SAFETY IMPLICATIONS OF DIFFERENCES IN AIRCRAFT EQUIPMENT, CERTIFICATION AND OPERATING RULES FOR CARGO CARRIERS

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1. INTRODUCTION

The Federal Aviation Regulations (FARs) govern the design and operation of aircraft and airlines, and represent the minimum acceptable standards for the industry. Manufacturers and operators are free to exceed these standards, but are not permitted to fail to meet them. Implicitly or explicitly, operators develop a corporate culture (usually referred to as their “safety culture”) that reflects the degree to which they apply their own, more stringent standards to supplement the FARs. Many operators regularly and purposely strive to exceed the FAA’s minimum standards. Others comply with the minimum standards and have internal controls in place to ensure that compliance. Still others are less conscientious about compliance, relying on FAA inspections as the only auditing mechanism to establish minimum standards of operation and minimum levels of safety.

The March 2001 paper entitled “Cargo Airline Operations and Safety” and prepared by the Air Line Pilots Association, International (ALPA) stated that the Federal Aviation Regulations regarding design, certification and operating rules do not necessarily provide equivalent levels of safety for passenger and cargo operations. Sometimes, cargo aircraft, because they are older designs, lack critical safety-related design improvements. Sometimes the exact same aircraft models are subject to different rules and limitations solely as a function of whether they are carrying passengers or cargo, even though they are operating over the same routes, in the same weather environment, and in the same ATC system as each other. These differences in the standards and rules result in a higher level of risk for cargo flight crews, cargo aircraft, other personnel aboard those aircraft, and for the general public as well. It should be clear that if we are to reduce, minimize or eliminate the risk differences between the cargo and passenger operations, then it will require changes to the FARs that permit these differences to exist.

Cargo operations accounted for approximately 6.3% of total flight departures from 1994-2003. Currently, the US cargo fleet contains over 1500 large aircraft. The cargo industry continues its growth, as borne out in two recent studies. According to the Boeing World Air Cargo Forecast 2000/2001 report,

> “During the next 20 years, the freighter fleet is expected to double… World airborne cargo will grow at 6.4% per year during the next 20 years. With the growth in air cargo anticipated to exceed passenger traffic growth in every major regional market, it is not surprising that forecasts anticipate the addition of more than 2,600 freighter airplanes by 2019."

Subsequent to September 11, 2001, this study was updated, with results similar to the earlier forecast. The Boeing World Air Cargo Forecast 2002/2003 reports that “The freighter fleet will increase over the next 20 years from 1,775 to 3,078 airplanes. History shows a doubling of the jet freighter fleet every 10 years to meet the air cargo sector's vibrant growth."

Currently, most cargo flights occur at night, but there are several operators who are already operating numerous flights during daytime hours. As cargo operators continue to increase their fleet sizes and numbers of operations, there will be an increase in the number of cargo flights during daytime hours, and therefore an increased intermixing of passenger and cargo flights in the US airspace system and environment. This provides additional impetus to ensure the safety standards for cargo operations match those of the passenger operators.

This paper is part of an effort to help identify, quantify and mitigate the increased levels of risk in the air cargo industry. The underlying conditions and the increased levels of risk compromise the goal of “One Level of Safety” across the US commercial air transportation system. This paper discusses these differences and safety implications in detail, and proposes solutions to reduce, minimize or eliminate the resulting safety deficiencies.

2. AIRCRAFT EQUIPMENT and CERTIFICATION RULES

Regulatory inconsistencies and changes, in combination with some characteristics of the cargo fleet composition, have resulted in an unwarranted, two tiered risk exposure for the US passenger and cargo fleets, with the cargo fleets unnecessarily subjected to higher levels of risk.

With respect to the FARs, the equipment requirements for cargo aircraft differ in certain regards from those of passenger aircraft. Cargo aircraft are explicitly exempt from certain safety equipment requirements that passenger aircraft are subject to. In addition, many cargo airlines operate older aircraft models that were certificated under different and less stringent regulations or methods than the current generation of aircraft. Some of these regulations and methods have been found to be lacking, and have been superceded. These older aircraft are typically models that are no longer operated by US passenger airlines, and this combination of the fleet composition and the regulatory differences result in lower minimum levels or margins of safety for the cargo airlines. These differences and issues are discussed in detail the following sections.

2.1 Smoke/Fire Detection and Protection in Cargo Aircraft

There are significant certification and operational regulatory differences between passenger and cargo aircraft with respect to smoke/fire detection and protection that put the cargo aircraft at higher levels of risk. These include such differences as equipment requirements and compartment accessibility. There are existing technologies that could be employed to help mitigate the effect of these other regulatory differences and thus decrease the risk associated with fires onboard cargo aircraft.

As used in this paper, the term ‘fire protection’ refers to methods to control, reduce or eliminate a fire, and can include containment by physical means, suppression, or extinguishment. ‘Suppression’ can be by passive (e.g. suffocation) or active (e.g. hand held or installed, remotely controlled) means of interrupting the combustion process by applying appropriate extinguishing agents.

2.1.1 Cargo Compartment Background Information

Compared to the requirements for passenger carrying aircraft, FAR 121.857 permits less stringent fire protection provisions on cargo aircraft.

With respect to aircraft fire detection and protection regulatory requirements, ALPA supports a single standard: installed smoke/fire detection and active, remotely operated suppression (see Table 1). Equipping cargo aircraft with anything less than this yields a greater potential to result in an uncontrolled fire and the loss of an aircraft. The addition of temperature trend monitoring systems results in an additional layer of risk reduction.

Table 1 (below) presents a synopsis of FAR 25.857, which delineates the smoke and fire detection & protection requirements for various compartments on passenger and cargo aircraft.

	CLASS A	CLASS B	CLASS C	CLASS D	CLASS E
AIRCRAFT TYPE: Passenger or Cargo	Not explicitly addressed	Not explicitly addressed	Not explicitly addressed	No Longer Any Such Classification (was: no detection, passive suppression)	Cargo Only
Required to be discoverable by crew at station	Yes	Not explicitly addressed	Not explicitly addressed		Not explicitly addressed
Means to exclude hazardous quantities of smoke, etc from spaces occupied by people	Not explicitly addressed	Yes	Yes		Yes
Accessible to crew in flight	Yes	Yes	Not explicitly addressed		Not explicitly addressed
Means to control ventilation & drafts	Not explicitly addressed	Not explicitly addressed	Yes	No Longer Any Such Classification (was: no detection, passive suppression)	Yes
Emergency exits accessible by crew	Not explicitly addressed	Not explicitly addressed	Not explicitly addressed		Yes
Onboard detection system	Not explicitly addressed	Yes	Yes		Yes
Protection/Suppression	Not explicitly addressed	Manual	Built in / Active		Passive

Table 1
Cargo Compartment Classification and Requirements

For many years ALPA has been actively involved with trying to increase the safety standards and criteria for aircraft cargo compartments. This activity has been primarily focused on the Class B (main deck cargo) compartment, the Class D cargo compartment, smoke/fire detection systems, and fire protection systems. Recently, the certification criteria were revised to eliminate Class D cargo compartments, but there are still deficiencies in the current detection and protection scheme, particularly with regard to cargo aircraft.

