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Floatplane Strikes Ridge During Sightseeing Flight

Five people were killed when a float-equipped Cessna U206G struck a mountain ridge in New Zealand. The report on the controlled-flight-into-terrain (CFIT) accident said that the pilot probably attempted to cross the ridge at low level and might have misjudged the ridge height because of visual illusions or distraction.

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FSF Editorial Staff

About 1538 local time on April 18, 1999, a float-equipped Cessna U206G operated by Waterwings Airways struck a mountain ridge near Milford Sound, New Zealand, during a scenic air transport flight. The pilot and four passengers were killed. The floatplane was destroyed.

The New Zealand Transport Accident Investigation Commission (TAIC), in its final report on the accident, said, "The pilot probably attempted to cross the ridge crest at low level and might have misjudged the height of the ridgetop because of visual illusions or distraction. Some localized turbulence or downdrafts and the fast [ground]speed of the aircraft may have contributed to the accident. Had the pilot applied a safe ridge-crossing technique, including maintaining a sufficient height margin above the ridge, the accident could have been avoided.

"The pilot was reported to have carried out unnecessary low flying and crossing of ridge crests with minimal clearance on scenic flights on a number of occasions over several years before the accident.

"The operator did not adequately supervise the pilot, independently investigate an allegation of the pilot low flying or establish a system to control or monitor the pilot's performance and compliance with safety requirements.

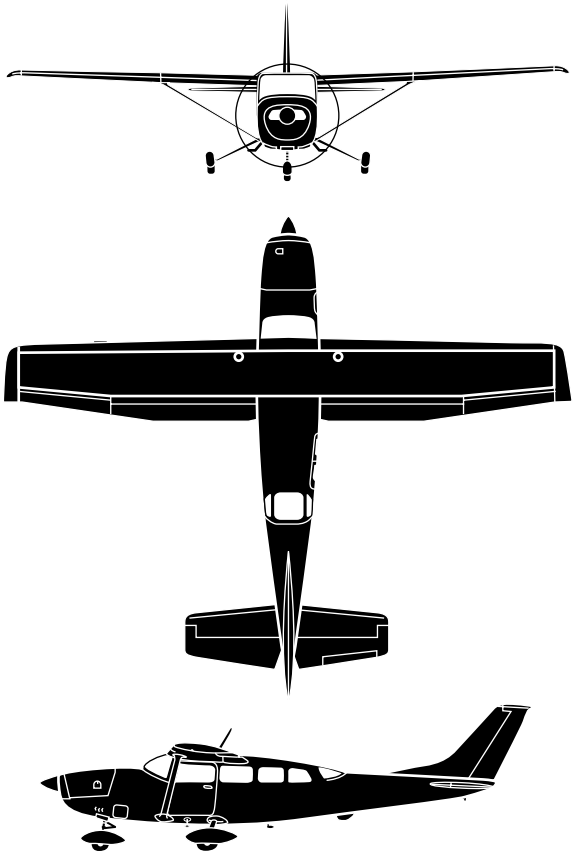
"The pilot's reported acts of unnecessary low flying were not made known to the [New Zealand] Civil Aviation Authority [CAA]. The operator's organizational shortcomings that probably contributed to the accident were not identified by or made known to the [CAA]."

The pilot, 44, had a commercial pilot license, a flight instructor rating and several aircraft type ratings, including a type rating for Cessna 206 float operations. He had 5,325 flight hours, including 4,500 flight hours in type.

The pilot had conducted flights in the accident aircraft from the operator's base at Te Anau for eight years. He was assisted by a relief pilot.

"[The pilot] was not paid a salary but was remunerated per flying hour," the report said. "The pilot was one of the operator's senior pilots, and he had responsibility for the day-to-day running of the Te Anau-based operation."

A flight examiner who conducted competency checks of the pilot in 1996, 1997 and 1998 said that the pilot's performance was above average.



Cessna U206G

The Cessna U206G "Stationair" is a single-engine, cargo/utility airplane with accommodations for a pilot and up to five passengers. The passenger seats can be removed to accommodate cargo loaded through doors on the right side of the fuselage. Floats and amphibious landing gear (floats with retractable wheels) were available as options.

The airplane has a 300-horsepower (224-kilowatt) Continental IO-520F reciprocating engine and a three-blade, constant-speed McCauley propeller. Usable fuel capacity is 88 gallons (333 liters).

The following data are for a float-equipped U206G: maximum takeoff-and-landing weight is 3,500 pounds (1,588 kilograms); maximum rate of climb at sea level is 925 feet per minute; maximum cruising speed at 75 percent power is 132 knots (244 kilometers per hour [kph]); service ceiling is 13,900 feet; and stall speed with flaps extended is 51 knots (95 kph).

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

"The examiner said that the pilot was a competent handler of the aircraft and [was] confident in his own abilities," the report said. "He said that, during the checks, the pilot showed some tendency to fly lower or closer to terrain than was necessary."

The examiner did not include a record of this observation in the pilot's competency-check reports, but discussed the risks of low flying with the pilot and told him not to fly unnecessarily low.

