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Low Engine Oil Pressure, Severe Vibration Prompt Pilatus PC-12 Forced Landing

The pilot did not follow the prescribed emergency procedure for a low-oil-pressure indication and eventually had to shut down the engine because of severe vibration. Three of the 10 occupants were seriously injured when the pressurized, single-engine turboprop aircraft was landed in a bog. The investigation did not determine why the oil-flow interruption occurred.

FSF Editorial Staff

During a scheduled flight from St. John's, Newfoundland, Canada, to Goose Bay, Labrador, May 18, 1998, the pilot of a Pilatus PC-12 observed a low-oil-pressure indication and turned back toward the departure airport. The pilot then shut down the engine because of a severe vibration and flew the aircraft toward the nearest airport: Clarenville, Newfoundland. The aircraft was destroyed about 1741 local time during a forced landing in a bog 1.5 nautical miles (2.8 kilometers) from Clarenville. The pilot, a company observer and one passenger were seriously injured; seven passengers received minor injuries or no injury.

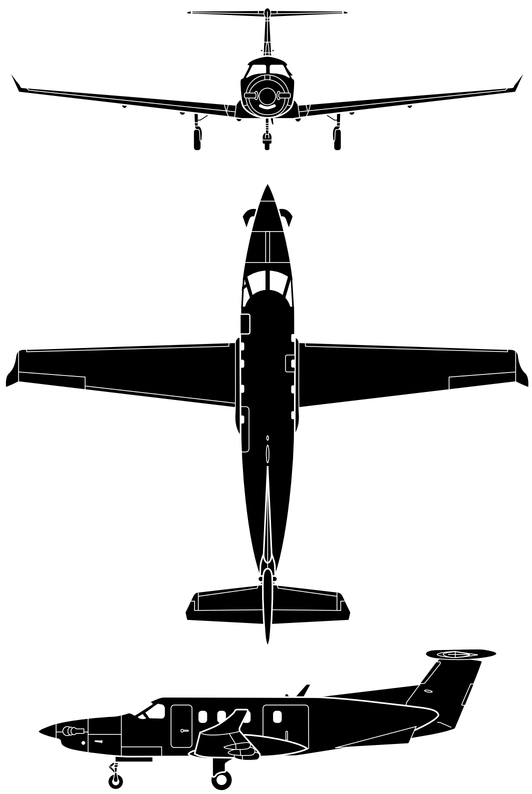
The Transportation Safety Board of Canada (TSB), in its final report, said that the causes of the accident were the following:

- "The pilot did not follow the prescribed emergency procedure for low oil pressure, and the engine failed before he could land safely;
- "The pilot's decision making was influenced by his belief that the low-oil-pressure indications were not valid; [and,]
- "The engine failed as a result of an interruption of oil flow to the first-stage planet-gear assembly; the cause of the oil-flow interruption could not be determined."

The pilot, 30, had 4,700 flight hours, including 800 flight hours in type.

"The pilot held an airline transport pilot license and a valid pilot-proficiency check on the PC-12 aircraft," the report said. "He had a valid medical certificate, signed by a Canadian aviation medical examiner on 28 April 1998.

"He had also completed all general and specific classroom training required by the Canadian Aviation Regulations (CARs) and the company operations manual to qualify him to act as pilot-in-command on the PC-12 aircraft."



Pilatus PC-12

The Pilatus PC-12 is a pressurized utility/business aircraft powered by a turboprop engine. The first flight was conducted in May 1991. Preproduction design modifications included winglets, longer wingspan, larger dorsal fin and ventral strakes. Deliveries began in September 1994.

The standard version has two flight-deck seats and eight cabin seats. The executive version has two flight-deck seats and six passenger seats. Maximum cabin-pressure differential is 5.8 pounds per square inch (0.4 bar).

The 1,605-shaft-horsepower (1,197-kilowatt) Pratt & Whitney PT6A-67B engine is flat-rated at 1,200 shp (895 kw) for takeoff and 1,000 shp (746 kw) for climb and cruise. The four-blade Hartzell propeller can be operated in reverse pitch.