During the past few decades, the certification & continuing airworthiness criteria for these compartments have been improving, specifically the minimum fire penetration resistance criteria for the cargo compartment liner. However, the most important approach to ensuring the continued safe operation of the aircraft with an onboard fire (one not located in the engines/nacelles) is provision of timely and accurate notification to the flight crew regarding smoke and/or fire, suppression of that smoke, and the controlled suppression of that fire. Anything short of these requirements introduces considerable risk of losing the aircraft and the people on board.

2.1.2 Recent Developments

Although changes have recently been made to FAR 121.857 regarding aircraft fire detection and protection requirements cargo aircraft continue to be held to lower safety standards than passenger aircraft.

At the time of the 1996 Valujet Everglades accident, there were five different classes (with respect to fire detection and suppression) of aircraft cargo compartments (see Table 1, above). Subsequent to that accident, the NTSB determined that Class D cargo compartments on passenger aircraft presented an unacceptable risk, and recognized the need for both fire detection and active suppression for cargo compartments on passenger aircraft. in. Class D compartments were those smaller than 1000 cubic feet, were independent of type of aircraft/operation (cargo or passenger), had no smoke or fire detection, and relied on passive means (oxygen starvation/suffocation) of fire suppression. As a result, in 1997, the NTSB issued Safety Recommendation A-97-56, which urged the FAA to "Expedite final rulemaking to require smoke detection and fire suppression systems for all Class D cargo compartments."

In response, effective March 2001, the FAA prohibited Class D compartments on Part 25 (transport category) aircraft. Passenger operators were required to convert these Class D compartments to Class C compartments, which feature both active detection and active suppression. In contrast, cargo operators had the choice of converting these Class D compartments to either Class C or Class E compartments, which feature active detection but passive suppression. The costs, in terms of equipment purchase and installation, weight, and maintenance would clearly tend to sway the cargo operators towards modifying their aircraft with the Class E compartments. The NTSB classified this response as "Closed–Acceptable Action". This FAA rulemaking, and the NTSB response, highlights the industry's differential treatment of the cargo and passenger fleets.

As part of the Federal Express Flight 1406 accident investigation, the NTSB stated that "Currently, inadequate means exist for extinguishing on-board aircraft fires." and made a recommendation (A-98-78) to "Reexamine the feasibility of on-board airplane cabin interior fire extinguishing systems...and, if found feasible, require the use of such systems." The FAA did conduct the NTSB-recommended study and determined that onboard fire-fighting capabilities were adequate, and that no additions or improvements were required. However, the FAA noted that it would continue to consider this issue in the design and certification of "very large *passenger* [emphasis added] aircraft" in the future. While the NTSB termed the FAA's response to this recommendation as "Closed–Acceptable" the NTSB noted that it was "disappointed" and encouraged the FAA "...to continue to evaluate these systems and promote new technology to reduce weight, increase reliability, and offer a system with the financial feasibility that will encourage airlines to adopt them." ALPA concurs with the NTSB in this regard, but also is disappointed that the NTSB did not comment on the FAA's exclusive focus on passenger aircraft.

2.1.3 Temperature monitoring

Despite other regulatory differences that expose cargo aircraft to higher risk levels, technology that can significantly assist flight crews in determining the accuracy of fire warnings and the status of onboard fires, although available, is not required on cargo aircraft.

As the sections above have detailed, there are some significant differences between the fire detection and protection requirements for cargo and passenger aircraft. In addition to these differences, ALPA believes that the current method & philosophy of fire detection does not provide the best protection for aircraft, and that this compounds the risk level of the cargo fleet.

The existing minimum standard is for a "light(s) only" fire detection system. "Light(s) only" refers to the fact that the only information available to the flight crew is the binary presence or absence of a 'smoke/fire detected' indication, where the 'presence' message is typically displayed as an illuminated annunciation in the cockpit. These "light(s) only" systems do not provide the flight crew with any temperature or temperature trend information that could assist the crew with diagnosing the situation. It is ALPA's position that a temperature monitoring and display system for each cargo compartment should be required in addition to existing smoke/fire detection systems. Such systems provide multiple advantages, and could help to partially compensate for the existing regulatory differences between cargo and passenger aircraft fire detection and protection schemes.

False fire warnings continue to be an issue of concern to both the cargo and passenger airlines. The addition of a companion temperature monitoring system (the technology is available today) to the current "light(s) only" system would greatly increase the reliability of the smoke/fire warnings. With the addition of temperature information, a flight crew could readily and accurately determine if the initial warning light is valid or is a malfunction. Equipment that can detect a range of temperatures and display that information to the flight crew at their station would enable a more accurate and realistic evaluation of the status and potential danger of the situation. If the temperature and trend information confirms the fire, once the appropriate abnormal or emergency actions are taken, a crew would be able to obtain an almost immediate indication of the effectiveness of these actions.

One other benefit of temperature monitoring includes more effective management of extinguishing agents to combat the fire. Indiscriminate use of limited agent could result in reduced protection over a longer period of time, which is a significant disadvantage if the aircraft is not in a position to land immediately (extended over water operations or over terrain not unsuitable for a survivable landing). The availability of a temperature monitoring system would enable a more accurate determination of the fire's status (e.g. extinguished, increasing, decreasing), and when or if the next introduction of agent would be required. The next application might be required prior to the next scheduled time due to the intensity of the fire, or it may be well after. Clearly, such detailed knowledge of the status of the fire and the effectiveness of the suppression actions decreases the risks associated with onboard fires.

Despite the accident history, and the NTSB recommendations, the FARs still do not require the main or lower decks of cargo aircraft (Class E compartments) to be equipped with active fire suppression systems. ALPA regards an active, remotely operated fire protection system (introduction of suppression agent into the compartment) that extinguishes or maintains the controlled suppression of the fire as a critical necessity.

RECOMMENDATIONS

REGULATORY CHANGES:
Require that all compartments of cargo aircraft be equipped with smoke and fire detection capability.

Require that all compartments of cargo aircraft be equipped with temperature trend monitoring capability.

Require that all compartments of cargo aircraft be equipped with provisions for active, remotely operated fire suppression.

2.2 Cockpit Doors

Unlike passenger aircraft, cargo aircraft are not required to be equipped with bulkheads and doors to isolate the cockpit from the cabin which would provide an additional or more robust barrier for smoke, fumes and fire.

