FLIGHT SAFETY FOUNDATION

ALAR

APPROACH-AND-LANDING ACCIDENT REDUCTION

TOOL KIT

FSF ALAR BRIEFING NOTE 5.1

Approach Hazards Overview

Few air transport accidents occur on calm sunny days; risk increases during flight over hilly terrain, with reduced visibility, adverse winds, contaminated runways and limited approach aids. Visual illusions also can contribute to approach-and-landing accidents.

Statistical Data

The Flight Safety Foundation Approach-and-landing Accident Reduction (ALAR) Task Force, in an analysis of 76 approach-and-landing accidents and serious incidents, including controlled-flight-into-terrain (CFIT) accidents, worldwide in 1984 through 1997,[1] found that:

- Fifty-three percent of the accidents and incidents occurred during nonprecision instrument approaches or visual approaches (42 percent of the visual approaches were conducted where an instrument landing system [ILS] approach was available);
- Fifty percent occurred where no radar service was available;
- Sixty-seven percent of the CFIT accidents occurred in hilly terrain or mountainous terrain;
- Fifty-nine percent of the accidents and incidents occurred in instrument meteorological conditions (IMC);
- Fifty percent occurred in precipitation (snow, rain);
- Fifty-three percent occurred in darkness or twilight;
- Thirty-three percent involved adverse wind conditions (i.e., strong crosswinds, tail winds or wind shear);
- Twenty-one percent involved flight crew disorientation or visual illusions;
- Twenty-nine percent involved nonfitment of available safety equipment (e.g., ground-proximity warning system [GPWS] or radio altimeter);
- Eighteen percent involved runway conditions (e.g., wet or contaminated by standing water, slush, snow or ice); and,
- Twenty-one percent involved inadequate ground aids (e.g., navigation aids, approach/runway lights or visual approach-slope guidance).

Awareness Program

A company awareness program on approach-and-landing hazards should emphasize the following elements that lead to good crew decisions:

- Use the FSF *Approach-and-Landing Risk Awareness Tool* to heighten crew awareness of the specific hazards to the approach;
- Use the FSF *Approach-and-Landing Risk Reduction Guide*;
- Anticipate by asking, "What if?" and prepare;
- Identify threats during approach briefings;
- Adhere to standard operating procedures (SOPs) and published limitations; and,
- Prepare options, such as:
  - Request a precision approach into the wind;
  - Select an approach gate[2] for a stabilized approach (see recommendations);
  - Wait for better conditions; or,
  - Divert to an airport with better conditions.

The company awareness program should include review and discussion of factors that may contribute to approach-and-landing accidents.

Approach briefings should include factors that are:

- Known to the crew (e.g., by means of notices to airmen [NOTAMs], dispatcher's briefing, automatic terminal information system [ATIS], etc.; or,

Recommended Elements of a Stabilized Approach

All flights must be stabilized by 1,000 ft above airport elevation in instrument meteorological conditions (IMC) and by 500 ft above airport elevation in visual meteorological conditions (VMC). An approach is stabilized when all of the following criteria are met:

1. The aircraft is on the correct flight path;
2. Only small changes in heading/pitch are required to maintain the correct flight path;
3. The aircraft speed is not more than V_{REF} + 20 kt indicated airspeed and not less than V_{REF};
4. The aircraft is in the correct landing configuration;
5. Sink rate is no greater than 1,000 fpm; if an approach requires a sink rate greater than 1,000 fpm, a special briefing should be conducted;
6. Power setting is appropriate for the aircraft configuration and is not below the minimum power for approach as defined by the aircraft operating manual;
7. All briefings and checklists have been conducted;
8. Specific types of approaches are stabilized if they also fulfill the following: instrument landing system (ILS) approaches must be flown within one dot of the glideslope and localizer; a Category II or Category III ILS approach must be flown within the expanded localizer band; during a circling approach, wings should be level on final when the aircraft reaches 300 ft above airport elevation; and,
9. Unique approach procedures or abnormal conditions requiring a deviation from the above elements of a stabilized approach require a special briefing.

An approach that becomes unstabilized below 1,000 ft above airport elevation in IMC or below 500 ft above airport elevation in VMC requires an immediate go-around.

Source: FSF ALAR Task Force

- Unknown and thus discovered as the approach and landing progresses.

The following FSF ALAR Briefing Notes provide information to supplement this discussion:

- 5.2 — Terrain;
- 5.3 — Visual Illusions;
- 5.4 — Wind Shear;
- 6.1 — Being Prepared to Go Around; and,
- 6.3 — Terrain-Avoidance (Pull-up) Maneuver.