The fuel tanks are in the wings. Maximum usable fuel capacity is 400 gallons (1,514 liters).

Wingspan is 53.3 feet (16.2 meters). Length is 47.3 feet (14.4 meters). Height is 13.9 feet (4.2 meters).

Maximum ramp weight is 9,083 pounds (4,120 kilograms). Maximum takeoff weight and landing weight is 9,039 pounds (4,100 kilograms). Maximum zero-fuel weight is 8,157 pounds (3,700 kilograms).

Maximum rate of climb at sea level is 1,940 feet per minute. Maximum cruising speed at 25,000 feet is 270 knots (500 kilometers per hour [kph]). Maximum operating altitude is 30,000 feet. Stall speed in clean configuration is 88 knots (163 kph). Stall speed in landing configuration is 61 knots (113 kph). Landing distance is 920 feet (280 meters). Landing distance over a 50-foot (15-meter) obstacle is 1,840 feet (560 meters).

Source: *Jane's All the World's Aircraft*

The pilot had completed required training in single-engine instrument flight rules (SEIFR) operations in a Cessna 208 flight simulator.

"To act as pilot-in-command on aircraft approved for SEIFR flight, pilots are required to have training in an approved synthetic training device (simulator)," the report said. "There is now an approved PC-12 simulator available for training; however, when the PC-12 was first certified for SEIFR flight, there was not. Consequently, TC [Transport Canada] issued a waiver allowing SEIFR operations in this aircraft, provided the pilots had training on the Cessna 208 simulator."

The pilot had not received formal training in decision making. The report said that the regulatory requirements for SEIFR operations do not include training in pilot decision making (PDM).

"This appears inconsistent in that the standard for reduced VFR [visual flight rules] limits [in] CASS [Commercial Air Service Standard] 723.28, 'VFR Flight Minima — Uncontrolled Airspace' requires pilots to have PDM training," the report said.

The pilot had flown 120 hours, including 80 flight hours in type, in the 90 days preceding the accident. He was off duty for 80 hours before reporting for work two hours before the accident occurred.

The pilot received a weather briefing before departure. Weather conditions at St. John's Airport included 15 statute miles (24 kilometers) visibility, a broken ceiling at 700 feet, an overcast at 1,000 feet, surface temperature 3 degrees Celsius (37 degrees Fahrenheit) and dew point 2 degrees Celsius (35 degrees Fahrenheit). The area forecast called for cloud tops at 8,000 feet and light-to-moderate rime icing and moderate mixed icing.

The Pilatus PC-12 was one of two aircraft operated by Kelner Airways.

"The primary use of the PC-12 was cargo operations; it was also used for scheduled passenger flights, which consisted of a once-daily Goose Bay–St John's–Goose Bay flight, six days a week," the report said. "The PC-12 aircraft was changed from passenger configuration to cargo configuration and vice versa during the station stops in Goose Bay, which were approximately 30 minutes in duration. The company observer usually installed the seats."

The accident aircraft was manufactured in 1996 and had accumulated 3,913 service hours. The other aircraft operated by Kelner Airways was a Beech 1900, which was used primarily for cargo operations and was used occasionally for passenger-carrying charter flights.

The report said that the PC-12 was dispatched for the flight to Goose Bay with the following deferred maintenance items:

- "'Emergency locator transmitter (ELT) removed.' — The ELT was removed prior to this flight for maintenance. CAR 605.39 allows for flight without an ELT for up to 90 days;

- "'Deice system inoperative, aircraft restricted.' — The outboard deicing boot on the left wing had been replaced prior to the flight; and, because the cure time on the sealant was 48 hours, the system was unserviceable; [and,]

- "'Low-oil-quantity light inoperative.' — During an unrelated maintenance action prior to the accident flight, the low-oil-quantity light was observed to be illuminated. The [oil] tank level was checked and found to be full. During subsequent troubleshooting of the system, the light extinguished, and maintenance [personnel were] unable to determine why it had illuminated. The filler cap and indicator assembly were suspected of having an intermittent fault. As an interim measure while awaiting replacement parts, the aircraft was placarded and a letter was sent to all flight crew advising them that the system was unserviceable and to visually check the oil level before each flight. The pilot had read the letter, and he [had] checked the oil before departing on the accident flight."