Cargo aircraft are exempt from requirements to be equipped with bulkheads and doors to isolate the cockpit from the cabin, which if installed, act as a secondary and typically more robust, barrier from smoke, fumes and fire. Without such bulkheads and doors, the flight crew is dependent on the smoke curtain as the only safety barrier required to "...prevent hazardous quantities of smoke, flames, or extinguishing agent, from any compartment occupied by the crew...”. Although newer smoke curtains have proven to be effective, older versions, still allowed by the current regulation, have a high potential for failure or degraded operation. In view of the lack of requirements for active fire suppression, such secondary smoke and fire barriers could help to reduce the risk to the flight crew and aircraft and could help to partially compensate for the existing regulatory differences between cargo and passenger aircraft fire detection and protection schemes.

RECOMMENDATIONS

STUDY ACTION:
Determine the nature and extent (historical and current) of problems associated with the condition and functionality of smoke curtains.

REGULATORY CHANGE:
Require the installation of bulkheads and doors to isolate the cockpit from the main cabin in order to provide the most reliable barrier for smoke, fumes and fire on all cargo aircraft.

2.3 Escape Slides

Unlike passenger aircraft, cargo aircraft are not required to be equipped with a means of emergency egress (e.g. slides) that permit rapid self-exit or assisted escape (rescue) of injured or non-ambulatory personnel from cargo aircraft.

Regardless of the sill height of the primary exit, cargo aircraft are not required to be equipped with escape slides for emergency egress. This means that in the event of an emergency evacuation, the crew and any other persons on board could be faced with an exit from the aircraft utilizing only an escape rope, tape or descender system. Most of these systems require exit via the cockpit ‘clearview’ (side, opening) windows. For a typical widebody aircraft standing on its landing gear, these cockpit windows are nearly 20 feet above the ground. The B747 cockpit escape hatch is in the cockpit ceiling, which is approximately 33 feet above the ground. The cockpit of the Airbus A-380 will be approximately 18 feet above the ground.

There are several shortcomings associated with these means of emergency egress. First, problems can occur if any crewmember is injured, unconscious or otherwise disabled to point of not being able to conduct his/her own egress. Aside from some aircraft that are equipped with ‘diapers’ (harnesses which attach to the descenders), short of pushing an injured/unconscious individual out the door and letting them fall to the ground, fellow crewmembers would find it very difficult to effect a rescue/removal of that individual from aircraft. Second, exit via these other means is significantly slower than exit by escape slides, and this process can be greatly hindered. This is primarily due to two reasons:

1) For each rope/tape/descender, the occupants must exit essentially serially; each occupant must nearly complete his or her egress before the next one can begin his or her egress. Slides allow parallel or near-parallel egress.
2) The total time per individual egress can be much longer- the individual needs to maneuver him/herself through the window prior to beginning the descent to the ground. This can be

an awkward and somewhat intimidating maneuver, and is significantly hindered by any type of injury to the occupant. Additional complications and hindrances are introduced when the aircraft has one or more jumpseaters or supernumeraries. In contrast, slides are essentially intuitive and undemanding to use.

Table 2 contains the egress times derived from a videotape of the evacuation of a recent cargo aircraft accident. This aircraft was equipped with slides (unusable for this event, although the door did open successfully) and escape tapes (one each per L/H & R/H cockpit clearview window). The start times are when the individuals first become visible in the video. Due to heavy smoke, camera angle, and other factors, there is some uncertainty regarding when these individuals actually began their egress. Individuals only become visible once they have exited the cockpit, although they have not necessarily initiated their descent using the escape tape, primarily because they are on the window ledge outside the cockpit waiting for the preceding person to complete his/her descent. The end times are when the individuals reach the ground. All seven individuals were pilots for this operator, and therefore could be expected to be at least acquainted with this egress procedure. As noted above, this situation could have been considerably worsened if any of these individuals had been injured or were unfamiliar with the escape procedure.

INDIVIDUAL	**R/H WINDOW**		**L/H WINDOW**		**EGRESS DURATION (seconds)**
	START	STOP	START	STOP	
A	1:03	1:06			3
B			1:05	1:21	16
C			1:58	2:26	28
D			2:40	2:56	16
E			2:48	3:13	25
F			3:03	3:20	17
G			3:17	3:40	23

Table 2
Actual Emergency Egress Times From a Widebody Cargo Aircraft
(Source: A recent cargo airline accident)

ALPA is aware that the NTSB is collecting information from the evacuees of this specific aircraft as well as others, and that this is part of a greater effort to support the FAA Civil Aeromedical Institute (CAMI) activity regarding Airbus A-380 cockpit escape mechanisms. While this is a positive sign, it does not negate the need for regulatory requirements for escape mechanisms (e.g. slides) that permit the egress or rescue by fellow crew members of injured or non-ambulatory personnel from cargo aircraft.

RECOMMENDATION

REGULATORY CHANGE:
Require cargo aircraft to be equipped with a means of emergency egress (e.g. slides) that permit rapid self-exit or assisted escape (rescue) of injured or non-ambulatory personnel from cargo aircraft.

2.4 Traffic Alert and Collision Avoidance System (TCAS)

Certain cargo aircraft models (B-1900, S-340, etc) are still not required to be equipped with TCAS, even though the same aircraft models configured to carry passengers are required to be so equipped.

Installation of Traffic Alert and Collision Avoidance Systems (TCAS) was mandated for certain passenger aircraft beginning in 1990, with a requirement for 100% of the affected fleet to be so equipped by 1993. Cargo airlines operating the same model aircraft in the same airspace as the affected passenger aircraft were exempt from TCAS equipage requirements. In 1995, in response to the 'One Level of Safety' campaign, the regulations were changed to require most smaller passenger aircraft (those with 10-30 seats) to be equipped with TCAS. Cargo aircraft of all sizes were again unaffected. In 2003, the regulations were modified to require that all aircraft with a maximum certificated takeoff weight of more than 33,000 lbs be equipped with TCAS by January 1, 2005. While this is a positive step that does result in the requirement for many cargo aircraft to be equipped with TCAS, there is still a disparity between the TCAS requirements for passenger and cargo aircraft. Certain cargo aircraft models are still not required to be equipped with TCAS, even though the same aircraft models configured to carry passengers are required to be so equipped. These aircraft include such models as the EMB-120, J-41 and S-340. ALPA maintains its position that TCAS should be required for these aircraft.

2.5 Fleet Modifications

The relative lack of technical support for aging cargo aircraft can adversely affect the continued airworthiness of aircraft and their components.

By virtue of their age and passenger-aircraft heritage, many current cargo aircraft have had numerous post-delivery modifications such as the installation of cargo doors and specialized floors. Many of these changes were designed and accomplished by organizations other than the original aircraft manufacturer, under the Supplemental Type Certificate (STC) provisions of the FARs. Several of these STC companies are no longer in business, although the aircraft that were modified by them are still flying in revenue service. Table 3 below presents two representative examples of this situation. When an STC company ceases to exist, it can result in technical, troubleshooting and parts support becoming difficult or impossible to obtain. This can adversely affect the continued airworthiness of the aircraft components or the aircraft itself. The FAA should review, and modify as necessary, its provisions for ensuring that the airworthiness of any aircraft is not compromised due to the extinction of a company holding an STC for a component or system on that aircraft.

