Manuals, Management and Coordination

by

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On Oct. 25, 1986, a Boeing 737-222 with 114 passengers and five crewmembers overran a landing runway at Charlotte, N.C. Three passengers were seriously injured and 28 passengers and four crewmembers sustained minor injuries.

While there were operational difficulties cited in the U.S. National Transportation Safety Board report (NTSB/AAA–87/08), references to the company operations manual, crew coordination and cockpit management make the report worthy of review and comment.

NTSB's interest in what the airline company operations manual had to say about standard operating procedures points out, once again, their concerns with stated policies. That interest does not limit itself to airline operations where operations manuals are a regulatory requirement but includes corporate aviation operations as well, where manuals are a voluntary imposition rather than required by regulations.

Crew coordination and cockpit management causal factors continue to appear in spite of all of the emphasis placed on the subjects in the last decade. What is of special concern is that "assertiveness" is still a catch-word.

Flight Routine Until Approach Initiated

The flight was routine until its arrival in the Charlotte area where instrument meteorological conditions (IMC) prevailed for an approach and landing to runway 36R. At 1953:06 hours on initial contact with approach control, the crew received the current Automated Terminal Information Service (ATIS) information, that indicated at 1850 the weather was reported as 500 feet overcast, visibility 1/2 mile with rain and fog, temperature 15.5 degrees C (60 degrees F), wind 100 degrees at six knots.

At 2001:02, the final controller directed the flight to fly a heading of 195 degrees "for close-in base leg" and 43 seconds later, the flight was directed to descend to 2,400 feet.

At 2001:18, the final controller transmitted the following local weather information: measured ceiling 400 feet overcast, visibility two miles, light rain and fog, temperature and dewpoint remain the same, wind 090 at eight knots.

At 2002:45, the final controller informed a flight ahead in the sequence that there was a right-to-left wind of 20-25 knots on the final approach recorder. According to the cockpit voice recorder (CVR), the subject flight received this information but neither crewmember commented on the winds or discussed possible changes needed to conduct the approach.

At 2004:26, the flight was cleared for the ILS approach.

At 2005:01, the first officer said, "Standard callouts," while simultaneously the captain said, "Gear down, it's going to be tight." The first officer did not acknowledge the gear down command and the gear was not lowered until 2005:40, 39 seconds after the command.

At 2005:36, the flight contacted Charlotte tower and was told that the surface wind was 100 degrees at four knots and was given clearance to land. At that time, the flaps were set to five degrees. At 2005:54, the captain called for "flaps ten" and then called for the next two flap settings of 15 degrees and 25 degrees.

At 2006:22, the captain commented to the first officer, "Yhea — George didn't do me any favors there," and two seconds later added, "we'll get back on it in a second." (After the accident, the captain said that "George" was the autopilot, adding that he preferred to use the autopilot on an

ILS approach but could not establish autopilot control on that flight.)

At 2006:37, the first officer said: "I'm going to start some lights for you now on the ah recalls been checked — the speed brake is manual — landing gear is down and three green, and flaps — to go."

The captain called for the final setting of flaps simultaneous with the first officer's saying, "to go." It could not be determined if the captain verbally responded to the first officer's callout that the speed brake was in manual. The first officer called 100 feet above minimums at 2007:03 and, at the same time, the ground proximity warning system (GPWS) alerted "Glideslope." The first officer called "at minimums" at 2007:09 and, at the same time, the GPWS alerted, "Whoop, whoop, pull up." The sound of touchdown was recorded at 2007:19 and, five seconds later, the first officer said, "Good show."

(After the accident the captain stated that he knew that the turn to final approach course was "a little late in coming" but that he believed that such "close-in" turns were common at Charlotte. He said he was aware that there was ". . . a hell of a tailwind." Since the winds at 6,000 msl were "significantly different" from the winds on the ground, he said that he planned the approach from ". . . the standpoint of a possible windshear." He said that he added 20 knots of airspeed, the maximum allowable under the airline procedures, to the Vref speed of 131 knots. He added that, although the airspeed fluctuated as much as 10 knots during the approach, the approach was "stable" as well as "safe." The first officer confirmed that, although the airline procedures require that the airplane be configured for landing at the final approach fix, "it goes without saying that this wasn't the way it was done. . . ." on this flight.)

According to the witnesses, the aircraft touched down at a point over 3,000 feet from the approach end of the runway.

The captain told NTSB investigators about the touchdown:

"I had my hands on the throttles. There's a detent. I cracked the thrust reversers to the detent to open them. As I did that, the speed brake had not deployed automatically. I manually deployed the speed brake, went directly back to the thrust reversers, and I did not get full reverse. I applied the brakes immediately after I deployed the speed brake. And when the wheel brakes were applied, there was no sensation of stopping, not a sensation of antiskid, a cycle, there was nothing. And I was still trying to pull full reverse. I lost high airspeeds where they're most effective and that's where I lost most of my stopping (capability)."

