LOC Up

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Loss of control accidents replaced CFIT as the leading cause of commercial aviation fatalities in 2007.

The overall safety of commercial jet operations worldwide remained excellent in 2007, but loss of control (LOC) accidents overtook controlled flight into terrain (CFIT) as the leading cause of fatalities. However, fatalities in accidents involving commercial jets, commercial turboprops and business aviation jets dropped to 763 from 903 in 2006.

While major commercial jet crashes increased from 11 in 2006 to 15 last year, eight accidents involved fatalities, compared with nine in 2006 (Table 1); deaths in commercial jet accidents dropped from 745 to 583. The 24 crashes of commercial turboprop aircraft in 2007 equaled the 2006 experience (Table 2); there were more fatalities in turboprop accidents, rising from 139 in 2006 to 159 last year. Business jets last year had 12 accidents that killed 21 people, compared with 10 accidents in 2006 and 19 deaths (Table 3, p. 14).

The encouraging safety picture came with a larger fleet in 2007. The total fleet of large jet transports rose 3.7 percent to 20,262, with 8 percent of that number Eastern-built. The fleet of commercial turboprops seating more than 14 passengers, 25 percent of which are Eastern-built, declined 2.1 percent to 6,350 airplanes. The number of business jets jumped 8.9 percent to 13,853. Fleets in regular commercial service are somewhat smaller; approximately 7 percent of the commercial turbojet fleet and 13 percent of the commercial turboprop fleet are inactive.

Of the 15 major accidents involving commercial jets in 2007 in all scheduled and unscheduled passenger and cargo operations, 11 were approach and landing accidents. There were two CFIT accidents and four LOC accidents.

Last year started out with only six major turboprop accidents by July. Normally, commercial turboprops average two to three times the number of commercial jet major accidents. The accident rate for the second half of the year was more typical for the turboprops.

While the major accident rate in accidents per million departures

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Major Accidents, Worldwide Commercial Jets
January 1, 2007–December 31, 2007

Date	Operator	Aircraft	Location	Phase	Fatal	
Jan. 1, 2007	Adam Air	737	Sulawesi, Indonesia	Enroute	102	●
Jan. 13, 2007	RPX Airlines	737	Kuching, Malaysia	Landing	0	
Feb. 13, 2007	Fort Aero	CRJ-100	Vnukovo, Russia	Takeoff	0	●
Feb. 21, 2007	Adam Air	737	Surabaya, Indonesia	Landing	0	
March 7, 2007	Garuda Indonesia	737	Yogyakarta, Indonesia	Landing	22	
March 17, 2007	UT Air	Tu-134	Samara, Russia	Landing	6	●
May 5, 2007	Kenya Airways	737	Douala, Cameroon	Takeoff	114	●
May 20, 2007	Air Canada Jazz	CRJ-100	Toronto, Canada	Landing	0	
June 28, 2007	TAAG Angola	737	M'banza Congo, Angola	Landing	5	
July 17, 2007	TAM	A320	São Paulo, Brazil	Landing	187	
July 17, 2007	Aero República	EMB-190	Santa Marta, Colombia	Landing	0	
Aug. 20, 2007	China Airlines	737	Naha, Okinawa, Japan	Post-Taxi	0	
Sept. 16, 2007	One-Two-Go Airline	MD-82	Phuket, Thailand	Landing	90	●
Oct. 26, 2007	Philippine Airlines	A320	Butuan, Philippines	Landing	0	
Nov. 30, 2007	Atlasjet Airlines	MD-83	Ispara, Turkey	Approach	57	●

● Loss-of-control accident ● CFIT accident

Source: Ascend and Aviation Safety Network

Table 1

Major Accidents, Worldwide Commercial/Corporate Jets
January 1, 2007–December 31, 2007