Company	Product(s) and Conversions	Aircraft	Remarks
Rosenbaum Aviation	Cargo doors, cargo floors, Class "E' cargo compartments, cargo pallet restraint system, provisions for additional crewmembers	Converted DC-8 passenger to cargo	Company no longer exists
Cammacorp	Re-engining program	Converted DC-8 Series 60 to Series 70	Company dissolved in 1986

Table 3 - Sample List of STC-Providing Companies No Longer In Existence

RECOMMENDATIONS

STUDY ACTION:
Determine the fleetwide extent of the major or significant post-delivery Supplemental Type Certificate (STC) modifications on aircraft which are currently in service in the cargo industry, and some principal indicators of the availability of technical support for these modifications.

REGULATORY CHANGES:
The FAA should review, and modify as necessary, its provisions for ensuring that the airworthiness of any aircraft is not compromised due to the extinction of a company holding an STC for a component or system on that aircraft.

2.6 The Aging Cargo Aircraft Fleet

Many cargo aircraft are older aircraft that are not certificated to the safety standards set by newer regulations, and which typically do not incorporate the safety improvements developed since their original certification.

A Dutch study (NLR-TP-2000-210) conducted in 2000 determined that worldwide, the average age of Western-built cargo aircraft has been steadily increasing from 14 to 22 years, whereas the average age of Western-built passenger aircraft has stayed relatively constant at approximately 10 years. In the United States, the average age of the cargo aircraft fleet is approximately four times that of the passenger fleet. As of January 2004, the average age of the US cargo fleet[1] is approximately 28 years, whereas the average age of the passenger fleet[2] is approximately 7 years. Chart A presents the fleet size and ages for most of the large passenger and cargo operators in the US.

[1] Operators with more than 5 aircraft DC-9/B727 sized or greater.
[2] Operators operating to FAR Part 121or equivalent

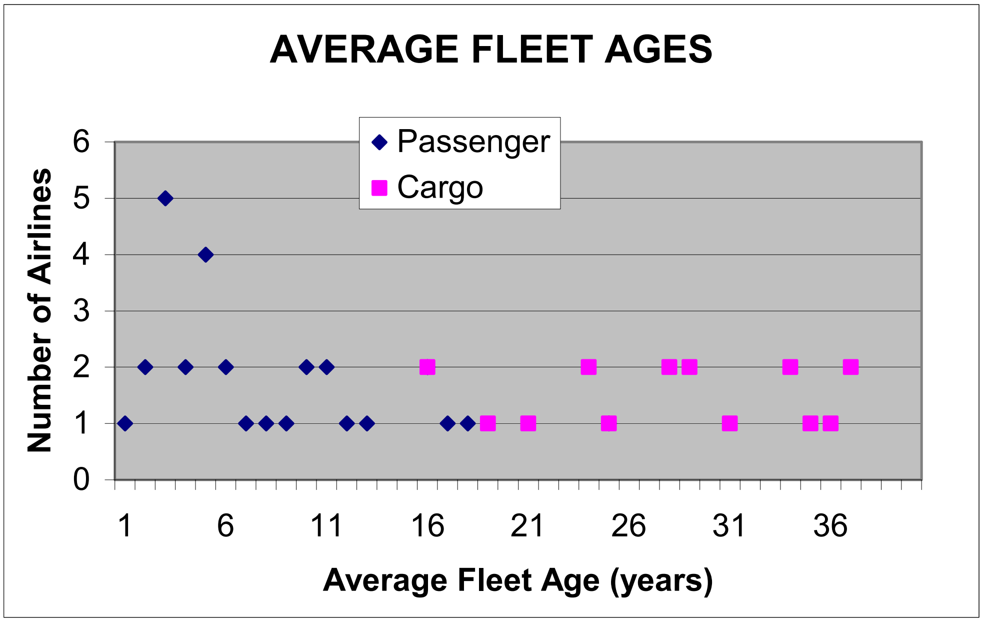

Chart A

Domestically or worldwide, the passenger aircraft fleet is continually being renewed at a relatively rapid pace. These new generation aircraft are typically designed according to newer standards that are a result of industry's continuously improving design philosophy regarding safety. In contrast, the cargo fleet does not typically enjoy the same pace of improvement, principally because older aircraft continue to remain profitable for the cargo operators. Many cargo aircraft do not meet the safety standards set by the newer regulations, since they generally are not required to incorporate improvements in certification standards developed subsequent to their original certification. Therefore, although older and newer aircraft may both be in compliance with the FARs, they are actually in compliance with differing subsets of the Regulations. In the end, this results in different margins of safety for the passenger and cargo fleets.

Table 4 provides some examples of the more significant design changes which have not been (nor are they required to be) incorporated in certain aircraft (such as DC-8s) still regularly utilized by the cargo operators.

Certification Item	FAR	FAR Amendment(s) & Revision Date(s)
Performance - General	25.101	Doc 5066, 12/24/64; 25-38,12/20/76
Takeoff ('V') Speeds	25.107	Doc 5066, 12/24/64; 25-38, 12/20/76; 25-42, 1/16/78
Accelerate-Stop Performance	25.109	Doc 5066, 12/24/64; 25-42:1/16/78
Takeoff Flight Path	25.111	Doc 5066, 12/24/64; 25-6, 7/2/65; 25-42,1/16/78; 25-54, 9/11/80; 25-72, 17/20/90
Flight Control Systems (Jams, 'Split Controls')	25.671(c)	Doc 5066, 12/24/64; 25-23: 4/8/70
Takeoff Warning System	25.703	25-42, 1/16/78
Reliability	25.1309	25-23, 4/8/70; 25-38 12/20/76; 25-41, 7/18/77

Table 4 - Sample Amendments to Significant Design Criteria

Significant safety improvements, especially those achieved through modifications of the design rules, are typically not retroactive on a mandatory basis. As discussed previously, non-mandatory design changes, even those that reduce hazards and risk levels, are frequently not implemented by operators. The February 2000 Emery Airlines DC-8 accident provides just such an example of how non-retroactive FAR design requirement changes can reduce the margins of safety. The original type certificate for this aircraft was awarded in 1959. The certification basis for this aircraft model (DC-8-71F) was CAR 4b with certain amendments. However, these amendments did not require either redundant locking fasteners on critical flight control rotating joints, or provisions to retain aircraft control in the event of flight control jams. A disconnected elevator control linkage resulted in the flight crew's inability to control the aircraft. Had the accident aircraft been equipped with either or both of these aforementioned FAR changes, it is unlikely that this accident would have occurred. To its credit, in its final report on the Emery accident, the NTSB made two safety recommendations (A-03-026, A-03-027) intended to reduce the risk posed by this regulatory shortcoming on both DC-8 and other aircraft.

