

Turbine accident stats 2000-2016: bizav accounts for more than half

by Gordon Gilbert

Business turbine airplane operations accounted for more than half of all turbine airplane accidents in the U.S. between 2000 and 2016. Over that 17-year period, business jets and turboprop airplanes combined suffered 771 accidents, 236 of which caused fatalities, according to the NTSB. These numbers represent 56 percent of all turbine airplane accidents in the U.S. (including the airlines) and 96 percent of the fatal accidents between 2000 and 2016.

Turboprops accounted for 70 percent of all U.S. turbine business airplane accidents and 75 percent of the fatalities. The 48 fatal accidents involving business jets were eight times the six fatal accidents involving passenger-carrying jetliners. However, the 159 fatalities from those bizav jet accidents were 31 percent of the 507 deaths on scheduled passenger flights by much more capacious airliners. On the airline side, 260 crew and passengers perished in a single accident, and in another airline accident a flight attendant was killed during an emergency evacuation after the airliner landed.

This data is derived from an NTSB computer run, prepared for AIN, that provides a detailed summary of what the agency concluded was every turbine airplane mishap that occurred in the U.S. between 2000 and 2016 under Parts 91, 91K, 135 on-demand, 135 scheduled, 121 and 125 (a total of 1,407 accidents). The NTSB also provided a list of the accident rates of these operational segments for the years 2004 through 2015.

PERSON VS PARCEL AND OTHER NON-PERTINENT

The purpose of this article is to focus on the private and on-demand segments in which personnel travel was the mission. As such, the Safety Board did its best to extract those aircraft and operations that didn't fit the accident criteria. Accidents involving experimental aircraft and ex-military trainers were removed. Aerial application, skydiving, public use, flight instruction and flight-testing were excluded because the NTSB deemed

U.S. Turbine Business Airplane and Airline Accidents • 2000-2016

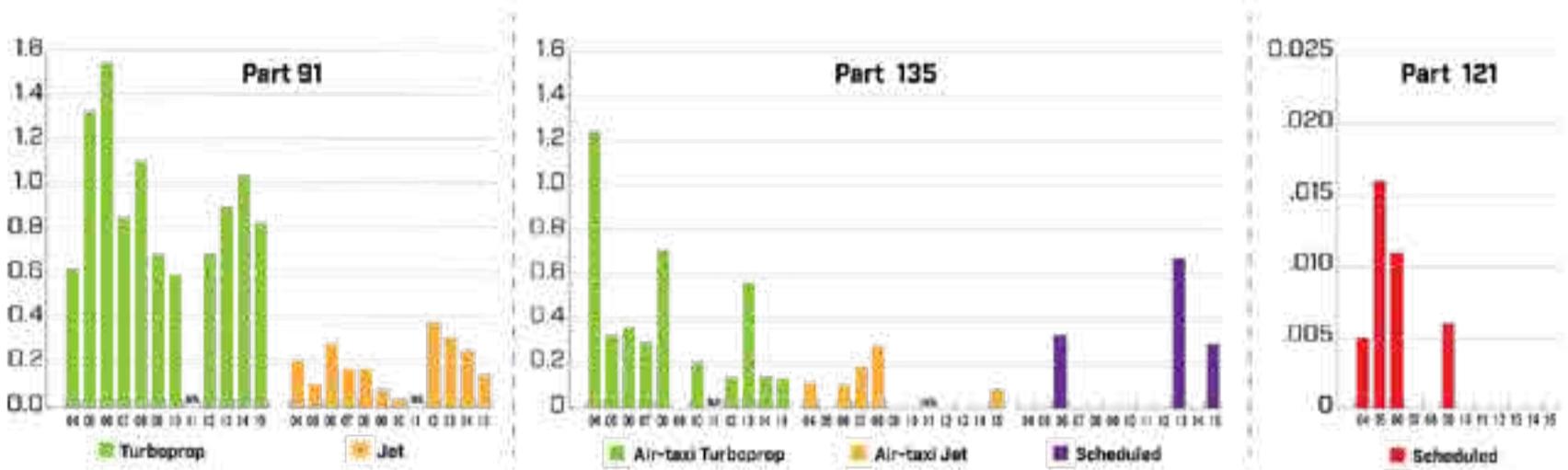
	Part 91 Business	Part 91 Pers	Part 91 Corp	Part 91 Pos/Ferry	Part 135 Air Taxi	Total All GA Ops	Part 135 Schd	Part 121 Schd/Nsched
Total	33	49	47	64	48	241	0	415
Nonfatal	29	34	40	52	38	193	0	409
Fatal	4	15	7	12	10	48	0	6
Fatalities	11	32	33	28	55	159	0	507
Total	61	212	36	76	145	530	33	74
Nonfatal	46	117	21	55	103	342	27	70
Fatal	15	95	15	21	42	188	6	4
Fatalities	39	243	51	35	114	482	26	103

Part 91 Corp includes three Part 91K nonfatal jet accidents and three Part 91K turboprop accidents.