Date	Operator	Aircraft	Location	Phase	Fatal	
Jan. 7, 2007	Ahrenkiel Consulting	Premier 1A	St. Tropez, France	Landing	0	
Jan. 9, 2007	Ameristar Jet Charter	Lear 24	Guadalajara, Mexico	Approach	2	●
Jan. 12, 2007	SunQuest Air Charter	Citation I	Van Nuys, CA, USA	Takeoff	2	●
Jan. 24, 2007	Air Trek Air Ambulance	Citation II	Butler, PA, USA	Landing	0	
May 3, 2007	Hamilton Ranches	Citation II	Dillon, MT, USA	Approach	2	●
June 4, 2007	Toy Air	Citation II	Milwaukee, WI, USA	Climb	6	●
June 30, 2007	IHR Admin Services	Citation I	Conway Field, AK, USA	Landing	1	
July 5, 2007	Jett Paquetería	Sabreliner	Culiacán, Mexico	Takeoff	3	
Oct. 7, 2007	Private	Gulfstream II	Santo Domingo, Venezuela	Landing	2	●
Nov. 4, 2007	Reali Táxi Aéreo	Lear 35	São Paulo, Brazil	Takeoff	2	
Nov. 11, 2007	Jetport Inc.	Global 5000	Fox Harbor, Canada	Landing	0	
Dec. 26, 2007	Jet Connection Business	CL-604	Almaty, Kazakhstan	Takeoff	1	

● Loss-of-control accident ● CFIT accident

Source: Ascend and Aviation Safety Network

Table 2

Major Accidents, Worldwide Commercial Turboprops (> 14 Seats)
January 1, 2007–December 31, 2007

Date	Operator	Aircraft	Location	Phase	Fatal	
Jan 9, 2007	Aeriantur-M Airlines	AN-26	Adana, Turkey	Approach	32	
March 30, 2007	Airlink	EMB-110	New Britain, PNG	Descent	2	
May 17, 2007	Safe Air Company	LET-410	Walikale, DRC	Climb	3	●
June 21, 2007	Karibu Airways	LET-410	Kamina, DRC	Climb	10	
June 25, 2007	PMT Air	AN-24	Sihanoukville, Cambodia	Approach	22	●
June 26, 2007	Business Aviation	LET-410	Brazzaville, Congo	Enroute	0	
July 1, 2007	Jet Airways	ATR-72	Indore, India	Landing	0	
July 8, 2007	Laird Air	DHC-6	Muncho Lake, Canada	Climb	1	
July 23, 2007	Djibouti Airways	AN-26	Dire Dawa, Ethiopia	Takeoff	1	
July 29, 2007	ATRAN Cargo Airlines	AN-12	Moscow, Russia	Climb	7	
Aug. 9, 2007	Air Moorea	DHC-6	Moorea-Temae, Polynesia	Climb	20	
Aug. 12, 2007	Jeju Air	DHC-8	Busan, Korea	Landing	0	
Aug. 21, 2007	SELVA Colombia	AN-26	Pasto, Colombia	Landing	0	
Aug. 22, 2007	Two Táxi Aéreo	EMB-110	Curitiba, Brazil	Enroute	2	
Aug. 26, 2007	Great Lake Business	AN-32	Kogolo, DRC	Approach	10	
Aug. 27, 2007	SELVA Colombia	AN-32	Mitu, Colombia	Ground	0	
Aug. 31, 2007	Solenta Aviation	DHC-6	Punia, DRC	Enroute	0	
Sept. 7, 2007	Transavia Service	AN-12	Goma, DRC	Landing	8	
Sept. 20, 207	Arctic Circle Air Svc	Skyvan	Mystic Lake, Alaska, USA	Climb	1	
Sept. 24, 2007	Free Airlines	LET-410	Malemba Nkulu, DRC	Landing	1	
Oct. 4, 2007	Africa One	AN -26	Kinshasa, DRC	Climb	21	
Oct. 8, 2007	Nacional de Aviación	LET-410	Cubarral, Colombia	Enroute	18	
Oct. 17, 2007	Imtrec Aviation	AN-12	Phnom Penh, Cambodia	Landing	0	
Nov. 8, 2007	Juba Air Cargo	AN-12	Khartoum, Sudan	Landing	0	

● Loss-of-control accident ● CFIT accident

Source: Ascend

Table 3

CFIT, LOC and approach and landing accidents continue to claim the majority of the aircraft and account for the majority of the commercial aircraft fatalities, with only two commercial jet CFIT accidents in 2007. The chart highlights how difficult it is to eliminate CFIT accidents, except for one fact: No aircraft equipped with a functioning terrain awareness and warning system (TAWS) has ever had a CFIT accident. Only 5 percent of the commercial jets in the world do not have TAWS, yet all of the eight CFIT accidents over the last three years came from that small fraction of the fleet.