RECOMMENDATIONS

STUDY ACTION:
Determine the industry exposure (in terms of number of aircraft and certification bases) regarding the incorporation (or lack) of certain significant safety-related design improvements such as dual locking fasteners on critical flight control joints, jam-resistant flight controls, etc.

REGULATORY CHANGES:
Require that aircraft in Part 121 commercial service that do not incorporate certain safety improvements developed since their original certification be modified to be in compliance with those standards.

3 OPERATING RULES

The FARs permit many cargo airlines to operate to less stringent safety standards than their passenger-carrying counterparts.

The lessons learned during commercial aviation's formative years were codified in 1938, and the federal regulations governing aviation have continually evolved to in order to improve safety. Some of these changes are a result of technological improvements, and many have their origins in accident investigations. In 1995, after multiple accidents involving FAR Part 135 commuter airlines, a new Part 119 and other regulatory changes were enacted in an effort to realize "One Level of Safety" in the US air transportation system.

This single level of safety effort upgraded most of the operators under FAR Part 135 to the more stringent FAR Part 121 Domestic/Flag regulations used by the larger passenger airlines.

However, cargo airlines were largely unaffected by this effort. Unlike their passenger carrying counterparts, cargo airlines frequently, but not exclusively, operate under FAR 121 Supplemental (instead of Domestic or Flag) Operations as defined in FAR Part 119. Furthermore, even when they are operating under Part 121 Domestic/Flag rules, the cargo airlines are exempt from certain aspects of these regulations (e.g. the requirement for an airport to be compliant with FAR Part 139 safety standards[3]). The end result is that many cargo airlines are operating under demonstrably lower safety standards than their passenger-carrying counterparts.

RECOMMENDATION

STUDY ACTION:
Catalog the safety-significant exemptions from FARs that are held by the US cargo operators in order to determine the current level of industry exposure.

3.1 FAR Part 121 (Supplemental Operations)

The FARs that govern many cargo carriers provide reduced margins of safety compared to those that govern most passenger carriers.

FAR Part 121 Supplemental regulations are less restrictive than those of FAR Part 121 Domestic or Flag in such diverse areas as dispatch, alternate airports, and flight time/duty time. Aircraft operations under Part 121 Supplemental do not require the use of aircraft dispatchers; this topic is discussed in detail below. As an aside, Part 121 Supplemental carriers are permitted to have longer flight and duty times than Part 121 Domestic or Flag carriers. Extended flight and duty times can contribute to flight crew fatigue, which in turn leads to deterioration in the overall level of safety, and can lead to incidents and accidents. In addition, when operating under Part 121 Supplemental, there is a higher likelihood of a crew flying into an unfamiliar or less well equipped airport, and the difficulties already present are compounded by fatigue. This was the case in the AIA accident in Guantanamo Bay, Cuba. Flight and duty time issues are covered more thoroughly in another ALPA paper that was prepared for this NTSB Cargo Forum.

The objective of the original Supplemental Air Carrier provisions was to allow nonscheduled operators the flexibility and growth potential that would have been unrealistic under the constraints of FAR 121 Domestic/Flag rules. But times have changed, and these regulatory accommodations now clearly result in differing levels of safety.

The FAR 121 rules for Supplemental air carriers are in direct contradiction to the “One Level of Safety” premise, and it appears to be both logical and justifiable that the flight crews, supernumeraries, and cargo, as well as the public who live under their flight paths, all be afforded the same level of safety as provided by the Part 121 Flag and Domestic rules. There should be no distinction between the safety regulations governing a commuter aircraft carrying 15 passengers or a cargo aircraft carrying 180,000 pounds of freight. Both of these aircraft will

[3] 14 CFR 121.590: Use of Certificated Land Airports

be sharing the same airspace, overflying the same populated areas, and interacting with the same traffic, weather hazards and other operational challenges.

3.1.1 ROUTE and AREA APPROVALS & SERVICES ('Flight Following' and 'Flight Dispatch')

Many cargo operations conducted under FAR Part 121 are not required to meet the highest standards for dispatch department functions, including operational control, weather reporting, and alternate airport requirements.

Redundancy is a key element of flight safety, and dispatch is an effective means of providing this redundancy in daily flight operations. In addition, it is well accepted that operational control, which is defined by the FAA as "…the exercise of authority over initiating, conducting or terminating a flight" is also critical to flight safety, and that the dispatch function is a significant contributor to high quality operational control. This has been publicly acknowledged by both the FAA and the NTSB. In its Advisory Circular (AC) 121-32 on Dispatch Resource Management (DRM) training, the FAA noted that:

> "The NTSB and Transportation Safety Board [TSB] of Canada have both found that inadequate operational control and inadequate collaborative decision making have been contributing factors in air carrier accidents. Effective management of available resources by aircraft dispatchers is one essential deterrent to such accidents."

Just what is "dispatch" and what does it do? Briefly stated, the dispatch function is part of a system of joint decision-making regarding the initiation, conduct and termination of a flight. It is no coincidence that this definition is the same as the FAA definition of operational control, with one primary difference- "joint decision-making." Regarding the conduct of the flight, dispatch responsibilities include the following:

- Weather analysis for the departure airport, enroute regions, destination airport, and alternate airport
- Aircraft operating and performance characteristics
- Maintenance considerations, including the minimum equipment and the configuration deviation lists (MEL and CDL)
- Coordination with air traffic control centers to anticipate and plan for the daily traffic flow within the National Airspace System
- Weight and balance
- Hazardous materials considerations
- Security issues

Under the dispatch system, dispatchers and flight crews *share* the responsibility for the safe and efficient conduct of the flight. Although the PIC retains final responsibility for, and authority over, the safe conduct of the flight, most significant decisions regarding the flight require the concurrence of both the dispatcher and flight crew. Thus, the aircraft dispatcher has critical safety oversight responsibilities with respect to the conduct of the flight. In addition, unlike the flight crew who are primarily focused on their individual flight, the dispatcher has the 'big picture' perspective of that flights interaction within the overall operational environment. As then-Chairman Jim Hall of the NTSB put it, “Although pilots may be the last line of defense in ensuring a flight’s safety...” dispatchers “...are undoubtedly the front line."

