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Balancing

The accident rate in U.S. airline all-cargo operations is two to five times higher than the accident rate in passenger and combined passenger/cargo, "combi," operations, according to a recent study by the Commercial Aviation Safety Team. The larger estimate results from eliminating relatively low-risk events such as ramp accidents and turbulence encounters from the equation.

Moreover, a study conducted by the National Aerospace Laboratory–Netherlands (NLR) and the U.K. Civil Aviation Authority (CAA) in 2000 indicates that there are 2.5 accidents per million large cargo airplane flights in North America, which is nearly five times higher than the accident rate for passenger flights in North America and more than twice as high as the accident rate for cargo flights in Europe.[1]

Nevertheless, the U.S. Federal Aviation Administration (FAA) says that accidents involving U.S. cargo aircraft are decreasing and that recently published guidelines for air carrier operators will contribute to the trend.

National Transportation Safety Board (NTSB) records show that in 1996 through 2005, 63 (14 percent) of the 449 accidents that occurred in U.S. Federal Aviation Regulations Part 121 air carrier operations involved cargo aircraft (Figure 1, page 30). Cargo aircraft were involved in five (21 percent) of the 24 fatal accidents during the period.

Of the 742 accidents in Part 135 air taxi operations during the 10-year period, 282 (38 percent) involved cargo aircraft (Figure 2, page 31). The total included 183 fatal accidents, of which 85 (46 percent) occurred in cargo operations. Part 135 applies, in part, to cargo operations conducted in airplanes with payload capacities of 7,500 lb (3,402 kg) or less, or in helicopters.

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Cargo Safety

The United States grapples with a relatively high accident rate in freight operations.

BY MARK LACAGNINA

Inconsistencies

Citing regulations that are less stringent for cargo operations than passenger/combi operations, the Air Line Pilots Association, International (ALPA) says that cargo operations never will match the safety of passenger operations until regulatory inconsistencies are eliminated to ensure "one level of safety."

Among examples discussed at an NTSB forum on air cargo safety in 2005 were exemptions from requirements for escape slides and active fire-suppression systems on the main decks of transport category cargo airplanes. Airport-certification rules do not require aircraft rescue and fire fighting (ARFF) facilities at airports served by cargo aircraft, which frequently carry hazardous materials.

An accident early this year that nearly destroyed a Douglas DC-8 freighter highlights the reason for concern about less-stringent regulations applied to cargo operations. The airplane was en route from Atlanta to Philadelphia on Feb. 7, 2006, when the flight crew detected an odor but could not determine the source. The odor dissipated, and, because the airplane was near Philadelphia, the crew decided to continue to the destination. The odor became detectable again during approach, and a smoke-warning light and then the lower-cargo-fire-warning light illuminated. Smoke began to enter the flight deck, and the crew donned their oxygen masks. The flight engineer told investigators that the smoke became so dense by the time the airplane was stopped on the runway that he could not see his hand in front of him. The DC-8 was substantially damaged by the fire, and the crew received minor injuries.

NTSB had not completed its investigation of the accident at press time, but preliminary information indicated that the fire-damaged cargo included laptop computers and cellular telephones with lithium batteries. These items were not required to be documented, marked and handled as hazardous materials because the lithium content of the batteries was below the specified minimum.

The Department of Transportation (DOT) called lithium batteries "an immediate threat to the flying public" when it outlawed their carriage in the cargo holds of passenger aircraft in 2004. The DOT action responded in part to an incident at Los Angeles International Airport in April 1999, when two cargo pallets containing 120,000 lithium batteries caught fire after they were damaged while being unloaded from a passenger aircraft. It took 30 minutes to extinguish the fire, and NTSB found signs that the batteries had burst and melted. FAA subsequently conducted flammability tests and concluded that "the presence of primary [nonrechargeable] lithium batteries can significantly increase the severity of an in-flight cargo-compartment fire."

Nevertheless, DOT exempted cargo aircraft from the prohibition against carrying lithium batteries because, it said, "the risk to public safety is much lower."

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Back of the Clock

More than half of cargo operations are conducted at night, while only about one-fifth of passenger and combi operations take place at night. Cargo pilots typically function on "the back of the clock" and rely on daytime sleep, which has been shown to be inferior to nighttime sleep.

According to Mark Rosekind, Ph.D., Alertness Solutions' president and chief scientist, complete circadian adaptation to night work rarely occurs. ALPA said that studies by the U.S. National Aeronautics and Space Administration have shown that night-cargo pilots lose an average of two hours of sleep per day, resulting in an accumulated sleep deficit of eight hours or more by the end of the week.