In addition to the commercial jet approach and landing accident record, business jets were involved in seven approach and landing accidents among the year's 12 accidents, and 50 percent of the turboprop major accidents occurred during approach and landing.

increased for the year, the five-year rolling average rate continues to show an encouraging slow decline (Figure 1). The major accident numbers are for both Western- and Eastern-built commercial jets, but the rate is for Western-built aircraft only because there are no reliable worldwide exposure data on Eastern-built aircraft with which to calculate rates.

The accident rate data highlight the considerable improvement made in aviation safety. If 2007 had the same rate as 1996, there would have been more than double the number of accidents during the year.

Clearly, the industry must continue to focus on this critical phase of flight (Figure 2, p. 16). Most, if not all, of the causes of these accidents are well documented; interventions that would have prevented them are addressed in the Flight Safety Foundation *ALAR Tool Kit*.

LOC accidents have taken over from CFIT as the leading killer in commercial jet operations. The term "loss of control" is somewhat misleading, since the flight crew often has total

control of the aircraft in this type of accident. The Foundation's definition of an LOC accident is: "an accident in which an aircraft is put into an unrecoverable position due to aircrew, aircraft or environmental factors, or a combination of these." Thus, the American Airlines Airbus A300 accident in 2001 was an LOC accident, the crew having no control after the loss of the vertical tail after takeoff from New York. Likewise, the 2004 Flash Airlines Boeing 737 accident in Egypt was an LOC accident, even though the crew had full control of the aircraft.

Runway Safety Initiative

The aviation industry today faces a major challenge in improving runway safety. Accidents on or near runways normally are high-visibility accidents since they happen at an airport, where there are a lot of people. As the numbers of other types of accidents decline, the relative importance of runway accidents has increased. When several international aviation organizations early last year asked the Foundation to coordinate a joint international effort to understand and address this challenge, the Runway Safety Initiative (RSI) was launched.

The RSI is using this definition of a runway safety issue: "Any safety issue that deals with the runway environment, or any surface being utilized as a runway, and the areas immediately adjacent to it, such as overruns or high-speed taxiways."

Runway safety issues fall into three broad categories: runway incursions (RI), runway excursions (RE) and the inappropriate use of runways — runway confusion (RC). International Civil Aviation Organization has published the following definition of a runway incursion: "Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and takeoff of aircraft." This new definition, recently adopted by the U.S. Federal Aviation Administration, brings most runway confusion incidents into the runway incursion category.

A runway incursion was the cause of the largest single aviation disaster ever, the 1977 collision of two Boeing 747s at Tenerife, Canary Islands. The worst runway incursion accident in the U.S. was at Los Angeles International Airport in 1991, resulting in 34 fatalities. The worst runway incursion accident in Europe occurred in 2001 at Linate airport, Milan, Italy, and resulted in 118 fatalities.

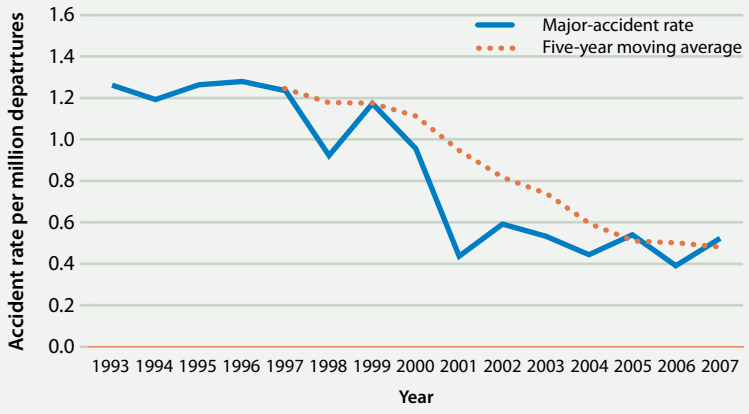
Runway incursions are part of a new breed of safety challenges in which there are not a lot of accidents — 10 in the last 14 years — but there are many incidents. Since basic risk management says risk equals probability times severity — and the severity potential of a runway incursion is high — the risk is

