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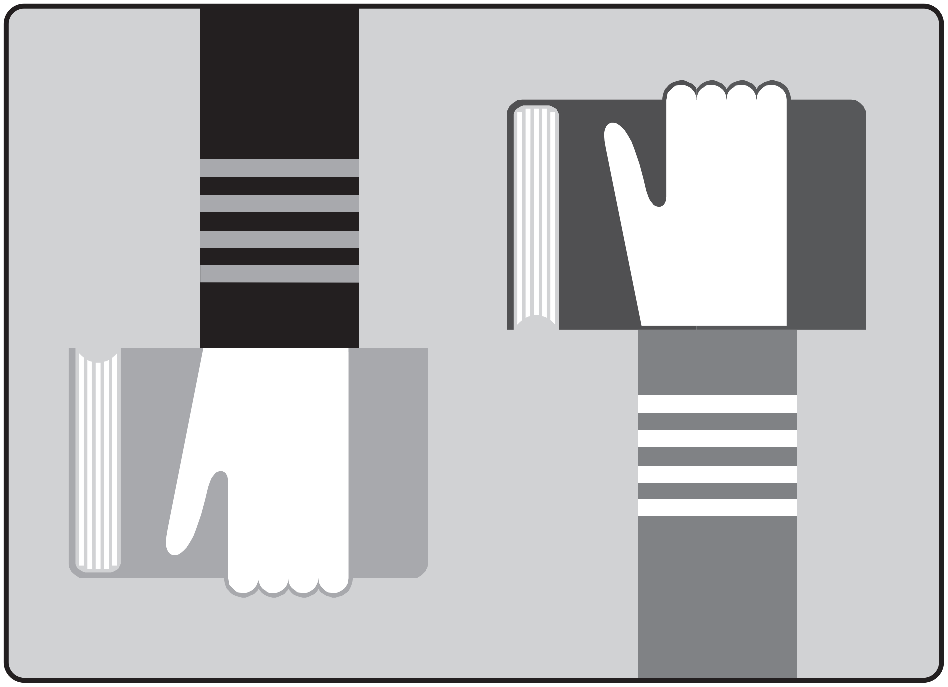
FLIGHT SAFETY
DIGEST

Mixed-crew Operations Require Special Consideration In Company Flight Manuals



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In This Issue

Flight Safety Foundation (FSF) is an international membership organization dedicated to the continuous improvement of flight safety. Nonprofit and independent, FSF was launched in 1945 in response to the aviation industry's need for a neutral clearinghouse to disseminate objective safety information, and for a credible and knowledgeable body that would identify threats to safety, analyze the problems and recommend practical solutions to them. Since its beginning, the Foundation has acted in the public interest to produce positive influence on aviation safety. Today, the Foundation provides leadership to more than 660 member organizations in 77 countries.

Mixed-crew Operations Require Special Consideration in Company Flight Manuals

An accident in a Gulfstream IV flown by pilots employed by different companies calls attention to issues that arise in mixed-crew pairings based on interchange agreements.

John A. Pope
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A Gulfstream IV, registered to Alberto-Culver USA but operated under the terms of an interchange agreement between Alberto-Culver and the Aon Corp., struck terrain after becoming briefly airborne following a loss of control during the takeoff roll on Runway 34 Palwaukee Municipal Airport, Wheeling, Illinois, U.S. The aircraft was destroyed by impact forces and a postimpact fire. The pilot flying (PF), the pilot not flying (PNF), the flight attendant and the one passenger were killed in the Oct. 30, 1996, accident.

The accident occurred in daylight visual meteorological conditions (VMC).

The U.S. National Transportation Safety Board (NTSB) determined that the probable cause of the accident was "the failure of the pilot-in-command (PIC) to maintain directional control of the airplane during the takeoff roll in a gusty crosswind, his failure to abort the takeoff and the failure of the copilot to adequately monitor and/or take sufficient remedial action to help avoid the occurrence.

Factors relating to the accident included the gusty crosswind condition, the drainage ditch, the flight crew's inadequate preflight, the nose-wheel steering-control select switch in the HANDWHEEL ONLY position and the lack of standardization of the two companies' operations manuals and interchange agreement."

The NTSB factual report on the accident revealed issues relative to abort procedures and the cockpit management characteristics of each pilot.

Under U.S. Federal Aviation Regulations (FARs) Part 91.501(c)(2), an interchange agreement enables a person to lease an airplane to another person in exchange for equal time, when needed, on the other person's airplane. No charge, assessment or fee is made, except that a charge may be made to compensate for the difference in the cost of owning, operating and maintaining the two airplanes.

The interchange agreement under which the flight was operating enabled each company to lease its G-IV airplane to the other company. For the accident flight, Aon had obtained the use of the aircraft owned by Alberto-Culver. Aon furnished one pilot, Alberto-Culver the other pilot.

"There was no mention made in the interchange agreement concerning mixed crews, nor was there any reference to mixed-crew operations in either company's operations manual," said the NTSB report. "Furthermore, in the event of a mixed-crew operation, there were no written or otherwise formal procedures for integrating the differences in company operating procedures."

The flight, operating under FARs Part 91, was scheduled to depart at 1300 hours local time under an instrument flight rules

(IFR) flight plan. The intended destination was the Burbank-Glendale-Pasadena (California, U.S.) Airport, with a return flight to Palwaukee scheduled for the following day.

The Alberto-Culver pilot, hereafter called the PNF, occupied the right seat and was listed as copilot on the flight plan for the first day of the trip. The pilot from Aon was in the left seat and was listed on the flight plan as PIC, and will be referred to hereafter as the PF. For the return flight planned for the following day, the Alberto-Culver pilot, who filed the flight plan, listed himself as PIC.

The weather conditions reported on the automatic terminal information service (ATIS) and recorded on the G-IV's cockpit voice recorder (CVR) were: wind estimated from 280 degrees at 20 knots (37 kilometers per hour [kph]) with gusts to 35 knots (65 kph); visibility greater than 10 miles (16 kilometers), estimated 2,500 feet (763 meters) overcast and altimeter setting 29.75 inches of mercury.

The NTSB report said, "The audio quality of the four-channel CVR [cockpit voice recorder] was extremely poor. The cockpit-area microphone track was dominated by a 400-Hz [hertz] tone which effectively masked the crewmember conversation." Nevertheless, fragments of the pilots' interaction with one another and with the tower could be discerned.

At 1229:25, the ATIS information "Foxtrot" was heard over the communications channel of the CVR.

Between 1229:25 and 1259:18, the pilots can be heard going through the aircraft checklists, but because of the poor tape quality, only fragments of their checklist challenges and responses can be heard.

At 1242:26, the air traffic controller issued the airplane its flight clearance.

At 1253:39, the PNF could be heard going through the checklist items for the nose-wheel steering and the pedal steering, but the responses were unintelligible.

At 1254:39, the aircraft was cleared to taxi to Runway 34.

At 1255:04, the PNF indicated that the flaps were set at 20.

At 1255.26, the PNF called for "crew brief."

At 1256:22, there were several seconds of unintelligible conversation.

At 1257:28, the air traffic controller instructed the accident aircraft to expedite down Runway 16 to the Runway 34 pad.

At 1257:33, the PNF responded, "We'll hustle down the 34 pad, Alpha Charlie."

At 1258:00, the ground controller asked the accident aircraft, "Will you be ready at the end?"

At 1258:03, the PNF responded, "Yes, we will, Alpha Charlie."