One of the more significant changes evolving in the US air transportation system is the concept known as “Free Flight”, whereby the individual aircraft assume greater autonomy in their flight routing to a far greater degree than is currently practiced. Under this scheme, lack of a dispatch organization could easily result in difficulties. As far back as 1998, the Airline Dispatchers Federation (ADF) noted the potential for problems. One ADF document noted:

> “The basic objective of Free Flight is to let the air carriers have more control over routes, altitudes, and airspeeds, to better utilize airspace and favorable meteorological conditions to reduce delays and expenses. By moving to a less regimented system, the triad of pilot, ATC controller, and dispatcher, will become more complex and interwoven, requiring greater expertise by all. By not requiring licensed aircraft dispatchers ... for certain air carrier operations, the FAA has eliminated key elements from the triad of safety and a vital component from the airspace safety net. These missing elements of safety and responsibility will have to be assumed by someone or accidents may result.”

Even before this, then-Chairman Jim Hall of the NTSB noted that “With the advent of free flight...” the dispatchers’ “...role will become even more critical. It is widely assumed that free flight will require more diligence by pilots and air traffic controllers, but the role of dispatchers will be equally important.”

From the discussions above, it can be clearly seen that flight dispatch functions and services, as defined by and required under FAR Part 121 Domestic and Flag Regulations, are an integral part of the safety equation. Again, in contrast, Part 121 Supplemental operators are not required to have flight dispatch. Instead, only ‘flight following’ services are required. While some of the functions provided by dispatch seem to also be provided by flight following, many are not. In accordance with the Regulations regarding flight following, there are no requirements for in-flight monitoring or communications. Most significantly however, the important redundancy in operational control is lost due to lack of any requirements for shared joint responsibility between the flight crew and the dispatch organization. This is a significant safety deficiency.

Despite the many technical improvements to aircraft and infrastructure that have occurred over the years, one thing remains fairly constant; we are all essentially the same human beings involved in the operation of the aircraft, and as such, are still capable of error. In more recent years, the study and application of human factors has expanded out of the flight deck and into the other areas, positively influencing the safe operation of the aircraft. The redundancy provided by the dispatch organization is in accordance with contemporary human factors-oriented approaches. Additionally, due to its centralized ‘mission control’ character, an airline's dispatch office is an effective vantage point from which to detect systemic errors, problems, and trends, and is well suited to implement corrective actions as required. A recent NASA study, “Joint Responsibility Between Captain and Dispatcher Under Part 121 Flight Dispatch Provides a Higher Level of Safety in Air Carrier Operations Planning and Problem Resolution” (Judith

Orasanu et al. ISBN 0-16-044126-9) provides additional insights into this topic. Table 5 presents the differences between 'Dispatch' and 'Flight Following' as required by FAR Part 121 Flag, Domestic and Supplemental regulations.

FAR 121 Flag and Domestic	**FAR 121 Supplemental**
Functions / Services	
Information necessary for the safe conduct of flight is obtained from dispatch. Jointly reviewed by both pilot in command and dispatcher.	Pilot in command is provided with information necessary for the safety of the flight and may be the only certificated person who reviews the fuel planning and examines the weather conditions affecting the flight's safety.
Pilot in command and aircraft dispatcher jointly responsible for the preflight planning, delay, and the dispatch release.	Each pilot in command of an aircraft is responsible for the preflight planning and the operation of the flight. Pilot in command and the director of operations are jointly responsible for the initiation, continuation, diversion, and termination of a flight.
Flights can be cancelled, delayed, rerouted or diverted by dispatcher and/or the pilot in command.	Pilot in command or the director of operations can cancel, delay, reroute or divert.
Two way communications provisions (between dispatch personnel and aircraft) are required along the entire route of flight	Two way communications provisions are only required at the departure, destination, intermediate and diversion airports.
A communication system is required between each airplane and the dispatch office and must be independent of any system operated by the United States	Means of communication by private or available public facilities (such as telephone, telegraph, or radio) to monitor the progress of each flight with respect to its departure at the point of origin and arrival at its destination, including intermediate stops and diversions therefrom
Qualified personnel are required to monitor each flight in real time.	A flight following system is not required to provide for in-flight monitoring.
During a flight, the aircraft dispatcher shall provide the pilot in command any additional available information of meteorological conditions (including adverse weather phenomena, such as clear air turbulence, thunderstorms, and low altitude wind shear), and irregularities of facilities and services that may affect the safety of the flight	Since neither in-flight monitoring center nor communication are required, it is possible that transfer of critical flight information may only occur at the flights' point of origin, destination, intermediate stops and diversion airports.
Must have an approved system for obtaining forecasts and reports of adverse weather phenomena, such as clear air turbulence, thunderstorms, and low altitude windshear, that may affect safety of flight on each route to be flown and at each airport to be used.	The certificate holder's manual must list procedures for operating in periods of ice, hail, thunderstorms, turbulence, or any potentially hazardous meteorological condition.
Organization Infrastructure	
Operator must show that it has enough dispatch centers, adequate for the operations to be conducted, that are located at points necessary to ensure proper operational control of each flight	Operations Specifications specify the location of the centers

Operator must provide enough qualified aircraft dispatchers at each dispatch center to ensure proper operational control of each flight	The system has adequate facilities and personnel to provide the information necessary for the initiation and safe conduct of each flight to the pilot in command and director of operations.
<u>Personnel Requirements</u>	
Dispatchers are required to be licensed and must have passed a 200 hour FAR 65 Aircraft Dispatcher course or equivalent experience.	Must show that the personnel the carrier designates to perform the function of operational control of the aircraft are able to perform their required duties.
Dispatcher must pass a written knowledge test and a practical knowledge test.	Flight followers are not certificated. No written test or practical knowledge test is required by the FAA.
20 hours of annual classroom recurrent training required.	No recurrent training required by the FAA.
Five hours annually observing flight procedures from cockpit.	Not required for flight followers.
Annual competency checks required by FAA.	Annual competency checks are not required by the FAA.
Differences training for all variations of a particular type airplane.	Differences training not required of flight followers
Reexamination of a Licensed Dispatcher can occur in accordance with USC 44709.	Not applicable - Personnel not required to hold a certificate.
Dispatchers must comply with FAA specified duty time regulations.	No FAA specified duty limitations for flight followers.

TABLE 5

Differences Between 'Dispatch' and 'Flight Following'
(Per FAR Part 121 Flag, Domestic and Supplemental Regulations)

Requirements for other safety related elements such as weather reporting and alternate airport requirement are also less stringent under Part 121 Supplemental regulations. The end result of all these regulatory differences can be a cargo airline and a passenger airline operating identical aircraft in the same airspace at the same time to two different levels of safety.

<u>RECOMMENDATION</u>

REGULATORY CHANGES:
Modify FAR Part 121, particularly Subparts 'F' and 'S', (dealing with Supplemental operators) to provide the same levels of safety for all operators.

3.2 Cargo Preparation and Loading

Until very recently, formal FAA guidance and regulation on cargo handling and loading was relatively sparse and unconsolidated. Recent FAA actions are promising, but additional progress is appropriate and must be pursued.