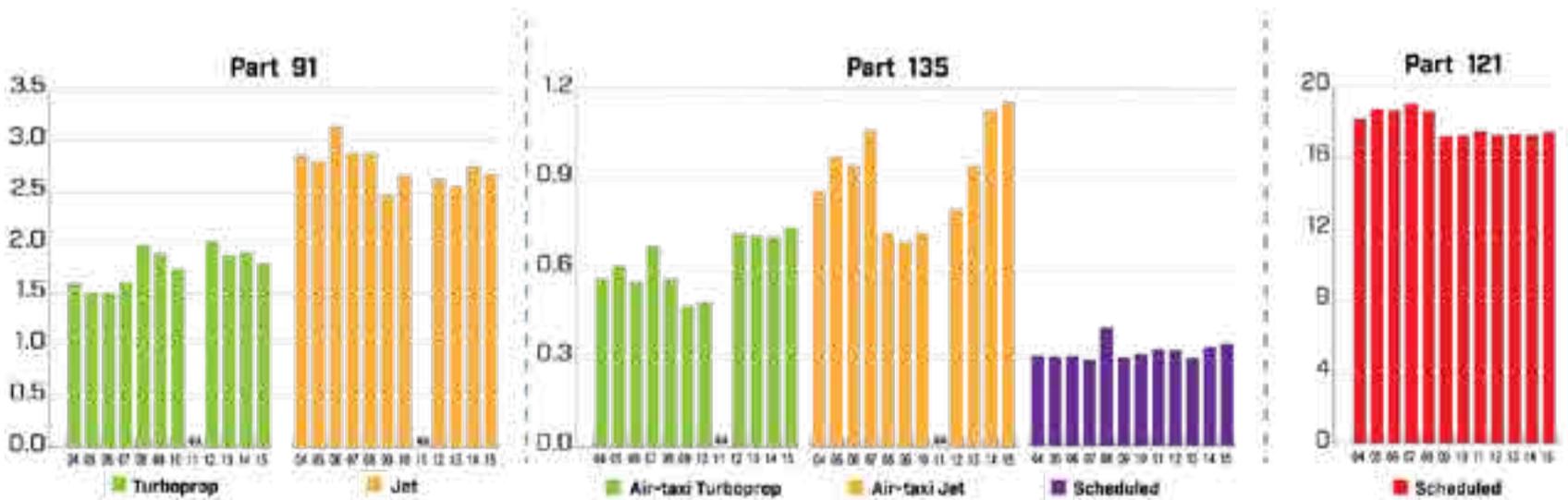
*Accidents involving cargo-only flights are not included. Source: NTSB

N/A = Not Available. No bars shown indicates no accidents that year for that segment.

FATAL ACCIDENT RATE 2004-2015 (per 100,000 flight hours)



ANNUAL FLIGHT HOURS 2004-2015 (in millions)



they “would not be relevant to your interest.”

In the flight-testing category, the Safety Board did not include in the detailed accident summary data the fatal manufacturer-flown accidents during test flying of the Swearingen SJ-30 in April 2003 and the Gulfstream G650 in April 2011. Technically, however, they occurred under Part 91 and are therefore calculated into the flight hour and rate data.

In addition, AIN omitted from the detailed summary database 114 Part 91 and 135 on-demand mishaps and Part 121 fatal accidents involving airplanes hauling parcels or other cargo. All told, the number of relevant Part 91, 91K, 135 and 121 accidents in the 16-year period was 1,293.

CREW TYPE IMPLICATIONS

Historically, it has been a given that aircraft crewed by paid or professional pilots have fewer accidents than those flown by their owners or other non-paid crew. A fact it might be, but quantifying it is

another matter. The NTSB divides general aviation accident statistics into five mission-based categories: corporate, positioning, air taxi, business and personal. Data shows that aircraft within the first three mission categories are almost always flown by paid pilots. The Safety Board’s business flight category consists primarily of aircraft with unpaid pilots.

Ascertaining the crew status for all personal missions, however, presents a problem. Accident reports in which the missions are labeled personal don’t always provide a distinction between paid and unpaid crews (although some reports have referred to the pilot as the airplane’s owner). Because AIN’s investigation of accident reports in the personal category shows that the overwhelming majority were being flown by non-paid pilots, references to paid pilots in this article apply only to those flying corporate, positioning and air-taxi missions.