The captain also stated he pushed the control column forward but did not indicate the amount of pressure applied. He added that, since it appeared that the antiskid system was not operating properly, he released the brakes in order to get wheel spinup, which would then activate the antiskid system. He was aware that his airline's procedures required that steady pressure be applied to the brakes in order for the antiskid system to be effective. Nevertheless, he stated that "I released the brakes after what I thought was an adequate time and reapplied the brakes, and any pumping situation might have been my nervousness on the brake pedals."

After touchdown, the airplane continued its rollout and, at 2007:43, the first officer said, "We're gonna get the lights on the overrun." Two seconds later, the airplane struck the localizer antenna array for runway 36R, located about 300 feet from the departure end of the runway, struck a concrete culvert used for drainage, and continued through a chain link fence, coming to rest about 440 feet beyond the departure end of runway 36R.

Pilots Qualified and Experienced

The captain had been a U.S. Air Force C-141 transport commander before joining the airline in May 1980. He flew the YS-11 and B-737 as a first officer, upgraded to captain on the F-28 in April 1984, and transitioned to captain on the B-737 in September 1985. At the time of the accident, he had accrued approximately 10,000 total flight hours, about 2,500 of those in the B-737 with 500 hours as captain.

The first officer had been a first officer in Part 135 commuter operations flying Metroliner and C-402 aircraft and was also a first officer in DC-6, DC-7 and CE-500 aircraft. He joined the airline in June 1984, and had flown as a second officer on the B-727 for about 13 months before he upgraded to first officer on the B-737 in August 1985. He had accrued approximately 4,100 flight hours, including about 500 hours in the B-737.

NTSB Found Captain At Fault

NTSB determined that the probable cause of the accident was the captain's failure to stabilize the approach and his failure to discontinue the approach to a landing that was conducted at an excessive speed beyond the normal touchdown point on a wet runway. Contributing to the accident was the captain's failure to optimally use the airplane decelerative devices. Also contributing to the accident was the lack of effective crew coordination during the approach. Contributing to the severity of the accident was the poor frictional quality of the last 1,500 feet of the runway and the obstruction presented by a concrete culvert located 318 feet beyond the departure end of the runway.

Required Company Procedures Not Followed

NTSB said that after the flight entered the Charlotte approach control airspace, the flight crew failed to follow certain required company procedures and did not monitor critical flight parameters. As a result, there was a diminution of the margin of safety which led directly to the failure of the captain to land within the proper area of the runway at a proper airspeed and then perform the procedures necessary to stop on the available runway.

Before the flight crossed the final approach fix, the captain did not reduce the airspeed to a value appropriate for the approach, nor did he configure the airplane as required, nor did the first officer call this to the attention of the captain.

This airline's procedures specified that before crossing the LOM, the final flap setting should have been selected and the airspeed should have been reduced to a level appropriate for that flap setting. On this flight, the final flap setting was 30 degrees and the final approach airspeed, or Vref, was 131 knots. The CVR indicates that the final flap setting was not accomplished until the airplane was on the glide slope, well inside the final approach fix. Further, the first officer did not lower the gear until 2005:39 and the captain did not select the final 30 degree flap setting until 2006:48, when the airplane was less than one mile from the runway threshold and two seconds before the first officer made the "500 feet" call. The airspeed was not reduced to 131 knots until after landing. Thus the approach was carried out in a manner well outside the parameters established in the airline's procedures.

Because the airplane was not configured for the landing until 500 feet above touchdown, NTSB said the captain was "behind" the airplane: That is, he was setting flaps, lowering the landing gear and trying to reduce the airspeed after the flight was descending on the glide slope and well inside the final approach fix.

Despite the captain's assertions that he added 20 knots to Vref because of his concern for a windshear condition, NTSB believed that, if correct, he failed to properly interpret and apply guidance provided on the subject in the company operations manual. From that guidance, with surface wind reports, the lack of significant convective activity and his knowledge of the tailwind on the approach, the captain should have known that the existing wind shear involved that of a tailwind shearing to a light crosswind or no wind. Under these conditions, significant speed increases are not needed and may compound airplane controllability because this type of windshear tends to increase indicated airspeed during descent, through the reducing tailwind shear. Moreover, four of the airline flights, that landed during the approximate 11-minute period before the subject flight, flew through similar wind conditions without any significant speed additions and without any reported difficulties in stopping.

Finally, the company operations manual states that "if the airplane is below 500 feet AGL and the approach becomes unstable, a go-around should be initiated immediately." NTSB said the captain should have promptly adhered to company guidance and executed a missed approach.

Crew Continued Unstable Approach

To NTSB, the evidence indicated that both pilots were aware that the approach was unstable, yet they continued it. The captain knew that the turn to the final approach course was going to be close and he accepted it. He was aware that the likelihood of a tailwind on final was high. Further, he had several indications that the approach was not procedurally correct — "it's going to be tight" — presumably in reference to configuring the airplane properly and capturing the glide slope and localizer, and "George didn't do me any favors there," when he recognized that the autopilot was not capturing the glide slope. This was probably caused by the excessive descent rate that exceeded the autopilot capabilities to maintain the glide slope path, due to the high airspeed and substantial tailwind.