At 1259:13, the tower controller instructed the accident aircraft, "Two Three Charlie, 34 expedite departure, turn left heading two niner zero. Cleared for takeoff."

At 1259:18, the PNF responded, "Cleared for takeoff, heading two nine zero. We'll hurry it out."

At 1259:35, sounds similar to an increase in engine rpm (revolutions per minute) were heard.

At 1259:48, several unintelligible words were recorded.

At 1259:53, the PNF said, "Larry."

At 1259:56, a sound similar to a human grunt was recorded.

At 1259:58, the PNF said, "Larry."

At 1300:01, rumbling sounds similar to that of an aircraft departing the runway were recorded.

At 1300:02, the sound of a triple caution chime was recorded.

At 1300:03, the PNF said, "Reverse."

At 1300:04, the following words were recorded: "No no no." (The CVR group could not determine which pilot made the statement.)

At 1300:05, the following words were recorded: "Go go go go, go." (The CVR group could not determine which pilot made the statement.)

At 1300:06, the sound of an unidentified tone of increasing frequency was heard.

At 1300:06, the sound of a triple caution chime was recorded.

At 1300:07, the CVR stopped recording.

The G-IV's tire tracks on the runway, examined in the investigation, indicated that the aircraft began to veer to the left as it passed the intersection of Runway 12-30 (Figure 1). The nose-gear tire tracks then ended but main-gear tire tracks continued through the grass beside the runway. The tire marks did not indicate braking action.

"The airplane traversed a shallow ditch that paralleled the runway, which resulted in separation of both main landing gear, the left and right flaps and a piece of left-aileron control cable from the airplane," said the NTSB brief of accident.

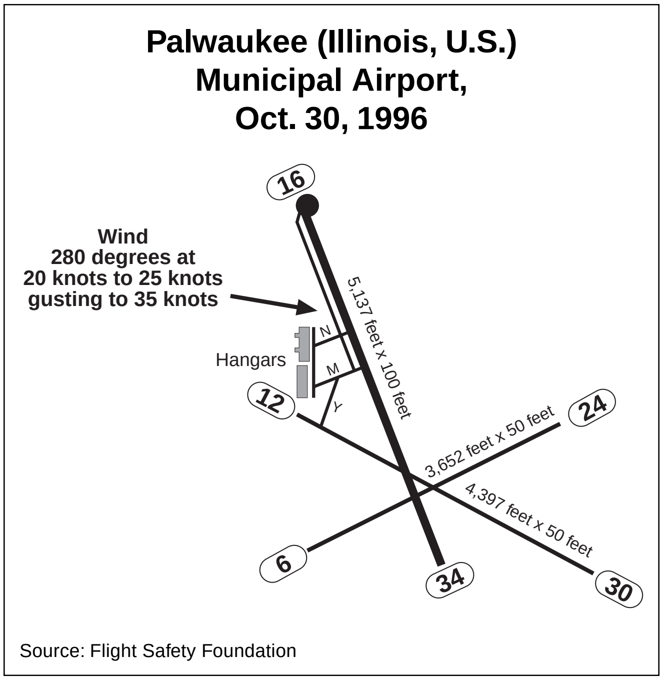

Figure 1

The G-IV, remaining off the runway, crossed Taxiways Yankee, Mike and November.

"The airplane slid on its belly roughly parallel with the runway and momentarily [became] airborne when it launched off a small berm near the departure end of Runway 34," said the report.

The aircraft flew over a road, struck an embankment, crossed another road, slid across a field and a stream bed, and stopped on the edge of an apartment-complex parking lot. An airport employee said that the aft portion of the aircraft exploded before the G-IV left the airport boundary. Another witness said that the explosion occurred at an estimated altitude of 20 feet.

"Witnesses reported that the airplane was engulfed in flames by the time it came to a stop in the parking lot … ," said the report. "They reported that rescue or evacuation of the persons on board the aircraft was not possible [because of] the fire and smoke."

The NTSB report discussed the nose-wheel steering switch that is standard equipment in G-IVs and is located on the nose-wheel steering-control panel forward of the nose-wheel-steering tiller (handwheel), on the left console.

"The switch was guarded by a red guard and was in the ON position when the red guard was down, allowing nose-wheel steering to be controlled by both tiller and rudder pedals," said the report. "If the switch was in the OFF position, nose-wheel steering control would be disabled both at the tiller and at the rudder pedals.

"According to the Alberto-Culver chief pilot and the Aon director of aviation, it was standard procedure at their respective flight departments to turn the nose-wheel steering switch to OFF for the preflight check, otherwise the switch was left in the guarded ON position."

Both the Alberto-Culver G-IV and the Aon G-IV had been modified with a nose-wheel steering-select control.

"This modification allowed the tiller to control nose-wheel steering while disabling nose-wheel steering by rudder pedals," said the report. "It was a two-position switch labeled NORMAL and HANDWHEEL ONLY. In the NORMAL position, nose-wheel steering could be controlled by both tiller and rudder pedals. In the HANDWHEEL ONLY position, the rudder pedals' input to the nose-wheel steering would be disabled, but the tiller input would remain enabled."

The nose-wheel steering-select control was installed on the left console aft of the tiller in the Alberto-Culver aircraft. The control was mounted on the center console in the Aon G-IV.

There also were differences between Alberto-Culver pilots and Aon pilots in procedures for using the control.

The report said, "According to the Alberto-Culver chief pilot, use of the nose-wheel steering-select control switch was at the discretion of the [PF]. Alberto-Culver pilots varied in their usage of the switch.

"The Alberto-Culver chief pilot, for example, reported that he usually left the switch in the HANDWHEEL ONLY position for the entire flight. He reported that the PNF [of the accident aircraft] usually left the switch in the NORMAL position for the entire flight.

"According to the Aon director of aviation, Aon pilots [and therefore, the PF of the accident flight] left the nose-wheel steering-select control switch in the NORMAL position all the time and turned the red-guarded nose-wheel steering switch OFF during the preflight control check, and then back ON prior to taxi."

Following the accident, the nose-wheel steering-select control switch was found in the HANDWHEEL ONLY position.

The Alberto-Culver operations manual said that either pilot could command an abort by saying, "Abort."

The Alberto-Culver manual said, "When an abort is commanded, the captain will immediately apply wheel brakes and simultaneously retard the power levers to idle, [and] initiate reverse thrust. The first officer will hold forward pressure on the yoke and manually deploy the speed brakes. The captain will guard the nose-wheel steering control and apply nose-wheel steering as necessary."

Under Alberto-Culver procedures, malfunctions that would be causes for an abort included engine failure, engine fire, oil-pressure light, engine-hot light, ground spoilers, thrust-reverser unlock light and pylon-hot light.

The Aon operations manual said that the PIC could, at his or her discretion, declare an emergency under circumstances that jeopardized flight safety. The PIC then would issue orders for responding to the emergency. No specific procedures for an aborted takeoff were given in the Aon manual.

"Neither the Alberto-Culver operations manual, the Aon operations manual [nor] the G-IV airplane flight manual [specifies] procedures for aborted takeoffs [caused by] loss of directional control during takeoff," said the report.

The PF, 53, had an airline transport pilot (ATP) certificate with airplane multi-engine land and airplane single-engine land ratings, and he was type-rated in the G-IV. He had a second-class medical certificate with the limitation that he wear glasses that correct for distant vision and possess glasses that correct for near vision. He had 17,086 hours of flight time, almost all as PIC, with 496 hours in type.