The report said that the weight and center of gravity were within limits when the aircraft departed from St. John's at 1655 on an instrument flight rules flight plan. The aircraft was being operated as Kelner Airways Flight 151.

The pilot was completing the climb to Flight Level (FL) 220 when he observed a low-oil-pressure indication. The low-oil-pressure caution light then illuminated.

"Upon leveling off at FL 220, approximately 39 nautical miles [72 kilometers] from St. John's Airport, the low-oil-pressure warning annunciator light activated," the report said.

The "engine emergencies" section of the PC-12 pilot operating handbook (POH) said that when the low-oil-pressure warning light illuminates and oil pressure is between 60 pounds per square inch (psi) and 90 psi, the pilot should ensure that Ng (engine gas-generator speed) is above 72 percent, reduce torque below 24 psi and "land as soon as practical."

The PC-12 POH said that when the low-oil-pressure warning light illuminates and oil pressure is below 60 psi, the pilot should "land as soon as possible using minimum torque."

The POH also said, "If possible, always retain glide capability to the selected landing area in case of total engine failure."

The report said, "The POH does not define the terms 'land as soon as practical' and 'land as soon as possible'; however, these terms are generally accepted to mean the following:

- "Land as soon as practical — Landing airport and duration of flight are at the discretion of the pilot. Extended flight beyond the nearest suitable airport is not recommended; [and,]

- "Land as soon as possible — Land without delay at [the] nearest airport where a safe approach and landing is reasonably assured."

The report said that the pilot probably could have landed with engine power at St. John's if he had turned back to St. John's when the low-oil-pressure warning light illuminated; however, the pilot, during previous flights, had observed low oil-pressure indications during climb and normal oil-pressure indications during cruise.

"The pilot … thought that the same thing was recurring on the accident flight and that the unserviceable low-quantity-annunciating system was also related to the low-oil-pressure indications he was experiencing," said the report.

The pilot told company maintenance personnel that he was observing low-oil-pressure indications. Company maintenance personnel told the pilot that he should return to St. John's. The messages between the pilot and the maintenance personnel were relayed through the company's dispatch office.

"The relaying of messages between the pilot and maintenance [personnel] took about six minutes, and the aircraft was, by then, 71 [nautical miles; 132 kilometers] from the St. John's airport and 40 [nautical miles; 74 kilometers] from the Gander airport," the report said. "The pilot then requested and received a clearance back to St. John's Airport from Gander Area Control Centre (ACC)."

The pilot turned the aircraft toward St. John's and began a descent. The aircraft was descending through FL 200 when an engine vibration began.

"The pilot declared an emergency with Gander ACC and was cleared direct to the St. John's airport," the report said.

The report said that the aircraft was 44 nautical miles (82 kilometers) from Gander when the engine vibration began and that the pilot "could have reached that airport if a decision had been made to divert there at that time."

The report said that the following factors influenced the pilot's decision to return to St. John's:

- "First, he reportedly had previous experience of the oil pressure diminishing during the climb and then returning to normal; he was expecting this to happen again;

- "He also thought that the low-oil-pressure indication was related to an unserviceable low-oil-quantity annunciating system;

- "Further, the weather in Gander, although not below limits, was not as good as the St. John's weather;

- “St. John’s was a maintenance base, and the suspected indicating problem could be quickly rectified and the flight could continue; whereas, if he diverted to Gander, the aircraft would be grounded; [and,]
- “Lastly, the pilot was advised by maintenance, via dispatch, to return to St. John’s.”

The report said that the pilot failed to recognize that he had encountered an “error trap,” which delayed his decision making and reduced his options for handling the emergency.