Yet, cargo-airline pilots can be scheduled to fly more hours than other Part 121 pilots. Cargo flights typically are conducted as "supplemental" operations under Part 121, and the regulations allow cargo pilots to fly up to 48 hours per week. The weekly flight time limit set by Part 121 for pilots in domestic passenger/combi operations is 30 hours, and the weekly limit for pilots in "flag," or international, passenger/combi operations, is 32 hours.

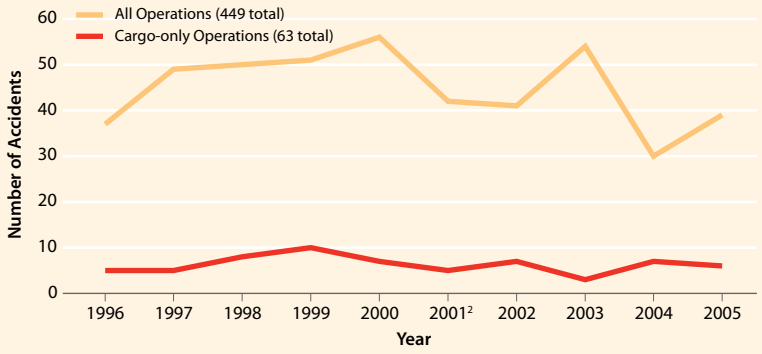
ALPA says that the rules applied to supplemental operations were developed about 50 years ago for unscheduled freight operations conducted in unpressurized piston airplanes and that an attempt begun by FAA in 1995 to modernize flight time/duty time regulations has stalled for various reasons.

The pilots' union also has cited inconsistencies in the establishment by airlines of modern safety programs. For example, of the 12 airlines with flight operational quality assurance (FOQA) programs in 2005, one was a cargo airline. Of the 32 aviation safety action programs in use, four were at cargo airlines. Line operations safety audits were being conducted by 16 airlines, none of which was a cargo airline.

Aging Aircraft

Aging-aircraft problems are not unique to the cargo industry, but they are more pronounced as economic factors drive cargo airlines to operate less expensive equipment. ALPA says that the average age of aircraft in the U.S. cargo fleet is 28 years, while the average for the passenger fleet is seven years. Outdated technology, higher maintenance requirements, lack of spare parts availability and the decline or absence of

U.S. Air Carrier Accidents[1]



	Fatal Accidents		Fatalities	
Year	All Operations	Cargo-only	All Operations	Cargo-only
1996	5	2	380	38
1997	4	1	8	5
1998	1	0	1	0
1999	2	0	12	0
2000	3	1	92	3
2001[2]	2	0	266	0
2002	0	0	0	0
2003	2	0	22	0
2004	2	1	14	1
2005	3	0	22	0
Total	**24**	**5**	**817**	**47**

1. Aircraft operated under U.S. Federal Aviation Regulations Part 121, *Operating Requirements: Domestic, Flag and Supplemental Operations*.
2. Does not include the hijackings of four air carrier aircraft that were flown into buildings and the ground, with 265 fatalities, on Sept. 11, 2001.

Source: U.S. National Transportation Safety Board

Figure 1

manufacturers' support are among the issues associated with aging aircraft. Many passenger aircraft have been converted to cargo aircraft by companies no longer in business.

Older aircraft typically do not incorporate safety improvements developed after their original certification. An example is the Emery Worldwide Airlines DC-8-71F that crashed in an automobile salvage yard while returning to land at Sacramento (California) Mather Airport on Feb. 16, 2000. The airplane entered an uncommanded nose-high attitude before reaching takeoff rotation speed. The pitch attitude continued to increase despite forward movement of the control column and application of nose-down stabilizer trim by the pilot flying. "The airplane rolled and pitched and climbed and descended as the pilots tried different combinations of flight control inputs and engine power settings to counter the airplane's uncommanded pitch-up while they attempted to maneuver back to the runway," the NTSB report said. The airplane was being turned onto base leg when it struck terrain.