Another area which has a direct bearing on flight safety, but is only peripherally addressed by the regulations, are the personnel and organizations that are directly involved in the cargo preparation and loading. The entire sequence of cargo loading operations, from preparation of the pallets/containers to the information provided to flight crews, has a direct effect on flight safety. Numerous incidents and several accidents have been attributed to improper loading of aircraft. Typical improper loading events can take the form of CG errors, weight errors, improperly restrained or unrestrained cargo, and improperly packaged cargo, particularly dangerous goods. CG errors can range from 'out of trim' to 'out of CG range.'

Although cargo flight crews are ultimately responsible for the proper weight, balance, restraint and security of their cargo, in most cases, the Company procedures and processes effectively deny the flight crews any practical means to verify that information. Instead, they are forced to rely on the robustness and overall quality of the loading procedures, equipment and personnel. In conflict with this increased dependence on the loaders, many cargo operators utilize different loading vendors at their different outstations, and many cargo handler positions are typically entry-level positions characterized by relatively high rates of turnover. As a result of the 1997 Fine Air accident in Miami, the NTSB acknowledged some deficiencies in the system and recommended that all individuals associated with the loading process be provided with consistent and comprehensive training in aircraft loading.

3.2.1 FAA CSAP ACIP

The FAA's draft Advisory Circular regarding cargo loading and handling is a positive action towards providing appropriate and consolidated guidance, but does not completely address all areas of concern.

In its December 2002 Cargo Strategic Action Plan, the FAA noted that "Recent incidents and accidents have shown that there are continuing cargo-handling issues that relate to 14 CFR Part 121/135 passenger and cargo operations" and that "certification, operations, and maintenance standards require updating and new development." In 2003 an Air Cargo Implementation Plan Working Group (ACIP WG) was formed to address the issues cited in the CSAP, and present its findings and recommendations to the FAA. In early 2004, the FAA draft of the resulting Advisory Circular (AC) was circulated within the ACIP WG. To its credit, this draft AC satisfactorily addresses many of the issues related to improving the robustness of the loading process, although as advisory material, it does not necessarily ensure that any of its tenets are actually followed by carriers. ALPA believes that this AC is lacking in certain respects, either because the AC did not sufficiently address a particular item, or did not address it at all. In addition to the discussion below, other topics relevant to this AC are discussed in other ALPA papers that have been prepared for this NTSB Cargo Safety Forum.

The section of the AC regarding loading vendors, and particularly their programs, does not provide sufficient guidance to ensure uniformity. Such uniformity of loading practices, procedures and forms across all of a carrier's outstations, and independent of the particular vendor serving that outstation, would be a positive move towards improving the robustness of the loading process. In addition, the draft AC does not explicitly call for the vendor organizations and personnel to have ready access to the carriers' relevant loading information. These conditions, or more specifically the lack thereof, were noted during the Emery 17 accident investigation. While these conditions and provisions may be implicit goals of the AC, it is ALPA's view that this section should be clarified and made more explicit in this regard.

3.2.2 Certification of Loading Personnel

Certain cargo handling and loading personnel who perform or supervise tasks critical to flight safety are not certificated by the FAA and are therefore not are not subject to the same accountability standards as their colleagues in many other segments of the air transportation industry.

ALPA feels that key personnel engaged in cargo loading functions perform safety-critical duties in the same sense as mechanics, controllers, and pilots. These individuals should be certificated by the FAA. Ensuring accurate loading is a cornerstone to the safety of cargo operations (see Table 6), and aircraft loading personnel play a key role in the accuracy of this loading. In consideration of the fact that flight crews are effectively denied the capability to verify accurate loading, it is incumbent upon the FAA and operators to improve the reliability and robustness of the procedures and processes utilized to load aircraft. In recognition of the criticality of proper loading, the US military utilizes specially trained personnel known as 'loadmasters' who are specifically responsible for the accurate loading of their cargo aircraft. Few if any commercial cargo carriers employ this approach. Also, despite the importance of the various functions involved in aircraft loading, the FAA still does not require any of the personnel involved in the cargo build-up or loading to be certificated. Alternative approaches might include station-based loadmasters, certification of supervisory loading personnel, or other innovative methods to ensure the reliability of the loading operations. This topic and related issues are also discussed in at least one other ALPA paper that has been prepared for this NTSB Cargo Safety Forum.

DATE LOCATION	AIRCRAFT TYPE	OPERATOR	EVENT SUMMARY	REMARKS
05/17/89 Anchorage, Alaska	B-747	Flying Tigers	Multiple tire failures during takeoff roll due to improperly loaded aircraft	Improper Loading 18,766 # lateral imbalance ANC89IA071
11/30/94 Chicago, IL	DC-8	AIR TRANSPORT INTERNATIONAL	Aircraft tipped back on tail during loading	Improper unloading CHI95LA049
01/28/95 Bellesville, MI	B-747	KALITTA AIR SERVICE	Cargo pallets shifted aft on takeoff, takeoff aborted	Improper loading CHI95LA078
8/7/97 Miami, FL	DC-8	FINE AIR	CG induced loss of control on takeoff	Improper loading DCA97MA059
11/21/97 Syracuse, NY	DC-9	Kitty Hawk	Cargo shifted during takeoff	Improper loading CHI98LA053

DATE LOCATION	AIRCRAFT TYPE	OPERATOR	EVENT SUMMARY	REMARKS

TABLE 6
Sample Loading Related Incidents and Accidents

3.2.3 Designation of Safety-Sensitive Positions

Certain cargo handling and loading personnel who perform tasks critical to flight safety are not considered by the FAA to be in 'safety-sensitive" positions, and are therefore not subject to mandatory drug and alcohol testing following an incident or accident.

Appendices I and J of Part 121 specify the safety-sensitive functions to which the post accident drug and alcohol testing requirements apply. These functions include the duties of flight crew members, flight attendants, flight instructors, aircraft dispatchers, aircraft maintenance or preventive maintenance personnel, ground security coordinators, aviation screeners, and air traffic controllers. Despite the discussions in the paragraphs above, as of this writing, FAA-specified safety-sensitive functions do not include cargo handling personnel or load planners. As part of the investigation into the Emery Worldwide Airways flight 17 accident, the NTSB made safety recommendations to correct this disparity in the regulations. Like the NTSB, ALPA believes that certain cargo loading personnel should be held to the same accountability standards as their colleagues in many other segments of the air transportation industry.

RECOMMENDATION

REGULATORY CHANGES:
Require that certain cargo handling and loading positions be designated as "safety sensitive positions" as defined by FAR PART 121.

3.3 FAR Part 139 (Airport Certification)

Cargo aircraft are permitted to operate into airports with fewer and less stringent regulatory safety standards than many passenger aircraft are permitted to operate into.

FAR Part 139 (Airport Certification) specifies the "...rules governing the certification and operation of land airports which serve any scheduled or unscheduled passenger operation of an air carrier that is conducted with an aircraft having a seating capacity of more than 30 passengers." In contrast, cargo aircraft, in accordance with FAR 121.590 (b), can operate into any airports "...if the following conditions are met:

(1) The airport is adequate for the proposed operation, considering such items as size, surface, obstructions, and lighting."

