II installed each year.

Table V - 1

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

	Existing Fleet			Forecasted Additions To Fleet			Total Fleet Size		
Year	Total	Would Not Require TCAS II Because of Proposed Rule	Would Require TCAS II Because of Proposed Rule	Total Airplanes	Passenger Conversions	Newly Manufactured Freighters	Total Airplanes	Airplanes With TCAS II Retrofits	Newly Manufactured Airplanes With TCAS II
N (A)	1,048	632	416	N.A.	N.A.	N.A.	1,048	N.A.	N.A.
N+1			139	50	35	15	1,098	139	15
N+2			139	50	35	15	1,148	139	15
N+3			138	50	35	15	1,198	138	15
N+4				50	35	15	1,248		15
N+5				50	35	15	1,298		15
N+6				50	35	15	1,348		15
N+7				50	35	15	1,398		15
N+8				50	35	15	1,448		15
N+9				50	35	15	1,498		15
N+10				50	35	15	1,548		15
N+11				50	35	15	1,598		15
N+12				50	35	15	1,648		15
N+13				50	35	15	1,698		15
N+14				50	35	15	1,748		15
N+15				50	35	15	1,798		15
N+16				50	35	15	1,848		15
N+17				50	35	15	1,898		15
N+18				50	35	15	1,948		15
N+19				50	35	15	1,998		15
N+20				50	35	15	2,048		15
Total	1,048	632	416	1,000	700	300	2,048	416	300

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 three years for the existing fleet to comply.

(B) It is also assumed that 33.3% of the existing fleet would be equipped with TCAS II (or equivalent) for each of those three years.

Last Revised: 04/18/2000

Table V-2

Forecast of Part 121 All Cargo Turbine-Powered <= 33,000 Pounds MCTOW And All 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 Airplanes	Passenger Conversions	Newly Manufactured Freighters	Total Airplanes	Airplanes With TCAS I Retrofits	Newly Manufactured Airplanes With TCAS I
N (A)	97	97	N.A.	N.A.	N.A.	97	N.A.	N.A.
N+1		33	0	0	0	97	33	0
N+2		33	0	0	0	97	33	0
N+3		31	0	0	0	97	31	0
N+4			0	0	0	97		0
N+5			0	0	0	97		0
N+6			0	0	0	97		0
N+7			0	0	0	97		0
N+8			0	0	0	97		0
N+9			0	0	0	97		0
N+10			0	0	0	97		0
N+11			0	0	0	97		0
N+12			0	0	0	97		0
N+13			0	0	0	97		0
N+14			0	0	0	97		0
N+15			0	0	0	97		0
N+16			0	0	0	97		0
N+17			0	0	0	97		0
N+18			0	0	0	97		0
N+19			0	0	0	97		0
N+20			0	0	0	97		0
Total	97	97	0	0	0	97	97	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 three years for the existing fleet to comply.

(B) It is also assumed that 33.3% of the existing fleet would be equipped with TCAS I (or equivalent) for each of those three years.

Last Revision: 04/18/2000

Table V-3

Forecast of Part 125 >33,000 Pounds MCTOW 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)	10	10	N.A.	N.A.	N.A.	10	N.A.	N.A.
N+1		4	0	0	0	10	4	0
N+2		3	0	0	0	10	3	0
N+3		3	0	0	0	10	3	0
N+4			0	0	0	10		0
N+5			0	0	0	10		0
N+6			0	0	0	10		0
N+7			0	0	0	10		0
N+8			0	0	0	10		0
N+9			0	0	0	10		0
N+10			0	0	0	10		0
N+11			0	0	0	10		0
N+12			0	0	0	10		0
N+13			0	0	0	10		0
N+14			0	0	0	10		0
N+15			0	0	0	10		0
N+16			0	0	0	10		0
N+17			0	0	0	10		0
N+18			0	0	0	10		0
N+19			0	0	0	10		0
N+20			0	0	0	10		0
Total	10	10	0	0	0	10	10	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 three years for the existing fleet to comply.

(B) It is also assumed that 33.3% of the existing fleet would be equipped with TCAS II (or equivalent) for each of those three years.

Last Revision: 04/18/2000

Table V-4

Forecast of Part 125 Turbine Powered <= 33,000 Pounds MCTOW And All Piston-Powered Commercial Operator 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 Airplanes	Passenger Conversions	Newly Manufactured Freighters	Total Airplanes	AirplanesWith TCAS I Retrofits	Newly Manufactured Airplanes With TCAS I
N (A)	31	31	N.A.	N.A.	N.A.	31	N.A.	N.A.
N+1		11	0	0	0	31	11	0
N+2		10	0	0	0	31	10	0
N+3		10	0	0	0	31	10	0
N+4			0	0	0	31		0
N+5			0	0	0	31		0
N+6			0	0	0	31		0
N+7			0	0	0	31		0
N+8			0	0	0	31		0
N+9			0	0	0	31		0
N+10			0	0	0	31		0
N+11			0	0	0	31		0
N+12			0	0	0	31		0
N+13			0	0	0	31		0
N+14			0	0	0	31		0
N+15			0	0	0	31		0
N+16			0	0	0	31		0
N+17			0	0	0	31		0
N+18			0	0	0	31		0
N+19			0	0	0	31		0
N+20			0	0	0	31		0
Total	**31**	**31**	**0**	**0**	**0**	**31**	**31**	**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 three years for the existing fleet to comply.

(B) It is also assumed that 33.3% of the existing fleet would be equipped with TCAS I (or equivalent) for each of those three years.

Last Revision: 04/18/2000

VI Part 121 Carriers - Estimated Incremental Costs Of The Proposed 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.

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.

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 3-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 3-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 years 2 and 3.

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 $88,000,000.

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 $51 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 $16,000,000 (See Table VI-1) and $6,000,000 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 $6,000,000 for the existing fleet (See Table VI-1) and $2,000,000 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 $57,000,000 for the existing fleet (See Table VI-1) and $22,000,000 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 $166,000,000 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 $117,000,000.

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 $82,000,000 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 $40,000,000.

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 $248,000,000 and the discounted present value of the total costs of the proposed rule over the next 20 years would be approximately $157,000,000.

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 and on all part 121 turbine-powered cargo airplanes with a MCTOW of 33,000 pounds or less. 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 3-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 3-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 years 2 and 3.

The undiscounted capital initial costs of installing TCAS I on the existing part 121 piston-powered cargo fleet and turbine-powered cargo fleet of 33,000 pounds MCTOW or less 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 $7,000,000.

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 $4,000,000

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 $1,000,000 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 $7,000,000 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 $19,000,000 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 $13,000,000.

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 $268,000,000 and the discounted present value of the total costs of the proposed rule over the next 20 years would be approximately $169,000,000.

Table VI-1

Cost Estimate for Equipping The Existing Part 121 Turbine Powered >33,000 Pounds MCTOW All-Cargo Airplane Fleet 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)	416														1.0000
N+1	139	$ 211,000	$ 29,329,000	$ 1	2,000	139	278,000	$ 278,000	$ 7,000	$ 973,000	$ 0.36	$ 100,080	$ 30,680,080	$ 28,673,603	0.9346
N+2	139	$ 211,000	$ 29,329,000	$ 1	2,000	278	556,000	$ 556,000	$ 7,000	$ 1,946,000	$ 0.36	$ 200,160	$ 32,031,160	$ 27,976,015	0.8734
N+3	138	$ 211,000	$ 29,118,000	$ 1	2,000	416	832,000	$ 832,000	$ 7,000	$ 2,912,000	$ 0.36	$ 299,520	$ 33,161,520	$ 27,069,749	0.8163
N+4	N.A.	N.A.	N.A.	$ 1	2,000	416	832,000	$ 832,000	$ 7,000	$ 3,016,000	$ 0.36	$ 299,520	$ 4,147,520	$ 3,164,143	0.7629
N+5	N.A.	N.A.	N.A.	$ 1	2,000	416	832,000	$ 832,000	$ 7,000	$ 3,016,000	$ 0.36	$ 299,520	$ 4,147,520	$ 2,957,182	0.7130
N+6	N.A.	N.A.	N.A.	$ 1	2,000	416	832,000	$ 832,000	$ 7,000	$ 3,016,000	$ 0.36	$ 299,520	$ 4,147,520	$ 2,763,493	0.6663
N+7	N.A.	N.A.	N.A.	$ 1	2,000	416	832,000	$ 832,000	$ 7,000	$ 3,016,000	$ 0.36	$ 299,520	$ 4,147,520	$ 2,582,661	0.6227
N+8	N.A.	N.A.	N.A.	$ 1	2,000	416	832,000	$ 832,000	$ 7,000	$ 3,016,000	$ 0.36	$ 299,520	$ 4,147,520	$ 2,413,857	0.5820
N+9	N.A.	N.A.	N.A.	$ 1	2,000	416	832,000	$ 832,000	$ 7,000	$ 3,016,000	$ 0.36	$ 299,520	$ 4,147,520	$ 2,255,836	0.5439
N+10	N.A.	N.A.	N.A.	$ 1	2,000	416	832,000	$ 832,000	$ 7,000	$ 3,016,000	$ 0.36	$ 299,520	$ 4,147,520	$ 2,108,184	0.5083
N+11	N.A.	N.A.	N.A.	$ 1	2,000	416	832,000	$ 832,000	$ 7,000	$ 3,016,000	$ 0.36	$ 299,520	$ 4,147,520	$ 1,970,487	0.4751
N+12	N.A.	N.A.	N.A.	$ 1	2,000	416	832,000	$ 832,000	$ 7,000	$ 3,016,000	$ 0.36	$ 299,520	$ 4,147,520	$ 1,841,499	0.4440
N+13	N.A.	N.A.	N.A.	$ 1	2,000	416	832,000	$ 832,000	$ 7,000	$ 3,016,000	$ 0.36	$ 299,520	$ 4,147,520	$ 1,721,221	0.4150
N+14	N.A.	N.A.	N.A.	$ 1	2,000	416	832,000	$ 832,000	$ 7,000	$ 3,016,000	$ 0.36	$ 299,520	$ 4,147,520	$ 1,608,408	0.3878
N+15	N.A.	N.A.	N.A.	$ 1	2,000	416	832,000	$ 832,000	$ 7,000	$ 3,016,000	$ 0.36	$ 299,520	$ 4,147,520	$ 1,503,061	0.3624
N+16	N.A.	N.A.	N.A.	$ 1	2,000	416	832,000	$ 832,000	$ 7,000	$ 3,016,000	$ 0.36	$ 299,520	$ 4,147,520	$ 1,404,765	0.3387
N+17	N.A.	N.A.	N.A.	$ 1	2,000	416	832,000	$ 832,000	$ 7,000	$ 3,016,000	$ 0.36	$ 299,520	$ 4,147,520	$ 1,313,105	0.3166
N+18	N.A.	N.A.	N.A.	$ 1	2,000	416	832,000	$ 832,000	$ 7,000	$ 3,016,000	$ 0.36	$ 299,520	$ 4,147,520	$ 1,227,251	0.2959
N+19	N.A.	N.A.	N.A.	$ 1	2,000	416	832,000	$ 832,000	$ 7,000	$ 3,016,000	$ 0.36	$ 299,520	$ 4,147,520	$ 1,146,789	0.2765
N+20	N.A.	N.A.	N.A.	$ 1	2,000	416	832,000	$ 832,000	$ 7,000	$ 3,016,000	$ 0.36	$ 299,520	$ 4,147,520	$ 1,071,719	0.2584
Total	**416**	**N.A.**	**$ 87,776,000**	**N.A.**	**N.A.**	**N.A.**	**15,810,000**	**$ 15,810,000**	**N.A.**	**$ 57,103,000**	**N.A.**	**$ 5,691,600**	**$ 166,380,600**	**$ 116,773,027**	**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 three years for the existing fleet to comply.
It is also assumed that 33.3% 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: 04/19/2000

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)	300														1.000
N+1	15	$ 171,000	$ 2,565,000	$ 1	2,000	15	30,000	$ 30,000	$ 7,000	$ 105,000	$ 0.36	$ 10,800	$ 2,710,800	$ 2,533,514	0.934
N+2	15	$ 171,000	$ 2,565,000	$ 1	2,000	30	60,000	$ 60,000	$ 7,000	$ 210,000	$ 0.36	$ 21,600	$ 2,856,600	$ 2,494,954	0.873
N+3	15	$ 171,000	$ 2,565,000	$ 1	2,000	45	90,000	$ 90,000	$ 7,000	$ 315,000	$ 0.36	$ 32,400	$ 3,002,400	$ 2,450,859	0.816
N+4	15	$ 171,000	$ 2,565,000	$ 1	2,000	60	120,000	$ 120,000	$ 7,000	$ 420,000	$ 0.36	$ 43,200	$ 3,148,200	$ 2,401,762	0.762
N+5	15	$ 171,000	$ 2,565,000	$ 1	2,000	75	150,000	$ 150,000	$ 7,000	$ 525,000	$ 0.36	$ 54,000	$ 3,294,000	$ 2,348,622	0.713
N+6	15	$ 171,000	$ 2,565,000	$ 1	2,000	90	180,000	$ 180,000	$ 7,000	$ 630,000	$ 0.36	$ 64,800	$ 3,439,800	$ 2,291,939	0.666
N+7	15	$ 171,000	$ 2,565,000	$ 1	2,000	105	210,000	$ 210,000	$ 7,000	$ 735,000	$ 0.36	$ 75,600	$ 3,585,600	$ 2,232,753	0.622
N+8	15	$ 171,000	$ 2,565,000	$ 1	2,000	120	240,000	$ 240,000	$ 7,000	$ 840,000	$ 0.36	$ 86,400	$ 3,731,400	$ 2,171,675	0.582
N+9	15	$ 171,000	$ 2,565,000	$ 1	2,000	135	270,000	$ 270,000	$ 7,000	$ 945,000	$ 0.36	$ 97,200	$ 3,877,200	$ 2,108,809	0.543
N+10	15	$ 171,000	$ 2,565,000	$ 1	2,000	150	300,000	$ 300,000	$ 7,000	$ 1,050,000	$ 0.36	$ 108,000	$ 4,023,000	$ 2,044,891	0.508
N+11	15	$ 171,000	$ 2,565,000	$ 1	2,000	165	330,000	$ 330,000	$ 7,000	$ 1,155,000	$ 0.36	$ 118,800	$ 4,168,800	$ 1,980,597	0.475
N+12	15	$ 171,000	$ 2,565,000	$ 1	2,000	180	360,000	$ 360,000	$ 7,000	$ 1,260,000	$ 0.36	$ 129,600	$ 4,314,600	$ 1,915,682	0.444
N+13	15	$ 171,000	$ 2,565,000	$ 1	2,000	195	390,000	$ 390,000	$ 7,000	$ 1,365,000	$ 0.36	$ 140,400	$ 4,460,400	$ 1,851,066	0.415
N+14	15	$ 171,000	$ 2,565,000	$ 1	2,000	210	420,000	$ 420,000	$ 7,000	$ 1,470,000	$ 0.36	$ 151,200	$ 4,606,200	$ 1,786,284	0.387
N+15	15	$ 171,000	$ 2,565,000	$ 1	2,000	225	450,000	$ 450,000	$ 7,000	$ 1,575,000	$ 0.36	$ 162,000	$ 4,752,000	$ 1,722,125	0.362
N+16	15	$ 171,000	$ 2,565,000	$ 1	2,000	240	480,000	$ 480,000	$ 7,000	$ 1,680,000	$ 0.36	$ 172,800	$ 4,897,800	$ 1,658,885	0.338
N+17	15	$ 171,000	$ 2,565,000	$ 1	2,000	255	510,000	$ 510,000	$ 7,000	$ 1,785,000	$ 0.36	$ 183,600	$ 5,043,600	$ 1,596,804	0.316
N+18	15	$ 171,000	$ 2,565,000	$ 1	2,000	270	540,000	$ 540,000	$ 7,000	$ 1,890,000	$ 0.36	$ 194,400	$ 5,189,400	$ 1,535,543	0.295
N+19	15	$ 171,000	$ 2,565,000	$ 1	2,000	285	570,000	$ 570,000	$ 7,000	$ 1,995,000	$ 0.36	$ 205,200	$ 5,335,200	$ 1,475,183	0.276
N+20	15	$ 171,000	$ 2,565,000	$ 1	2,000	300	600,000	$ 600,000	$ 7,000	$ 2,100,000	$ 0.36	$ 216,000	$ 5,481,000	$ 1,416,290	0.258
Total	**300**	**N.A.**	**$ 51,300,000**	**N.A.**	**N.A.**	**N.A.**	**6,300,000**	**$ 6,300,000**	**N.A.**	**$ 22,050,000**	**N.A.**	**$ 2,268,000**	**$ 81,918,000**	**$ 40,018,237**	**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.