“Error traps (unsafe actions taken as a result of wrongful assumptions) … are covered in TC-recognized [PDM] courses,” the report said. “The intent of the PDM course is to reduce risks associated with flight by providing pilots with better decision-making skills.”

The aircraft was approximately 49 nautical miles (91 kilometers) from St. John’s when the vibration became so severe that the pilot had to shut down the engine. At the time, the aircraft was at about 13,000 feet.

The pilot told Gander ACC that the engine had failed, and he asked for vectors to the nearest suitable airport.

Gander ACC told the pilot that St. John’s was the nearest suitable airport. The report said that the pilot would have been able to glide the aircraft to St. John’s if he had maintained 22,000 feet until the engine failed; because the pilot began a descent when he turned back to St. John’s, however, the aircraft was beyond gliding range of the airport.

“When the pilot advised Gander ACC of this, the controller provided him with vectors to the Clarenville Airport, the only other airport in the area, which was 20 [nautical miles; 37 kilometers] back,” the report said. “Clarenville Airport is located approximately 47 [nautical miles; 87 kilometers] southeast of Gander.”

Clarenville Airport had a 3,933-foot (2,000-meter) runway and no ground-based navigational aids.

The pilot requested information on weather conditions at Clarenville. There was no active weather-reporting facility at Clarenville Airport. Gander ACC requested a weather report from the Royal Canadian Mounted Police in Clarenville.

“The information relayed to the pilot was that the cloud layer was estimated to be above the surrounding hills and the visibility was estimated to be approximately five [statute] miles [eight kilometers],” the report said.

The aircraft broke out of clouds 400 feet to 500 feet above a wooded area.

“The front windscreen was obscured with engine oil on the outside and condensation on the inside; consequently, the pilot side-slipped the aircraft to see out the side window,” the report said. “The airport was not visible, and the pilot elected to force-land [the aircraft] in a bog.”

The aircraft struck the tops of four small trees at the edge of the bog.

“The angle at which the tops of the trees were broken is consistent with the aircraft being in a 15-degree, left-bank attitude when it struck the trees,” the report said. “The first ground impact was when the left wing tip contacted the bog approximately 63 feet [19 meters] beyond the broken trees and dug a 58-foot-long [18-meter] gouge in the bog on a heading of 270 degrees.”

The aircraft fuselage contacted the ground about 20 feet (six meters) from the end of the gouge, and the engine separated from the aircraft.

“After the initial fuselage ground contact, the aircraft skipped forward approximately 75 feet [23 meters] while rotating counterclockwise through approximately 180 degrees before touching the ground again with the trailing edges of first the right wing, then the left wing,” the report said. “The aircraft then skipped another 75 feet, still rotating counterclockwise, before coming to a rest on a heading of 225 degrees, with the engine underneath the right wing.”

The left wing separated from the aircraft and came to rest beneath the tail section.

“Heavy streaks of oil were observed along both sides of the fuselage, as well as lighter traces of oil on top of the fuselage,” the report said. “There was oil on the windscreens during flight, which affected the pilot’s ability to see outside, but the windscreens broke out of the aircraft during impact, and it was not possible to determine how much oil had been on them.”

The pilot and the company observer were trapped in their seats by the instrument panel and the cockpit floor, which were displaced during impact. The cabin remained intact, and the main cabin door, the cargo door and the overwing exit were serviceable.

“One of the passengers took charge of getting the other passengers out and away from the aircraft, and of providing first-aid care to the pilot and the observer,” the report said. “He then collected some fuel that was spilling from a ruptured fuel line and started a fire to keep the passengers warm.”

The report said that the search for the aircraft was not affected by the absence of an ELT signal.

“The general location of the aircraft was known, the crash site was in a large open bog, one of the passengers was able to fire a flare, and the ceiling and visibility allowed a visual air search,” the report said. “Therefore, the absence of an ELT did not have a detrimental effect on locating the aircraft.

However, the remoteness of the flight's planned route supports the importance of an ELT."