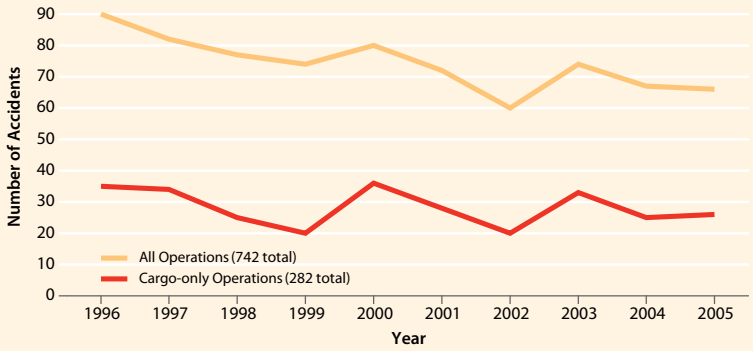
DC-8 elevators are driven by control tabs on the trailing edges. NTSB determined that the bolt attaching the pushrod to the control tab on the right elevator had been improperly secured and inspected during recent maintenance. The bolt migrated from its fitting, and the disconnected control tab moved to a trailing-edge-up position, creating aerodynamic forces that caused an extreme nose-up pitch attitude that the pilots were unable to correct.

The accident airplane had been manufactured in 1968 and converted to a freighter in 1993. The DC-8 was certified in 1959 under the transport category airplane airworthiness standards of Civil Aeronautics Manual 4b, which did not require two separate locking devices on critical fasteners in flight-control systems. The current standards in Part 25 require dual-locking devices at critical flight-control attachments.

Load Verification

There are no license requirements for cargo-handling companies and personnel. "Cargo preparation and loading personnel are frequently not

U.S. Air Taxi Accidents[1]



	Fatal Accidents		Fatalities	
Year	All Operations	Cargo-only	All Operations	Cargo-only
1996	29	13	63	16
1997	15	7	39	9
1998	17	9	45	10
1999	12	5	38	6
2000	22	11	71	12
2001	18	10	60	14
2002	18	7	35	7
2003	18	8	42	9
2004	23	10	64	12
2005	11	5	18	5
Total	**183**	**85**	**475**	**100**

1. Aircraft operated under U.S. Federal Aviation Regulations Part 135, *Operating Requirements: Commuter and On-Demand Operations*.

Source: U.S. National Transportation Safety Board

Figure 2

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extensively trained, and, in many cases, these jobs are minimum-wage, high-turnover positions," said ALPA's Terry McVenes and William McReynolds at the NTSB forum. "Many cargo loaders perform their jobs in adverse and demanding physical conditions, under schedule-driven pressure. These circumstances increase the likelihood of errors."

Ultimate responsibility for proper loading rests with the flight crew, but cargo pilots often have no practical way to verify the aircraft's weight and balance before takeoff, the NLR/CAA study said.

FAA data show that a disproportionate percentage of Part 121 cargo aircraft hull loss and fatal accidents involve loss of control on takeoff (Figure 3, page 33). An example was the Aug. 7, 1997, crash of a Fine Air DC-8 at Miami International Airport. The airplane entered an extreme nose-up pitch attitude on takeoff, stalled and struck the ground, killing the three flight crewmembers, a security guard aboard the airplane and one person on the ground. The crew had trimmed the horizontal stabilizer according to the center of gravity (CG) shown on the load sheet. However, the cargo had not been loaded according to the airline's instructions; the CG was aft of the location indicated on the load sheet. The NTSB report said that the trim set by the crew likely caused a greater-than-expected pitching moment that was exacerbated by the lighter control-column forces resulting from the aft CG location. NTSB said that the accident might have been avoided if the crew had an independent method for verifying the aircraft's weight and balance.

FAA said that Advisory Circular (AC) 120-85, *Air Cargo Operations*, was published in June 2005 in direct response to safety recommendations by NTSB based on its investigation of the Fine Air accident.

The AC includes recommended procedures for cargo loading and unloading, operational control of the procedures, designation of trained load supervisors to oversee and verify the procedures, use and calibration of scales for measuring cargo weight, maintenance of cargo-restraint devices, and training cargo personnel and flight crews. The guidelines are specific to Part 121 cargo operations and are not mandatory.

Part 135 Accidents

NTSB at press time had completed the investigations of 74 of the 85 fatal Part 135 cargo accidents that occurred in 1996 through 2005. The aircraft included nine twin-turboprop airplanes (12 percent); 10 single-engine turboprops (14 percent), all of which were Cessna 208 Caravans; 32 piston twins (43 percent); and 20 single-engine piston airplanes (27 percent). There also was one jet — a Learjet 25 that struck terrain when the first officer, the pilot flying, became disoriented during a takeoff in nighttime instrument meteorological conditions (IMC) — and two helicopters that crashed in the Gulf of Mexico while transporting cargo to offshore platforms.