Table VI-3

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

Year	Total Fleet Costs					
	Existing Fleet		Newly Manufactured Fleet		Total Fleet	
	Non-Discounted	Discounted	Non-Discounted	Discounted	Non-Discounted	Discounted
N(A)						
N+1	$ 30,680,080	$ 28,673,603	$ 2,710,800	$ 2,533,514	$ 33,390,880	$ 31,207,117
N+2	$ 32,031,160	$ 27,976,015	$ 2,856,600	$ 2,494,954	$ 34,887,760	$ 30,470,969
N+3	$ 33,161,520	$ 27,069,749	$ 3,002,400	$ 2,450,859	$ 36,163,920	$ 29,520,608
N+4	$ 4,147,520	$ 3,164,143	$ 3,148,200	$ 2,401,762	$ 7,295,720	$ 5,565,905
N+5	$ 4,147,520	$ 2,957,182	$ 3,294,000	$ 2,348,622	$ 7,441,520	$ 5,305,804
N+6	$ 4,147,520	$ 2,763,493	$ 3,439,800	$ 2,291,939	$ 7,587,320	$ 5,055,432
N+7	$ 4,147,520	$ 2,582,661	$ 3,585,600	$ 2,232,753	$ 7,733,120	$ 4,815,414
N+8	$ 4,147,520	$ 2,413,857	$ 3,731,400	$ 2,171,675	$ 7,878,920	$ 4,585,532
N+9	$ 4,147,520	$ 2,255,836	$ 3,877,200	$ 2,108,809	$ 8,024,720	$ 4,364,645
N+10	$ 4,147,520	$ 2,108,184	$ 4,023,000	$ 2,044,891	$ 8,170,520	$ 4,153,075
N+11	$ 4,147,520	$ 1,970,487	$ 4,168,800	$ 1,980,597	$ 8,316,320	$ 3,951,084
N+12	$ 4,147,520	$ 1,841,499	$ 4,314,600	$ 1,915,682	$ 8,462,120	$ 3,757,181
N+13	$ 4,147,520	$ 1,721,221	$ 4,460,400	$ 1,851,066	$ 8,607,920	$ 3,572,287
N+14	$ 4,147,520	$ 1,608,408	$ 4,606,200	$ 1,786,284	$ 8,753,720	$ 3,394,692
N+15	$ 4,147,520	$ 1,503,061	$ 4,752,000	$ 1,722,125	$ 8,899,520	$ 3,225,186
N+16	$ 4,147,520	$ 1,404,765	$ 4,897,800	$ 1,658,885	$ 9,045,320	$ 3,063,650
N+17	$ 4,147,520	$ 1,313,105	$ 5,043,600	$ 1,596,804	$ 9,191,120	$ 2,909,909
N+18	$ 4,147,520	$ 1,227,251	$ 5,189,400	$ 1,535,543	$ 9,336,920	$ 2,762,794
N+19	$ 4,147,520	$ 1,146,789	$ 5,335,200	$ 1,475,183	$ 9,482,720	$ 2,621,972
N+20	$ 4,147,520	$ 1,071,719	$ 5,841,000	$ 1,416,290	$ 9,988,520	$ 2,488,009
Totals	$ 166,380,600	$ 116,773,027	$ 81,918,000	$ 40,018,237	$ 248,298,600	$ 156,791,264

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 three years for the existing fleet to comply.

Latest Revision: 04/19/2000

Table VI-4

Cost Estimate For Equipping The Existing Part 121 Turbine-Powered <= 33,000 Pounds MCTOW And All Piston-Powered All-Cargo Airplane Fleet With TCAS I

		Costs													
		Initial Costs		O & M Expenses					Tranining Expenses		Incremental Fuel Costs		Total Costs		
Year	Air-planes	Unit	Total	Unit Expense (B)	Flight Hours Per Airplane	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)	97														1.0000
N+1	33	$75,000	$ 2,475,000	$ 1	2,000	33	66,000	$ 66,000	$ 3,800	$ 125,400	$ 0.36	$ 23,760	$ 2,690,160	$ 2,514,224	0.9346
N+2	33	$75,000	$ 2,475,000	$ 1	2,000	66	132,000	$ 132,000	$ 3,800	$ 250,800	$ 0.36	$ 47,520	$ 2,905,320	$ 2,537,506	0.8734
N+3	31	$75,000	$ 2,325,000	$ 1	2,000	97	194,000	$ 194,000	$ 3,800	$ 368,600	$ 0.36	$ 69,840	$ 2,957,440	$ 2,414,158	0.8163
N+4	N.A.	N.A.	N.A.	$ 1	2,000	97	194,000	$ 194,000	$ 3,800	$ 368,600	$ 0.36	$ 69,840	$ 632,440	$ 482,488	0.7629
N+5	N.A.	N.A.	N.A.	$ 1	2,000	97	194,000	$ 194,000	$ 3,800	$ 368,600	$ 0.36	$ 69,840	$ 632,440	$ 450,930	0.7130
N+6	N.A.	N.A.	N.A.	$ 1	2,000	97	194,000	$ 194,000	$ 3,800	$ 368,600	$ 0.36	$ 69,840	$ 632,440	$ 421,395	0.6663
N+7	N.A.	N.A.	N.A.	$ 1	2,000	97	194,000	$ 194,000	$ 3,800	$ 368,600	$ 0.36	$ 69,840	$ 632,440	$ 393,820	0.6227
N+8	N.A.	N.A.	N.A.	$ 1	2,000	97	194,000	$ 194,000	$ 3,800	$ 368,600	$ 0.36	$ 69,840	$ 632,440	$ 368,080	0.5820
N+9	N.A.	N.A.	N.A.	$ 1	2,000	97	194,000	$ 194,000	$ 3,800	$ 368,600	$ 0.36	$ 69,840	$ 632,440	$ 343,984	0.5439
N+10	N.A.	N.A.	N.A.	$ 1	2,000	97	194,000	$ 194,000	$ 3,800	$ 368,600	$ 0.36	$ 69,840	$ 632,440	$ 321,469	0.5083
N+11	N.A.	N.A.	N.A.	$ 1	2,000	97	194,000	$ 194,000	$ 3,800	$ 368,600	$ 0.36	$ 69,840	$ 632,440	$ 300,472	0.4751
N+12	N.A.	N.A.	N.A.	$ 1	2,000	97	194,000	$ 194,000	$ 3,800	$ 368,600	$ 0.36	$ 69,840	$ 632,440	$ 280,803	0.4440
N+13	N.A.	N.A.	N.A.	$ 1	2,000	97	194,000	$ 194,000	$ 3,800	$ 368,600	$ 0.36	$ 69,840	$ 632,440	$ 262,463	0.4150
N+14	N.A.	N.A.	N.A.	$ 1	2,000	97	194,000	$ 194,000	$ 3,800	$ 368,600	$ 0.36	$ 69,840	$ 632,440	$ 245,260	0.3878
N+15	N.A.	N.A.	N.A.	$ 1	2,000	97	194,000	$ 194,000	$ 3,800	$ 368,600	$ 0.36	$ 69,840	$ 632,440	$ 229,196	0.3624
N+16	N.A.	N.A.	N.A.	$ 1	2,000	97	194,000	$ 194,000	$ 3,800	$ 368,600	$ 0.36	$ 69,840	$ 632,440	$ 214,207	0.3387
N+17	N.A.	N.A.	N.A.	$ 1	2,000	97	194,000	$ 194,000	$ 3,800	$ 368,600	$ 0.36	$ 69,840	$ 632,440	$ 200,231	0.3166
N+18	N.A.	N.A.	N.A.	$ 1	2,000	97	194,000	$ 194,000	$ 3,800	$ 368,600	$ 0.36	$ 69,840	$ 632,440	$ 187,139	0.2959
N+19	N.A.	N.A.	N.A.	$ 1	2,000	97	194,000	$ 194,000	$ 3,800	$ 368,600	$ 0.36	$ 69,840	$ 632,440	$ 174,870	0.2765
N+20	N.A.	N.A.	N.A.	$ 1	2,000	97	194,000	$ 194,000	$ 3,800	$ 368,600	$ 0.36	$ 69,840	$ 632,440	$ 163,422	0.2584
Total	97	N.A.	$ 7,275,000	N.A.	N.A.	N.A.	3,690,000	$ 3,690,000	N.A.	$ 7,011,000	N.A.	$ 1,328,400	$ 19,304,400	$ 12,506,119	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 three years for the existing fleet to comply. It is also assumed that 33.3% 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 80 percent of TCAS II training expenses.

Latest Revision: 04/19/2000

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		Piston & Turbine <= 33,000 Lbs		Total Fleet	
	Non-Discounted	Discounted	Non-Discounted	Discounted	Non-Discounted	Discounted
N (A)						
N+1	$ 33,390,880	$ 31,207,116	$ 2,690,160	$ 2,514,224	$ 36,081,040	$ 33,721,340
N+2	$ 34,887,760	$ 30,470,970	$ 2,905,320	$ 2,537,506	$ 37,793,080	$ 33,008,476
N+3	$ 36,163,920	$ 29,520,608	$ 2,957,440	$ 2,414,158	$ 39,121,360	$ 31,934,766
N+4	$ 7,295,720	$ 5,565,905	$ 632,440	$ 482,488	$ 7,928,160	$ 6,048,393
N+5	$ 7,441,520	$ 5,305,804	$ 632,440	$ 450,930	$ 8,073,960	$ 5,756,734
N+6	$ 7,587,320	$ 5,055,431	$ 632,440	$ 421,935	$ 8,219,760	$ 5,477,366
N+7	$ 7,733,120	$ 4,815,414	$ 632,440	$ 393,820	$ 8,365,560	$ 5,209,234
N+8	$ 7,878,920	$ 4,585,531	$ 632,440	$ 368,080	$ 8,511,360	$ 4,953,611
N+9	$ 8,024,720	$ 4,364,645	$ 632,440	$ 343,984	$ 8,657,160	$ 4,708,629
N+10	$ 8,170,520	$ 4,153,075	$ 632,440	$ 321,469	$ 8,802,960	$ 4,474,544
N+11	$ 8,316,320	$ 3,951,084	$ 632,440	$ 300,472	$ 8,948,760	$ 4,251,556
N+12	$ 8,462,120	$ 3,757,181	$ 632,440	$ 280,803	$ 9,094,560	$ 4,037,984
N+13	$ 8,607,920	$ 3,572,287	$ 632,440	$ 262,463	$ 9,240,360	$ 3,834,750
N+14	$ 8,753,720	$ 3,394,693	$ 632,440	$ 245,260	$ 9,386,160	$ 3,639,953
N+15	$ 8,899,520	$ 3,225,186	$ 632,440	$ 229,196	$ 9,531,960	$ 3,454,382
N+16	$ 9,045,320	$ 3,063,650	$ 632,440	$ 214,207	$ 9,677,760	$ 3,277,857
N+17	$ 9,191,120	$ 2,909,909	$ 632,440	$ 200,231	$ 9,823,560	$ 3,110,140
N+18	$ 9,336,920	$ 2,762,795	$ 632,440	$ 187,139	$ 9,969,360	$ 2,949,934
N+19	$ 9,482,720	$ 2,621,972	$ 632,440	$ 174,870	$ 10,115,160	$ 2,796,842
N+20	$ 9,628,520	$ 2,488,010	$ 632,440	$ 163,422	$ 10,260,960	$ 2,651,432
Total	**$ 248,298,600**	**$ 156,791,265**	**$ 19,304,400**	**$ 12,506,119**	**$ 267,603,000**	**$ 169,297,384**

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 three years for the existing fleet to comply.

Latest Revision: 04/19/2000

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 operate 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 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 $4,000,000. The corresponding discounted amount is estimated to be approximately $2,800,000.

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 $6,200,000. 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 proposed rule, are shown on Table VII-3.

These total non-discounted costs are estimated to be approximately $10,100,000. The corresponding discounted costs are estimated to be approximately $6,800,000.

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)	10														1.0000
N+1	4	$ 211,000	$ 844,000	$ 1	2,000	4	8,000	$ 8,000	$ 7,000	$ 28,000	$ 0.36	$ 2,880	$ 882,880	$ 825,140	0.9346
N+2	3	$ 211,000	$ 633,000	$ 1	2,000	7	14,000	$ 14,000	$ 7,000	$ 49,000	$ 0.36	$ 5,040	$ 701,040	$ 612,288	0.8734
N+3	3	$ 211,000	$ 633,000	$ 1	2,000	10	20,000	$ 20,000	$ 7,000	$ 70,000	$ 0.36	$ 7,200	$ 730,200	$ 596,062	0.8163
N+4	N.A.	N.A.	N.A.	$ 1	2,000	10	20,000	$ 20,000	$ 7,000	$ 70,000	$ 0.36	$ 7,200	$ 97,200	$ 74,154	0.7629
N+5	N.A.	N.A.	N.A.	$ 1	2,000	10	20,000	$ 20,000	$ 7,000	$ 70,000	$ 0.36	$ 7,200	$ 97,200	$ 69,304	0.7130
N+6	N.A.	N.A.	N.A.	$ 1	2,000	10	20,000	$ 20,000	$ 7,000	$ 70,000	$ 0.36	$ 7,200	$ 97,200	$ 64,764	0.6663
N+7	N.A.	N.A.	N.A.	$ 1	2,000	10	20,000	$ 20,000	$ 7,000	$ 70,000	$ 0.36	$ 7,200	$ 97,200	$ 60,526	0.6227
N+8	N.A.	N.A.	N.A.	$ 1	2,000	10	20,000	$ 20,000	$ 7,000	$ 70,000	$ 0.36	$ 7,200	$ 97,200	$ 56,570	0.5820
N+9	N.A.	N.A.	N.A.	$ 1	2,000	10	20,000	$ 20,000	$ 7,000	$ 70,000	$ 0.36	$ 7,200	$ 97,200	$ 52,867	0.5439
N+10	N.A.	N.A.	N.A.	$ 1	2,000	10	20,000	$ 20,000	$ 7,000	$ 70,000	$ 0.36	$ 7,200	$ 97,200	$ 49,407	0.5083
N+11	N.A.	N.A.	N.A.	$ 1	2,000	10	20,000	$ 20,000	$ 7,000	$ 70,000	$ 0.36	$ 7,200	$ 97,200	$ 46,180	0.4751
N+12	N.A.	N.A.	N.A.	$ 1	2,000	10	20,000	$ 20,000	$ 7,000	$ 70,000	$ 0.36	$ 7,200	$ 97,200	$ 43,157	0.4440
N+13	N.A.	N.A.	N.A.	$ 1	2,000	10	20,000	$ 20,000	$ 7,000	$ 70,000	$ 0.36	$ 7,200	$ 97,200	$ 40,338	0.4150
N+14	N.A.	N.A.	N.A.	$ 1	2,000	10	20,000	$ 20,000	$ 7,000	$ 70,000	$ 0.36	$ 7,200	$ 97,200	$ 37,694	0.3878
N+15	N.A.	N.A.	N.A.	$ 1	2,000	10	20,000	$ 20,000	$ 7,000	$ 70,000	$ 0.36	$ 7,200	$ 97,200	$ 35,225	0.3624
N+16	N.A.	N.A.	N.A.	$ 1	2,000	10	20,000	$ 20,000	$ 7,000	$ 70,000	$ 0.36	$ 7,200	$ 97,200	$ 32,922	0.3387
N+17	N.A.	N.A.	N.A.	$ 1	2,000	10	20,000	$ 20,000	$ 7,000	$ 70,000	$ 0.36	$ 7,200	$ 97,200	$ 30,774	0.3166
N+18	N.A.	N.A.	N.A.	$ 1	2,000	10	20,000	$ 20,000	$ 7,000	$ 70,000	$ 0.36	$ 7,200	$ 97,200	$ 28,761	0.2959
N+19	N.A.	N.A.	N.A.	$ 1	2,000	10	20,000	$ 20,000	$ 7,000	$ 70,000	$ 0.36	$ 7,200	$ 97,200	$ 26,876	0.2765
N+20	N.A.	N.A.	N.A.	$ 1	2,000	10	20,000	$ 20,000	$ 7,000	$ 70,000	$ 0.36	$ 7,200	$ 97,200	$ 25,116	0.2584
Total	10	N.A.	$ 2,110,000	N.A.	N.A.	N.A.	382,000	$ 382,000	N.A.	$ 1,337,000	N.A.	$ 137,520	$ 3,966,520	$ 2,808,126	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 three years for the existing fleet to comply. It is also assumed that 33.3% 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: 04/18/2000