Associates of the PF indicated that he had good "stick-and-rudder" skills.

The report said, "With a 'laid-back' and quiet personality, he tended to defer to the pilot with more expertise or knowledge, whether that pilot was flying [in the] right or left seat. He tended not to initiate checklists and did not verbalize aborted takeoff procedures during pretakeoff briefings."

His associates said that the PF tended to "unload" the nose wheel on the G-IV during takeoff to reduce stress on the aircraft caused by uneven runways.

The PNF, 50, had an ATP certificate with airplane multi-engine land and airplane single-engine land ratings, and was type-rated in the G-IV. He had a first-class medical certificate with the limitation that he wear lenses to correct for distant vision and possess glasses to correct for near vision. He had 12,595 hours of flight time, 9,514 hours of which were as PIC, with 2,281 hours in type.

Associates of the PNF described him as an excellent pilot with very good systems knowledge of the G-IV.

The report said, "He was described as being quiet and professional, but not an assertive, outgoing person. He was comfortable with being the PIC when he was assigned that position. … As a copilot, the PNF was described as someone who would 'respect the left seat,' and not one to jump in and 'take over the airplane.'"

The Alberto-Culver flight operations manual's takeoff procedures required the first officer (the right-seat pilot) to make V_1 (takeoff decision speed) and V_r (rotation speed) callouts. The Aon flight manual did not specify procedures for takeoff and climb.

"It was not possible to determine if the V speeds were called out, nor if there was any 'Abort' call made for an aborted takeoff, [because of] the poor quality of the CVR tape," said the report.

The accident prompts several comments and recommendations pertaining to company operations manuals.

The NTSB has said that an operations manual is an important communications tool. As one *Flight Safety Digest* article[1] said, "In the NTSB's view, the nature of corporate flying dictates that the basic policies and procedures be documented and be well known to pilots.

The NTSB suggested that an operations manual would be the most practical means of establishing common administrative procedures and flight-operations procedures to ensure that a strong measure of standardization would be conveyed to pilots. More specifically, the NTSB said that the manual should standardize pilot procedures and cockpit procedures during takeoff, while en route and during approach and landing phases."

"Neither the Alberto-Culver operations manual, the Aon operations manual [nor] the G-IV airplane flight manual [specifies] procedures for aborted takeoffs [caused by] loss of directional control during takeoff," said the report.

When both companies have operations manuals, the aviation department managers of the interchange participants should compare manuals and highlight all differences in procedures (e.g., takeoff, abort, climb, cruise, descent, instrument approach and landing). Then they should agree on standardized procedures when mixed flight crews are used. Fortunately, most operational procedures are very similar, and only minor changes may be necessary.

If the interchange aircraft are of the same type but components are configured differently, pilots should be made aware of the differences.

If the company operations manual has a section devoted to cockpit standard operating procedures, words such as the following should be added at the beginning of that section and highlighted:

"When a flight is to be operated under an interchange agreement and a mixed crew is assigned, the PF will ensure that the PNF is thoroughly briefed on the procedures to be used for all phases of flight, including takeoff, abort situations, climb, cruise, descent, instrument approach (including callouts) and landing. The PNF will be required to acknowledge understanding of — and the need for exact compliance with — those procedures.

"Any procedure that is not clearly understood will be reviewed until both pilots are satisfied that they have a mutual understanding of what is required in cockpit performance. Differences in component configuration between the aircraft normally operated by the respective flight crewmembers will be pointed out, and both pilots will acknowledge the configuration and operation of the components on the aircraft to be flown."

Most operations manuals contain a section, "Takeoffs Will Be Delayed," describing adverse weather conditions (thunderstorms, wind shear, high winds, etc.) that are cause for delaying a takeoff. If mixed flight crews are used, another line can be added to state that the takeoff will be delayed "until the complete takeoff briefing is accomplished and acknowledged as understood by both pilots."

If one of the interchange participants does not have a company operations manual, a manual should be prepared. (This does not imply that the company without a manual should copy the other participant's manual, because the companies will not necessarily operate their aircraft the same way.) The two aviation department managers then must resolve what procedures will apply to a mixed crew.

If neither participant in the interchange agreement possesses a company operations manual, and there is not already a thorough understanding of shared standard operating procedures by crewmembers by both participants, then the safety responsibility is on the aviation department managers and the mixed flight crew to ensure that such an understanding is developed.

In most manuals, abort procedures are rather simply stated and are similar to those in the Alberto-Culver manual. Before outlining those procedures, however, the manual should discuss the factors pertaining to an abort. Three factors remain constant:

- Proper training on abort procedures;
- Thorough briefing prior to takeoff by the PF; and,
- Complete understanding of each pilot's responsibilities.

It is normal for the PF to command and execute a takeoff abort for a directional-control problem or a catastrophic aircraft malfunction. During the takeoff roll, however, the PNF might be the first to observe an indication of a malfunction. Therefore, the PNF must be briefed by the PF on what malfunctions would be causes for an abort prior to V_1.

The usual practice in corporate aircraft is for either pilot, on recognition of the need, to state loudly and firmly, "Abort." The PF must then, without hesitation, begin executing the abort procedure.

The time between the recognition of a problem, a call to abort and execution of the abort procedures may be measured in seconds. Therefore, immediate action is needed. Discussion can take place when the aircraft has been brought safely to a stop rather than while abort procedures are being executed.

Reasons for an abort usually include directional-control loss, engine fire or failure, thrust-reverser deployment and interior-compartment smoke or fire.

The question arises whether the flight crew had time for a complete pretakeoff briefing, including the nose-wheel steering and abort procedures.

The NTSB said that the G-IV PF often did not initiate checklists and did not verbalize takeoff procedures during pretakeoff briefings. When the accident aircraft was being taxied toward the takeoff runway, the flight crew told the controller that they would be ready at the end of the runway.

A minute later, the local controller said, "Two three alpha charlie, three four, expedite departure, turn left heading two niner zero, cleared for takeoff."

Eighteen seconds later, the PNF responded, "Cleared for takeoff, heading two nine zero. We'll hurry it out."

Given this sequence of events, the question arises whether the flight crew had time for a complete pretakeoff briefing, including the nose-wheel steering and abort procedures. This might have been a situation involving the "hurry-up syndrome," the common term used to describe the degradation of a pilot's performance caused by a perceived or actual need to speed up tasks or duties.[2] This phenomenon can occur when there has been a delay because of weather or mechanical problems and the flight crew wants to make up for lost time. High-level executive passengers or other passengers with rigid schedules also can encourage the hurry-up syndrome.[3,4]

The hurry-up syndrome is sometimes reflected by a disregard for company operations-manual procedures that call for either a complete pretakeoff briefing using a checklist or, when there is a series of takeoffs and landings during the day, the call for a "standard takeoff briefing" and completion of an abbreviated checklist for subsequent takeoffs.

Adding the previously suggested wording about when takeoffs will be delayed may eliminate the hurry-up syndrome. Anxiety about scheduling is alleviated when the company operations manual specifies that takeoff will not occur until a complete pretakeoff briefing has been accomplished.

The purpose of company operations manuals and the use of checklists is to ensure compliance, standardization of procedures and the counteraction of complacency. The true value of standardized cockpit procedures is that what needs to be done is checked and cross-checked so that when anything is abnormal, the abnormality can be detected and corrected.