Search-and-rescue personnel aboard a helicopter observed the signal flare and located the accident site at 1845. All the aircraft occupants were evacuated from the accident site by 2045.

The aircraft's Pratt & Whitney PT6A-67B engine was disassembled and examined at a manufacturer's facility under the supervision of a TSB investigator. The examination showed that the power turbine had separated from the reduction-gear drive when oil stopped flowing to the reduction gearbox (RGB) first-stage planet-gear assembly. The power-turbine blades then separated but were contained within the engine case.

"There was no service history of a similar failure; and, despite extensive examination and testing on the engine and related systems and components, no cause for the interruption in oil flow to the first-stage planet-gear assembly could be found," the report said. "Other noteworthy findings of the tear-down examination were that no other areas in the engine had signs of oil-supply starvation, including the second-stage planet bearings."

The report said that, because the chip-detector system was disabled in flight, the aircraft did not meet requirements for SEIFR operations.

"To be approved for [SEIFR] flight, a chip-detector system to warn the pilot of excessive ferrous material in the engine-lubricating system is required," the report said. "The design feature of the chip detector installed on this aircraft was such that indications to the cockpit were disabled whenever the landing gear was retracted; therefore, this installation did not meet the requirements of the standard governing the transport of passengers in single-engine aircraft, [CASS] 723.22."

The report also said that the PC-12 chip-detector system was not capable of detecting metal fragments in the entire oil system.

"The chip-detector system on board the PC-12 is installed at the six o'clock position in the [RGB]," the report said. "Only the oil lubricating the RGB and a portion of the lubricating oil from the [no. 3 and no. 4] engine bearings pass over the chip detector before returning to the scavenge oil pump.

"None of the lubricating oil from the [no. 1 and no. 2] engine bearings and none of the oil from the accessory gearbox pass over a chip detector before returning to the scavenge oil pump. Oil from these areas goes first through the scavenge oil pump, then through the pressure pump and oil filter before returning to lubricate the engine components. As a result, metal generated in these areas would be filtered out prior to encountering the chip detector in the RGB."

The report said that the PC-12 chip-detector system could detect metal fragments in the entire oil system if the system included a second chip detector near the accessory gearbox oil-drain plug.

"The chip detector would have increased the probability of giving the pilot advance warning of the impending engine failure and might have influenced his decision making had it been operational in flight," said the report.

The report said that CASS 723.22 requires two independent electrical-power-generating sources, either of which must be capable of powering essential flight instruments and electrical equipment.

"The PC-12 meets this requirement with a 28-volt direct-current system comprised of a main generator, a secondary generator and a 24-volt battery," the report said. "In the case of engine failure or failure of both generators, [the battery] will power essential electrical systems for 20 minutes if the load is reduced below 60 amps or for 30 minutes if the load is reduced below 50 amps."

The pilot deactivated the windshield-heat system to conserve battery power after he shut down the engine.

"The aircraft stayed airborne for approximately 15 minutes after the engine failed," the report said. "Therefore, it is probable that the battery would still have been able to power the essential instruments even if windshield heat remained selected 'on.'"

The report said that a PC-12 configured for optimum glide performance would require 32.5 minutes to descend from the maximum authorized altitude (30,000 feet) to sea level. The typical load from essential electrical equipment is about 50 amps, and a 40-amp-hour battery at 70 percent capacity could supply 50 amps for 31 minutes.

"Powering only the essential instruments and lights, battery power might be nearly or completely spent prior to touchdown," the report said. "It may also be necessary to power other electrical systems, further reducing battery life. An attempted engine relight or the use of a landing light at night would both place a large draw on a battery."

The report said, "The CARs do not require that SEIFR aircraft have a sufficient emergency electrical supply to power necessary electrical systems throughout the entirety of an engine-out let-down from the aircraft's maximum operating level at an optimal glide speed and configuration. Other rule-making authorities have recognized that standard battery supplies are inadequate for emergency SEIFR purposes.

"This is reflected in the Australian SEIFR requirement for emergency electrical supply, and a similar requirement is proposed in the European Joint Aviation Requirements–Operations (JAR–OPS) SEIFR draft regulations."