Table VII-2

Cost Estimate For Equipping The Existing Turbine-Powered <= 33,000 Pounds MCTOW And All Piston-Powered 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)	31														1.0000
N+1	11	$75,000	$ 825,000	$ 1	2,000	11	22,000	$ 22,000	$ 3,800	$ 41,800	$ 0.36	$ 7,920	$ 896,720	$ 838,075	0.9346
N+2	10	$75,000	$ 750,000	$ 1	2,000	21	42,000	$ 42,000	$ 3,800	$ 79,800	$ 0.36	$ 15,120	$ 886,920	$ 774,636	0.8734
N+3	10	$75,000	$ 750,000	$ 1	2,000	31	62,000	$ 62,000	$ 3,800	$ 117,800	$ 0.36	$ 22,320	$ 952,120	$ 777,216	0.8163
N+4	N.A.	N.A.	N.A.	$ 1	2,000	31	62,000	$ 62,000	$ 3,800	$ 117,800	$ 0.36	$ 22,320	$ 202,120	$ 154,197	0.7629
N+5	N.A.	N.A.	N.A.	$ 1	2,000	31	62,000	$ 62,000	$ 3,800	$ 117,800	$ 0.36	$ 22,320	$ 202,120	$ 144,112	0.7130
N+6	N.A.	N.A.	N.A.	$ 1	2,000	31	62,000	$ 62,000	$ 3,800	$ 117,800	$ 0.36	$ 22,320	$ 202,120	$ 134,673	0.6663
N+7	N.A.	N.A.	N.A.	$ 1	2,000	31	62,000	$ 62,000	$ 3,800	$ 117,800	$ 0.36	$ 22,320	$ 202,120	$ 125,860	0.6227
N+8	N.A.	N.A.	N.A.	$ 1	2,000	31	62,000	$ 62,000	$ 3,800	$ 117,800	$ 0.36	$ 22,320	$ 202,120	$ 117,634	0.5820
N+9	N.A.	N.A.	N.A.	$ 1	2,000	31	62,000	$ 62,000	$ 3,800	$ 117,800	$ 0.36	$ 22,320	$ 202,120	$ 109,933	0.5439
N+10	N.A.	N.A.	N.A.	$ 1	2,000	31	62,000	$ 62,000	$ 3,800	$ 117,800	$ 0.36	$ 22,320	$ 202,120	$ 102,738	0.5083
N+11	N.A.	N.A.	N.A.	$ 1	2,000	31	62,000	$ 62,000	$ 3,800	$ 117,800	$ 0.36	$ 22,320	$ 202,120	$ 96,027	0.4751
N+12	N.A.	N.A.	N.A.	$ 1	2,000	31	62,000	$ 62,000	$ 3,800	$ 117,800	$ 0.36	$ 22,320	$ 202,120	$ 89,741	0.4440
N+13	N.A.	N.A.	N.A.	$ 1	2,000	31	62,000	$ 62,000	$ 3,800	$ 117,800	$ 0.36	$ 22,320	$ 202,120	$ 83,880	0.4150
N+14	N.A.	N.A.	N.A.	$ 1	2,000	31	62,000	$ 62,000	$ 3,800	$ 117,800	$ 0.36	$ 22,320	$ 202,120	$ 78,382	0.3878
N+15	N.A.	N.A.	N.A.	$ 1	2,000	31	62,000	$ 62,000	$ 3,800	$ 117,800	$ 0.36	$ 22,320	$ 202,120	$ 73,248	0.3624
N+16	N.A.	N.A.	N.A.	$ 1	2,000	31	62,000	$ 62,000	$ 3,800	$ 117,800	$ 0.36	$ 22,320	$ 202,120	$ 68,458	0.3387
N+17	N.A.	N.A.	N.A.	$ 1	2,000	31	62,000	$ 62,000	$ 3,800	$ 117,800	$ 0.36	$ 22,320	$ 202,120	$ 63,991	0.3166
N+18	N.A.	N.A.	N.A.	$ 1	2,000	31	62,000	$ 62,000	$ 3,800	$ 117,800	$ 0.36	$ 22,320	$ 202,120	$ 59,807	0.2959
N+19	N.A.	N.A.	N.A.	$ 1	2,000	31	62,000	$ 62,000	$ 3,800	$ 117,800	$ 0.36	$ 22,320	$ 202,120	$ 55,886	0.2765
N+20	N.A.	N.A.	N.A.	$ 1	2,000	31	62,000	$ 62,000	$ 3,800	$ 117,800	$ 0.36	$ 22,320	$ 202,120	$ 52,228	0.2584
Total	31	N.A.	$ 2,325,000	N.A.	N.A.	N.A.	1,180,000	$ 1,180,000	N.A.	$ 2,242,000	N.A.	$ 424,800	$ 6,171,800	$ 4,000,721	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 three years for the existing fleet to comply.
It is also assumed that 33.3% 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.

Table VII-3

Total Cost Estimate For Equipping The Part 125 Commercial Operator Fleet With TCAS

Year	Total Fleet Costs					
	Turbine > 33,000 Pounds		Piston & Turbine <=33,000 Lbs		Total Fleet	
	Non-Discounted	Discounted	Non-Discounted	Discounted	Non-Discounted	Discounted
N(A)						
N+1	$ 882,880	$ 825,140	$ 896,720	$ 838,075	$ 1,779,600	$ 1,663,215
N+2	$ 701,040	$ 612,288	$ 886,920	$ 774,636	$ 1,587,960	$ 1,386,924
N+3	$ 730,200	$ 596,062	$ 952,120	$ 777,216	$ 1,682,320	$ 1,373,278
N+4	$ 97,200	$ 74,154	$ 202,120	$ 154,197	$ 299,320	$ 228,351
N+5	$ 97,200	$ 69,304	$ 202,120	$ 144,112	$ 299,320	$ 213,416
N+6	$ 97,200	$ 64,764	$ 202,120	$ 134,673	$ 299,320	$ 199,437
N+7	$ 97,200	$ 60,526	$ 202,120	$ 125,860	$ 299,320	$ 186,386
N+8	$ 97,200	$ 56,570	$ 202,120	$ 117,634	$ 299,320	$ 174,204
N+9	$ 97,200	$ 52,867	$ 202,120	$ 109,933	$ 299,320	$ 162,800
N+10	$ 97,200	$ 49,407	$ 202,120	$ 102,738	$ 299,320	$ 152,145
N+11	$ 97,200	$ 46,180	$ 202,120	$ 96,027	$ 299,320	$ 142,207
N+12	$ 97,200	$ 43,157	$ 202,120	$ 89,741	$ 299,320	$ 132,898
N+13	$ 97,200	$ 40,338	$ 202,120	$ 83,880	$ 299,320	$ 124,218
N+14	$ 97,200	$ 37,694	$ 202,120	$ 73,382	$ 299,320	$ 111,076
N+15	$ 97,200	$ 35,225	$ 202,120	$ 73,248	$ 299,320	$ 108,473
N+16	$ 97,200	$ 32,922	$ 202,120	$ 68,458	$ 299,320	$ 101,380
N+17	$ 97,200	$ 30,774	$ 202,120	$ 63,991	$ 299,320	$ 94,765
N+18	$ 97,200	$ 28,761	$ 202,120	$ 59,807	$ 299,320	$ 88,568
N+19	$ 97,200	$ 26,876	$ 202,120	$ 55,886	$ 299,320	$ 82,762
N+20	$ 97,200	$ 25,116	$ 202,120	$ 52,228	$ 299,320	$ 77,344
Total	**$ 3,966,520**	**$ 2,808,125**	**$ 6,171,800**	**$ 3,995,722**	**$ 10,138,320**	**$ 6,803,847**

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 three years for the existing fleet to comply.

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 $278,000,000. The corresponding discounted costs are estimated to be approximately $176,000,000.

Table IX-1

Total Cost Estimate For The Proposed Rule

Year	Total Rule Costs					
	Part 121		Part 125		Total Rule	
	Non-Discounted	Discounted	Non-Discounted	Discounted	Non-Discounted	Discounted
N(A)						
N+1	$ 36,081,040	$ 33,721,340	$ 1,779,600	$ 1,663,215	$ 37,860,640	$ 35,384,555
N+2	$ 37,793,080	$ 33,008,476	$ 1,587,960	$ 1,386,924	$ 39,381,040	$ 34,395,400
N+3	$ 39,121,360	$ 31,934,766	$ 1,682,320	$ 1,373,278	$ 40,803,680	$ 33,308,044
N+4	$ 7,928,160	$ 6,048,393	$ 299,320	$ 228,351	$ 8,227,480	$ 6,276,744
N+5	$ 8,073,960	$ 5,756,734	$ 299,320	$ 213,416	$ 8,373,280	$ 5,970,150
N+6	$ 8,219,760	$ 5,477,366	$ 299,320	$ 199,437	$ 8,519,080	$ 5,676,803
N+7	$ 8,365,560	$ 5,209,234	$ 299,320	$ 186,386	$ 8,664,880	$ 5,395,620
N+8	$ 8,511,360	$ 4,953,611	$ 299,320	$ 174,204	$ 8,810,680	$ 5,127,815
N+9	$ 8,657,160	$ 4,708,629	$ 299,320	$ 162,800	$ 8,956,480	$ 4,871,429
N+10	$ 8,802,960	$ 4,474,544	$ 299,320	$ 152,145	$ 9,102,280	$ 4,626,689
N+11	$ 8,948,760	$ 4,251,556	$ 299,320	$ 142,207	$ 9,248,080	$ 4,393,763
N+12	$ 9,094,560	$ 4,037,984	$ 299,320	$ 132,898	$ 9,393,880	$ 4,170,882
N+13	$ 9,240,360	$ 3,834,750	$ 299,320	$ 124,218	$ 9,539,680	$ 3,958,968
N+14	$ 9,386,160	$ 3,639,953	$ 299,320	$ 111,076	$ 9,685,480	$ 3,751,029
N+15	$ 9,531,960	$ 3,454,382	$ 299,320	$ 108,473	$ 9,831,280	$ 3,562,855
N+16	$ 9,677,760	$ 3,277,857	$ 299,320	$ 101,380	$ 9,977,080	$ 3,379,237
N+17	$ 9,823,560	$ 3,110,140	$ 299,320	$ 94,765	$ 10,122,880	$ 3,204,905
N+18	$ 9,969,360	$ 2,949,934	$ 299,320	$ 88,568	$ 10,268,680	$ 3,038,502
N+19	$ 10,115,160	$ 2,796,842	$ 299,320	$ 82,762	$ 10,414,480	$ 2,879,604
N+20	$ 10,260,960	$ 2,651,432	$ 299,320	$ 77,344	$ 10,560,280	$ 2,728,776
Total	$ 267,603,000	$ 169,297,923	$ 10,138,320	$ 6,803,847	$ 277,741,320	$ 176,101,770

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 three years for the existing fleet to comply.

Last Revised: 05/03/2000

X. Comparison Of Benefits And Costs

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 over $176 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 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 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 $2,700,000, the value of a fatality avoided used in FAA analyses. The cost, estimated in this manner, is $1,134,000,000. 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.

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

XI. INITIAL REGULATORY FLEXIBILITY ANALYSIS

A. Introduction and Purpose of This Analysis

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

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

The FAA determined that this proposal would result 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 would minimize the rule's economic burdens for affected small entities, while achieving its safety objectives.

Under Section 63(b) of the RFA, the analysis must address:

- Description of reasons the agency is considering the action
- Statement of the legal basis and objectives for the proposed rule
- Description of the recordkeeping and other compliance requirements of the proposed rule
- All federal rules that may duplicate, overlap, or conflict with the proposed rule
- Description and an estimated number of small entities to which the proposed rule would apply
- Analysis of small firms' ability to afford the proposed rule

- Conduct a competitive analysis
- Estimation of the potential for business closures
- Describe the alternatives considered
- Conduct a disproportionality analysis

B. Reasons Why the Rule Is Being Proposed

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 has been required in certain part 121, 125 and 129 airplanes with more than 30 passenger seats.

Since December 31, 1995, a TCAS I system has been 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, would reduce this risk. In addition, the 106th Congress enacted legislation (The Wendell H. Ford Aviation and Investment and Reform Act ("AIR 21")) that directs the FAA Administrator to require, in part, that certain cargo airplanes be equipped with collision avoidance technology by December 31, 2002. The statute provides for an extension of up to 2 years.

C. Statement of the Legal Basis and Objectives

Under Title 49 of the United States Code, the FAA Administrator is required to consider the following matters, among others, as being in the public interest: assigning, maintaining, and enhancing safety and security as the highest priorities in air commerce. (See 49 U.S.C. §40101(d)(1).). Additionally, it is the FAA Administrator's statutory duty to carry out his or her responsibilities "in a way that best tends to reduce or eliminate the possibility or recurrence of accidents in air transportation." (See 49 U.S.C. §44701(c).)

Accordingly, this proposed rule would amend Title 14 of the Code of Federal Regulations to require the installation and use of TCAS II, or its equivalent, on all part

121 and 125 turbine-powered airplanes of more than 33,000 pounds MCTOW. The FAA proposes that affected airplanes be equipped no later than October 31, 2003.

In addition, this proposed rule would amend Title 14 of the Code of Federal Regulations to require the installation and use of TCAS I, or its equivalent, on all part 121 and 125 turbine-powered airplanes of 33,000 pounds MCTOW or less and all piston powered airplanes, regardless of weight. The FAA proposes that affected airplanes be equipped as proposed by no later than October 31, 2003.

D. Projected Reporting, Record keeping and Other Requirements

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

E. Overlapping, Duplicative, or Conflicting Federal Rules

The FAA is unaware that the proposed rule would overlap, duplicate, or conflict with existing Federal Rules.

F. Estimated Number of Small Firms Potentially Impacted

Under the RFA, the FAA must determine whether or not a proposed 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.

Entities potentially affected by the proposed rule include: scheduled air transportation carriers (standard industrial code (SIC) 4512), air courier services (SIC 4513) and nonscheduled air transportation carriers (SIC 4522). The FAA used a guideline of 1,500 employees or less per firm as the criteria for the determination of a small business.