In the 17-year period studied, jets being flown

U.S. Business Jet Accidents by Airplane Model Parts 91, 91K and 135 • Years 2000-2016

Manufacturer	Model	Total	Nonfatal	Fatal	Fatalities
Beechjet	400	7	7	0	0
Boeing	727/737	3	3	0	0
Bombardier	Challenger/Global	18	16	2	4
	Learjet	51	37	14	32
BAe	Hawker 125/800	9	6	3	17
Cessna	Citation	85	68	17	51
Dassault	Falcon	16	16	0	0
Grumman/Gulfstream	II/III/IV/V/150/200	17	14	3	28
Eclipse	500	5	5	0	0
Embraer	Phenom	7	6	1	3
IAI	Westwind	5	3	2	5
Mitsubishi	MU-300	3	3	0	0
Raytheon	Premier I	9	6	3	9
Rockwell	Sabreliner	6	3	3	10
Total		241	193	48	159

Source: NTSB. Accidents involving cargo-only flights not included.

by salaried crews under corporate Part 91 were involved in just seven fatal accidents, only one more than Part 121 jetliners during the same time frame. However, adding positioning and air-taxi flights to the mix results in 29 fatal accidents involving aircraft flown by paid pilots, or four times as many fatal crashes as Part 121 jets. The 19 fatal accidents attributable to business and personal Part 91 jets were three times as many as under Part 121.

The 12 fatal crashes of jet aircraft on positioning flights accounted for 34 percent of all Part 91 fatal accidents, and the 28 deaths from positioning missions represented 30 percent of all fatalities from Part 91 accidents. Bizjets operating under on-demand Part 135 suffered 10 fatal accidents.

Fatal crashes represented 20 percent of all 241 business jet accidents, but the 188 fatal crashes of

U.S. Business Turboprop Accidents by Airplane Model Parts 91, 91K and 135 • Years 2000-2016

Manufacturer	Model	Total	Nonfatal	Fatal	Fatalities
Beech	King Air	120	81	39	133
	A36*	8	2	6	13
	99/1900	21	16	5	9
Casa	212	2	1	1	6
Cessna	208	61	45	16	32
	210*	7	4	3	8
	206/207*	4	3	1	1
	402/421*	3	0	3	7
	Conquest	25	13	12	25
Convair	580	1	1	0	0
de Havilland Canada	DHC-2/3*	15	9	6	29
	DHC-6	7	5	2	2
Embraer	110/120	6	4	2	2
Fairchild	Turbo Porter	2	1	1	1
Grumman	Grumman G21*	1	0	1	4
Gulfstream	Rockwell Commander	25	15	10	25
Helio	Courier	1	1	0	0
Maule	Turbine	2	2	0	0
Mitsubishi	MU-2	34	16	18	33
Piaggio	Avanti	9	9	0	0
Pilatus	PC-12	22	14	8	28
Piper	Cheyenne	29	17	12	33
	PA-46-500 M/Meridian	37	25	12	26
	PA-46-310/350*	21	12	9	23
Quest	Kodiak	4	3	1	1
Short Brothers	SD3-30	12	9	3	8
Socata (Daher)	TBM 700/800	26	15	11	25
Swearingen	SA-227	25	19	6	8
Total		530	342	188	482

*Piston-powered airplanes converted to turbine power. Source: NTSB

turboprops accounted for 35 percent of all 530 propjet accidents. Turboprops being flown under corporate and business missions were involved in 15 fatal accidents each. Fatal accidents represented half of all the Part 91 corporate turboprop accidents but only a quarter of those in the Part 91 business category, despite the fact that the corporate flights were under the command of paid pilots.

By far the highest number of fatalities in turboprop accidents occurred under personal flying, unlike their jet counterparts. Those 243 deaths represented 53 percent of those killed in all turboprop crashes. There were three times more turboprop air-taxi accidents than air-taxi jet crashes, although Part 135 propjets flew many thousands of hours less each year than air-taxi jets, according to FAA activity figures. Air-taxi operations by turboprops netted 42 fatal accidents compared with six for scheduled charter turboprops.

ACCIDENTS BY AIRFRAME

Most models of business jet and turboprop experienced an accident of varying degrees of severity that required an investigation, according to the NTSB data. Purpose-built business jet models escaping fatalities in U.S. operations over the 16-year time frame were the Beechjet 400, Dassault Falcon, Eclipse 500 and Mitsubishi MU-300. The Piaggio Avanti was the only general aviation turboprop having more than two accidents that suffered no fatal crashes.