The report said that Australian regulations require a SEIFR aircraft to have an electrical system of "sufficient capacity and duration that is capable of providing power following the failure of all generated power, for those loads essential for:

- "One attempt at engine restart;
- "Descent from maximum operating altitude to be made at the best-range gliding speed and in the best gliding configuration, or for a minimum of one hour, whichever is greater;
- "Continued safe landing; and,
- "If appropriate, the extension of landing gear and flaps."

CAR 605.31 requires pressurized aircraft to have at least a 10-minute supply of supplemental oxygen for passengers and crew, or a supply sufficient to allow an emergency descent to 13,000 feet. The report said that the regulation does not require pressurized SEIFR aircraft to have sufficient supplemental oxygen for an engine-out descent at optimum glide performance from the aircraft's maximum operating altitude to 13,000 feet.

"The [PC-12] oxygen system is designed to provide oxygen to the crew and passengers for 10 minutes," the report said. "From 25,000 feet (the maximum altitude for passenger carriage in single-pilot IFR operations), it would take 11.5 minutes to descend to 13,000 feet at the optimum glide rate. The oxygen would be depleted 1.5 minutes prior to reaching 13,000 feet."

The report said that, before SEIFR operations were authorized in Canada, Transport Canada proposed a requirement for engine-trend-monitoring systems that would provide early indications of engine damage and performance deterioration.

"The final SEIFR rule, however, did not include a requirement for such a system," the report said. "The Australian CASA [Civil Aviation Safety Authority] has included a requirement for automatic engine performance and condition monitoring, and the draft European policy has adopted this requirement.

"The FAA [U.S. Federal Aviation Administration] requires an inspection program that incorporates either the manufacturer's recommended engine-trend-monitoring program, which includes an oil analysis if appropriate, or an FAA-approved engine-trend-monitoring program that includes an oil analysis at defined intervals."

The report said that "significant advances" in aircraft-equipment technologies have occurred since Canada authorized SEIFR operations in 1993.

"GPS [global positioning system] satellite navigation in commercial navigation is now common, and automatic engine health and usage-monitoring systems (HUMS) and advanced onboard oil-debris-monitoring systems that can detect nonferrous oil-debris particles are more available," the report said. "The Australian regulatory authority introduced SEIFR rules, after Canada had done so, and incorporated some of these newer systems into its SEIFR rule."

The report said that Australian regulations require SEIFR aircraft to have the following:

- Passenger seats that meet the standards in U.S. Federal Aviation Regulations Part 23, Amendment 36;
- An approved shoulder harness or a safety belt with a diagonal shoulder strap for each passenger seat;
- Airborne weather radar equipment;
- HUMS; and,
- An engine-fire-warning system.

"These items would help either to prevent a loss of engine power or to lessen the adverse consequences of an engine-out occurrence," said the report. "The Australians also require that electrical equipment such as landing lights and radar/radio altimeters be capable of being powered by the airplane's emergency electrical supply system (battery). The landing lights and radio altimeter on the accident Pilatus were capable of being powered by the battery; however, this was not a requirement of the Canadian rule."

The report said that the accident investigation resulted in the following findings:

- "The pilot's records indicated that he was certified, trained and qualified for the flight in accordance with existing regulations;
- "The maintenance records indicate that the aircraft was maintained in accordance with existing regulations;
- "The weight and center of gravity were within the prescribed limits;
- "The aircraft did not meet the approval requirements for SEIFR flight because the engine-chip detector was not operational during flight;
- "The engine-chip-detecting system, as it is presently configured on the PC-12, does not monitor the entire engine-lubricating system for ferrous particles;
- "The pilot stated that he had experienced unusual engine-oil-pressure indications on the occurrence aircraft in the past;
- "The pilot was aware that the low-oil-quantity annunciating system was unserviceable prior to the occurrence flight;

- “The engine failed as a result of an interruption of oil flow to the first-stage planet-gear assembly; the cause of the oil-flow interruption could not be determined. There is no history of a similar type failure;