To determine which entities would 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.

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.

3. Part 125 all-cargo commercial operators who fly turbine-powered airplanes with a MCTOW greater than 33,000 pounds.

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.

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

Group 1 consists of a total of 41 firms (Table XI-1). Fifteen of these 41 firms would not incur costs as a result of the proposed rule either because of voluntary compliance, or because their equipment must meet existing international standards. The remaining 26 firms were examined to determine which of them met the FAA criteria of a small business. Based upon the SBA criteria 16 of the remaining 26 Group 1 firms qualify as small businesses.

Group 2 consists of a total of 18 firms (Table XI-2). Sixteen firms qualified as small businesses, based on the criteria of 1,500 employees per firm. No information was found for two of these firms. The FAA assumes that these firms are also small businesses. Thus all 18 Group 2 firms are considered to be small firms.

Group 3 consists of 3 firms (Table XI-3). Employment data was available for only one of these firms. The firm for which the data was available qualified as a small business. The FAA assumes that the other two firms are also small businesses. All three Group 3 firms are considered to be small firms.

Group 4 consists of 19 firms (Table XI-3). Employment data was available for nine of these firms. All the firms for which the employment data was available qualified as a small business. The FAA assumes that the other ten firms are also small businesses. Thus all 19 Group 4 firms are considered to be small firms.

In all there are a total of 56 small businesses that might be affected by the proposed rule.

G. Cost and Affordability for Small Entities

The FAA estimated the impact on Group 1 small entities in two steps. First, the FAA used a compliance cost of $223,000 cost per airplane multiplied by the operator's fleet size to obtain the estimated one-year cost of this rulemaking for each operator. Then the FAA calculated an affordability measure by dividing this cost by the operator's 1998 (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. The value of this ratio is 2 percent or less for all but 3 of the 16 firms in Group 1. Of the firms with a higher value for the ratio the percentage ranges from 4.3 percent to 7.9 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 cost per airplane 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 1998 (parent company) revenues. This ratio provides a measure of affordability. The value of this ratio of cost per revenue is 2 percent or less for 5 of the 16 Group 2 firms. For the remaining Group 2 firms the value of this ration ranged from 3.2 percent to 15.6 percent.

No financial data was found for the three firms in Group 3.

The FAA estimated the financial impact on Group 4 entities using the same methodology as that for Group 2. Financial data was available for six of the nineteen Group 4 firms. One of the six firms had a value of this ratio of less than 2%. The remaining five firms had ratio values ranging from 4.6 percent to 32.8 percent.

Of the 39 firms considered to be small, and for which information was available, nearly 40 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 60 percent of the firms with annual costs greater than 2 percent and perhaps for firms where financial data was not available the impact of this proposed rule ranges from significantly negative to nearly no impact. A no impact outcome is likely for a firm that may choose not to operate for hire – an outcome that is likely for at least some part 125 operators.

H. 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 eighteen part 121 (class 2 operators) 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.

I. Disproportionality Analysis

Relative to larger air cargo operators, smaller air cargo operators are likely to be disproportionately impacted by this rulemaking. Large cargo air carriers are expected to incur costs, which are a relatively smaller percentage of annual revenue, than those of the smaller cargo air carriers.

J. Business Closure Analysis

Slightly more than 20 firms have high compliance cost per annual revenue ratios. Some or even many of these firms could potentially face a business closure due to this proposed rulemaking. The FAA does not have sufficient information to provide a more refined estimate of the potential business closures.

K. Analysis of Alternatives

The FAA acknowledges that the proposed rule is likely to have a significant impact on a substantial number of small entities. The agency considered three alternatives to the proposed rule. These are:

1. Exclude small entities
2. Extend compliance deadline for small entities
3. Establish lesser technical requirements for small entities

The FAA concludes that the option to exclude small entities from all the requirements of the proposed rule is not justified. If small entities were excluded the intended safety improvement would be forfeited.

The FAA also considered options that would lengthen the compliance period for small operators. The FAA believes that the requirement, as proposed, would place a modest burden on small entities with respect to time constraints. Small entities would have 3 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.

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

The FAA concludes that the current proposal is the preferred alternative because the current proposal provides for a common collision avoidance system for all operators who fly in the same airspace under the same operating environment.

Table XI-1 - Group 1 - Part 121 All-Cargo Turbine-Powered > 33,000 Pounds MCTOW Air Carriers - 1998 - Employees And Revenues

Type of Operator/Operator	Airplanes No.	Compliance Cost $223,000	Employees	Cost as % of Annual Revenue	Operating Revenue* 1998	Small Business Yes Could Be Affected	Small Business Yes Affected
		$ 223,000					
1. AIRBORNE EXPRESS	72	$ 16,056,000	7,200	0.6%	$ 2,912,000,000		
2. AIR TRANSPORT INT'L	0	$ -	575	0.0%	$ 112,254,000		
3. ALOHA	1	$ 223,000	2,230	0.1%	$ 231,141,000		
4. AMERICAN INT'L AIRWAYS	1	$ 223,000	2,904	0.1%	$ 402,811,000		
5. AMERIJET INT'L	8	$ 1,784,000	550	1.8%	$ 97,566,000	1	
6. ARROW AIR	0	$ -	110	0.0%	$ 87,454,000		
7. ATLAS AIR	0	$ -	444	0.0%	$ 397,866,000		
8. BAX GLOBAL	2	$ 446,000	27,000	0.0%	$ 3,100,000,000		
9. CAPITAL CARGO INT'L AIRLINES	6	$ 1,338,000	88	7.9%	$ 16,920,000	2	1
10. CHALLENGE AIR CARGO	3	$ 669,000	718	0.5%	$ 137,921,000	3	
11. CHARTER AMERICA	4	$ 892,000	5	N.A.	N.A.	4	N.A.
12. CONTINENTAL MICRONESIA	7	$ 1,561,000	39,300	0.0%	$ 7,213,000,000		
13. CUSTOM AIR TRANSPORT	2	$ 446,000	96	4.3%	$ 10,388,000	5	2
14. DHL AIRWAYS	25	$ 5,575,000	1,236	0.4%	$ 1,285,950,000	6	
15. EAGLE AIRLINES	1	$ 223,000	2,200	0.1%	$ 417,100,100		
16. EASTWIND AIRLINES	5	$ 1,115,000	N.A.	5.1%	$ 22,000,000		
17. EMERY WORLDWIDE	24	$ 5,352,000	967	0.1%	$ 4,266,000,000	7	
18. EVERGREEN INT'L	10	$ 2,230,000	407	0.6%	$ 353,000,000	8	
19. EXPRESS ONE INT'L	20	$ 4,460,000	571	5.1%	$ 86,892,000	9	3
20. FALCON AIR EXPRESS	1	$ 223,000	88	1.6%	$ 13,955,000	10	
21. FEDEX	0	$ -	7,561	0.0%	$ 13,446,874,000		
22. FINE AIR	0	$ -	315	0.0%	$ 99,500,000		
23. FLORIDA WEST	0	$ -	46	0.0%	$ 102,176,000		
24. GEMINI AIR CARGO	0	$ -	250	0.0%	$ 103,276,000		
25. KITTY HAWK AIR CARGO	31	$ 6,913,000	252	1.0%	$ 715,000,000	11	
26. NORTHERN AIR CARGO	3	$ 669,000	245	1.6%	$ 41,568,000	12	
27. NORTHWEST	0	$ -	48,000	0.0%	$ 8,996,338,000		
28. POLAR AIR CARGO	0	$ -	418	0.0%	$ 318,400,000		
29. PUROLATOR	1	$ 223,000	12,000	0.0%	$ 828,500,000		
30. RELIANT AIRLINES	1	$ 223,000	80	0.9%	$ 25,000,000	13	
31. RICH INTL	0	$ -	29	0.0%	$ 151,000,000		
32. RYAN INT'L AIRLINES	9	$ 2,007,000	654	1.4%	$ 138,769,000	14	
33. SKY TREK INT'L AIRLINES	2	$ 446,000	36	N.A.	N.A.	15	N.A.
34. TOWER AIR	0	$ -	1,584	0.0%	$ 487,827,000		
35. TRADEWINDS AIRLINES	0	$ -	249	0.0%	$ 50,000,000		
36. TRANS CONTINENTAL	1	$ 223,000	155	0.4%	$ 84,500,000		
37. UNITED AIRLINES	0	$ -	32,767	0.0%	$ 17,472,108,000		
38. UNITED PARCEL SERVICE	125	$ 27,875,000	6,000	0.1%	$ 22,500,000,000		
39. USA JET AIRLINES	7	$ 1,561,000	255	1.8%	$100,000,000	16	
40. WORLD AIRWAYS	0	$ -	945	0.0%	$ 280,339,000		
41. ZANTOP INTL	0	$ -	180	0.0%	$ 15,230,000		
Total	372						

SOURCES

1. American Big Businesses Disc, 1998, infoUSA Inc., 5711 S. 86th Circle, Omaha, NE 68127
2. DOT/BTS Air Carrier Financial Statistics Quarterly, June 1998/1997 (Second Quarter)
3. DOT/BTS Air Carrier Financial Statistics Quarterly, September 1998/1997 (Third Quarter)
4. Dun & Bradstreet Million Dollar Directory, 1998
5. Moody's Transportation Manual, 1998
6. NASDAC, FAA, and Gellman Employment Data located in the "Operators" folder in APO's J drive
7. WAD data based on AvData 1/98

*Operating Revenue or sales of the parent company. Occasionally the value will be for the year 1997.

Last Revised: 04/19/2000

Table XI-2

roup 2 - Part 121 Turbine-Powered <= 33,000 Pounds MCTOW And All Piston-Powered All-Cargo Air Carriers - 1998 - Employees and Revenues

Air Carrier	Airplanes					Small Business	
		Compliance Cost	Employees	Cost as % of Annual Revenue	Operating Revenue*	Yes	Yes
	No.	$82,000			1998		Affected
1. AIR ALASKA CARGO	1	$ 82,000	N.A.	N.A.	N.A.	N.A.	N.A.
2. ALASKA CENTRAL EXPRESS	4	$ 328,000	N.A.	N.A.	N.A.	N.A.	N.A.
3. ALASKA ISLAND AIR	1	$ 82,000	10	13.7%	$ 600,000	1	1
4. ARCTIC CIRCLE AIR SERVICE	3	$ 246,000	31	5.5%	$ 4,500,000	2	2
5. ARCTIC TRANSPORTATION SERVICES, INC.	2	$ 164,000	65	3.2%	$ 5,057,000	3	3
6. BERING AIR	1	$ 82,000	85	1.1%	$ 7,500,000	4	
7. CAPE SMYTHE AIR SERVICE	1	$ 82,000	105	0.9%	$ 9,500,000	5	
8. CORPORATE AIR	14	$ 1,148,000	300	5.7%	$ 20,285,000	6	4
9. F.S. AIR SERVICE	2	$ 164,000	22	8.2%	$ 2,000,000	7	5
10. FALCON AIR EXPRESS AIRLINES	4	$ 328,000	49	10.9%	$ 3,000,000	8	6
11. FRONTIER FLYING SERVICE	1	$ 82,000	85	1.4%	$ 6,000,000	9	
12. GREAT LAKES AVIATION	4	$ 328,000	110	4.0%	$ 8,300,000	10	7
13. MERLIN EXPRESS	26	$ 2,132,000	820	1.5%	$ 141,000,000	11	
14. MOUNTAIN AIR CARGO	4	$ 328,000	350	0.9%	$ 36,100,000	12	
15. RENOWN AVIATION	4	$ 328,000	68	3.6%	$ 9,000,000	13	8
16. RHOADES AVIATION	13	$ 1,066,000	60	14.1%	$ 7,567,000	14	9
17. TATONDUK OUTFITTERS	5	$ 410,000	85	3.4%	$ 12,000,000	15	10
18. TOLAIR SERVICES	7	$ 574,000	60	15.6%	$ 3,680,000	16	11
Total	97					16	11

SOURCES

1 American Big Businesses Disc, 1998, infoUSA Inc., 5711 S. 86th Circle, Omaha, NE 68127

2 DOT/BTS Air Carrier Financial Statistics Quarterly, June 1998/1997 (Second Quarter)

3 DOT/BTS Air Carrier Financial Statistics Quarterly, September 1998/1997 (Third Quarter)

4 Dun & Bradstreet Million Dollar Directory, 1998

5 Moody's Transportation Manual, 1998

6 NASDAC, FAA, and Gellman Employment Data located in the "Operators" folder in APO's J drive

7 WAD data based on AvData 1/98

*Operating Revenue or sales of the parent company. Occasionally the value will be for the year 1997.

Last Revised: 04/18/2000

Table XI-3

U.S. Part 125 Commercial Cargo Operators - 1998 - Employees and Revenues

Type of Operator/Operator	Airplanes No.	Compliance Cost $223,000	Employees	Cost as % of Annual Revenue	Operating Revenue* 1998	Small Business Yes	Yes Affected
1. Group 3 - Part 125 Turbine-Powered > 33,000 Pounds MCTOW All-Cargo Commercial Operators							
1. C AND M Airways, Inc.	5	$ 1,115,000	N.A.	N.A.	N.A.	N.A.	N.A.
2. Contract Cargo Airlines, Inc.	1	$ 223,000	N.A.	N.A.	N.A.	N.A.	N.A.
3. Traffic Management Corporation	4	$ 892,000	37	N.A.	N.A.	N.A.	N.A.
Total	10						
2. Group 4 - Part 125 Turbine-Powered <= 33,000 Pounds MCTOW And All Piston-Powered All-Cargo Commercial Operators							
Compliance Cost		$ 82,000					
1. Airway Transport	1	$ 82,000	7	10.9%	$ 750,000	N.A.	N.A.
2. Blumenthal, James R.	1	$ 82,000	N.A.	N.A.	N.A.	1	1
3. Brooks Air Transport, Inc.	2	$ 164,000	N.A.	N.A.	N.A.	2	2
4. Cascade Air, Inc.	2	$ 164,000	3	32.8%	$ 500,000	3	3
5. Custom Air Service, Inc.	1	$ 82,000	1	N.A.	N.A.	4	4
6. Dodita Air Cargo, Inc.	2	$ 164,000	N.A.	N.A.	N.A.	5	5
7. Everts Air Fuel	6	$ 492,000	37	0.2%	$ 300,000,000	6	6
8. Ferreteria E Implementos San Franci	3	$ 246,000	N.A.	N.A.	N.A.	7	7
9. Florida Air Transport, Inc.	1	$ 82,000	7	N.A.	N.A.	8	8
10. Fresh Air, Inc.	1	$ 82,000	N.A.	N.A.	N.A.	9	9
11. Miami Air Lease, Inc.	1	$ 82,000	3	32.8%	$ 250,000	10	10
12. Nord Star Airlines, Inc.	1	$ 82,000	N.A.	N.A.	N.A.	11	11
13. Northern Air Fuel	1	$ 82,000	7	N.A.	N.A.	12	12
14. Piedmont Air Transport, Inc.	2	$ 164,000	N.A.	N.A.	N.A.	13	13
15. Powers & Hawkins Enterprizes	2	$ 164,000	N.A.	N.A.	N.A.	14	14
16. RPG Airlift, Inc.	1	$ 82,000	N.A.	N.A.	N.A.	15	15
17. Richard Air Of Florida, Inc.	1	$ 82,000	7	10.9%	$ 750,000	16	16
18. Tiger Contract Cargo	1	$ 82,000	N.A.	N.A.	N.A.	17	17
19. Woods Air Fuel	1	$ 82,000	15	4.6%	$ 1,800,000	18	18
Total	31						

SOURCES

1. American Big Businesses Disc, 1998, infoUSA Inc., 5711 S. 86th Circle, Omaha, NE 68127
2. DOT/BTS Air Carrier Financial Statistics Quarterly, June 1998/1997 (Second Quarter)
3. DOT/BTS Air Carrier Financial Statistics Quarterly, September 1998/1997 (Third Quarter)
4. Dun & Bradstreet Million Dollar Directory, 1998
5. Moody's Transportation Manual, 1998
6. NASDAC, FAA, and Gellman Employment Data located in the "Operators" folder in APO's J drive
7. WAD data based on AvData 1/98

*Operating Revenue or sales of the parent company. Occasionally the value will be for the year 1997.