The PF must thoroughly brief the PNF on the use of checklists and on procedures for takeoff, instrument approach and landing. Those briefings require repetition and attention, no matter how time-consuming or boring they may be for crews who always fly together.

Compliance with tedious and time-consuming procedures enhances crew resource management. Statistics reveal that most airplane accidents occur during the takeoff and landing phases of flight; safety can depend on attention to what the company operations manual and checklists prescribe for takeoffs and landings.

The company operations manual is valuable in the management of the flight department only if flight crews comprehend the need for such a document as a guideline to safe operations. A manual that is not studied and used scrupulously is useless. A manual that is well prepared, well understood and well used enhances the aviation department's professionalism and safety.♦

Editorial note: This article was based in part on the NTSB brief of accident and factual aviation report, NTSB ID no. CHI97MA017. The conclusions related to company operating procedures and company flight operations manuals are the author's.

References

1. Pope, J.A. "Developing a Corporate Aviation Department Operating Manual Reinforces Standard — and Safe — Operating Procedures." *Flight Safety Digest* Volume 14 (April 1995).

2. McElhatton, J.; Drew, C. "'Hurry-up' Syndrome Identified as a Causal Factor in Aviation Safety Incidents." *Human Factors & Aviation Medicine* Volume 40 (September–October 1993).

3. Pope, J.A. "Anatomy of a Mountain Crash: Error Chain Leads to Tragedy." *Accident Prevention* Volume 49 (October 1992).

4. Lawton, R. "Lack of Management Oversight Cited in Controlled-flight-into-terrain Accident of FAA Aircraft." *Accident Prevention* Volume 51 (August 1994).

About the Author

John A. Pope established John A. Pope & Associates, an aviation consulting firm located in Arlington, Virginia, U.S., after retiring in 1984 as vice president of the U.S. National Business Aircraft Association. He has assisted more than 60 corporations in developing their operations manuals. He has also conducted more than 20 workshops dedicated to developing corporate aviation operations manuals.

He served as a command pilot in the U.S. Air Force and the Air National Guard. He retired as a colonel from the U.S. Air Force Reserve after 33 years of service.

Further Reading from FSF Publications

Pope, J.A. "Comparing Accident Responses: Looking Beyond Causes to Identify Recurrent Factors." *Flight Safety Digest* Volume 14 (June 1995).

Gross, R.L. "Studies Suggest Methods for Optimizing Checklist Design and Crew Performance." *Flight Safety Digest* Volume 14 (May 1995).

Pope, J.A. "Developing a Corporate Aviation Department Operating Manual Reinforces Standard — and Safe — Operating Procedures." *Flight Safety Digest* Volume 14 (April 1995).

Canadian Accidents and Accident Rate Rose Slightly in 1997

Despite the marginally worse numbers compared with 1996, most Canadian accident statistics remained better than those for the 1988–1995 period. "Collision/risk of collision/loss of separation" led the incident categories.

FSF Editorial Staff

The overall Canadian aviation-accident rate rose slightly in 1997 compared with 1996, yet remained lower than the rate for all years between 1988 and 1995. Reportable incidents declined from 716 in 1996 to 682 in 1997, but incidents in the category "Collision/risk of collision/loss of separation" rose from 195 to 224 and were higher than any year in the 1988–1996 period.

The statistics were compiled by the Transportation Safety Board of Canada (TSB) and published in TSB Statistical Summary, Aviation Occurrences 1997.

There were 36 fatal accidents to Canadian-registered aircraft in 1997, including three that occurred outside the country, and 353 accidents, including 12 outside the country. The 353 accidents involved 292 airplanes (140 in commercial operations) and 56 helicopters. (The remaining accident aircraft were balloons, gliders and gyrocopters.)

At 9.1 accidents per 100,000 flight hours, the 1997 rate exceeded the 1996 rate of 8.8 accidents per 100,000 flight hours. But the 1997 rate was better than the 10.1 accidents to 14.6 accidents per 100,000 flight hours that were recorded in the years from 1988 to 1995.

The 36 fatal accidents involving Canadian aircraft represented a decrease of 16 percent from the 43 fatal accidents in 1996, although the number of fatalities increased from 70 to 77 and the number of serious injuries from 38 to 69.

Of the 353 accidents to Canadian aircraft, seven were to airliners. None of those accidents involved fatalities. [The TSB defines an airliner as an airplane used by a Canadian air operator in an air transport service or in aerial work involving sightseeing operations, and that has a maximum certificated takeoff weight (MCTOW) of more than 8,618 kilograms (19,000 pounds) or for which a Canadian type certificate has been issued authorizing the transport of 20 or more passengers.]

Sixteen Canadian commuter aircraft were involved in accidents, and one of those was a fatal accident. [The TSB defines a commuter aircraft as an airplane used by a Canadian air operator, in an air transport service or in aerial work involving sightseeing operations, that is (a) a multi-engine aircraft that has a MCTOW of 8,618 kilograms (19,000 pounds) or less and a seating configuration, excluding pilot seats, of 10 to 19 seats, or (b) a turbojet-powered airplane that has a maximum zero-fuel weight of 22,680 kilograms (50,000 pounds) or less and for which a Canadian type certificate has been issued authorizing the transport of not more than 19 passengers.]

Helicopters were involved in 56 accidents, eight of them fatal, resulting in 21 fatalities.

Reportable incidents, of which there were 682, were at a higher level than in most years of the 1988–1996 period. "Collision/risk of collision/loss of separation" incidents, which in previous years had often been less frequent than "declared emergency" and "engine failure" incidents, were the type most often reported in 1997.

Small differences in accident statistics from one year to the next are rarely statistically significant, although long-term trends can indicate progress or causes for concern that need to be addressed.

Table 1
Canadian Aviation Safety Statistics, 1988–1997

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Canadian-registered Aircraft Accidents*	**497**	**482**	**498**	**453**	**435**	**422**	**380**	**390**	**342**	**353**
Airplanes Involved**	427	408	415	378	385	366	302	315	274	292
Airliners	10	11	3	11	7	15	6	7	6	7
Commuter Aircraft	11	8	13	7	9	10	9	15	7	16
Air Taxi/Specialty Aircraft	153	164	149	137	129	118	113	138	108	117
Private/State	253	225	250	223	240	223	174	155	153	152
Helicopters Involved	58	59	70	64	34	52	63	68	56	56
Other Aircraft Involved***	15	19	14	14	17	8	21	12	12	10
Hours Flown (Thousands)****	3,623	3,737	3,411	3,301	3,308	3,490	3,776	3,810	3,900	3,900
Accident Rate (per 100,000 Hours)	13.7	12.9	14.6	13.7	13.1	12.1	10.1	10.2	8.8	9.1
Fatal Accidents	**50**	**60**	**47**	**64**	**47**	**48**	**33**	**52**	**43**	**36**
Airplanes Involved**	41	51	36	56	39	45	30	44	34	29
Airliners	2	5	0	3	0	3	0	1	1	0
Commuter Aircraft	2	1	2	1	1	0	3	1	1	1
Air Taxi/Specialty Aircraft	13	10	13	17	9	16	12	22	12	10
Private/State	24	35	21	35	29	26	15	20	20	18
Helicopters Involved	8	8	8	7	3	3	3	11	7	8
Other Aircraft Involved	1	1	3	2	4	0	0	0	3	0
Fatalities	**95**	**155**	**91**	**373**	**80**	**102**	**80**	**107**	**70**	**77**
Serious Injuries	**52**	**90**	**60**	**55**	**64**	**63**	**36**	**53**	**38**	**69**
Non-Canadian Aircraft Accidents	**26**	**26**	**25**	**30**	**25**	**17**	**22**	**18**	**22**	**17**
Fatal Accidents	4	4	2	5	8	1	4	3	4	5
Fatalities	4	4	3	12	19	2	9	12	13	11
Serious Injuries	7	11	7	3	6	3	1	2	2	6
All Aircraft: Reportable Incidents	**644**	**688**	**694**	**685**	**664**	**598**	**578**	**618**	**716**	**682**
Collision/Risk of Collision/Loss of Separation	189	215	211	159	156	146	152	143	195	224
Declared Emergency	101	169	160	220	200	190	138	190	200	191
Engine Failure	201	186	191	173	176	150	172	166	177	144
Smoke/Fire	61	57	58	69	71	55	62	53	78	61
Other	92	61	74	64	61	57	54	66	66	62

* Ultralight aircraft excluded

** Some accidents may involve multiple aircraft, so the number of aircraft involved may not sum to the number of accidents.