Evidence Indicates Speed Brake Not Armed

The first officer did inform the captain that the speed brake lever was in manual, i.e. down detent, contrary to the airline's requirement that the speed brake lever be armed before landing. The captain's response to that call is unclear on the CVR and NTSB could not determine whether he armed the speed brake lever. However, the failure of the ground spoilers to deploy immediately after landing suggested that they were not armed.

GPWS Alert Ignored

The GPWS alerted twice, further indicating that the approach was unstable and not in accordance with company procedures. Since the runway was in sight when the first GPWS sounded, and since the first officer called minimums when the second alert sounded, the captain probably recognized that terrain clearance was adequate, and as a result, believed that he could safely ignore the alert.

However NTSB thought that the GPWS was alerting, not because of inadequate terrain clearance, but because of an excessive descent rate close to the ground. Because the airspeed was considerably higher than required at that point and because the aircraft had only just been configured for the landing, the captain should have recognized that the approach was not stabilized at the appropriate airspeed, descent rate, and power setting. Consequently, the margin of safety for landing on a wet runway had been reduced to an unacceptably low level.

Safe Stop Was Possible

NTSB believed that the airplane could have been stopped on the remaining runway had the captain made optimal use of decelerative devices, i.e. spoilers, thrust reversers, brakes and the antiskid system.

The evidence suggested to NTSB that the spoilers were not armed nor deployed. This in spite of repeated guidance in the company operations manual on the need to arm spoilers and, if not armed, to deploy them upon touchdown before the other decelerative devices.

First Officer Showed Lack of Assertiveness

While the decision to continue the approach belonged to the captain only, NTSB believed that the first officer participated in the decision making process in the information he provided to the captain. The first officer recited the landing checklist, stated that the speed brakes were in the manual mode of operation and called out the approach lights when they became visible.

The first officer's statement about the speed brake lever being in manual contained the clear implication that it was not armed as required. To NTSB, this was a subtle reminder to the captain that he was not adhering to the required approach and landing procedures.

The first officer did not point out to the captain that the airplane was still not configured for landing when it was well inside the final approach fix and he did not call out excessive airspeeds throughout the approach. The company operations manual requires the first officer to use standard callouts, "including any significant deviation especially when less than 500 feet above field elevation. Call out significant deviations from programmed airspeed, descent rate and instrument indications."

Therefore, NTSB concluded that the first officer's lack of assertiveness in providing the captain with needed information and the captain's failure to respond to the "subtle" callout of the speed brakes as required in the manual are indicative of deficient crew coordination, also known as cockpit resource management. This deficiency contributed to the accident.

NTSB recognized the difficulty that first officers face in attempting to provide captains with needed information at critical points in flight when such conversation could be distracting. More important is the difficulty they may face when attempting to influence the pilot-in-command to reconsider and possibly alter a decision. Thus, said NTSB, it would have been very difficult, once inside the final approach fix, for the first officer to suggest that the approach was not stabilized and, as a result, they should go around. Such a suggestion could, said NTSB, if presented inappropriately, distract the captain and could potentially endanger the safety of flight.

Comments and Observations

There is a practical value to spelling out procedures in the company operations manual which pilots sometimes have trouble understanding. That need comes from the misperception that the aircraft manufacturer's flight or operating manuals contain all there is to know about flying the aircraft.

Company operations manuals go beyond the approved rituals that are required to activate and use the aircraft's systems and components by injecting what can be described as the "people relationship" into the cockpit environment. That ingredient creates a check and cross-check monitoring exercise designed to keep all of the crewmembers involved in flying the airplane. Training programs that embrace the company operations manual procedures assure understanding of crewmember roles which then should translate into common practice when in actual flight conditions.

The need for assertiveness in the cockpit has been stressed repeatedly since the lack of it was recognized as a major accident causal factor in numerous accidents. Should a "subtle" hint be considered a form of assertiveness? To some that might be as effective as a "bash on the head with a wet noodle."

For the subject flight, a reader might assume that both pilots did not see anything particularly wrong with the way the approach was being conducted. The first officer did say, "Good show," which might be interpreted as a compliment to the captain for his skill. In this scenario, the "subtle" comment about the speed brake being in manual could have indicated no more than a casual observation.

On the other hand, if the first officer was truly concerned with non-conformance to established procedures, more forceful assertiveness on his part was in order. But, when and how should he have revealed his concern for the safety of the flight and his own body?

If the phase of flight was such that the luxury of time permitted use of an established procedure, an adaptation of the "two-communication rule" used by many airlines to question subtle incapacitation might have been appropriate. That adaptation could read: "If the pilot flying does not inform the pilot not flying of proposed deviations to a standard operating procedure or standard flight profile, the pilot not flying is required to twice question the pilot flying as to the nature and reason for deviation from the procedure or profile. If the safety of flight is about to be compromised and there has been no response from the pilot flying after the second communication, the pilot not flying shall be prepared to assume control of the aircraft."