- “The indications of low oil pressure were genuine but were not considered valid by the pilot; this was an error trap (unsafe action taken as a result of wrongful assumptions, unsafe conditions or practices) that the pilot did not recognize. Thus, he did not follow the ‘land as soon as possible’ instruction called for in the ‘Emergencies’ section of the POH;

- “The terms ‘land as soon as possible’ and ‘land as soon as practical’ are not defined in the POH;

- “Contrary to the recommended procedure of retaining glide capability, the pilot commenced a descent as soon as the aircraft turned back toward St. John’s;

- “The aircraft departed into a region where icing had been forecast with a wing deicing system that was inoperative;

- “There are no means to clear ice from critical wing surfaces on the PC-12 once the engine has been shut down; pilots would need to compensate for the adverse effects of ice during the let-down and landing;

- “The ELT had been removed prior to the flight for maintenance; CAR 605.39 allows for flight without an ELT for up to 90 days;

- “The CARs do not require pilots involved in SEIFR to have received pilot decision-making training;

- “The CARs that govern SEIFR do not list as part of the required equipment list] a system capable of monitoring and recording those parameters critical to engine performance and condition;

- “The CARs do not require that pressurized SEIFR aircraft have sufficient supplemental oxygen to allow for an optimal glide profile during an engine-out let-down from the aircraft’s maximum operating level until a cabin altitude of 13,000 feet is attained;

- “The CARs do not require that SEIFR aircraft have a sufficient emergency electrical supply to power necessary electrical systems throughout the entirety of an engine-out let-down from the aircraft’s maximum operating level at an optimal glide speed and configuration; [and,]

- “The equipment standard for SEIFR in the CARs is not as stringent as that of other regulatory aviation authorities, such as the Australian regulatory authority.”

Based on these findings, TSB recommended that the Canadian Department of Transport take the following actions:

- “Require that pressurized SEIFR aircraft have sufficient supplemental oxygen to allow for an optimal glide profile during an engine-out let-down from the aircraft’s maximum operating level until a cabin altitude of 13,000 feet is attained. (A00-01);

- “Require that SEIFR aircraft have a sufficient emergency electrical supply to power essential electrical systems following engine failure throughout the entirety of a descent, at optimal glide speed and configuration, from the aircraft’s maximum operating level to ground level. (A00-02);

- “Require that the magnetic chip-detecting system on PT-6-equipped single-engine aircraft be modified to provide a warning to the pilot of excessive ferrous material in the entire engine-oil-lubricating system. (A00-03);

- “Require that [SEIFR] operators have in place an automatic system or an approved program that will monitor and record those engine parameters critical to engine performance and condition. (A00-04);

- “Review the equipment standard for SEIFR and include equipment technologies that would serve to further minimize the risks associated with SEIFR flight. (A00-05); [and,]

- “Improve the quality of pilot decision making in commercial air operations through appropriate training standards for crewmembers. (A00-06).”

The report said that, as of Feb. 4, 2000, the following actions were taken as a result of the accident investigation:

- Transport Canada on July 15, 1998, told operators of PC-12s registered in Canada to conduct aircraft modifications that preclude disabling the chip-detector system;

- Transport Canada proposed reducing from 90 days to 30 days the period in which an ELT may be inoperable in an air-taxi aircraft. The TSB subsequently recommended further reduction or elimination of the period in which an ELT is allowed to be inoperable; and,

- Transport Canada on Oct. 21, 1999, published Commercial and Business Aviation Advisory Circular 0163, which provides information for “standardization of terminology related to aircraft emergency procedures.”♦

[FSF editorial note: This article, except where specifically noted, was based on Transportation Safety Board of Canada *Aviation Occurrence Report A98A0067: Engine Failure/ Forced Landing; V. Kelner Airways Limited; Pilatus PC-12, C-FKAL; Clarenville, Newfoundland 1.5 nm SE; 18 May 1998*. The 32-page report includes appendixes.]

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