*** Includes gliders, balloons and gyrocopters.

**** Source: Statistics Canada (1996, 1997 hours flown are estimated).

Source: Transportation Safety Board of Canada

Publications Received at FSF Jerry Lederer Aviation Safety Library

Many Benefits of FAA Modernization Program Not Yet Realized, GAO Report Says

Book examines human factors in air traffic control.

FSF Editorial and Library Staffs

Advisory Circulars (ACs)

Announcement of Availability — National Fire Protection Association (NFPA) Aircraft Familiarization Charts Manual. U.S. Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5210-20. March 12, 1998. 1 p. Available through GPO.*

The National Fire Protection Association (NFPA) *Aircraft Familiarization Charts Manual* was originally developed by Transport Canada under the name *Airport Safety and Operational Requirements: E.R.S. Aircraft Crash Charts.* In 1996, the NFPA was granted permission by Transport Canada to reprint this publication under the present name.

The advisory circular (AC) announces the availability of the NFPA *Aircraft Familiarization Charts Manual*. [Adapted from AC.]

Aircraft Certification Service Fees for Providing Production Certification-Related Services Outside the United States. U.S. Federal Aviation Administration (FAA) Advisory Circular (AC) 187-2. March 11, 1998. 7 pp. Available through GPO.*

This advisory circular (AC) provides a means of compliance with Title 14 U.S. Code of Federal Regulations (CFR) Part 187, Fees, Related Services Outside the United States, concerning fees by U.S. Federal Aviation Administration (FAA) Aircraft Certification Service personnel. This regulation is not mandatory, but is intended to encourage voluntary agreement between the FAA and the production approval holder, for production certification-related services pertaining to products and parts manufactured or assembled outside the United States.

Includes one appendix: List of Aircraft Certification Service, Manufacturing Inspection Offices. [Adapted from AC.]

Reports

Performance Demonstrations of Zinc Sulfide and Strontium Aluminate Photoluminescent Floor Proximity Escape Path Marking Systems. McLean, Garnet A.; Chittum, Charles B. U.S. Federal Aviation Administration (FAA) Office of Aviation Medicine. Report no. DOT/FAA/AM-98/2. February 1998. 8 pp. Tables, references. Available through NTIS.**

Keywords:
1. Emergency Lighting
2. Photoluminescence

U.S. Federal Aviation Regulations (FARs) Part 25.812 requires transport-category airplanes to have emergency-lighting systems independent of the main lighting system, including a floor-proximity escape-route marking system. Typically, transport-category aircraft floor-proximity marking systems have consisted of incandescent luminaries spaced at intervals on the floor, or mounted on seat assemblies along the aisle. The electricity required to power these systems has at times made them vulnerable to a variety of problems, including battery and wiring failures, burned-out light bulbs and other damage or disruption from vibration, passenger traffic, galley-cart strikes and hull breakage in accidents.

One promising alternative nonelectrical type of marking system is based on photoluminescent technology. This technology is characterized by the ability of the photoluminescent material to absorb and store ambient energy from available sources such as daylight or aircraft-interior electric lights and then emit the stored energy as visible light when all other light sources are extinguished.

Tests were conducted using two photoluminescent materials, zinc sulfide and strontium aluminate. Results showed that the strontium aluminate materials were superior to the zinc sulfide materials in providing the necessary guidance for egress in floor-proximity marking systems. [Adapted from Introduction.]

An Evaluation of Pilot Acceptance of the Personal Minimums Training Program for Risk Management. Jensen, Richard S.; Guilkey, James E.; Hunter, David R. U.S. Federal Aviation Administration (FAA) Office of Aviation Medicine. Report no. DOT/FAA/AM-98/6. February 1998. 11 pp. Figure, tables, references, appendix. Available through NTIS.**

Keywords:
1. Aeronautical Decision Making
2. Pilots
3. Pilot Training
4. Decision Aids
5. Judgment
6. Decision Making

This study is based on a previous preliminary training program designed to help pilots develop personal minimums for risk management prior to takeoff, where data show that most errors that lead to incidents and accidents occur. The new personal-minimums training program was field-tested at FAA seminars and other meetings across the United States (Columbus, Ohio; Baltimore, Maryland/Washington, D.C.; Long Beach, California; Chicago, Illinois; Anchorage, Alaska; Oshkosh, Wisconsin; Wright-Patterson Air Force Base, Ohio), to determine how well the program is accepted by the aviation community, to familiarize FAA managers with the program and to help refine the program.

After each seminar, participants were asked to complete a brief training-program evaluation, consisting of multiple-choice and open-ended questions. About 25 percent of seminar participants completed the evaluation forms. Analysis of the responses indicated that pilots who received the training believed that the training program was helpful and that they would use it in their future preflight decision making. Respondents also indicated that they understood the core concepts of the program and that they would recommend personal-minimums training to other pilots. Interpretation of the results also supported continued development of the personal-minimums training program, using video and computer-aided instruction formats. [Adapted from Background and Summary.]

Evaluating the Decision-Making Skills of General Aviation Pilots. Driskill, Walter E.; Weissmuller, Johnny J.; Quebe, John C.; Hand, Darryl K.; Hunter, David R. U.S. Federal Aviation Administration (FAA) Office of Aviation Medicine. Report no. DOT/FAA/AM-98/7. February 1998. 14 pp. Figure, tables, references, appendixes. Available through NTIS.**

Keywords:
1. Pilots
2. Aircraft Pilots
3. Decision Making
4. Aviation Safety
5. Linear Modeling
6. Policy Capturing

The objective of this study was to develop a methodology to assess the decision-making skills of general aviation (GA) pilots. Decisions made by GA pilots (each with about 500 hours of flight time) were compared to the decisions recommended by a panel of expert pilots for a set of 51 scenarios. The scenarios were presented, describing the circumstances of the flight and requiring from the pilot a decision critical to flight safety. For each scenario there were four alternative decision choices, ranging from best to worst.

Overall, the results showed that the decisions made by GA pilots agreed with the panel of expert pilots in situations where flight safety was critical. Nevertheless, agreement by individual GA pilots with the recommended solutions varied widely, when the scenario items were analyzed using a right/wrong scoring system, with GA pilots selecting the recommended alternative about 50 percent of the time. The data also indicated that the least risk-averse pilots are at opposite ends of the experience spectrum: the youngest, with the least experience, and pilots with the highest levels of total and recent experience. [Adapted from Background and Conclusions.]