Given the nature of the macho pilot psyche, that rule may be a difficult one to implement. However, if it only serves the purpose of getting the attention of the pilot flying to the point where a correction is made, the first officer's assumption of control becomes a moot point. Debate about the propriety of asking the questions need to be reviewed, but only after the aircraft has landed safely. The point is whether the procedure is useful and whether it should be included in the company operations manual.

The subject flight presented a different scenario in that the lack of conformance to the manual procedures, as NTSB stated, put the captain "behind" the airplane. If the reader assumes that the first officer recognized the problems that were accumulating, was without the time for a formal question and answer period, and wanted to really assert himself, what courses were open in light of the rapid progression of approach?

If the first officer were a trained "by-the-book" pilot, he could have shouted out what was not in order and, more or less, demanded some sort of response from the captain that would have led to corrections or a go-around. He might have assumed verbal command by ordering "Go Around! Execute Missed Approach!"

NTSB does make a valid point that distracting the captain of the subject flight, when things were quietly deteriorating, could have had an adverse affect on the safety of the flight. A shouting and overly assertive first officer was hardly what was needed during this critical phase of the flight even though that sort of conduct may have prevented the accident.

The first officer's concern about his immediate welfare should have made him consider an appropriate course of action. Given the option of distracting the captain or saving the flight, the choice may have been more obvious.

The series of events in the flight from the outer marker to where it finally ended 400 feet beyond the departure end of the runway suggests a comparison with a snowball going down hill, picking up speed and debris before it comes to a sudden stop.

There were several clearly defined steps that could have been taken to slow down or interrupt the chain of events that led to this accident. Causal factors attributed to failure to comply with operations manual procedures and a lack of crew coordination and assertiveness repeats like a broken record in NTSB accident files. All of this suggests going back to basics: practice, drill and training so that the messages come through loud and clear to aircrews.

Crew coordination demands that all the crewmembers stay in the loop of operating and controlling the aircraft. Assertiveness is required in the cockpit, but understanding the whys and wherefores of it are an integral part of crew coordination.

About the Author

John A. Pope established John A. Pope & Associates, an aviation consulting firm located in Arlington, VA, U.S.A., after retiring in 1984 as vice president of the U.S. National Business Aircraft Association. He specializes in developing comprehensive operation manuals for corporate flight departments.

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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 service.

Reports Received At FSF

AC 150/5325-5C. *Aircraft Data.* FAA Advisory Circular. 29 June 1987. AAS-100, FAA Hq., Washington, DC 20591 U.S.

Summary: This presents a listing of principal aircraft weights and dimensions that affect airport facility design. It is to be used for guidance in airport development. Data presented are for common civil aircraft and those military aircraft which frequently utilize civil facilities.

AC 120-45. *Advanced Training Devices (Airplane only) Evaluation and Qualification.* 11 May 1987. ASO-205, FAA Hq., Washington, DC 20591 U.S.

This circular sets forth an acceptable means to evaluate of airplane Advanced Training Devices (ATD) submitted for approval under FAR 135.335. This AC should be used in conjunction with applicable regulations in order to assure compliance with the requirements. This AC applies to the evaluation of airplane ATDs only. Criteria for airplane simulator and visual system evaluation are contained in AC 120-40 as amended, and criteria for the evaluation of helicopter simulators are currently under development and will be set forth in a similar document.

AC 91-66. *Noise Abatement for Helicopters*. FAA Advisory Circular. 4 June 1987. AFS-840, FAA Hq., Washington, DC 20591 U.S.

Summary: This presents guidelines intended to assist pilots, operators, managers and other interested persons in the establishment of effective noise reduction procedures when operating helicopters. It is not comprehensive, but if the flight procedures and concepts outlined are followed, significant noise abatement will be achieved and public acceptance of helicopter operations should be enhanced in noise-sensitive areas.

Civil Aviation and Flight Safety In Canada

In Canada, civil aviation includes all aircraft operations under Canadian Transport commission Air Transport Committee (ATC) license classes 1 through 8 and operations by federal and provincial governments as well as private flying (general aviation). The Canadian Department of Transportation, a regulatory agency, is responsible for the operations of national and international air transportation system; the Canadian Aviation Safety Board (CASB), which was created as an independent agency only four years ago, is responsible for advancing aviation safety by conducting independent investigation and, if necessary, public inquiries into aviation accidents, incidents and other safety related occurrences in order to identify safety deficiencies as evidenced by aviation occurrences and reporting publicly on its investigation and public inquiries as well as making recommendations designed to eliminate or reduce safety deficiencies.

Canada has one of the highest levels of aviation activity in the world. There were 27,000 registered civil aircraft recording about 3.5 million flight hours in 1987. Although the civilian aircraft fleet was about one tenth the size of that of the United States, it was four times that of the next largest aviation nation. On a per capita basis, Canada is virtually equal to the United States with about one aircraft per thousand people. There were more than 84,000 licensed personnel involved in Canadian civil aviation, including pilots, navigators, flight engineers, air traffic controllers and aircraft maintenance engineers. There are about 1,200 airports and several thousands uncertified airstrips, which handled 58 million enplaned and deplaned passengers annually. Airline operation, including both scheduled and non-scheduled services, accounts for about 23% of annual total aircraft hours flown, Federal and provincial government accounts for 3%; air taxi 30%; personal and flying club 30%; industrial special flying and all others account for 14%.