Notes

1. Flight Safety Foundation. "Killers in Aviation: FSF Task Force Presents Facts About Approach-and-landing and Controlled-flight-into-terrain Accidents." *Flight Safety Digest* Volume 17 (November–December 1998) and Volume 18 (January–February 1999): 1–121. The facts presented by the FSF ALAR Task Force were based on analyses of 287 fatal approach-and-landing accidents (ALAs) that occurred in 1980 through 1996 involving turbine aircraft weighing more than 12,500 pounds/5,700 kilograms, detailed studies of 76 ALAs and serious incidents in 1984 through 1997 and audits of about 3,300 flights.
2. The FSF Approach-and-landing Accident Reduction (ALAR) Task Force defines *approach gate* as "a point in space (1,000 feet above airport elevation in instrument meteorological conditions or 500 feet above airport elevation in visual meteorological conditions) at which a go-around is required if the aircraft does not meet defined stabilized approach criteria."

Related Reading From FSF Publications

Brotak, Ed. "Extreme Weather Makers." *AeroSafety World* Volume 4 (July 2009).

Bjellos, David. "Practical Necessity." *AeroSafety World* Volume 4 (July 2009).

Lacagnina, Mark. "Short Flight, Long Odds." *AeroSafety World* Volume 4 (May 2009).

Werfelman, Linda. "Flying Into the Sea." *AeroSafety World* Volume 4 (January 2009).

Dean, Alan; Pruchnicki, Shawn. "Deadly Omissions." *AeroSafety World* Volume 3 (December 2008).

Mook, Reinhard. "Treacherous Thawing." *AeroSafety World* Volume 3 (October 2008).

Lacagnina, Mark. "Missed Assessment." *AeroSafety World* Volume 3 (October 2008).

Lacagnina, Mark. "Snowed." *AeroSafety World* Volume 3 (September 2008).

Werfelman, Linda. "Safety on the Straight and Narrow." *AeroSafety World* Volume 3 (August 2008).

Lacagnina, Mark. "Bad Call." *AeroSafety World* Volume 3 (July 2008).

Lacagnina, Mark. "Close Call in Khartoum." *AeroSafety World* Volume 3 (March 2008).

Werfelman, Linda. "Blindsided." *AeroSafety World* Volume 3 (February 2008).

Carbaugh, David. "Good for Business." *AeroSafety World* Volume 2 (December 2007).

Bateman, Don; McKinney, Dick. "Dive-and-Drive Dangers." *AeroSafety World* Volume 2 (November 2007).

Tarnowski, Etienne. "From Nonprecision to Precision-Like Approaches." *AeroSafety World* Volume 2 (October 2007).

FSF International Advisory Committee. "Pursuing Precision." *AeroSafety World* Volume 2 (September 2007).

Johnsen, Oddvard. "Improving Braking Action Reports." *AeroSafety World* Volume 2 (August 2007).

Lacagnina, Mark. "CFIT in Queensland." *AeroSafety World* Volume 2 (June 2007).

Rosenkrans, Wayne. "Real-Time Defenses." *AeroSafety World* Volume 2 (May 2007).

Donoghue, J.A. "Incursions, Excursions and Confusions." *AeroSafety World* Volume 2 (March 2007).

Fahlgren, Gunnar. "Tail Wind Traps." *AeroSafety World* Volume 2 (March 2007).

Rosenkrans, Wayne. "Knowing the Distance." *AeroSafety World* Volume 2 (February 2007).

Gurney, Dan. "Last Line of Defense." *AeroSafety World* Volume 2 (January 2007).

Berman, Benjamin A.; Dismukes, R. Key. "Pressing the Approach." *AviationSafety World* Volume 1 (December 2006).

Rash, Clarence E. "Flying Blind." *AviationSafety World* Volume 1 (December 2006).

Gurney, Dan. "Tricks of Light." *AviationSafety World* Volume 1 (November 2006).

Rosenkrans, Wayne. "CFIT Checklist Goes Digital." *AviationSafety World* Volume 1 (August 2006).

Gurney, Dan. "Night VMC." *AviationSafety World* Volume 1 (July 2006).

Flight Safety Foundation (FSF) Editorial Staff. "Fast, Low Approach Leads to Long Landing and Overrun." *Accident Prevention* Volume 63 (January 2006).