Air Traffic Control: Observations on FAA's Modernization Program. Statement of Gerald L. Dillingham, associate director, Transportation Issues, Resources, Community, and Economic Development Division, U.S. General Accounting Office (GAO), before the Subcommittee on Aviation, Committee on Commerce, Science and Transportation, U.S. Senate, Feb. 26, 1998. Report no. GAO/T-RCED-98-93. 26 pp. Appendixes. Available through GAO.***

Beginning in late 1981, the U.S. Federal Aviation Administration (FAA) began a program to modernize its National Airspace System (NAS), a multibillion-dollar investment made up of more than 200 separate projects. The major objectives of the program are to replace and upgrade NAS equipment and facilities to meet the demands of the expected increase in air traffic, enhance the aviation safety margin and increase the efficiency of the air traffic control (ATC) system.

Nevertheless, many benefits expected of the modernization program have not been realized because of delays and other problems. As a result, the GAO designated the FAA modernization program a high-risk information-technology initiative in 1995 and again in 1997. The FAA is now developing a new modernization program. This testimony discusses: (1) the status of key modernization projects, (2) the FAA's efforts to correct modernization problems and (3) the opportunities and challenges of the FAA's new modernization approach.

Several findings are outlined: (1) The FAA has been forced to implement costly interim projects because of the agency's difficulty in delivering key systems such as the Wide Area Augmentation System and the Standard Terminal Automation Replacement System within cost and schedule estimates;

(2) Although the FAA has implemented many GAO recommendations, sustained management attention will be necessary to improve management of the modernization program; (3) The FAA is seeking collaboration and commitment from users in developing a new approach, thus delivering user benefits earlier and reducing the cost of the modernization; (4) The approaching year-2000 computer crisis must be quickly addressed by the FAA. [Adapted from Introduction.]

Aviation Safety: Weaknesses in Inspection and Enforcement Limit FAA in Identifying and Responding to Risks. U.S. General Accounting Office (GAO) Report to Congressional Requesters, February 1998. Report no. GAO/RCED-98-6. 124 pp. Tables, figures, appendixes. Available through GAO.***

This report examines the outcomes of the U.S. Federal Aviation Administration (FAA) inspection and enforcement processes in fiscal years 1990 through 1996. GAO analyzed FAA data for the fiscal years 1990 through 1996 and conducted nationwide surveys during February and March 1997 of 600 safety inspectors and 175 security special agents who also perform inspections for the FAA. Interviews were also conducted with safety and security inspectors in two FAA regions, managers in all FAA programs that conduct inspections, and regional counsel in all nine FAA regions.

Among the findings were that during the fiscal years 1990 through 1996, nearly 96 percent of the two million inspections conducted by Flight Standards and Security resulted in no reports of problems or violations. GAO questions whether this is an accurate measure of regulatory compliance. Almost 121,000 enforcement cases were resolved during this period using administrative actions (46 percent), legal actions (34 percent) or no action (19 percent). Missing data accounted for the 1 percent of enforcement cases where the resolution could not be determined. Because FAA's databases do not distinguish major from minor cases, FAA cannot assign risk-based priorities for resolving enforcement cases.

GAO recommends providing guidance to FAA's inspection staff on how to distinguish major from minor violations, and to legal staff on how to distinguish major from minor cases. GAO also recommends improvement and integration of FAA's inspection and enforcement databases to identify major violations and major legal cases, target resources to the violation and enforcement cases most likely to impact aviation safety and security, and link inspection and enforcement data so that violations can be effectively tracked. [Adapted from Introduction and Executive Summary.]

Cockpit Integration of GPS: Initial Assessment—Menu Formats and Procedures. Wreggit, Steven S.; Marsh, Delbert K. U.S. Federal Aviation Administration (FAA) Office of Aviation Medicine. Report no. DOT/FAA/AM-98/9. March 1998. 15 pp. Figure, tables, references, appendix. Available through NTIS.**

Keywords:
1. Aviation Research
2. Cockpit Displays
3. Control Display Units
4. Flight Simulation
5. Global Positioning System
6. Human-machine Interface
7. Menus
8. Navigation
9. User-computer Interface

Global-positioning-system (GPS) receivers have become very popular with general aviation pilots. These receivers are produced by many manufacturers and are relatively inexpensive as hand-held or add-on units placed within the cockpit. Nevertheless, GPS receivers may distract the pilot from important tasks such as flying and visual scanning for aircraft because of the lack of standards concerning data entry and retrieval, display type, and cockpit placement.

Nine general aviation pilots participated in this study, which was designed to collect usability data from the voluntary subjects as they interacted with a GPS unit during a flight using an aircraft simulator. The flight simulator was the Basic General Aviation Research Simulator (BGARS), whose controls and displays simulate those of a Beech Sundowner. The GPS device was the Magellan EC-10X. Three phases were involved: Phase 1 required the completion of a pretest screening questionnaire, and training to use the GPS unit and BGARS. In Phase 2, the GPS-usability test, routine flight tasks were performed in the BGARS along with 37 GPS-related tasks requiring waypoint setting, GPS navigation and general GPS data entry and retrieval. In Phase 3, the subjects completed a postflight questionnaire and were interviewed about apparent problems experienced when interacting with the GPS.

Results demonstrated that inconsistencies of menu structures on the GPS unit hampered or prevented the completion of some tasks. The report suggests basic human-factors design principles that could make the evaluated GPS unit easier to use, minimize head-down time and increase safety. [Adapted from Introduction and Conclusions.]

Airport Financing: Funding Sources for Airport Development. U.S. General Accounting Office (GAO) Report to Congressional Committees, March 1998. Report no. GAO/RCED-98-71. 52 pp. Tables, figures, appendixes. Available through GAO.***

The United States has the largest, most extensive aviation system in the world, with more than 18,000 airports, ranging in size from large commercial transportation centers serving more than 30 million passengers a year, to small grass strips serving only a few aircraft. More than 3,300 of those airports are part of the national airport system, and therefore eligible for federal assistance.

To maintain safety and efficiency, these airports have planned a range of development projects such as new runways, passenger terminals and navigation aids. But it is difficult to assess the airports' capacity to finance their development because of incomplete financial information about airports. This report attempts to clarify the issue by answering three questions: (1) How much are airports of various sizes spending on capital development and where is the money coming from? (2) Will current funding levels be sufficient to meet capital development planned for the five-year period from 1997 through 2001? (3) If a difference exists between current funding and planned development, what is the potential effect of various proposals to increase airport funding?

The report recommends that the U.S. Secretary of Transportation seek authority from the U.S. Congress to use Airport Improvement Program grants to capitalize state revolving funds in states that have a demonstrated capability and desire to manage a revolving fund. This will help smaller airports meet some of their costs, but avoid any reduction in the level of financial support for larger airports. [Adapted from Introduction, Background and Conclusions.]

Books

Airplane Maintenance and Repair: A Manual for Owners, Builders, Technicians, and Pilots. Carmody, Douglas S. New York, New York, United States: McGraw-Hill, 1998. 346 pp.

This is described as an essential guide to airplane maintenance, troubleshooting and repair, with information developed through the combined experience of hundreds of professional airplane-maintenance technicians. The author takes the reader through 29 procedures step by step. Among the topics are repair and maintenance of engines, airframes, electrical systems, fuel systems, hydraulic systems, and brakes, tires and propellers. At the end of each chapter there is a guideline for preventive maintenance, outlining who can perform it, the standards that must be met and who can return the aircraft to service. Readers will also find a bolt chart and directions for keeping a maintenance log and selecting and using tools. Advice is also given on getting the best service for an airplane. [Adapted from Introduction and Preface.]