The safety performance in Canadian civil aviation is very compatible with that of other nations in the world. Safety trends in Canadian aviation since 1979 have been generally favorable. Although total and fatal accidents fluctuated annually, the total accidents over the past nine year period declined from 726 in 1979, to 438 in 1985 and increased to 472 in 1977; the fatal accidents also declined from 109 in 1979, to 40 in 1985, rose to 65 in 1986 and then went down to 53 in 1987. A statistical comparison of the total accidents, fatal accidents and rates for the past nine years, is shown in Table 1. However, the safety performance of Canadian civil aviation appears much encouraging if the trends are analyzed by a three-year rolling average of total accident and fatal accident rate as depicted in the following Figure 1. Note that the two safety indicators have been on the downward trend since 1979.

Table 1
Total Accidents, Fatal Accidents and Fatalities
Canadian Civil Aviation
1979 — 1987

Year	Accidents Total	Fatal	Aircraft Fatalities	Aircraft Hours Hours Flown(1)	Accident Rates Per 100,000 Aircraft Hours Total	Fatal
1979	726	109	254	3,960,780	18.3	2.8
1980	684	76	149	4,265,188	16.0	1.8
1981	695	88	172	4,123,288	16.9	2.1
1982	539	62	123	3,688,713	14.6	1.7
1983	510	63	148	3,447,277	14.8	1.8
1984	458	57	120	3,322,200	13.8	1.7
1985	438	40	71	3,256,280	13.4	1.2
1986	471	65	113	3,400,000 (EST)	13.9 (EST)	1.9 (EST)
1987	472	53	97	3,500,000 (EST)	13.5 (EST)	1.5 (EST)

Source: Accident, Incident Database, CASB.

Another interesting finding in analyzing Canadian civil aircraft activity is that the accident rate and fatal accident rate of rotary-wing aircraft is slightly superior to that of fixed-wing aircraft. The following Table 2 is a statistical comparison of accidents and rates for fixed-wing versus rotary-wing aircraft total accident or fatal accident rates in one year is lower and that in another year is higher than that for fixed-wing aircraft. Rotary-wing aircraft safety performance could look much better if the exposure and accident data for large aircraft operated by airlines are excluded from comparison. No adjustment to the statistics can be made because the breakdown of airline fixed-wing and rotary-wing aircraft hours and accident data are not available. However, it should be noted that in Canada, most airlines (not included air taxi) operate large fixed-wing aircraft and the hours flown of which accounted for about 23% of total civil aircraft flying hours but number of airline accidents accounts for less than 2% of the total. Apparently, the accident rate for small fixed-wing aircraft accident rates would go up much higher than that for rotary-wing aircraft if airline exposure and accident data are excluded from the comparison.

Table 2
Total Accident, Fatal Accidents, and Fatalities
Fixed-wing Versus Rotary-wing Aircraft
Canadian Civil Aviation

	Fixed-Wing Aircraft						Rotary-Wing Aircraft					
Year	No. of A/C*	Flying Hours (Millions)	Accidents Total	Fatal	Rate	Fatal Rate	No. of A/C*	Flying Hr. (Millions)	Total	Accidents Fatal	Rate	Fatal Rate
1977	15,940	3.28	622	75	19.0	2.3	843	0.41	69	6	16.8	1.5
1978	16,887	3.45	606	85	17.5	2.5	892	0.48	89	8	18.6	1.7
1979	17,076	3.42	623	95	18.2	2.8	1,000	0.54	98	11	18.3	2.0
1980	17,745	3.67	582	62	15.8	1.7	1,146	0.59	99	14	16.8	2.4
1981	17,156	3.50	570	72	16.3	2.1	1,132	0.62	122	15	19.7	2.4
1982	17,472	3.19	482	55	15.1	1.7	1,072	0.50	54	7	10.8	1.4
1983	16,879	3.01	456	56	15.1	1.9	983	0.43	53	7	12.3	1.6
1984	16,699	2.93	417	54	14.2	1.8	937	0.39	38	3	9.7	0.8
1985	16,584	2.87	384	33	N/A	N/A	899	0.39	52	6	N/A	N/A
1986	N/A	N/A	423	58	N/A	N/A	N/A	N/A	47	7	N/A	N/A
1987	N/A	N/A	411	42	N/A	N/A	N/A	N/A	55	9	N/A	N/A