Accident Classification

Last year, Flight Safety Foundation changed from using "hull loss" as the primary accident criterion to a new standard, "major accident." A major accident is defined as an accident in which any of three conditions is met. The first condition is that the aircraft is destroyed or sustains major damage. Major damage is defined by the Ascend Damage Index (ADI), a measure developed by Paul Hayes of Ascend. The ADI is the ratio of the cost of repairs to the projected value of the aircraft had it been brand new at the time of the accident. If the ADI is over 50 percent, the damage is considered major. The second condition defining of a major accident is that there are multiple fatalities. The third condition is that there is one fatality and the aircraft is substantially damaged. The major accident classification criteria ensure that an accident is not determined by an aircraft's age or by its insurance coverage, and it gives a more accurate reflection of the high-risk areas that need to be addressed.

— JB

Western-Built Commercial Jet Major-Accident Rates, 1993–2007

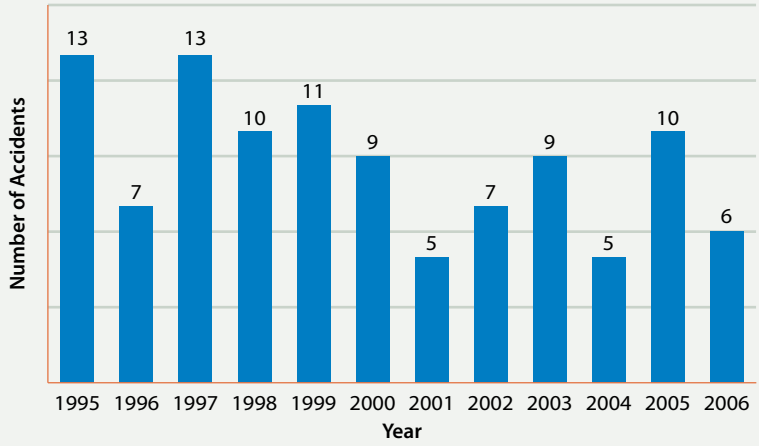


Note: Worldwide departures are estimated through Dec. 31, 2007. Total departure data are not available for Eastern-built aircraft.

Source: Ascend

Figure 1

Approach-and-Landing Major Accidents, Commercial Jets, 1995–2006



Source: Boeing, Ascend

Figure 2

high. Thus, runway incursions get a lot of attention despite the low number of accidents.

However, runway excursions, including overruns — going off the end of a runway — and veer-offs — going off the side of the runway — must not be overlooked. Many runway excursions incur minimal damage and do not cause deaths or injuries, yet in most years there are more fatalities associated with excursions than incursions. A runway excursion accident is unlike a CFIT accident, which, by definition, is "without prior knowledge of the crew." A runway excursion is normally not a total surprise to the crew.

Runway safety is influenced by many aviation industry elements. The stakeholders in this issue include almost everyone involved in aviation — manufacturers, aircraft operators, airports, air traffic control (ATC) and regulators.

Manufacturers do a great job of providing the operators with safe, reliable aircraft. They also provide operators with the data and procedures that crews need for normal and many non-normal operations. They currently are not required to provide data and procedures easily used by pilots for landing in all runway conditions. Without good data on how the aircraft will perform under certain runway conditions, landings become a series of physics experiments.

Operators must use available manufacturer information and provide crews with good standard operating procedures, to include stabilized approach criteria and a true "no fault" go-around policy. They must also provide crews with the training that will enable them to address runway safety challenges during line operations. The crews must practice good decision making, and they must have the information available to make good decisions. Although the flight crew may be the final link in the chain of runway safety, finding that the crew made an error should be the beginning of an investigation, not the end. The investigation needs to determine what role the airport, ATC, the regulator and even management played in the accident or incident.

Airports have a vital role in runway safety. Issues like airport design, lighting, approach aids, runway design, runway markings and signage, runway cleaning and clearing, runway condition measurement, and runway end safety areas are only part of a long list of items that an airport controls that can reduce the risk of a runway safety event.