FSF Editorial Staff. "DC-10 Overruns Runway in Tahiti While Being Landed in a Storm." *Accident Prevention* Volume 62 (August 2005).

FSF Editorial Staff. "B-737 Crew's Unstabilized Approach Results in Overrun of a Wet Runway." *Accident Prevention* Volume 60 (July 2003).

FSF Editorial Staff. "Sabreliner Strikes Mountain Ridge During Night Visual Approach." *Accident Prevention* Volume 60 (April 2003).

FSF Editorial Staff. "Inadequate Weather Communication Cited in B-737 Microburst-downdraft Incident." *Airport Operations* Volume 29 (January–February 2003).

FSF Editorial Staff. "Reduced Visibility, Mountainous Terrain Cited in Gulfstream III CFIT at Aspen." *Accident Prevention* Volume 59 (November 2002).

FSF Editorial Staff. "Erroneous ILS Indications Pose Risk of Controlled Flight Into Terrain." *Flight Safety Digest* Volume 21 (July 2002).

Veillette, Patrick R. "Data Show That U.S. Wake-turbulence Accidents Are Most Frequent at Low Altitude and During Approach and Landing." *Flight Safety Digest* Volume 21 (March–April 2002).

FSF Editorial Staff. "MD-82 Overruns Runway While Landing in Proximity of Severe Thunderstorms." *Accident Prevention* Volume 59 (February 2002).

FSF Editorial Staff. "Cargo Airplane Strikes Frozen Sea During Approach in Whiteout Conditions." *Accident Prevention* Volume 59 (January 2002).

FSF Editorial Staff. "Runway Overrun Occurs After Captain Cancels Go-around." *Accident Prevention* Volume 58 (June 2001).

FSF Editorial Staff. "During Nonprecision Approach at Night, MD-83 Descends Below Minimum Descent Altitude and Contacts Trees, Resulting in Engine Flame-out and Touchdown Short of Runway." *Accident Prevention* Volume 54 (April 1997).

FSF Editorial Staff. "Dubrovnik-bound Flight Crew's Improperly Flown Nonprecision Instrument Approach Results in Controlled-Flight-into-Terrain Accident." *Flight Safety Digest* Volume 15 (July–August 1996).

FSF Editorial Staff. "Captain's Failure to Establish Stabilized Approach Results in Controlled-flight-into-terrain Commuter Accident." *Accident Prevention* Volume 52 (July 1995).

Duke, Thomas A.; FSF Editorial Staff. "Aircraft Descended Below Minimum Sector Altitude and Crew Failed to Respond to GPWS as Chartered Boeing 707 Flew into Mountain in Azores." *Accident Prevention* Volume 52 (February 1995).

Lawton, Russell. "Breakdown in Coordination by Commuter Crew During Unstabilized Approach Results in Controlled-flight-into-terrain Accident." *Accident Prevention* Volume 51 (September 1994).

Lawton, Russell. "Captain Stops First Officer's Go-around, DC-9 Becomes Controlled-flight-into-terrain (CFIT) Accident." *Accident Prevention* Volume 51 (February 1994).

FSF Editorial Staff. "Cockpit Coordination, Training Issues Pivotal in Fatal Approach-to-Landing Accident." *Accident Prevention* Volume 51 (January 1994).

Notice

The Flight Safety Foundation (FSF) Approach-and-Landing Accident Reduction (ALAR) Task Force produced this briefing note to help prevent approach-and-landing accidents, including those involving controlled flight into terrain. The briefing note is based on the task force's data-driven conclusions and recommendations, as well as data from the U.S. Commercial Aviation Safety Team's Joint Safety Analysis Team and the European Joint Aviation Authorities Safety Strategy Initiative.

This briefing note is one of 33 briefing notes that comprise a fundamental part of the FSF *ALAR Tool Kit,* which includes a variety of other safety products that also have been developed to help prevent approach-and-landing accidents.

The briefing notes have been prepared primarily for operators and pilots of turbine-powered airplanes with underwing-mounted engines, but they can be adapted for those who operate airplanes with fuselage-mounted turbine engines, turboprop power plants or piston engines. The briefing notes also address operations with the following: electronic flight instrument systems; integrated autopilots, flight directors and autothrottle systems; flight management systems; automatic ground spoilers; autobrakes; thrust reversers; manufacturers'/operators' standard operating procedures; and, two-person flight crews.

This information is not intended to supersede operators' or manufacturers' policies, practices or requirements, and is not intended to supersede government regulations.

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