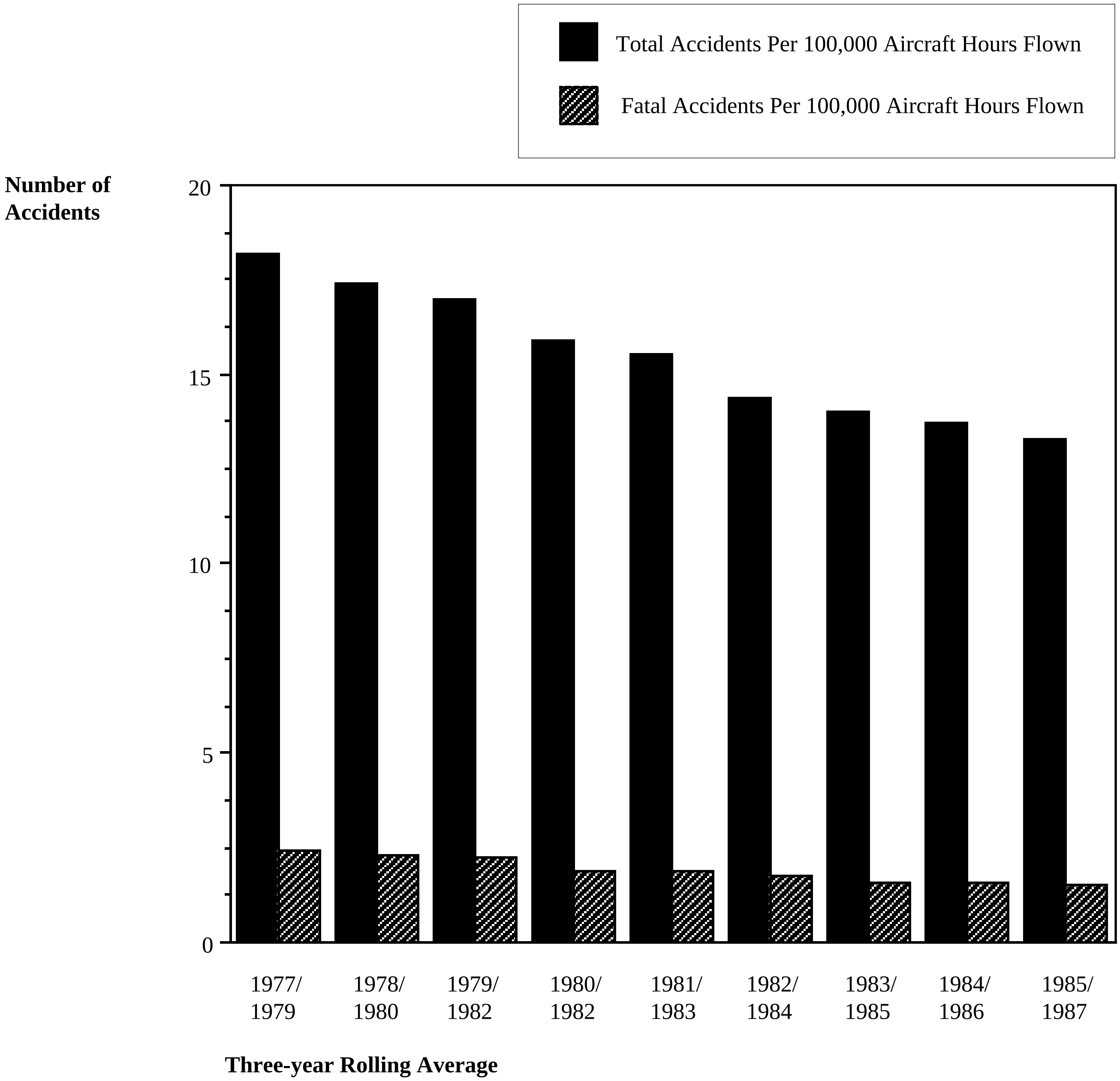
Source: Accident, Incident Database, CASB.

Note: Accident rate is the number of accidents per 100,000 hours flown.

Excludes a small number of other aircraft types (balloons, etc.)

* Registered aircraft with a valid Certificate of Airworthiness.

Figure One
Safety Trends
Canadian Civil Aviation
1979—1987



Accident/Incident Briefs

Leaking Loo

United Kingdom — March

Boeing 737: Minor damage. No injuries.

Shortly after the airline jet took off from Gatwick for Malaga, the forward toilet floor became awash with blue fluid. The pilots were treated to a display of numerous warning lights and flags, including: STAB OUT OF TRIM, MACH TRIM FAIL, RAD ALT FAIL, OMEGA RED WNG, and the autopilot disengaged and could not be re-engaged.

After landing the electronics bay was opened and large amounts of the blue liquid poured out. Some of the fluid was still dripping onto several electronic components. The cause was traced to a loose tank overflow pipe to the forward toilet sink. A new O ring was installed and the tank reinstalled.

Blades Away

United Kingdom — February

Bowing 747: Major damage to one engine. No injuries.

Enroute from New York to London with 259 persons on board.

The aircraft was about 44 minutes from landing and was still in cruising flight. The number 2 engine turbine gas temperature (TGT) gauge reading dropped to 130 degrees C. After checking the electrical power to the gauge and seeing that all other parameters seemed normal, the TGT gauge was suspected of being faulty, and the engine was allowed to continue running.

Thirteen seconds after touchdown at Heathrow Airport when reverse thrust had been selected on all four engines, there was a fire warning indication for number 2 engine. The crew shut the engine down and the fire warning went out.