Flight to the Future: Human Factors in Air Traffic Control. Wickens, Christopher D.; Mavor, Anne S.; McGee, James P., eds. National Research Council. Washington, D.C., United States: National Academy Press, 1997. 368 pp.

This book contains a report produced by the Panel on Human Factors in Air Traffic Control Automation, established in 1994 at the request of the U.S. Federal Aviation Administration (FAA). The panel conducted a two-phase study of the human-factors aspects of the U.S. air traffic control system, of the national airspace system and of proposed future automation issues concerning how human beings will interact with the system.

The major focus of the study is the relationship between human beings and the tools they use in accomplishing system tasks. The first phase centered on understanding the complexities of the current system that will be addressed by automation, examined how some levels of automation already have been implemented and investigated human factors as they relate to the functions of air traffic controllers in the system and in the organizational context in which they operate.

This report, which presents the results of the panel's first-phase deliberations, is divided into two parts. Part I is the Baseline Description of the Air Traffic Control System, including the selection, training and assessment of controllers, along with the operations involved in keeping the equipment and systems functioning. The second part concerns current knowledge about human factors and how they relate to the air traffic controller.

Appendix A is Aviation and Related Acronyms; Appendix B is Contributors to the Report; and Appendix C is Biographical Sketches. There is also an index. [Adapted from Preface.]

Managing the Risks of Organizational Accidents. Reason, James. Brookfield, Vermont, United States: Ashgate Publishing Company, 1997. 252 pp.

This is a book for, in the words of the author, "real people" — those who have the responsibility to think about, as well as manage and regulate, the risks of hazardous technologies. Sections include "The Human Contribution," "Navigating the Safety Space," "A Practical Guide to Error Management" and "Engineering a Safety Culture."

The book is not directed to any particular industry, but to all organizations facing physical hazards, from nuclear power plants to oil companies, offices and air transport. The book's emphasis is on principles and practicalities, with a focus on organizational accidents. These are accidents having multiple causes involving many people operating at different levels, and which can affect innocent bystanders, assets and the environment. The author said that he hopes that his ideas can help avoid rare but catastrophic organizational accidents.

Includes an Index. [Adapted from Preface.]

Aviation Safety — The Human Factor: A Handbook for Flight Safety Officers and Aviation Accident Investigators. Alkov, Robert A. Casper, Wyoming, United States: Endeavor Books, 1997. 192 pp.

Written with the professional aviation safety professional in mind, this handbook covers the basic human-factors principles needed to run an accident-prevention program. It is designed to provide practical information for the aviation safety officer who is not necessarily trained as a psychologist or physiologist, and make it possible to apply human-factors principles to investigations.

The handbook is organized according to the "perception of stimuli–cognitive process–response" model of psychology.

Part I presents definitions and a model for the study of human factors, and lists prospective expert consultants. Part II addresses aviation psychology. In Part III, human factors are applied to the workplace. Part IV contains practical considerations of human factors in accident investigation and prevention of human error. Part V describes an FAA proposal for establishing a human-factors-safety program.

Part VI is the appendix and includes a bibliography, glossary, reprints of safety articles and an index. [Adapted from Preface.]

Sources

* Superintendent of Documents
U.S. Government Printing Office (GPO)
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Updated U.S. Federal Aviation Administration (FAA) Regulations and Reference Materials

Advisory Circulars (ACs)

AC No.	Date	Title
21-29B	Feb. 20, 1998	*Detecting and Reporting Suspected Unapproved Parts*. (Cancels AC 21-29A, *Detecting and Reporting Suspected Unapproved Parts*, dated July 16, 1992.)
65-13S	March 16, 1998	*FAA Inspection Authorization Directory*. (Cancels AC 65-13R, *FAA Inspection Authorization Directory*, dated April 18, 1997.)

Federal Aviation Regulations (FARs)

Part	Effective Date	Change	Subject
Part 21	Feb. 23, 1998	Change 3	*Certification Procedures for Products and Parts*. (Incorporates Amendment 21-75, "Primary Category Seaplanes," adopted Nov. 19, 1997.)
Part 61	Dec. 31, 1997	Change 2	*Certification: Pilots, Flight Instructors, and Ground Instructors*. (Incorporates an amendment to Special Federal Aviation Regulation [SFAR] 73: SFAR 73-1, Robinson R-22/R-44 Special Training and Experience Requirements, adopted and effective Dec. 31, 1997.)
Part 91	Jan. 29, 1998	Change 21	*General Operating and Flight Rules*. (Revises three Special Federal Aviation Regulations [SFARs]: SFAR 50-2, SFAR 67 and SFAR 71; and incorporates Amendment 91-255, "Pilot, Flight Instructor, Ground Instructor, and Pilot School Certification Rules" adopted Dec. 19, 1997.)
Part 91	Feb. 17 and March 20, 1998	Change 22	*General Operating and Flight Rules*. (Incorporates Amendment 91-256, "Improved Standards for Determining Rejected Takeoff and Landing Performance," adopted Feb. 10, 1998; revises Paragraphs 2 and 3 of Special Federal Aviation Regulation [SFAR] No. 79, adopted Feb. 10, 1998.)
Part 25	March 19, 20 and 25, 1998	Change 12	*Airworthiness Standards: Transport Category Airplanes*. (Incorporates Amendment 25-92, "Improved Standards for Determining Rejected Takeoff and Landing Performance," adopted Feb. 10, 1998; Amendment 25-93, "Revised Standards for Cargo or Baggage Compartments in Transport Category Airplanes," adopted Feb. 10, 1998; and Amendment 25-94, "Transport Category Airplanes, Technical Amendments, and Other Miscellaneous Corrections," adopted Feb. 12, 1998.)
Part 1	March 20, 1998	Change 7	*Definitions and Abbreviations*. (Incorporates Amendment 1-48, "Improved Standards for Determining Rejected Takeoff and Landing Performance," adopted Feb. 10, 1998.)

International Reference Updates

Joint Aviation Authorities (JAA)

Date	Title
June 1, 1998	Revision to JAA Administrative and Guidance Material: Section Four — Operations.
June 1, 1998	Revision to JAA Administrative and Guidance Material: Section Two — Maintenance.

Accident/Incident Briefs

Jet Ranger Pilot, Incapacitated by Carbon Monoxide, Flies Helicopter into Radio Tower

Turbulence during descent injures eight passengers, one crewmember of Boeing 747.

FSF Editorial Staff

The following information provides an awareness of problems through which such occurrences may be prevented in the future. Accident/incident briefs are based on preliminary information from government agencies, aviation organizations, press information and other sources. This information may not be entirely accurate.

Air Carrier

Collision on Taxiway Occurs In Low Light Conditions

Airbus A340, de Havilland Dash 8. Substantial damage. No injuries.

The A340 was taxiing and the DHC-8 was stationary, awaiting clearance to taxi onto a runway, when the collision occurred at an airport in South Africa. The collision caused damage to the A340's right wing tip and to the DHC-8's elevator, horizontal stabilizer and rudder. The collision occurred in late afternoon. An investigator said that because of the time of year (late spring), light conditions could have been a factor in the collision.