The significance of this regulatory disparity becomes evident when the scope and depth of Part 139 is examined more closely. Part 139 prescribes an extensive set of airport-related conditions, capabilities, facilities and equipment that must be satisfied in order for the designated aircraft to operate into that airport. These include such items as airport rescue and fire fighting (ARFF), Hazmat handling and storage, an airport emergency plan, marking and lighting standards, snow and ice control programs, physical protection of navigational aids protection, and wildlife hazard management.

One of the most glaring and critical discrepancies is the ability of cargo aircraft (frequently loaded with Hazmat) to operate into or out of airports with no requirement for Airport Rescue and Fire Fighting (ARFF). During its investigation of the Federal Express Flight 1406 accident (DC-10 at Newburgh, NY) the NTSB observed that "...aircraft rescue and firefighting capabilities must also be improved so that firefighters are able to extinguish aircraft interior fires in a more timely and effective manner..." and made a recommendation (A-98-077) that airport emergency plans should specifically address hazardous materials emergencies. While the FAA response to this particular recommendation is classified by the NTSB as "satisfactory", neither this NTSB recommendation nor any others address the root problem of requiring ARFF support for cargo operations.

Furthermore, there are no NTSB recommendations addressing the greater disparity of not requiring Part 139 certification, or some equivalent level of safety, for cargo operations.

RECOMMENDATION

REGULATORY CHANGES:
Modify FAR Parts 121 and 139 to require the availability of Airport Rescue and Fire Fighting (ARFF) services for all-cargo operations.

4. CONCLUSIONS

1) Regulatory inconsistencies and changes, in combination with some characteristics of the cargo fleet composition, have resulted in an unwarranted, two tiered risk exposure for the US passenger and cargo fleets, with the cargo fleets unnecessarily subjected to higher levels of risk.
2) Compared to the requirements for passenger carrying aircraft, FAR 121.857 permits less stringent fire protection provisions on cargo aircraft.
3) Although changes have recently been made to FAR 121.857 regarding aircraft fire detection and protection requirements, cargo aircraft continue to be unjustifiably held to lower safety standards than passenger aircraft.
4) Despite other regulatory differences that expose cargo aircraft to higher risk levels, technology that can significantly assist flight crews in determining the accuracy of fire warnings and the status of on board fires is available but not required on cargo aircraft.
5) Limitations in FAA fire detection and suppression requirements for cargo aircraft necessitate other design solutions to improve cargo aircraft survivability in the event of an onboard fire.
6) Unlike passenger aircraft, cargo aircraft are not required to be equipped with bulkheads and doors to isolate the cockpit from the cabin which would provide an additional or more robust barrier for smoke, fumes and fire.
7) Unlike passenger aircraft, cargo aircraft are not required to be equipped with a means of emergency egress (e.g. slides) that permit rapid self-exit or assisted escape (rescue) of injured or non-ambulatory personnel from cargo aircraft.
8) Certain cargo aircraft models (B1900, S-340, etc) are still not required to be equipped with TCAS, even though the same aircraft models configured to carry passengers are required to be so equipped.
9) The relative lack of technical support for aging cargo aircraft can adversely affect the continued airworthiness of aircraft and their components.
10) Many cargo aircraft are older aircraft that do not meet the safety standards set by newer regulations, and which typically do not incorporate the safety improvements developed since their original certification.
11) The FARs permit many cargo airlines to operate to less stringent safety standards than their passenger-carrying counterparts.
12) The FARs that govern many cargo carriers provide reduced margins of safety compared to those that govern most passenger carriers.
13) Many cargo operations conducted under FAR Part 121 are not required to meet the highest standards for dispatch department functions, including operational control, weather reporting, and alternate airport requirements.
14) Until very recently, formal FAA guidance and regulation on cargo handling and loading was relatively sparse and unconsolidated. Recent FAA actions are promising, but additional progress is appropriate and must be pursued.

15) The FAA's recent draft Advisory Circular regarding cargo loading and handling is a positive action towards providing appropriate and consolidated guidance but does not completely address all areas of concern.

16) Certain cargo handling and loading personnel who perform tasks critical to flight safety are not certificated by the FAA and are therefore not subject to the same accountability standards as their colleagues in many other segments of the air transportation industry.

17) Certain cargo handling and loading personnel who perform tasks critical to flight safety are not considered by the FAA to be in 'safety-sensitive" positions, and are therefore not subject to mandatory drug and alcohol testing following and incident or accident.

18) Cargo aircraft are permitted to operate into airports with fewer and less stringent regulatory safety standards than many passenger aircraft are permitted to operate into.

5. RECOMMENDATIONS

5.1 Study Actions

1) Determine the nature and extent (historical and current) of problems associated with the condition and functionality of smoke curtains.
2) Determine the fleetwide extent of the major or significant post-delivery Supplemental Type Certificate (STC) modifications on aircraft which are currently in service in the cargo industry, and some principal indicators of the availability of technical support for these modifications.
3) Determine the industry exposure (in terms of number of aircraft and certification bases) regarding the incorporation (or lack) of certain significant safety-related design improvements such as dual locking fasteners on critical flight control joints, jam-resistant flight controls, etc.
4) Catalog the safety-significant exemptions from FARs that are held by the US cargo operators in order to determine the current level of industry exposure.

5.2 Regulatory Changes

1) Require that all compartments of cargo aircraft be equipped with smoke and fire detection capability.
2) Require that all compartments of cargo aircraft be equipped with temperature monitoring capability.
3) Require that all compartments of cargo aircraft be equipped with provisions for active, remotely operated fire suppression.

4) Require the installation of bulkheads and doors to isolate the cockpit from the main cabin in order to provide the most reliable barrier for smoke, fumes and fire on all cargo aircraft.
5) Require cargo aircraft to be equipped with a means of emergency egress (e.g. slides) that permit rapid self-exit or assisted escape (rescue) of injured or non-ambulatory personnel from cargo aircraft.
6) The FAA should review, and modify as necessary, its provisions for ensuring that the airworthiness of any aircraft is not compromised due to the extinction of a company holding an STC for a component or system on that aircraft.
7) Require that aircraft in Part 121 commercial service that do not incorporate certain safety improvements developed since their original certification be modified to be in compliance with those standards.
8) Modify 14 CFR Part 121, particularly Subparts 'F' and 'S', (dealing with Supplemental operators) to provide the same levels of safety for all operators.
9) Require that certain cargo handling and loading positions be designated as "safety sensitive positions" as defined by FAR Part 121.
10) Modify FAR Parts 121 and 139 to require the availability of Airport Rescue and Fire Fighting (ARFF) services for all-cargo operations.