Last Revised: 04/19/2000

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 proposed rule and has determined that it would impose the same costs on domestic and international entities and thus has a neutral trade impact.

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

Appendices

Appendix V-1, Page 1								
Existing Part 121 All-Cargo Turbine-Powered Fleet > 33,000 Pounds MCTOW								
Year Ending 1998 - Details								
	AIRPLANE		**ENGINE**					
Type of Operator/Operator	Model	Series	Model	Series	Noise Stage	Use	Mfr	Total
I. PART 121 ALL CARGO TURBINE AIRPLANE OPERATORS								
1. AIRBORNE EXPRESS								
AIRBORNE EXPRESS	767	-200F	CF6	80A	3	F	B	6
AIRBORNE EXPRESS	DC-8	-61FH	JT3D	3B	2	F	D	10
AIRBORNE EXPRESS	DC-8	-61FH	JT3D	3B	3	F	D	1
AIRBORNE EXPRESS	DC-8	-61FH	JT3D	7	3	F	D	1
AIRBORNE EXPRESS	DC-8	-61H	JT3D	3B	2	F	D	1
AIRBORNE EXPRESS	DC-8	-62FH	JT3D	3B	2	F	D	1
AIRBORNE EXPRESS	DC-8	-62FH	JT3D	3B	3	F	D	4
AIRBORNE EXPRESS	DC-8	-62FH	JT3D	7	3	F	D	1
AIRBORNE EXPRESS	DC-8	-63FH	JT3D	7	2	F	D	2
AIRBORNE EXPRESS	DC-8	-63FH	JT3D	7	3	F	D	14
AIRBORNE EXPRESS	DC-8	-73F	CFM56	2C	3	F	D	1
AIRBORNE EXPRESS	DC-9	-10FH	JT8D	7B	3	F	D	2
AIRBORNE EXPRESS	DC-9	-30F	JT8D	11	2	F	D	2
AIRBORNE EXPRESS	DC-9	-30F	JT8D	7B	2	F	D	6
AIRBORNE EXPRESS	DC-9	-30F	JT8D	9A	2	F	D	6
AIRBORNE EXPRESS	DC-9	-30FH	JT8D	7B	3	F	D	23
AIRBORNE EXPRESS	DC-9	-30FH	JT8D	9A	3	F	D	6
AIRBORNE EXPRESS	DC-9	-40F	JT8D	11	2	F	D	11
AIRBORNE EXPRESS	DC-9	-40F	JT8D	15	2	F	D	9
AIRBORNE EXPRESS	DC-9	-40FH	JT8D	11	3	F	D	3
AIRBORNE EXPRESS	DC-9	-40FH	JT8D	15	3	F	D	4
SUBTOTAL AIRBORNE EXPRESS								**114**
2. AIR TRANSPORT INTL								
AIR TRANSPORT INTL	DC-8	-61FH	JT3D	3B	2	F	D	1
AIR TRANSPORT INTL	DC-8	-62CH	JT3D	7	2	F	D	1
AIR TRANSPORT INTL	DC-8	-62FH	JT3D	3B	2	F	D	2
AIR TRANSPORT INTL	DC-8	-62FH	JT3D	3B	3	F	D	2
AIR TRANSPORT INTL	DC-8	-62FH	JT3D	7	2	F	D	1
AIR TRANSPORT INTL	DC-8	-62FH	JT3D	7	3	F	D	1
AIR TRANSPORT INTL	DC-8	-63CH	JT3D	7	3	F	D	1
AIR TRANSPORT INTL	DC-8	-63FH	JT3D	7	3	F	D	2
SUBTOTAL- AIR TRANSPORT INTL								**11**
3. ALOHA	737	-200C	JT8D	17	2	F	B	1

Appendix V-1,Page 2

Existing Part 121 All-Cargo Turbine-Powered Fleet > 33,000 Pounds MCTOW

Year Ending 1998 - Details

	AIRPLANE		ENGINE					
Type of Operator/Operator	Model	Series	Model	Series	Noise Stage	Use	Mfr	Total
. PART 121 ALL CARGO TURBINE AIRPLANE OPERATORS								
4. AMERICAN INT'L AIRWAYS								
AMERICAN INT'L AIRWAYS	727	-200F	JT8D	9	2	F	B	1
AMERICAN INT'L AIRWAYS	747	-100F	JT9D	7A	3	F	B	2
AMERICAN INT'L AIRWAYS	747	-200F	JT9D	7F	3	F	B	1
AMERICAN INT'L AIRWAYS	747	-200M	JT9D	7J	3	M	B	1
AMERICAN INT'L AIRWAYS	DC-8	-51FH	JT3D	3B	2	F	D	2
AMERICAN INT'L AIRWAYS	DC-8	-54FH	JT3D	3B	2	F	D	2
AMERICAN INT'L AIRWAYS	DC-8	-55FH	JT3D	3B	2	F	D	5
AMERICAN INT'L AIRWAYS	DC-8	-61FH	JT3D	3B	2	F	D	5
AMERICAN INT'L AIRWAYS	DC-8	-62CH	JT3D	3B	2	F	D	1
AMERICAN INT'L AIRWAYS	DC-8	-62FH	JT3D	3B	3	F	D	2
AMERICAN INT'L AIRWAYS	DC-8	-63CH	JT3D	7	3	F	D	1
AMERICAN INT'L AIRWAYS	DC-8	-63FH	JT3D	7	3	F	D	1
AMERICAN INT'L AIRWAYS	L-1011	-200F	RB211	524B	3	F	L	6
SUBTOTAL - AMERICAN INT'L AIRWAYS								30
5. AMERIJET INTL								
AMERIJET INTL	727	-200F	JT8D	15	2	F	B	2
AMERIJET INTL	727	-200F	JT8D	15A	2	F	B	2
AMERIJET INTL	727	-200FH	JT8D	15	3	F	B	1
AMERIJET INTL	727	-200FH	JT8D	17	3	F	B	1
AMERIJET INTL	727	-200FH	JT8D	9	3	F	B	1
AMERIJET INTL	727	-200FH	JT8D	9A	3	F	B	1
SUBTOTAL - AMERIJET INTL								8
6. ARROW AIR								
ARROW AIR	DC-8	-62FH	JT3D	3B	2	F	D	2
ARROW AIR	DC-8	-62FH	JT3D	7	2	F	D	3
ARROW AIR	DC-8	-63FH	JT3D	7	2	F	D	2
ARROW AIR	L-1011	-200F	RB211	524B	3	F	L	2
SUBTOTAL - ARROW AIR								9
7. ATLAS AIR								
ATLAS AIR	747	-200C	CF6	50E2	3	F	B	1
ATLAS AIR	747	-200F	CF6	50E2	3	F	B	13
ATLAS AIR	747	-200F	JT9D	7J	3	F	B	1
SUBTOTAL - ATLAS AIR								15
8. BAX GLOBAL								
BAX GLOBAL	727	-200FH	JT8D	9	3	F	B	2
BAX GLOBAL	DC-8	-63FH	JT3D	7	2	F	D	2
BAX GLOBAL	DC-8	-63FH	JT3D	7	3	F	D	3
BAX GLOBAL	DC-8	-71F	CFM56	2C	3	F	D	11
SUBTOTAL - BAX GLOBAL								18

Appendix V-1,Page 3

Existing Part 121 All-Cargo Turbine-Powered Fleet > 33,000 Pounds MCTOW

Year Ending 19[illegible] - Details

	AIRPLANE		ENGINE					
Type of Operator/Operator	Model	Series	Model	Series	Noise Stage	Use	Mfr	Total
I. PART 121 ALL CARGO TURBINE AIRPLANE OPERATORS								
9. CAPITAL CARGO INT'L AIRLINES								
CAPITAL CARGO INT'L AIRLINES	727	-200F	JT8D	15	2	F	B	1
CAPITAL CARGO INT'L AIRLINES	727	-200F	JT8D	15A	2	F	B	1
CAPITAL CARGO INT'L AIRLINES	727	-200F	JT8D	17	2	F	B	1
CAPITAL CARGO INT'L AIRLINES	727	-200FH	JT8D	17	3	F	B	1
CAPITAL CARGO INT'L AIRLINES	727	-200FH	JT8D	17R	3	F	B	1
CAPITAL CARGO INT'L AIRLINES	727	-200FH	JT8D	7B	3	F	B	1
SUBTOTAL - CAPITAL CARGO INT'L AIRLINES								6
10. CHALLENGE AIR CARGO								
CHALLENGE AIR CARGO	757	-200F	RB211	535E4	3	F	B	3
CHALLENGE AIR CARGO	DC-10	-40F	JT9D	59A	3	F	D	2
SUBTOTAL - CHALLENGE AIR CARGO								5
11. CHARTER AMERICA								
CHARTER AMERICA	727	-100C	JT8D	7B	2	F	B	1
CHARTER AMERICA	727	-100F	JT8D	7B	2	F	B	1
CHARTER AMERICA	727	-100FH	JT8D	7B	3	F	B	1
CHARTER AMERICA	727	-200F	JT8D	7B	2	F	B	1
SUBTOTAL - CHARTER AMERICA								4
12. CONTINENTAL MICRONESIA								
CONTINENTAL MICRONESIA	727	-200FH	JT8D	15	3	F	B	3
CONTINENTAL MICRONESIA	727	-200FH	JT8D	17R	3	F	B	4
SUBTOTAL - CONTINENTAL MICRONESIA								7
13. CUSTOM AIR TRANSPORT	727	-200F	JT8D	15	2	F	B	2
14. DHL AIRWAYS								
DHL AIRWAYS	727	-100F	JT8D	7B	2	F	B	5
DHL AIRWAYS	727	-100FH	JT8D	7B	3	F	B	6
DHL AIRWAYS	727	-200F	JT8D	7B	2	F	B	1
DHL AIRWAYS	727	-200FH	JT8D	15	3	F	B	1
DHL AIRWAYS	727	-200FH	JT8D	15A	3	F	B	1
DHL AIRWAYS	727	-200FH	JT8D	17R	3	F	B	3
DHL AIRWAYS	727	-200FH	JT8D	7B	3	F	B	4
DHL AIRWAYS	727	-200FH	JT8D	9	3	F	B	3
DHL AIRWAYS	727	-200FH	JT8D	9A	3	F	B	1
DHL AIRWAYS	A300	F4-200	CF6	50C2	3	F	A	1
DHL AIRWAYS	DC-8	-73F	CFM56	2C	3	F	D	8
SUBTOTAL - DHL AIRWAYS								34
15. EAGLE AIRLINES	DC-9	-30	JT8D	7B	2	[illegible]	[illegible]	1

Appendix V-1,Page 4

Existing Part 121 All-Cargo Turbine-Powered Fleet > 33,000 Pounds MCTOW

Year Ending 199[illegible] - Detailed	AIRPLANE		ENGINE					
Type of Operator/Operator	Model	Series	Model	Series	Stage	Use	Mfr	Total
I. PART 121 ALL-CARGO TURBINE AIRPLANE OPERATORS								
16. EASTWIND AIRLINES								
EASTWIND AIRLINES	737	-200	JT8D	9A	2		B	1
EASTWIND AIRLINES	737	-200H	JT8D	9A	3		B	2
EASTWIND AIRLINES	737	-700	CFM56	7B22	3		B	2
SUBTOTAL - EASTWIND AIRLINES								5
17. EMERY WORLDWIDE								
EMERY WORLDWIDE	727	-100	JT8D	7B	2		B	1
EMERY WORLDWIDE	727	-100F	JT8D	7B	2	F	B	7
EMERY WORLDWIDE	727	-100FH	JT8D	7B	3	F	B	9
EMERY WORLDWIDE	727	-200FH	JT8D	7	3	F	B	3
EMERY WORLDWIDE	727	-200FH	JT8D	7B	3	F	B	4
EMERY WORLDWIDE	DC-8	-54FH	JT3D	3B	2	F	D	2
EMERY WORLDWIDE	DC-8	-62FH	JT3D	3B	2	F	D	6
EMERY WORLDWIDE	DC-8	-62FH	JT3D	7	2	F	D	1
EMERY WORLDWIDE	DC-8	-63FH	JT3D	7	2	F	D	9
EMERY WORLDWIDE	DC-8	-71F	CFM56	2C	3	F	D	9
EMERY WORLDWIDE	DC-8	-73C	CFM56	2C	3	F	D	1
EMERY WORLDWIDE	DC-8	-73F	CFM56	2C	3	F	D	12
SUBTOTAL - EMERY WORLDWIDE								64
18. EMPIRE AIRLINES	F-27	TURBOPROP			10	F		10
19. EVERGREEN INT'L								
EVERGREEN INT'L	727	-100C	JT8D	7A	2	C	B	1
EVERGREEN INT'L	727	-100F	JT8D	7B	2	F	B	1
EVERGREEN INT'L	747	-100F	JT9D	7A	3	F	B	6
EVERGREEN INT'L	747	-100F	JT9D	7AH	3	F	B	1
EVERGREEN INT'L	747	-200C	JT9D	7A	3	F	B	1
EVERGREEN INT'L	747	-200C	JT9D	7F	3	F	B	1
EVERGREEN INT'L	DC-9	-10F	JT8D	7A	2	F	D	2
EVERGREEN INT'L	DC-9	-30F	JT8D	9A	2	F	D	3
EVERGREEN INT'L	DC-9	-30FH	JT8D	11	3	F	D	1
EVERGREEN INT'L	DC-9	-30FH	JT8D	9A	3	F	D	2
SUBTOTAL - EVERGREEN INT'L								19
20. EXPRESS ONE [illegible]								
EXPRESS ONE INT'L	727	-100F	JT8D	7B	2	F	B	3
EXPRESS ONE INT'L	727	-100FH	JT8D	7B	3	F	B	1
EXPRESS ONE INT'L	727	-200F	JT8D	15	2	F	B	1
EXPRESS ONE INT'L	727	-200FH	JT8D	15	3	F	B	1
EXPRESS ONE INT'L	727	-200FH	JT8D	17	3	F	B	1
EXPRESS ONE INT'L	727	-200FH	JT8D	17R	3	F	B	2
EXPRESS ONE INT'L	727	-200FH	JT8D	7B	3	F	B	1
EXPRESS ONE INT'L	727	-200FH	JT8D	9	3	F	B	9
EXPRESS ONE INT'L	727	-200FH	JT8D	9A	3	F	B	1
SUBTOTAL - EXPRESS ONE INT'L								20
21. FALCON AIR EXPRESS	727	-100C	JT8D	7	2	C	[illegible]	[illegible]