Aircraft Encounters Turbulence During Descent for Landing

Boeing 747. Minor damage. One serious injury, eight minor injuries.

The aircraft was descending to land at an airport in Japan with 289 people aboard. The flight crew attempted to stay clear of cumulonimbus clouds with tops at about 20,000 feet. The crew turned on the fasten-seat-belt lights and informed the cabin crew that the aircraft would enter rough air. The cabin crew advised the passengers of the impending turbulence. Most of the cabin crewmembers then seated themselves and fastened their seat belts. The aircraft encountered turbulence when it entered the clouds about two minutes later.

The flight crew said that the aircraft encountered strong turbulence while descending between 14,000 feet and 3,500 feet. The crew said that they encountered showers of hail at about 14,000 feet.

One passenger, who was inside a lavatory in the aft cabin, sustained serious injuries. Seven passengers and one cabin crewmember sustained minor injuries. Three of the injured passengers were in lavatories, and one injured passenger was standing outside a lavatory. Three of the injured passengers were seated with unfastened seat belts. Most of the passengers' injuries were sprained necks and blows to the head. The flight attendant was cleaning a galley and sprained her neck and suffered a blow to her back during the turbulence.

Aircraft Rolls Backward After Chocks Inserted at Gate

Boeing 737. No damage. No injuries.

The aircraft taxied to the gate at an undisclosed airport. A ground crewmember used hand signals to inform the flight crew that the chocks had been placed around the aircraft's wheels. The flight crew was proceeding with the parking-and-securing checklist when the captain became aware that the aircraft was rolling backward. The flight crew slowly applied the brakes to bring the aircraft to a halt. The ground crewmember told the flight crew that the chocks had slipped out from behind the wheels because the ramp is sloped and was slippery from oil and other fluids.

Emergency Landing Follows Hydraulic-system Failure

Boeing 737. No damage. No injuries.

The flight crew discovered a hydraulic-system problem during a flight in Russia. The hydraulic system for one of the B-737's landing-gear struts had failed. As a precaution, the flight crew continued flying beyond their scheduled landing time to consume excess fuel. The aircraft then was landed safely at the destination airport with the landing gear extended. None of the crewmembers or 103 passengers was injured.

Air Taxi
Commuter

High Sink Rate on Approach Results In Gear Collapse on Landing

British Aerospace Jetstream 31. Substantial damage. No injuries.

After seeing the runway during an NDB (nondirectional-beacon) approach to an airport in Canada, the pilot flying made course corrections to align the aircraft with the runway. A high sink rate developed, and the aircraft landed hard on the runway. The main landing gear collapsed, and the propellers on both engines struck the runway.

The aircraft slid on its belly pod and nose landing gear for about 1,800 feet (546 meters). The left wing struck snow adjacent to the runway, causing the aircraft to turn about 160 degrees. The 13 passengers and two crewmembers exited through the right overwing exit after the aircraft came to a stop.

Overloaded Cargo Aircraft Stalls, Lands Short of Runway

Antonov AN-12. Substantial damage. One serious injury.

During a nonscheduled passenger and cargo flight, the aircraft stalled and landed hard 406 feet (123 meters) short of the runway threshold during a night, visual approach to an airport in Russia. The aircraft bounced, touched down on the runway and then rolled off the runway. The main landing gear and fuselage were damaged. One passenger was seriously injured, and one passenger sustained minor injuries. Seven passengers and the eight crewmembers were not injured.

The cargo had not been weighed or examined before takeoff, and the aircraft was overloaded by 8.9 metric tons (19,625 pounds). Investigators said that the flight crew maintained an airspeed on approach that was not adequate for the aircraft's gross weight.

Corporate
Executive

Unauthorized Use of Spoilers Causes Hard Landing

Canadair Challenger. No damage. No injuries.

The twin-jet business/regional-transport aircraft, with a crew of two and six passengers aboard, completed a daylight ILS (instrument landing system) approach in heavy rain and winds gusting to 20 knots. The aircraft was flared for landing but rose (ballooned) above the runway. The pilot not flying operated the in-flight spoilers. The stick shaker activated, and the aircraft touched down hard first on the right main landing gear, then on the nose gear and left main gear. The landing was completed without further incident. The report said that the aircraft flight manual prohibits the use of in-flight spoilers below 300 feet (92 meters).

Hydraulic Leak Results in Loss Of Steering and Braking

Cessna Citation VII. Minor damage. No injuries.

After an uneventful flight, the twin-jet, long-range executive-transport aircraft was taxiing from the landing runway when the hydraulic low-pressure light illuminated. Shortly thereafter, the nose-wheel steering system and the braking system failed. The aircraft then rolled off the paved surface, struck a marker board and entered a shallow ditch, where the nose gear collapsed.

An inspection found that almost all of the hydraulic fluid had drained from the hydraulic system. The cause of the leak was a loose fitting at a hydraulic pressure switch located in the aircraft's baggage compartment.

Other General Aviation

Piper PA-30 Landed Gear-Up in a Field After Vibration Encountered During Test Flight

Piper Twin Comanche. No damage. No injuries.

The pilot was making a test flight in England to investigate a reported vibration of the flight-control column. The aircraft began vibrating severely, and the pilot had difficulty maintaining control. The aircraft was landed gear-up in a field. Preliminary inspection disclosed that the nut and bolt connecting the control rod to the stabilizer trim tab was missing.

Aircraft Crashes on Takeoff after Being Refueled on a Field

Cessna 177. Substantial damage. No injuries.

The pilot landed the single-engine airplane on a field after exhausting the fuel supply during a flight in the United States. After adding fuel to the aircraft, the pilot attempted to take off from the field. The pilot began a left turn about six feet above treetops. The left wing contacted the trees, and the aircraft struck the ground.

Rotorcraft

Carbon Monoxide Incapacitation Found in Jet Ranger Accident

Bell 206-B3. Aircraft destroyed. Four fatalities.

The helicopter was in level flight when it struck a 253-foot (77-meter) radio tower. The main rotor blades partially separated, and the helicopter descended out of control to the ground. The radio tower was depicted on aviation navigational charts and was marked by a strobe light. The pilot had flown in the area for many years. Postmortem examination of the pilot found that he had moderate chronic pulmonary emphysema and that his blood was 26 percent saturated by carbon monoxide. The source of the carbon monoxide poisoning was not determined. The three passengers did not have carbon monoxide in their blood.

Pilot Becomes Disoriented, Loses Control After Flying into Clouds

Hughes 269. No damage. No injuries.

The pilot was on a cross-country flight in England when he inadvertently flew into clouds and became unsure of his position. Air traffic control advised the pilot of his position and suggested that he climb to the minimum safe sector altitude of 3,000 feet. The pilot then declared a MAYDAY and said that he had lost control of the helicopter.

The pilot said that the helicopter had been "sucked" into a black cloud and then spun two or three times. The pilot said that he regained control of the helicopter beneath the clouds at about 1,500 feet and then landed without further incident.

Oil-filter Separation Suspected Of Causing Forced Landing

Rotorway Elite. Substantial damage. No injuries.

The pilot was conducting a test flight when smoke began to emerge from the experimental helicopter's engine compartment. The pilot diverted to the nearest airport. The helicopter was 50 feet (15 meters) above the ground when it lost engine power. The helicopter landed hard and slid a short distance before coming to a stop upright. The two occupants exited the helicopter before the helicopter caught fire. The oil filter was found some distance from the wreckage.♦

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