U.S. National Transportation Safety Board

Investigators are probing the role that lithium batteries played in a cargo fire that nearly destroyed a DC-8 freighter in February 2006.

The final reports on 40 fatal accidents that occurred in 2001 through 2005 classify 19 (48 percent) as loss-of-control accidents. Several reports cite the pilots' failure to maintain adequate airspeed. A Britten-Norman Islander entered an uncontrolled descent after being flown into thunderstorms. The pilot of a Piper Lance became spatially disoriented after the pneumatic pump failed, rendering the attitude and direction indicators inoperative in nighttime IMC. An elevator trim tab actuator was not properly secured during maintenance of a Cessna 402's elevator; the tab jammed, causing an excessive nose-down pitch moment when the airplane was on final approach.

Fatigue was cited as a cause of two fatal accidents. The pilot of a Piper Aerostar had been on duty more than 14 hours when the airplane struck terrain during a missed instrument landing system (ILS) approach. The report on a Piper Seneca that struck a mountain said that the pilot had made several requests for someone to accompany him on the flight because he was tired.

Fifty-three (19 percent) of the 282 Part 135 cargo aircraft accidents in 1996 through 2005 and 11 (13 percent) of the 85 fatal accidents during the 10-year period occurred in Alaska. The risks to flight operations in the vast state are amplified by rough terrain, variable weather conditions and the lack of weather-reporting stations and navigational aids.[2] Aircraft, primarily single-engine airplanes operated by single pilots under visual flight rules, serve as the main link between regional hubs and widely scattered villages, many of which have unlighted gravel or dirt airstrips.

The state and the FAA have launched several initiatives to improve safety in Alaska. The Capstone Program, for example, includes development of global positioning system (GPS) approach procedures and dissemination of weather information and surveillance of traffic via the automatic dependent surveillance–broadcast (ADS-B) system.

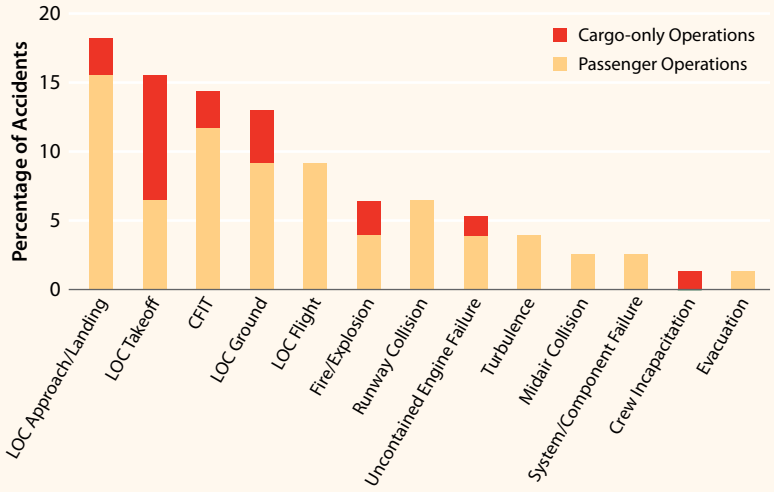
Wait and See

FAA currently is deferring any rule-making action affecting air cargo operations while it gauges voluntary acceptance and implementation of the recommendations in AC 120-85.

Testifying at a congressional hearing on FAA safety programs in September 2006, Nicholas Sabatini, the agency's associate administrator for aviation safety, said that the hull loss accident rate for cargo aircraft in Part 121 operations has consistently improved and currently is about one-third of what it was in 1990.

Similar data are not available for Part 135 cargo operations, but Sabatini said that the total number of accidents in 2005 was about one-half of the total in 1990. "In both types of operations, the accident rates are declining," he said. "The trends are coming down." ●

U.S. Air Carrier Hull Loss and Fatal Accidents, 1987–2000



CFIT = Controlled flight into terrain LOC = Loss of control

Source: U.S. Federal Aviation Administration

Figure 3

Notes

1. Roelen, A.L.C.; Pikaar, A.J.; Ovaa, W. "An Analysis of the Safety Performance of Air Cargo Operators." *Flight Safety Digest* Volume 20 (July 2001).

2. Bailey, Larry L.; Peterson, Linda M.; Williams, Kevin W.; Thompson, Richard C. "Controlled Flight Into Terrain; A Study of Pilot Perspectives in Alaska." *Flight Safety Digest* Volume 20 (November–December 2001).