Citations and Learjets accounted for the most accidents among business jets: 136 versus 105 for all the other models combined. Of the 85 Citation accidents, 17 (21 percent) resulted in 51 fatalities. Twelve of the fatal Citation crashes were tagged as “personal or business” flights under Part 91; two were listed as flown by a salaried crew; and an air-taxi flight and a positioning flight accounted for two accidents. In another fatal crash under Part 91 in which a bird strike brought down a Citation 500, the NTSB didn’t report on the crew status.

Of the 51 Learjet crashes, 14 (28 percent) were fatal for 32 people. Seven, or half the fatal Learjet crashes, occurred while positioning the aircraft; six happened under Part 135 and only one under corporate Part 91. There were no Learjet fatal crashes listed specifically as flown by non-salaried crews, although this model had several nonfatal accidents under the command of unpaid pilots and being flown on personal or business missions.

Not surprisingly, considering the size of the fleet, King Airs accounted for more turboprop accidents than any other type, with a total of 120, or 22 percent of all propjet mishaps. The 39 fatal King Air accidents resulted in 133 deaths that broke down thus: corporate flights by paid pilots (30); business flights by unpaid pilots (17); personal flights (55); positioning flights (17); air taxi flights (13); and one in an unknown operation.

Cessna 208 Caravans conducting private, corporate and unscheduled air-taxi operations had a total of 61 accidents, 16 of them fatal for 32 people. The fatalities (shown in parentheses) broke down as positioning flights (one); air-taxi flights (15); personal (14); and business flights by unpaid pilots (two). There were no fatalities in the three corporate Caravan accidents being flown by a paid crew. Eighty-six Caravans carrying parcels or other cargo were involved in accidents.

The Piper PA-46-500 M/Meridian single had the third highest number of accidents and the seventh most fatalities among the turboprops: 37 total crashes and 26 people killed. All but one fatal crash occurred under the command of non-paid pilots. Piston-powered Piper PA-46s converted to turboprop power were involved in 21 total accidents and 23 fatalities. All accidents were being flown by non-paid pilots. No conversions were performed by Piper.

The Piper Cheyenne and Mitsubishi MU-2 tied for the second most fatalities in turboprop accidents, with 66 people dying.

Part 91K fractional operations were involved in

only six accidents in the 16-year period. The mishaps, resulting in minor or no injuries, befell three jets and two turboprops: Piaggio Avanti (twice), PC-12, Hawker 800XP, Challenger 300 and Citation 560XL.

RELATING THE RATES

The NTSB also provided AIN with rate data—accidents per 100,000 flight hours—from 2004 through 2015, the latest year for which full data was available. Before 2004 the FAA's activity data did not separate Part 91 and small Part 135 aircraft operations. Rate data effectively indicates how frequently accidents occur in relation to how many hours per year a particular operational segment flies.

As mentioned earlier, rate and flight-hour data for general aviation is based on more accidents than in the detailed accident summary because activity figures provided by the FAA, and that the NTSB uses to calculate the rates of general aviation accidents under Part 91, include “everything not in Parts 121 and 135,” the Board said. For example, “There are also experimental and ag airplanes powered by turboprops that were intentionally excluded from the detailed summary data.”

Readers will notice that there is no rate or flight-hour data for the general aviation segments in 2011. “We have two sources for activity data,” the NTSB explained. “They are the FAA general aviation and Part 135 non-scheduled activity reports, and DOT Form 41 data (which is processed by the FAA to calculate Part 121 and scheduled Part 135 activity).” In 2011 there was a new survey contractor and, according to sources, the FAA had some concerns about its methodology, so numbers were not published for that year.

Annual hours rose between 2004 and 2015 for all general aviation turbine segments except for Part 91 jet flying, according to the FAA's data. There appears to be no absolute correlation between changes in annual total flight hours and

the improvement or decline in accident rates. For example, when hours spiked in 2008 for Part 91 business jets the fatal rate remained the same as in 2007, a year of fewer hours. But in 2009, when flight hours bottomed, the Part 91 fatal jet rate declined too.

All GA segments except Part 91 turboprops had lower accident rates in 2015 than they did in 2004. Note that Part 121 operations ended the study period with a higher total accident rate despite annual activity plummeting by nearly 750,000 flight hours from 2004 to 2015.