Appendix V-1,Page 5								
Existing Part 121 All-Cargo Turbine-Powered Fleet > 33,000 Pounds MCTOW								
Year Ending 1998 - Details								
	AIRPLANE		**ENGINE**		**Noise**			
Type of Operator/Operator	**Model**	**Series**	**Model**	**Series**	**Stage**	**Use**	**Mfr**	**Total**
I. PART 121 ALL CARGO TURBINE AIRPLANE OPERATORS								
22. FEDEX								
FEDEX	727	-100F	JT8D	7B	2	F	B	27
FEDEX	727	-100FH	JT8D	7B	3	F	B	35
FEDEX	727	-200F	JT8D	15	2	F	B	24
FEDEX	727	-200F	JT8D	15A	2	F	B	2
FEDEX	727	-200F	JT8D	17	2	F	B	4
FEDEX	727	-200F	JT8D	17A	2	F	B	4
FEDEX	727	-200F	JT8D	17R	2	F	B	2
FEDEX	727	-200FH	JT8D	15	3	F	B	38
FEDEX	727	-200FH	JT8D	15A	3	F	B	3
FEDEX	727	-200FH	JT8D	17	3	F	B	1
FEDEX	727	-200FH	JT8D	17A	3	F	B	2
FEDEX	727	-200FH	JT8D	17R	3	F	B	4
FEDEX	727	-200RF	JT8D	217C	3	F	B	11
FEDEX	747	-200F	CF6	50E2	3	F	B	2
FEDEX	747	-200F	JT9D	70A	3	F	B	1
FEDEX	747	-400F	CF6	80C2B1F	3	F	B	2
FEDEX	A300	-600F	CF6	80C2A5F	3	F	A	30
FEDEX	A310	-200F	CF6	80A3	3	F	A	25
FEDEX	A310	-200F	JT9D	7R4D1	3	F	A	5
FEDEX	A310	-200F	JT9D	7R4E1	3	F	A	9
FEDEX	DC-10	-10C	CF6	6D	3	F	D	1
FEDEX	DC-10	-10F	CF6	6D	3	F	D	23
FEDEX	DC-10	-30C	CF6	50C2	3	F	D	4
FEDEX	DC-10	-30F	CF6	50C2	3	F	D	18
FEDEX	MD-11	-11F	CF6	80C2D1F	3	F	D	26
SUBTOTAL - FEDEX								**303**
23. FINE AIR								
FINE AIR	DC-8	-54FH	JT3D	3B	2	F	D	3
FINE AIR	DC-8	-54FH	JT3D	3B	3	F	D	3
FINE AIR	DC-8	-55FH	JT3D	3B	2	F	D	1
FINE AIR	DC-8	-61FH	JT3D	3B	2	F	D	2
FINE AIR	L-1011	-200F	RB211	524B	3	F	L	1
SUBTOTAL - FINE AIR								**10**
24. FLORIDA WEST	DC-8	-61FH	JT3D	3B	2	F	D	1
25. GEMINI AIR CARGO	DC-10	-30F	CF6	50C2	3	F	D	8

Appendix V-1,Page 6

Existing Part 121 All-Cargo Turbine-Powered Fleet > 33,000 Pounds MCTOW

Year Ending 1998 - Details								
	AIRPLANE		ENGINE		Noise			
Type of Operator/Operator	Model	Series	Model	Series	Stage	Use	Mfr	Total
I. PART 121 ALL CARGO TURBINE AIRPLANE OPERATORS								
26. KITTY HAWK AIR CARGO								
KITTY HAWK AIR CARGO	727	-100F	JT8D	7	2	F	B	1
KITTY HAWK AIR CARGO	727	-100FH	JT8D	7B	3	F	B	1
KITTY HAWK AIR CARGO	727	-200F	JT8D	15	2	F	B	1
KITTY HAWK AIR CARGO	727	-200F	JT8D	7B	2	F	B	3
KITTY HAWK AIR CARGO	727	-200F	JT8D	9	2	F	B	9
KITTY HAWK AIR CARGO	727	-200FH	JT8D	15	3	F	B	4
KITTY HAWK AIR CARGO	727	-200FH	JT8D	7	3	F	B	1
KITTY HAWK AIR CARGO	727	-200FH	JT8D	7B	3	F	B	1
KITTY HAWK AIR CARGO	727	-200FH	JT8D	9	3	F	B	5
KITTY HAWK AIR CARGO	DC-9	-10F	JT8D	7A	2	F	D	1
KITTY HAWK AIR CARGO	DC-9	-10F	JT8D	7B	2	F	D	3
KITTY HAWK AIR CARGO	DC-9	-10FH	JT8D	7A	3	F	D	1
KITTY HAWK AIR CARGO	CONVAIR	600	URBOPROP	5		F		5
KITTY HAWK AIR CARGO	CONVAIR	640	URBOPROP	2		F		2
SUBTOTAL - KITTY HAWK AIR CARGO								38
27. MOUNTAIN AIR CARGO	FOKKER	F-27	URBOPROP					22
28. NORTHERN AIR CARGO								
NORTHERN AIR CARGO	727	-100F	JT8D	7A	2	F	B	1
NORTHERN AIR CARGO	727	-100FH	JT8D	7B	3	F	B	2
SUBTOTAL - NORTHERN AIR CARGO								3
29. NORTHWEST								
NORTHWEST	747	-200F	JT9D	7F	3	F	B	6
NORTHWEST	747	-200F	JT9D	7Q	3	F	B	2
SUBTOTAL - NORTHWEST								8
30. POLAR AIR CARGO								
POLAR AIR CARGO	747	-100F	JT9D	7A	3	F	B	10
POLAR AIR CARGO	747	-200F	JT9D	7Q	3	F	B	2
SUBTOTAL - POLAR AIR CARGO								12
31. PUROLATOR	727	-200F	JT8D	15	2	F	B	1
32. RELIANT AIRLINES	DC-9	-10F	JT8D	7B	2	F	D	1
33. RENOWN AVIATION								
RENOWN AVIATION	ELECTRA	L-188	URBOPROP					2
RENOWN AVIATION	CONVAIR	580	URBOPROP					3
SUBTOTAL - RENOWN AVIATION								5

Existing Part 121 All-Cargo Turbine-Powered Fleet > 33,000 Pounds MCTOW								
Year Ending 1996 - Details								
	AIRPLANE		**ENGINE**					
Type of Operator/Operator	Model	Series	Model	Series	Stage	Use	Mfr	Total
I. PART 121 ALL CARGO TURBINE AIRPLANE OPERATORS								
34. RICH INTL	**L-1011**	**-200F**	**RB211**	**524B**	**3**	**F**	**L**	**1**
35. RYAN INT'L AIRLINES								
RYAN INT'L AIRLINES	727	-100F	JT8D	7B	2	F	B	5
RYAN INT'L AIRLINES	727	-100FH	JT8D	7B	3	F	B	3
RYAN INT'L AIRLINES	727	-200FH	JT8D	7B	3	F	B	1
SUBTOTAL - RYAN INT'L AIRLINES								**9**
36. SKY TREK INT'L AIRLINES								
SKY TREK INT'L AIRLINES	727	-200F	JT8D	15	2	F	B	1
SKY TREK INT'L AIRLINES	727	-200FH	JT8D	15	3	F	B	1
SUBTOTAL - SKY TREK INT'L AIRLINES								**2**
37. TOWER AIR	**747**	**-200F**	**JT9D**	**7Q**	**3**	**F**	**B**	**1**
38. TRADEWINDS AIRLINES	**L-1011**	**-1F**	**RB211**	**22B**	**3**	**F**	**L**	**1**
39. TRANS CONTINENTAL								
TRANS CONTINENTAL	727	-100FH	JT8D	7B	3	F	B	1
TRANS CONTINENTAL	DC-8	-54FH	JT3D	3B	2	F	D	1
TRANS CONTINENTAL	DC-8	-55FH	JT3D	3B	2	F	D	2
TRANS CONTINENTAL	DC-8	-61FH	JT3D	3B	2	F	D	1
TRANS CONTINENTAL	DC-8	-62FH	JT3D	3B	3	F	D	1
TRANS CONTINENTAL	DC-8	-62FH	JT3D	7	2	F	D	1
SUBTOTAL - TRANS CONTINENTAL								**7**
40. UNITED AIRLINES	**DC-10**	**-30F**	**CF6**	**50C2**	**3**	**F**	**D**	**4**
41. UNITED PARCEL SERVICE								
UNITED PARCEL SERVICE	727	-100RF	TAY651	54	3	F	B	44
UNITED PARCEL SERVICE	727	-200FH	JT8D	15	3	F	B	6
UNITED PARCEL SERVICE	727	-200FH	JT8D	17R	3	F	B	2
UNITED PARCEL SERVICE	747	-100F	JT9D	7A	3	F	B	12
UNITED PARCEL SERVICE	747	-200F	JT9D	7Q	3	F	B	4
UNITED PARCEL SERVICE	757	-200F	PW2000	2040	3	F	B	35
UNITED PARCEL SERVICE	757	-200F	RB211	535E4	3	F	B	32
UNITED PARCEL SERVICE	757	-200F	RB211	535E4B	3	F	B	6
UNITED PARCEL SERVICE	767	-300F	CF6	80C2B6F	3	F	B	27
UNITED PARCEL SERVICE	DC-8	-71F	CFM56	2C	3	F	D	23
UNITED PARCEL SERVICE	DC-8	-73F	CFM56	2C	3	F	D	26
SUBTOTAL - UNITED PARCEL SERVICE								**217**
42. USA JET AIRLINES								
USA JET AIRLINES	DC-9	-10C	JT8D	7B	2	F	D	2
USA JET AIRLINES	DC-9	-10CH	JT8D	7B	3	F	D	2
USA JET AIRLINES	DC-9	-10F	JT8D	7B	2	F	D	3
SUBTOTAL - USA JET AIRLINES								**7**
43. WORLD AIRWAYS	**MD-11**	**-11F**	**PW4000**	**4460**	**3**	**F**	**D**	**1**
44. ZANTOP INTL	**DC-8**	**-54FH**	**JT3D**	**3B**	**2**	**F**	**D**	**2**
SUBTOTAL - U.S. PART 121 AIRLINE TURBINE FREIGHTERS >33,000 LBS.								**1,048**
Appendix V-1,Page 8								

Appendix V-1,Page 8								
Existing Part 121 All-Cargo Turbine-Powered Fleet > 33,000 Pounds MCTOW								
Year Ending 1998 - Details								
	AIRPLANE		**ENGINE**		Noise			
Type of Operator/Operator	Model	Series	Model	Series	Stage	Use	Mfr	Total
II. LESSORS AND BROKERS								
1. AIR TRADE LSG	707	-320CH	JT3D	3B	2	F	B	1
2. AIRCRAFT INVESTMENT ASSOC.	727	-100F	JT8D	7B	2	F	B	1
3. ALG INC	707	-320CH	JT3D	3B	2	F	B	2
4. BABCOCK & BROWN	A300	F4-200	CF6	50C2	3	F	A	1
5. BANK OF NY	747	-100F	JT9D	7A	3	F	B	1
6. BEHC	747	-200F	JT9D	70A	3	F	B	5
7. COOK AIRCRAFT LSG	727	-100FH	JT8D	7	3	F	B	1
8. FINOVA CAPITAL								
FINOVA CAPITAL	727	-200F	JT8D	9	2	F	B	1
FINOVA CAPITAL	747	-200F	JT9D	7Q	3	F	B	2
SUBTOTAL - FINOVA CAPITAL								3
9. FIRST SECURITY BANK								
FIRST SECURITY BANK	747	-200F	JT9D	7Q	3	F	B	1
FIRST SECURITY BANK	A300	F4-200	CF6	50C2	3	F	A	1
SUBTOTAL - FIRST SECURITY BANK								2
10. G & B CORP	DC-8	-55FH	JT3D	3B	2	F	D	1
11. GATX LEASING	747	-100F	JT9D	7A	3	F	B	1
12. GENERAL AVN TECH.	727	-100F	JT8D	9A	2	F	B	1
13. GLOBAL AIRCRAFT SALES	DC-10	-10F	CF6	6D	3	F	D	1
14. INTL AIR LEASES								
INTL AIR LEASES	707	-320CH	JT3D	3B	2	F	B	1
INTL AIR LEASES	DC-8	-62FH	JT3D	3B	2	F	D	2
INTL AIR LEASES	DC-8	-62FH	JT3D	3B	3	F	D	1
INTL AIR LEASES	DC-8	-62FH	JT3D	7	3	F	D	1
SUBTOTAL INTL AIR LEASES								5
15. NATIONSBANC LEASING	DC-8	-71F	CFM56	2C	3	F	D	1
16. PACIFIC HARBOR CAPITAL	747	-200F	JT9D	7A	3	F	B	1
17. POLARIS LEASING	747	-100F	JT9D	7A	3	F	B	3
18. RAYTHEON E-SYSTEMS	DC-8	-55FH	JT3D	3B	2	F	D	1
19. TRANS PACIFIC LSG	727	-200F	JT8D	17	2	F	B	1
SUBTOTAL - LESSORS AND BROKERS								33
GRAND TOTALS U.S. TURBINE AIR CARGO AIRCRAFT >33,000 LBS.								1,06[illegible]
Source: U.S. JET FLEET-1998; APO/FAA DATA								

Appendix V-2, Page 1								
Part 121 All-Cargo Turbine-Powered Fleet > 33,000 Pounds MCTOW Which Would Require TCAS-II Or Equivalent								
Year Ending 1998 - Details								
	AIRPLANE		**ENGINE**					
Type of Operator/Operator	**Model**	**Series**	**Model**	**Series**	**Noise Stage**	**Use**	**Mfr**	**Total**
I. PART 121 ALL CARGO TURBINE AIRPLANE OPERATORS								
1. AIRBORNE EXPRESS								
AIRBORNE EXPRESS	DC-9	-10FH	JT8D	7B	3	F	D	2
AIRBORNE EXPRESS	DC-9	-30F	JT8D	11	2	F	D	2
AIRBORNE EXPRESS	DC-9	-30F	JT8D	7B	2	F	D	6
AIRBORNE EXPRESS	DC-9	-30F	JT8D	9A	2	F	D	6
AIRBORNE EXPRESS	DC-9	-30FH	JT8D	7B	3	F	D	23
AIRBORNE EXPRESS	DC-9	-30FH	JT8D	9A	3	F	D	6
AIRBORNE EXPRESS	DC-9	-40F	JT8D	11	2	F	D	11
AIRBORNE EXPRESS	DC-9	-40F	JT8D	15	2	F	D	9
AIRBORNE EXPRESS	DC-9 .	-40FH	JT8D	11	3	F	D	3
AIRBORNE EXPRESS	DC-9	-40FH	JT8D	15	3	F	D	4
SUBTOTAL AIRBORNE EXPRESS								**72**
2. AIR TRANSPORT INTL								**0**
3. ALOHA	**737**	**-200C**	**JT8D**	**17**	**2**	**F**	**B**	**1**
4. AMERICAN INT'L AIRWAYS								
AMERICAN INT'L AIRWAYS	727	-200F	JT8D	9	2	F	B	1
SUBTOTAL - AMERICAN INT'L AIRWAYS								**1**
5. AMERIJET INTL								
AMERIJET INTL	727	-200F	JT8D	15	2	F	B	2
AMERIJET INTL	727	-200F	JT8D	15A	2	F	B	2
AMERIJET INTL	727	-200FH	JT8D	15	3	F	B	1
AMERIJET INTL	727	-200FH	JT8D	17	3	F	B	1
AMERIJET INTL	727	-200FH	JT8D	9	3	F	B	1
AMERIJET INTL	727	-200FH	JT8D	9A	3	F	B	1
SUBTOTAL - AMERIJET INTL								**8**
6. ARROW AIR								**0**
7. ATLAS AIR								**0**
8. BAX GLOBAL								
BAX GLOBAL	727	-200FH	JT8D	9	3	F	B	2
SUBTOTAL - BAX GLOBAL								**2**
9. CAPITAL CARGO INT'L AIRLINES								
CAPITAL CARGO INT'L AIRLINES	727	-200F	JT8D	15	2	F	B	1
CAPITAL CARGO INT'L AIRLINES	727	-200F	JT8D	15A	2	F	B	1
CAPITAL CARGO INT'L AIRLINES	727	-200F	JT8D	17	2	F	B	1
CAPITAL CARGO INT'L AIRLINES	727	-200FH	JT8D	17	3	F	B	1
CAPITAL CARGO INT'L AIRLINES	727	-200FH	JT8D	17R	3	F	B	1
CAPITAL CARGO INT'L AIRLINES	727	-200FH	JT8D	7B	3	F	B	1
SUBTOTAL - CAPITAL CARGO INT'L AIRLINES								**6**