An uncontained failure of the number 2 engine had caused minor damage to the wing flaps, fuselage fairing and the adjacent engine. The non-containment of the blades was traced to complete failure of the anti-rotation pins that restrain the third stage low-pressure turbine stator vanes. Contributing factors were listed as inadequate design strength of the pins.

Wrong Place For High Spirits

United Kingdom — May 87 (Final Report)

Boeing 747: No damage. Minor injuries to two.

One and three-quarters hours out of Caracas, Venezuela, on a flight to London, the cabin services director (CSD) reported that a male passenger in a party of six was drunk and disorderly, and was causing a disturbance to others in the club section. Five minutes later the CSD reported to the captain that the drunken passenger had struck him and had subsequently been removed from his seat and restrained on the floor by three of his colleagues. The passenger had been shouting, swearing and throwing glasses and bottles of wine at other passengers, and had interfered with cabin service. He also had attacked a husband and wife seated next to him, breaking the husband's glasses.

The captain went to speak with the unruly passenger who proceeded to kick and spit at him. The passenger was "restrained" and checked by a nurse, who was on board the aircraft.

In the meantime, another member of the same party, also intoxicated, went into a toilet where he proceeded to smoke so heavily that smoke poured from around the door and the smoke alarm sounded. A cabin crew member discharged a fire extinguisher under the door and the passenger emerged.

Upon arrival at London the unruly passenger was arrested.

The airline has since introduced self-locking restraint devices and developed procedures to identify and deal with potentially unruly passengers who are likely to cause in-flight safety hazards or disturbances.

Accident/incident briefs are based upon preliminary information from government agencies, aviation organizations, press information and other sources. The information may not be accurate.

Gear Down/Gear Up

United States — July

Embraer 110: Minor damage. No reported injuries.

The commuter aircraft was on a long final approach when a tower controller visually observed that the gear was down. The aircraft was next observed skidding down the runway gear up.

The aircraft sustained minor damage and there were no injuries reported.

Scraped Nose

United States — July

Beech 99: Substantial damage. No injuries.

The commuter flight had departed IFR from Indianapolis, Ind., for Owensboro, Ky. Fifteen miles out of the departure airport, the pilot reported a problem with the landing gear and requested clearance to return. After working unsuccessfully for 45 minutes trying to get a safe gear down indication, the pilot elected to land with the nose gear cocked approximately 45 degrees toward the rear of the airplane.

After touchdown, the nose gear collapsed and the airplane slid to a halt on the runway. The forward section of the aircraft suffered substantial damage but there were no injuries to the occupants.

Bent Leg

United Kingdom — Dec. 1987 (Final Report)

DHC-6 Twin Otter: Substantial damage to nose gear area. No injuries to 15.

The commuter aircraft was making a landing approach to an approved beach landing strip with 20-knot winds and heavy rain. The pilot had reported that it was difficult to judge height above the surface because the flooded beach merged with the sea in the background. The airplane touched down and became airborne again, after which a go-around was initiated. The Twin Otter touched down a second time before climbing off. (It was considered that initial damage to the nose gear strut and tire may have occurred at this time.)

The pilot initiated another landing. When the propellers were selected in the Beta range after touchdown, the pilot felt vibration in the airframe until the airplane came to a stop. Steering became progressively more difficult and the pilot had to maneuver using asymmetric power.

Inspection disclosed a bent nose gear strut and damage to surrounding structure and to the nose tire. There were no injuries to the two crew members or the 13 passengers.

Broken Leg On Landing

United States — July

Mitsubishi MU-2: Minor damage. No injuries.

The business turboprop made an uneventful landing but, as the pilot turned off to a taxiway, the left main gear failed. The aircraft sustained minor damage and there were no injuries to the occupants.

Upon inspection it was found that the left main gear strut had broken loose from the landing gear.

Midair On Final

United States — No Date

Cessna 310, Cessna 152: No damage to 310, substantial damage to 152. No injuries to 3 persons.

Both aircraft were on final approach. The Cessna 310 passed under the C-152 and landed first. While the Cessna 152 was attempting to make a go-around, its left horizontal stabilizer struck the rotating beacon of the Cessna 310, which is on the top of the vertical stabilizer. The C-152 then landed in front of the C-310. The Cessna 152 sustained substantial damage and the C-310 was not damaged. The instructor and student in the C-152, and the pilot in the C-310 were not injured.

Other General Aviation

Sheepish Landing

United Kingdom — March

Socata Tobago: Minor damage. No injuries.

The pilot overflew the airfield for a visual inspection prior to landing. He saw that there were sheep near the threshold of Runway 2 and made two low approaches to encourage the animals to move. He made a third approach, intending to land from it, but the sheep were still too close to the landing area, so he diverted to another airport.

The pilot was again confronted with sheep and he decided to return to a third airport. However, as his route would pass the original destination, he decided to make one last try after he noticed that the sheep had moved further away from the runway threshold. After he touched down and was well into the landing run, a sheep broke from left to right across the runway in front of the airplane. After hard braking, the nose and propeller missed the animal, but it jumped and was hit by the wing leading edge and the flap. There was minor damage to the airplane; the fate of the sheep was not reported.