ATC also plays a big role. As any pilot knows, ATC can destabilize any approach. Late runway changes and "slam dunk" approaches are just two examples of how ATC can destabilize an approach, and a stabilized approach is critical in reducing the risk of runway excursions.

Finally, the regulator plays a vital role in runway safety. It oversees all the stakeholders. It can also provide approaches with vertical guidance, critical to a stabilized approach.

The first product of the RSI is a Runway Safety Products Catalog (Table 4). This lists the material available to address certain aspects of runway safety. The RSI team has also provided data on runway safety issues. In compiling runway safety data (Table 5), runway excursions predominate in the number of both accidents and fatalities.

The RSI team has concluded that as an industry we are being effective in preventing runway incursion accidents, but the number of incidents and potential severity still present a very high risk. Runway excursions are the most common type of runway accident, and the most

Runway Safety Products Catalog

Product Title	Originator	Type Product	Target Audience
Runway incursion			
1. ICAO Runway Safety Toolkit	ICAO	CD and web	Aircrew, airports, ATM, management
2. Runway and Surface Safety	FAA	CD and web	Flight instructors, pilot examiners
3. Taxi 101	FAA	CD and web	Maintenance personnel
4. Runway Incursion Prevention	FAA, ACI, IATA, PAAST	CD and web	Aircrew, airports, ATM program
5. European Action Plan for the Prevention of Runway Incursions	Eurocontrol et al	CD and web	Aircrews, airports, ATM vehicle drivers
6. Runway Incursion Joint Safety Analysis and Implementation Team Reports	FAA (CAST)	CD	Aircrews, airports, ATM
7. FAA Runway Safety Website	FAA	Web site	Aircrews, ATM, vehicle drivers
8. Enhanced Taxiway Centerline	FAA	CD and web	Aircrews, ATM, airports
9. AOPA Runway Safety Course	FAA, AOPA	Web site	General aviation pilots
10. ALPA Runway Safety Course	FAA, ALPA	Web site	Aircrews
11. ACI Airside Safety Handbook	ACI	Handbook	Airports
12. Sporty's Pilot Guide to Runway Safety	Sporty's	CD	General aviation pilots
Runway excursion			
1. ALAR Tool Kit	Flight Safety Foundation	CD	Aircrews, ATM, airports
2. Managing Threats and Errors During Approach and Landing: How to Avoid a Runway Overrun	Flight Safety Foundation	Web	Aircrews
3. Takeoff Safety Training Aid	FAA	CD and web	Aircrews
Runway confusion			
Many runway incursion products may be applicable here.			

Note: These groups are participating in the RSI: European Aviation Safety Agency, Civil Air Navigation Services Organisation, International Federation of Air Line Pilots Associations, U.S. Federal Aviation Administration, Air Traffic Control The Netherlands (LVNL), Boeing, Airbus, Embraer, Direction Générale de l'Aviation Civile - France, International Federation of Air Traffic Controllers' Associations, National Aerospace Laboratory (NLR) - Netherlands, Airports Council International, International Air Transport Association, European Regions Airline Association, Eurocontrol, Association of Asia Pacific Airlines, U.S. National Transportation Safety Board, and Association of European Airlines.

Source: FSF Runway Safety Initiative

Table 4

common type of fatal runway safety accident. The severity of a runway excursion depends on the energy of the aircraft when departing the runway environment and on the airport layout. A major risk reduction factor is flying a stabilized approach and landing in the touchdown zone. Not every unstabilized approach ends up as an excursion — but almost every excursion starts with an unstable approach.

In preventing runway confusion, many of the interventions developed for runway incursions, such as moving maps, signage, etc., will be beneficial.

The Foundation continues to strive to make aviation safer by reducing the risk of an accident. We have had great success advancing toward that goal, but challenges remain. In an industry where the risk will never be zero, we face a constant challenge in meeting the public's expectation of perfection as the minimum acceptable standard. ●

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Runway Safety Fatality Data, 1995–2007

	Number of Fatal Accidents	Onboard Fatalities
Incursions	5	129
Excursions	31	680
Confusion	2	132
Total	**464**	**941**

Note: The total number of accidents was 1,332.

Source: FSF Runway Safety Initiative

Table 5