Appendix V-2, Page 2								
Part 121 All-Cargo Turbine-Powered Fleet > 33,000 Pounds MCTOW Which Would Require TCAS-II Or Equivalent								
Year Ending 1996 - Details								
	AIRPLANE		**ENGINE**					
Type of Operator/Operator	**Model**	**Series**	**Model**	**Series**	**Noise Stage**	**Use**	**Mfr**	**Total**
I. PART 121 ALL CARGO TURBINE AIRPLANE OPERATORS (Cont.)								
10. CHALLENGE AIR CARGO								
CHALLENGE AIR CARGO	757	-200F	RB211	535E4	3	F	B	3
SUBTOTAL - CHALLENGE AIR CARGO								**3**
11. CHARTER AMERICA								
CHARTER AMERICA	727	-100C	JT8D	7B	2	F	B	1
CHARTER AMERICA	727	-100F	JT8D	7B	2	F	B	1
CHARTER AMERICA	727	-100FH	JT8D	7B	3	F	B	1
CHARTER AMERICA	727	-200F	JT8D	7B	2	F	B	1
SUBTOTAL - CHARTER AMERICA								**4**
12. CONTINENTAL MICRONESIA								
CONTINENTAL MICRONESIA	727	-200FH	JT8D	15	3	F	B	3
CONTINENTAL MICRONESIA	727	-200FH	JT8D	17R	3	F	B	4
SUBTOTAL - CONTINENTAL MICRONEIA								**7**
13. CUSTOM AIR TRANSPORT	**727**	**-200F**	**JT8D**	**15**	**2**	**F**	**B**	**2**
14. DHL AIRWAYS								
DHL AIRWAYS	727	-100F	JT8D	7B	2	F	B	5
DHL AIRWAYS	727	-100FH	JT8D	7B	3	F	B	6
DHL AIRWAYS	727	-200F	JT8D	7B	2	F	B	1
DHL AIRWAYS	727	-200FH	JT8D	15	3	F	B	1
DHL AIRWAYS	727	-200FH	JT8D	15A	3	F	B	1
DHL AIRWAYS	727	-200FH	JT8D	17R	3	F	B	3
DHL AIRWAYS	727	-200FH	JT8D	7B	3	F	B	4
DHL AIRWAYS	727	-200FH	JT8D	9	3	F	B	3
DHL AIRWAYS	727	-200FH	JT8D	9A	3	F	B	1
SUBTOTAL - DHL AIRWAYS								**25**
15. EAGLE AIRLINES	**DC-9**	**-30**	**JT8D**	**7B**	**2**		**B**	**1**
16. EASTWIND AIRLINES								
EASTWIND AIRLINES	737	-200	JT8D	9A	2		B	1
EASTWIND AIRLINES	737	-200H	JT8D	9A	3		B	2
EASTWIND AIRLINES	737	-700	CFM56	7B22	3		B	2
SUBTOTAL - EASTWIND AIRLINES								**5**
17. EMERY WORLDWIDE								
EMERY WORLDWIDE	727	-100	JT8D	7B	2		B	1
EMERY WORLDWIDE	727	-100F	JT8D	7B	2	F	B	7
EMERY WORLDWIDE	727	-100FH	JT8D	7B	3	F	B	9
EMERY WORLDWIDE	727	-200FH	JT8D	7	3	F	B	3
EMERY WORLDWIDE	727	-200FH	JT8D	7B	3	F	B	4
SUBTOTAL - EMERY WORLDWIDE								**24**
18. EMPIRE AIRLINES	**F-27**		**TURBOPROP**		**10**	**F**		**10**

Appendix V-2, Page 3

Part 121 All-Cargo Turbine-Powered Fleet > 33,000 Pounds MCTOW Which Would Require TCAS-II Or Equivalent

Year Ending 199[illegible] - Details								
	AIRPLANE		ENGINE					
Type of Operator/Operator	Model	Series	Model	Series	Noise Stage	Use	Mfr	Total
I. PART 121 ALL CARGO TURBINE AIRPLANE OPERATORS (Cont.)								
19. EVERGREEN INT'L								
EVERGREEN INT'L	727	-100C	JT8D	7A	2	C	B	1
EVERGREEN INT'L	727	-100F	JT8D	7B	2	F	B	1
EVERGREEN INT'L	DC-9	-10F	JT8D	7A	2	F	D	2
EVERGREEN INT'L	DC-9	-30F	JT8D	9A	2	F	D	3
EVERGREEN INT'L	DC-9	-30FH	JT8D	11	3	F	D	1
EVERGREEN INT'L	DC-9	-30FH	JT8D	9A	3	F	D	2
SUBTOTAL - EVERGREEN INT'L								10
20. EXPRESS ONE INT'L								
EXPRESS ONE INT'L	727	-100F	JT8D	7B	2	F	B	3
EXPRESS ONE INT'L	727	-100FH	JT8D	7B	3	F	B	1
EXPRESS ONE INT'L	727	-200F	JT8D	15	2	F	B	1
EXPRESS ONE INT'L	727	-200FH	JT8D	15	3	F	B	1
EXPRESS ONE INT'L	727	-200FH	JT8D	17	3	F	B	1
EXPRESS ONE INT'L	727	-200FH	JT8D	17R	3	F	B	2
EXPRESS ONE INT'L	727	-200FH	JT8D	7B	3	F	B	1
EXPRESS ONE INT'L	727	-200FH	JT8D	9	3	F	B	9
EXPRESS ONE INT'L	727	-200FH	JT8D	9A	3	F	B	1
SUBTOTAL - EXPRESS ONE INT'L								20
21. FALCON AIR EXPRESS	727	-100C	JT8D	7	2	C	B	1
22. FEDEX								0
23. FINE AIR								0
24. FLORIDA WEST								0
25. GEMINI AIR CARGO								0
26. KITTY HAWK AIR CARGO								
KITTY HAWK AIR CARGO	727	-100F	JT8D	7	2	F	B	1
KITTY HAWK AIR CARGO	727	-100FH	JT8D	7B	3	F	B	1
KITTY HAWK AIR CARGO	727	-200F	JT8D	15	2	F	B	1
KITTY HAWK AIR CARGO	727	-200F	JT8D	7B	2	F	B	3
KITTY HAWK AIR CARGO	727	-200F	JT8D	9	2	F	B	9
KITTY HAWK AIR CARGO	727	-200FH	JT8D	15	3	F	B	4
KITTY HAWK AIR CARGO	727	-200FH	JT8D	7	3	F	B	1
KITTY HAWK AIR CARGO	727	-200FH	JT8D	7B	3	F	B	1
KITTY HAWK AIR CARGO	727	-200FH	JT8D	9	3	F	B	5
KITTY HAWK AIR CARGO	DC-9	-10F	JT8D	7A	2	F	D	1
KITTY HAWK AIR CARGO	DC-9	-10F	JT8D	7B	2	F	D	3
KITTY HAWK AIR CARGO	DC-9	-10FH	JT8D	7A	3	F	D	1
KITTY HAWK AIR CARGO	CONVAIR	600	TURBO PROP	5		F		5
KITTY HAWK AIR CARGO	CONVAIR	640	TURBO PROP	2		F		2
SUBTOTAL - KITTY HAWK AIR CARGO								38
27. MOUNTAIN AIR CARGO	FOKKER	F-27	TURBOPROP					22
28. NORTHERN AIR CARGO								

NORTHERN AIR CARGO	727	-100F	JT8D	7A	2	F	B	1
NORTHERN AIR CARGO	727	-100FH	JT8D	7B	3	F	B	2
SUBTOTAL - NORTHERN AIR CARGO								**3**
29. NORTHWEST								**0**
30. POLAR AIR CARGO								**0**

Appendix V-2, Page 4								
Part 121 All-Cargo Turbine-Powered Fleet > 33,000 Pounds MCTOW Which Would Require TCAS-II Or Equivalent								
Year Ending 1998 - Details								
	AIRPLANE		ENGINE					
Type of Operator/Operator	Model	Series	Model	Series	Noise Stage	Use	Mfr	Total
I. PART 121 ALL CARGO TURBINE AIRPLANE OPERATORS (Cont.)								
31. PUROLATOR	727	-200F	JT8D	15	2	F	B	1
32. RELIANT AIRLINES	DC-9	-10F	JT8D	7B	2	F	D	1
33. RENOWN AVIATION								
RENOWN AVIATION	ELECTRA	L-188	TURBOPROP					2
RENOWN AVIATION	CONVAIR	580	TURBOPROP					3
SUBTOTAL - RENOWN AVIATION								5
34. RICH INTL	L-1011	-200F	RB211	524B	3	F	L	1
35. RYAN INT'L AIRLINES								
RYAN INT'L AIRLINES	727	-100F	JT8D	7B	2	F	B	5
RYAN INT'L AIRLINES	727	-100FH	JT8D	7B	3	F	B	3
RYAN INT'L AIRLINES	727	-200FH	JT8D	7B	3	F	B	1
SUBTOTAL - RYAN INT'L AIRLINES								9
36. SKY TREK INT'L AIRLINES								
SKY TREK INT'L AIRLINES	727	-200F	JT8D	15	2	F	B	1
SKY TREK INT'L AIRLINES	727	-200FH	JT8D	15	3	F	B	1
SUBTOTAL - SKY TREK INT'L AIRLINES								2
37. TOWER AIR								0
38. TRADEWINDS AIRLINES								0
39. TRANS CONTINENTAL	727	-100FH	JT8D	7B	3	F	B	1
40. UNITED AIRLINES								0
41. UNITED PARCEL SERVICE								
UNITED PARCEL SERVICE	727	-100RF	TAY651	54	3	F	B	44
UNITED PARCEL SERVICE	727	-200FH	JT8D	15	3	F	B	6
UNITED PARCEL SERVICE	727	-200FH	JT8D	17R	3	F	B	2
UNITED PARCEL SERVICE	757	-200F	PW2000	2040	3	F	B	35
UNITED PARCEL SERVICE	757	-200F	RB211	535E4	3	F	B	32
UNITED PARCEL SERVICE	757	-200F	RB211	535E4B	3	F	B	6
SUBTOTAL - UNITED PARCEL SERVICE								125
42. USA JET AIRLINES								
USA JET AIRLINES	DC-9	-10C	JT8D	7B	2	F	D	2
USA JET AIRLINES	DC-9	-10CH	JT8D	7B	3	F	D	2
USA JET AIRLINES	DC-9	-10F	JT8D	7B	2	F	D	3
SUBTOTAL - USA JET AIRLINES								7
43. WORLD AIRWAYS								0
44. ZANTOP INTL	DC-8	-54FH	JT3D	3B	2	F	D	0
SUBTOTAL - U.S. PART 121 AIRLINE TURBINE FREIGHTERS >33,000 LBS.								418

Appendix V-2, Page 5								
Existing Part 121 All-Cargo Turbine-Powered Fleet > 33,000 Pounds MCTOW Which Would Require TCAS-II Or Equivalent								
Year Ending 199[illegible] - Details								
	AIRPLANE		ENGINE					
Type of Operator/Operator	Model	Series	Model	Series	Noise Stage	Use	Mfr	Total
II. LESSORS AND BROKERS								
1. AIR TRADE LSG	707	-320CH	JT3D	3B	2	F	B	1
2. AIRCRAFT INVESTMENT ASSOC.	727	-100F	JT8D	7B	2	F	B	1
3. ALG INC.	707	-320CH	JT3D	3B	2	F	B	2
4. BABCOCK & BROWN	A300	F4-200	CF6	50C2	3	F	A	1
5. BANK OF NY	747	-100F	JT9D	7A	3	F	B	1
6. BEHC	747	-200F	JT9D	70A	3	F	B	5
7. COOK AIRCRAFT LSG	727	-100FH	JT8D	7	3	F	B	1
8. FINOVA CAPITAL								
FINOVA CAPITAL	727	-200F	JT8D	9	2	F	B	1
FINOVA CAPITAL	747	-200F	JT9D	7Q	3	F	B	2
SUBTOTAL - FINOVA CAPITAL								3
9. FIRST SECURITY BANK								
FIRST SECURITY BANK	747	-200F	JT9D	7Q	3	F	B	1
FIRST SECURITY BANK	A300	F4-200	CF6	50C2	3	F	A	1
SUBTOTAL - FIRST SECURITY BANK								2
10. G & B CORP	DC-8	-55FH	JT3D	3B	2	F	D	1
11. GATX LEASING	747	-100F	JT9D	7A	3	F	B	1
12. GENERAL AVN TECH.	727	-100F	JT8D	9A	2	F	B	1
13. GLOBAL AIRCRAFT SALES	DC-10	-10F	CF6	6D	3	F	D	1
14. INTL AIR LEASES								
INTL AIR LEASES	707	-320CH	JT3D	3B	2	F	B	1
INTL AIR LEASES	DC-8	-62FH	JT3D	3B	2	F	D	2
INTL AIR LEASES	DC-8	-62FH	JT3D	3B	3	F	D	1
INTL AIR LEASES	DC-8	-62FH	JT3D	7	3	F	D	1
SUBTOTAL INTL AIR LEASES								5
15. NATIONSBANC LEASING	DC-8	-71F	CFM56	2C	3	F	D	1
16. PACIFIC HARBOR CAPITAL	747	-200F	JT9D	7A	3	F	B	1
17. POLARIS LEASING	747	-100F	JT9D	7A	3	F	B	3
18. RAYTHEON E-SYSTEMS	DC-8	-55FH	JT3D	3B	2	F	D	1
19. TRANS PACIFIC LSG	727	-200F	JT8D	17	2	F	B	1
SUBTOTAL - LESSORS AND BROKERS								33
GRAND TOTAL[illegible] TURBINE AIR CARGO AIRCRAFT >33,000 LBS.								449
Source: U.S. JET FLEET 199[illegible]; APO/FAA DATA.								