Over the 12-year period for which the rate breakdown was available, Part 121 jetliners averaged 0.034 fatal accidents per 100,000 hours. Part 91 business jets averaged 0.197 for fatal accidents. The fatal rate for Part 135 air-taxi jets not only bettered that for the Part 91 jets, averaging 0.155, but also notched no fatal accidents in six of the years between 2004 and 2015. The fatal rate for turboprops under Part 135 averaged 0.414 and the segment had no fatal crashes in 2009. For turboprops flying Part 91, the fatal rate averaged 0.930. Rates were unavailable to compare Part 91 airplanes flown by paid crews with those flown by unpaid crews.

Nevertheless, these rates show that although airliners continue to remain civil aviation's safest segment, the Part 135 on-demand air taxi segment has the next lowest rate, followed by Part 91 jet operations, Part 135 on-demand turboprop flights and then the Part 91 turboprop category last.

The safety picture changes, however, when looking at numbers of accidents: while passenger airliners still have fewer fatal accidents than business airplanes, they do not have fewer fatalities than Part 91 aircraft flown by paid pilots. From 2000 through 2016, Part 91 corporate jets had seven fatal accidents that killed 33 people compared to six airline accidents in that period that were fatal to 507 passengers and crew. The bottom line: the bizav safety picture depends on how you see the numbers. □

The Infamous Seven

Over the 17-year period from 2000 to 2016, the NTSB investigated seven fatal accidents involving business jets on corporate flights being flown by salaried pilots under Part 91. In all, 33 people were killed. Passengers were being carried in all but one of the aircraft involved.

Rockwell Sabreliner, May 10, 2000, Kaunakakai, Hawaii. Fatalities: 6.

The airplane hit a mountain shortly after the pilots terminated an instrument approach and continued visually at night. The crew and four passengers were killed. "Inadequate crew coordination led to the captain's decision to discontinue the instrument approach procedure and initiate a maneuvering descent solely by visual references at night in an area of mountainous terrain," the NTSB concluded.

Learjet 24B, Dec. 23, 2003, Helendale, California. Fatalities: 2.

During flight at cruising altitude, the aircraft departed controlled flight and crashed. The captain and the first officer were killed, and the airplane was destroyed. Visual conditions prevailed for the flight, which operated on an IFR flight plan. The Safety Board could not determine why the crew lost control of the aircraft.

Cessna Citation 560, Feb. 16, 2005, Pueblo, Colorado. Fatalities: 8.

The two pilots and six passengers lost their lives when their aircraft, on an ILS approach in icing conditions, stalled and crashed. The NTSB blamed the flight crew for not effectively monitoring and maintaining airspeed, and not complying with procedures for deice boot activation on the approach, which caused an aerodynamic stall.

Cessna Citation 560, Jan. 24, 2006, Carlsbad, California, Fatalities: 4.

During the approach in a tailwind, the aircraft was flying 30 knots faster than the correct airspeed, resulting in touchdown 1,500 feet farther along the runway than normal, and much faster than normal. The captain then delayed the initiation of a go-around. Although the aircraft lifted off the runway, the delay resulted in the aircraft hitting a localizer antenna platform before striking terrain. Both pilots and two passengers were killed.

Beechcraft Premier, Feb. 20, 2013, Thomson, Georgia. Fatalities: 5.

En route the copilot had to remind the pilot about a speed restriction and also to adjust his altimeter. During the approach, an "anti-skid fail" message came on but even after the copilot commented on this, the pilot did not respond and ignored the warning. A few seconds after touchdown the pilot initiated a go-around but failed to retract the lift dump. The light jet lifted off near the departure end of the runway and the left wing struck a utility pole and the aircraft crashed, killing all five aboard. The NTSB said that contributing to the accident "was the pilot's lack of systems knowledge and his fatigue caused by acute sleep loss."

Canadair Challenger 600, Jan. 1, 2014, Aspen, Colorado. Fatalities: 1.

The final portion of the approach was not stabilized, the NTSB said. The airplane stayed nose down during the final descent and initial contact with the runway, after which it went airborne before hitting the runway again and coming to rest inverted. The copilot was killed. Contributing to the accident was the flight crew's decision to land with a tailwind above the airplane's operating limitations and failure to conduct a go-around when the approach became unstabilized.

Gulfstream IV, May 31, 2014, Bedford, Massachusetts. Fatalities: 7.

All seven people aboard were killed when the jet overran the end of the runway during a rejected takeoff after the pilots couldn't get the aircraft to rotate. The NTSB determined that the crew did not perform a flight control check before takeoff; were not aware that the gust lock system was engaged; and delayed starting the rejected takeoff procedure once they realized that the controls were locked. Contributing to the accident was the flight crew's "habitual noncompliance with checklists." —G.G.