Preflight Food For Thought

United Kingdom — Spring 1988

Cessna 152: No incident

During a pilot rally, a preflight inspection competition was held, the results of which may offer some accident-prevention insights. Ten faults were arranged on a Cessna 152 and the airplane was inspected by a total of 229 pilots and student pilots and a few non-pilots. Nine found all defects, 40 found 9 defects and 61 found 8. Here are the defects and how well they were noticed.

FAULT	MISSED BY
Both halves of seatbelt missing	54%
Clear tape over static port	19%
Pitot head removed from under wing	9%
Screws missing from wingtip fairing	66%
Nose strut deflated	25%
Nut gone from nosewheel axle bolt	49%
Aileron push rod disconnected	None
Brake pad removed	7%
Tail tie-down eye loose	19%
Lower rudder hinge bolt nut removed	9%

Since only one aileron moved, no one missed it — but the missing nosewheel axle nut could have led to problems for half of the contestants (maybe the fact that the cotter pin was craftily left in place fooled them).

Hopefully, the non-pilots among the group were responsible for the written report of "Pilot's (sic) head missing" and for the other spellings of pitot: piteo, petot and peato.

Close, Very Close

United Kingdom — April

Fuji FA200: No damage. No injuries to two.

The pilot had just taken a guest for a one-hour aerobatic flight. After they landed and parked the airplane, the pilot facetiously suggested that the right-hand wing be "waggled" to see if it was still attached. To his horrified surprise the wing tip did move forward and backward when it was shaken.

What allowed the movement, and could have led to a disaster, was wear in the wing attachment points. A manufacturer's technical bulletin (No. 200-18) gives details for inspection and repair when such wear is discovered.

Dead End

United States — No date

Piper PA-28: Substantial damage. Minor injuries to two.

After takeoff on a pleasure flight, the pilot turned to a heading that took the airplane up a canyon. When he came to a dead end and tried to turn around, the right wing struck a tree which spun the airplane around, causing it to strike a hill.

The aircraft was substantially damaged but the two occupants sustained only minor injuries.

Good Landing

United States — July

If it's true that the definition of a good landing is one that you walk away from, this one can be classified a good landing.

During an aerial application operation, the pilot had emptied his tanks and was making a final pass to check the coverage, when the aircraft struck a guy wire on a radio transmitting tower.

The aircraft came to rest inverted in a corn field hidden from view. The pilot, uninjured, walked to a road for assistance.

No Response

United States — July

Piper PA-24: Substantial damage. No injuries.

The pilot had lowered his landing gear and reduced power so he could overfly the airport to check the wind direction.

When he added power, the engine failed to respond. The pilot then made a deadstick landing. The airplane overshot the end of the runway, the nose gear collapsed and the Comanche slid into a fence along the airport boundary, sustaining substantial damage. The pilot was unhurt.

First One Thing . . .

United States — July

Piper J-3 Cub: Substantial damage. No injuries.

The pilot departed on a pleasure flight. Forty minutes later the engine lost a cylinder. During the forced landing, the airplane ended up in a four-foot-deep pond — 50 feet from dry land. The airplane was substantially damaged but there were no injuries.

Rotorcraft

Vibration Is A Message

United States — May

Aerospatiale 355: Minor damage. No injuries to 4.

While transporting a patient to a hospital, the pilot noticed a vibration in the floor of the helicopter. After levelling off in cruise power, the vibration decreased temporarily. Then it increased suddenly, there was a bang and the tail rotor output shaft separated from the tail rotor gear box.

Without yaw control, the pilot twice attempted run-on landings at a nearby airport, but had to abort them because of excessive yaw. He then shut down both engines and accomplished a successful autorotative landing. No injuries were reported to the pilot, the patient or the two flight nurses. The aircraft received minor damage.

A Loud Silence

United States — May

Hiller UH-12E: Substantial damage. No injuries to one.

The pilot on an aerial application flight was turning the helicopter prior to releasing the remaining spray when he heard a loud screeching sound followed by silence, and no power. Because of the low altitude, the pilot was not able to go into autorotation and the aircraft hit the ground. The landing skids separated on impact and the helicopter came to rest on its right side. The aircraft was substantially damaged but the pilot reported no injuries.

Later examination revealed that the engine's crankcase had split and the number two cylinder had partially separated.

Dusted Off

United States — May

Hughes 369E: Substantial damage. Mixed injuries to four.

The pilot reported that he experienced loss of ground reference because of blowing dust, and that as a result was unable to maintain control of the helicopter. Consequently, the aircraft landed hard and sustained substantial damage. Minor injuries were suffered by the pilot and two of the passengers, and a third passenger received serious injuries.

Downwind Takeoff

United States — May

Hughes 269B: Substantial damage. No injuries.

The pilot was making a downwind takeoff and experienced a loss of engine power. While he was attempting to make an emergency landing in a parking lot, the tail rotor struck a moving vehicle. The helicopter was substantially damaged, but there were no injuries to the occupants of either the aircraft or the ground vehicle.