APPENDIX V-3

PART 121 ALL-CARGO FLEET: TURBINE-POWERED <= 33,000 MCTOW AND ALL PISTON-POWERED AIRPLANES

OPERATOR	AIRPLANE				TOTAL
	TYPE	PURPOSE	Engine	MCTOW	AIRPLANES
1. AIR ALASKA CARGO	440	CARGO	PISTON	49,100	1
2. ALASKA CENTRAL EXPRESS	B-1900	CARGO	TURBOPROP	16,950	4
3. ALASKA ISLAND AIR	DC-3	CARGO	PISTON	26,200	1
4. ARCTIC CIRCLE AIR SERVICE	SKYVAN	CARGO	TURBOPROP	12,700	3
5. ARTIC TRANSPORTATION SERVICES, INC.	CASA 212	CARGO	TURBOPROP	16,093	2
6. BERING AIR	CASA 212	CARGO	TURBOPROP	16,093	1
7. CAPE SMYTHE AIR SERVICE	DC-3	CARGO	PISTON	26,200	1
8. CORPORATE AIR					
CORPORATE AIR	330	CARGO	TURBOPROP	22,900	3
CORPORATE AIR	360	CARGO	TURBOPROP	17,350	3
CORPORATE AIR	B-1900	CARGO	TURBOPROP	16,950	1
CORPORATE AIR	B-99	CARGO	TURBOPROP	10,900	4
CORPORATE AIR	DHC-6	CARGO	TURBOPROP	12,500	3
SUBTOTAL - CORPORATE AIR					14
9. F.S. AIR SERVICE					
F.S. AIR SERVICE	CASA 212	CARGO	TURBOPROP	16,093	1
F.S. AIR SERVICE	SKYVAN	CARGO	TURBOPROP	12,700	1
SUBTOTAL - F.S. AIR SERVICE					2
10. FALCON AIR EXPRESS AIRLINES	B-1900	CARGO	TURBOPROP	16,950	4
11. FRONTIER FLYING SERVICE	DC-3	CARGO	PISTON	26,200	1
12. GREAT LAKES AVIATION	B-1900	CARGO	TURBOPROP	16,950	4
13. MERLIN EXPRESS	METRO	CARGO	TURBOPROP	14,500	26
14. MOUNTAIN AIR CARGO	330	CARGO	TURBOPROP	22,900	4
15. RENOWN AVIATION	440	CARGO	PISTON	49,100	4
16. RHOADES AVIATION					
RHOADES AVIATION	240	CARGO	PISTON	42,000	3
RHOADES AVIATION	340	CARGO	PISTON	47,000	3
RHOADES AVIATION	440	CARGO	PISTON	49,100	3
RHOADES AVIATION	DC-3	CARGO	PISTON	26,200	4
SUBTOTAL - RHOADES AVIATION					13
17. TATONDUK OUTFITTERS	DC-6	CARGO	PISTON	106,000	5
18. TOLAIR SERVICES					
TOLAIR SERVICES	240	CARGO	PISTON	42,000	1
TOLAIR SERVICES	440	CARGO	PISTON	49,100	2
TOLAIR SERVICES	DC-3	CARGO	PISTON	26,200	4
SUBOTOTAL - TOLAIR SERVICES					7
TOTAL - PART 121 ALL-CARGO FLEET: TURBINE-POWERED <=33,000 POUNDS & ALL PISTON POWERED					97
LAST REVISED: 04/19/2000					

Appendix V-4				
Part 125 > 33,000 Pound MCTOW Turbine-Powered Commercial Operator Fleet (1)				
	Airplane		**Engine**	**Total**
Operator	**Type**	**Purpose**	**Type**	**Airplanes**
1. C And M Airways, Inc.	CV-640	Cargo	Turboprop	5
2. Contract Cargo Airlines, Inc.	DC-8F-55	Cargo	Turbofan	1
3. Traffic Management Corp.	DC-8F-55	Cargo	Turbofan	1
" " "	L-188-A	Cargo	Turboprop	3
Subtotal - Traffic Mgmt. Corp.				**4**
Total Airplanes				**10**
1. Excludes:	(1) Deviation Holders (2) Airplanes Configured For > 30 Seats (3) 10-30 Seat Airplanes; (4) Piston Powered Airplanes			
Last Revised: 04/19/2000				

Appendix V-5

Part 125 Turbine-Powered<= 33,000 MCTOW And All Piston-Powered Commercial Operator Fleet (1)

No.	Operator	Airplane Type	Airplane Purpose	Engine Type	Total Airplanes
1	Airway Transport	DC-3	Pax/Cargo	Piston	1
2	Blumenthal, James R.	DC-4	Cargo	Piston	1
3	Brooks Air Transport, Inc.	DC-4	Cargo	Piston	2
4	Cascade Air, Inc.	DC-3	Cargo	Piston	2
5	Custom Air Service, Inc.	DC-4	Cargo	Piston	1
6	Dodita Air Cargo, Inc.	M-440	Cargo	Piston	2
7	Everts Air Fuel	C-46	Cargo	Piston	4
	" " "	DC-6	Cargo	Piston	2
	Subtotal - Everts Air Fuel				**6**
8	Ferreteria E Implementos	C-46	Cargo	Piston	1
	San Franci	M-440	Cargo	Piston	2
	Subtotal - Ferreteria E Implementos San Franci				**3**
9	Florida Air Transport, Inc.	DC-6	Cargo	Piston	1
10	Fresh Air, Inc.	M-440	Cargo	Piston	1
11	Miami Air Lease, Inc.	M-340	Cargo	Piston	1
12	Nord Star Airlines, Inc.	DC-6	Cargo	Piston	1
13	Northern Air Fuel	DC-6	Cargo	Piston	1
14	Piedmont Air Transport, Inc	DC-6	Cargo	Piston	2
15	Powers And Hawkins	C97	Pax/Cargo	Piston	1
	Enterprizes	DC-6	Pax/Cargo	Piston	1
	Subtotal - Powers And Hawkins Enterprises				**2**
16	RPG Airlift, Inc.	M-440	Cargo	Piston	1
17	Richard Air of Florida, Inc.	M-340	Cargo	Piston	1
18	Tiger Contract Cargo	M-340	Cargo	Piston	1
19	Woods Air Fuel	DC-6	Cargo	Piston	1
Total Airplanes					**31**

1. Excludes:
   (1) Deviation Holders
   (2) Turbine Airplanes > 30 seats.

Last Revision: 04/19/2000

List of Sources

List of Sources, Page One

No.	Source
1.	__________, II Morrow Will Become UPS Aviation Technologies, UPS: 1999 News Release, http://www.ups.com/bin/shownews.cgi?19990512aviiationtech, 05/12/1999.
2.	__________, 1998-1999 World Air Cargo Forecast, The Boeing Company, http://www.bo3eing.com/commercial/cargo/index.html.
3.	__________, *A3XX is "Viable, " Airbus To Approach Airlines,* Aviation Daily Electronic Edition, Article: 145916, 12/9/1999.
4.	__________, ADS-B Trials Described As Successful, Aviation Daily Electronic Edition, Article: 125623, 7/14/1999.
5.	__________, *Aeroflot Selects Allied Signal To Supply Collision Avoidance Systems*, Aviation Daily Electronic Edition, Article: 138317, 8/20/1999.
6.	__________, *Airbus, Boeing See Continuing Market Growth*, Aviation Daily Electronic Edition, Article: 1133611, 6/15/1999.
7	__________, *Air Force One Incident Trips TCAS Debate*, SafeNews – July 1997, http: aviationweek.com/safety/nz_jul97.htm
8.	__________, *Air Force One, UPS 747 Separation Violation Reported*, SafeNews – July 1997, http://aviationweek.com/safety/nz_jul97.htm.
9.	__________, *Allied Signal Acquires Honeywell for $13.8 Billion*, Aviation Daily Electronic Edition, Article: 133114, 06/08/1999.
10.	__________, Allied Signal Gets Approval For New Collision Avoidance Systems, Aviation Daily Electronic Edition, Article: 136824, 07/30/1999.
11.	__________, ALPA Renews Call To Mandate TCAS For Cargo Carriers, ALPA Press Release #99.16, 03/03/1999, http://www.alpa.org.
12.	__________, *BA Concorde And AA 767 Too Close For Comfort*, AVFLASH, Volume 5, Issue 2, May 31, 1999.
13.	__________, *Boeing Expects Air Cargo Fleet To Double by 2017*, http://www.boeing.com/news/releases/1998/news_release_981027b.html, 10/27/1998.
14.	Callaham, Lejeune, Zeitlin, Assessment of Midair Collision Risk and Safety Benefits of TCAS II for Cargo Aircraft, MITRE, Center for Advanced Aviation System Development, June 1999.
15.	__________, *Capstone Moves Forward….*, B/CA Online, http://www.aviationweek.com/bca/reg/11.htm.

List of Sources, Page Two

No.	Source
16.	________, *"Closest NMAC On Record" Involves British Airways And Korean Air Transports*, AVweb News Wire, Updated Monday, July 19, 1999, http://www.avweb.com/toc/newswire.html.
17.	________, *DLM-900*, Rockwell Collins – DLM 900, http://www.collins.rockwell.com/at-systems/products/dlm900/index.asp, 02/07/2000.
18.	Dahl, Robert V., *Air Cargo Market Retains Luster*, Aviation Week & Space Technology Online, Source Book; http://www.aviationweek.com/aviation/sourcebook/99cargo.htm; 12/22/1999.
19.	________, *Delta Air Lines L-1011 And An Alaska Airlines MD-80*, SafeNews Update – 09/14/1998, http://aviationweek.com/safety/news/1998/nz122198.htm.
20.	________, *Delta 767 And A Caledonian L-1011 In Close Call*, SafeNews Update – 12/21/98, http://www.aviationweek.com/safety/news/1998/nz122198.htm
21.	________, *DOJ Approves Allied Signal/Honeywell Merger With Conditions*, B/CA Online, http://www.aviaitonweek.com/bca/intell17.htm, 01/13/2000.
22.	________, *EC Clears Honeywell/Allied Signal Merger*, Aviation Daily, Electronic Edition, Article: 145420, 12/02/1999.
23.	______, *Editorial: TCAS Need On Military And Cargo Transports*, Safe News Update, 10/17/97, http://www.aviationweek.com/safety/nz101797.htm.
24.	_______, *FAA, Cargo Airlines Test ADS-B*, Aviation Daily, Electronic Edition, Article: 135507, 7/13/1999.
25.	_______, *FAA Doubts TCAS In "Near Crash"*, SafeNews Update – 12/21/98, http://www.aviationweek.com/safety/news/1998/nz1221198.htm.
26.	________, *FAA Orders Mode C Transponder Check*, Avflash, Vol. 5, Issue 46a, 11/15/1999.
27.	________, FedEx to Equip Air Fleet with Advanced Safety Systems, http://www.fedex.com/us/about/pressreleases/pressrelease011398.html, 1/13/98.
28.	________, GMF'99, The Airbus Global Market Forecast, Airbus Industrie, http://www.airbus.com, 1999.
29.	Gardner, Guy S., Statement of Guy S. Gardner Associate Administrator For Regulation and Certification, Federal Aviation Administration Before The House Committee On Transportation And Infrastructure, Subcommittee On Aviation Concerning The Installation Of TCAS II On Cargo Carrier Aircraft, February 26, 1997.
30.	Godfrey, Joe, *ADS-B Update*, AVWEB AirVenture, DayThree, Oshkosh, 1999, 07/30/1999, http://www.avweb.com/oshkosh/osh99/day3/adsb.html.

List of Sources, Page Three

No.	Source
31.	Hall, Jim, Chairman, National Transportation Board Safety Recommendation A-99-55 and – 56, http://www.ntsb.gov/recs/letters/1999/A_99_5_56.pdf, 9/9/1999.
32.	_______, Hectic Week At Atlanta Control Center: Computer Outages Try Patience of Controllers...As NMAC Between Delta Flight And Turboprop Reported, AVWEV News Wire (05-july-99).
33.	________, *Honeywell – Threat Warning and Avoidance Systems*, http://www.cas.honeywell.com/ats/products/twasys.html., 5/26/1999.
34.	_______, Hoppin, David and Clancy, Brian, *Turbulence Ahead, The 1999 MergeGlobal World Air Cargo Forecast*, Air Cargo World Online Features, http://www.aircargoworld.com/feat/feature3.htm, 6/1/1999.
35.	_______, Industry Team To Work With Cargo Airlines On New Surveillance System, Aviation Daily, Electronic Edition, Article: 132129, 5/24/1999.
36.	Kebajian, Richard, *#3 349 Fatalities – November 12, 1966 – New Delhi, India – Saudi Arabian Airways/Kazastan Airlines*, PlaneCrashInfo.com: Twenty Worst Aviation Accidents, http://www3.tstonramp.com/~kebab/worst20.htm.
37.	Lejeune, Zeitlin, Estimate of Risk Reduction for Cargo Carriers Using TCAS II, MITRE/CAASD; December 1997.
38.	_______, *Mid-Air Collision In Canada Prevented By TCAS,* Reflexions, Issue 10, June 1995, http://www.ntsb.gov/itsa/midair_collision_canada_preven.htm.
39.	_______, *Mission Management Systems*, Collins Air Transport TCAS II, www.collins.rockwell.com/government-systems/products/pdf/mission_management/tcas.pdf, Revision 1/1/2000.
40.	_______, More 727s, http://www.aircargoworld.com/Updates_news.htm, 6/1/99.
41.	_______, *Nightmare Week In Air Control Center Ends In Near Collision*, AVweb: NATCA Press Release On ATL ARTCC, July 5, 1999.
42.	______, NTSB: Cargo Aircraft Need TCAS II, B/CA Online, http://www.aviationweek.com/bca/reg15.htm, 01/13/2000.
43.	_______, *NTSB Wants FAA To Require New Equipment On Aircraft*, Aviation Daily, Electronic Edition, Article: 139834, 9/13/1999.
44.	_______, *Polar Air Cargo News*, Airwise News, 8/8/1999, http://www.airwise.com/news/freight/polar.htm.
45.	_______, Proposal to Require Traffic Alert and Collision Avoidance System (TCAS-II) on Cargo Aircraft, The Subcommittee on Aviation, Hearing, February 26, 1997, http://www.house.gov/transportation/aviation/avhearin/tcas/memo.htm.

List of Sources, Page Four

No.	Source
46.	_______, *Question Your TCAS?;* http://www.AvWeb.com/newswire/news9942.html, 10/26/1999.
47.	_______, *Risk of Mid-Air Collisions Drops in U.K.*, Aviation Daily, Electronic Edition, Article: 140710, 9/24/1999.
48.	_______, Rockwell Collins Airborne Collision Avoidance Systems Approved, Rockwell Collins Press Release 535-NR-4, 10/26/1999, http://www.cca.rockwell.com/.
49.	Saber, Rick, *Closest NMAC On Record – 21Jul 1999*, AvWeb, http://www.avweb.com/toc/avmail/html.
50.	_______, *Safety Issues May bring FAA Conferees Closer Together*, Aviation Daily, Electronic Edition, Article: 141940, 10/12/1999.
51.	_______, *Series 9000 Avionics*, Rockwell Collins – Series 9000 Avionics, http://www.collins.rockwell.com/at-systems/products/series.9000/index.asp, 02/07/2000.
52.	_______, *TCAS II Change for European Airspace*; B/CA Online, Intelligence, http://www.aviationweek.com/bca/intell15.htm, 12/22/1999.
53.	_______, The 747 Special Freighter Cargo – Containers & Pallets, Boeing Wichita Modification Center, http://www.boeing.com/assocproducts/modcenter/mrc7473g.htm, 6/10/1999.
54.	_______, The Value of Air Cargo, The Boeing Company, http://www.boeing.com/commercial/value/8_cg.html, 6/10/1999.
55.	________, *Turbulence Cited in New Delhi Crash*, SafeNews – July 1997, http://www.aviationweek.com/safety/nz_jul97.htm.
56.	________, *UPS Aviation To Demonstrate Advanced Flight Technology*, Aviation Daily, Electronic Edition, Article: 133023, 6/7/1999.
57.	________, *UPS Pilots Want FAA To Hasten Extending Single Level Of Safety To Cargo*, Aviation Daily, Electronic Edition, Article: 145404, 12/02/1999
58.	________, *UPS To Equip Alaskan Aircraft With ADS-B Under FAA Contract*, Aviation Daily, Electronic Edition, Article: 140310, 9/20/1999.
59.	________, U.S. Domestic Air Freight And Express Industry Performance Analysis 1996/1997, Air Cargo Management Group, July 1997.
60.	_________, Using Boeing for a 747 Freighter Conversion Isn't the Cheapest Way to Go But it May Be the Least Expensive, Boeing Wichita Modification Center, http://www.boeing.com/assocproducts/modcenter/mrchome.htm, 6/10/1999.

List of Sources, Page Five

No.	Source
61.	_______, ...While UPS Wins $3.9 Million Avionics Contract, B/CA Online, http://www.aviationweek.com/bca/reg12.htm, 01/13/2000.
62.	_______, *Widening Emery*, http://www.aircargoworld.com/Update_news.htm, 6/1/1999.
63.	_______, World Jet Inventory Year-End 1998; Jet Information Services, Inc., Tables 20 and 21, p27, March, 1999.