The accident aircraft was the only floatplane on Lake Te Anau and the only Waterwings Airways aircraft based at Te Anau. In 1978, the aircraft was manufactured as a landplane; in 1986, the aircraft was converted to a floatplane and was registered to Waterwings Airways.

The floatplane had accumulated 7,175 service hours, including 19.6 service hours since a maintenance inspection on April 8, 1999.

"At the last inspection, a new vacuum pump, left-hand muffler assembly and oil-filter adapter were fitted," the report said. "In February 1999, the left air duct for the [cabin heater] was replaced. A carbon-monoxide detector was fitted to the instrument console to provide an early warning of any carbon monoxide ingress to the cabin … . There were no reports made by the pilot or the relief pilot of any carbon monoxide ingress to the cabin."

The report said, "The aircraft was carrying several minor defects on the day of the accident, none of which should have limited its performance."

The pilot began duty about 1430 on the day of the accident. He was scheduled to conduct a scenic flight from Te Anau to Milford Sound and back to Te Anau, with no landing at Milford Sound. The route was over the Fiordland area of New Zealand's South Island.

The report said that the pilot had accumulated most of his flying experience in the Fiordland area.

"He had flown the route between Te Anau and Milford Sound many times during the eight years he had worked for the operator," said the report.

The pilot obtained a preflight weather briefing from Milford Sound Aerodrome Flight Information Service.

"The Milford Sound Aerodrome Flight Information Service reported the weather in the afternoon to be good, with a light-and-variable surface wind tending westerly," the report said. "Some cloud at 3,000 feet had dissipated, but there were still a few clouds at 7,000 [feet].

"Reports received … from pilots in the area said the wind aloft was generally southerly [and that there was] turbulence below 8,000 feet. Cloud was reported around an area called The Divide, near Lake Fergus, about eight kilometers [four nautical miles] east of the accident site."

Estimated flight time was one hour, and the floatplane had fuel for about 1.6 hours of flying. The floatplane was within weight-and-balance limits when the flight departed about 1510. The pilot flew the floatplane to 6,000 feet.

"The pilot's usual route was to fly north via Lake Te Anau to its head, pass near Lake Erskine, circle Mount Tutoko to the northeast of Milford Sound, circle Milford Sound township and return via the western side of Lake Te Anau," said the report.

At 1530, the pilot told Queenstown Information that the flight was 12 kilometers [6.5 nautical miles] south of the head of Lake Te Anau.

"The pilot's voice was reported to have sounded normal during the transmission, which was the last radio call the pilot was heard to make," said the report.

The floatplane was reported missing at 1655. Airplanes and helicopters were used to search for the floatplane.

"The wreckage was subsequently located on 21 April at about 1015 hours, after a search involving 100 flying hours," said the report.

The floatplane had struck a 6,400-foot ridge approximately 60 feet (18 meters) below the crest (see photograph, page 4). The ridge formed the northern boundary of a valley. The floatplane's emergency locator transmitter was destroyed during the impact.

"The accident site was on the south face of a craggy, vertical mountain ridge 600 meters [1,969 feet] east of Mount Suter, 17 kilometers [nine nautical miles] south of Milford Sound, at an elevation of approximately 6,340 feet," said the report.

The floatplane was in a straight-and-level attitude and on a true heading of about 015 degrees when it struck the ridge.

"There was no evidence of any significant nose-low [attitude] or nose-high attitude at impact," the report said. "Fragmentation of the aircraft indicated that it had hit the ridge at high speed. Most of the wreckage then tumbled some 3,000 feet [915 meters] down the near-vertical mountain face, almost directly beneath the impact point. No fire occurred."

There was no evidence of preimpact mechanical failure or malfunction.

"The engine assembly was sent to an approved engine-overhaul facility for disassembly and … inspection," the report said. "The examination showed normal component wear patterns. There were no indications of abnormal wear or any failure that could have caused an engine failure or power loss prior to impact. There was evidence indicating that the engine was subject to a sudden stoppage while it was rotating at a speed consistent with at least normal cruise power."

Postmortem examination of the pilot showed nothing that would have affected his ability to fly the floatplane.

"There was no medical or pathological evidence of pilot incapacitation or impairment …," said the report. "The pilot was observed to be in good health and spirits, and behaving normally in the days preceding the accident flight."

Each of the passengers had received multiple fatal injuries.

"The injuries were consistent with severe longitudinal deceleration resulting from the aircraft impacting the mountain face in a level attitude at high speed and the trauma from a fall of some 3,000 feet down a sheer, craggy mountain face," said the report.

The report said that 10 passengers who had flown with the pilot said that he had flown close to terrain.

"All the passenger reports … stated that the pilot flew the aircraft low across terrain, flew low through [mountain] passes and cut across the tops of ridgelines with very little clearance above the ridgetops," the report said. "A passenger who was familiar with the aircraft reported that the pilot flew up to ridgelines from below and 'popped' over the top of the ridges at low level. The passenger also said the pilot 'whipped' low across passes and got close to terrain.

"Another passenger said the pilot struck the tops of trees with the floats of the aircraft. Several of the passengers said they were frightened and did not intend to fly in small aircraft again."

A passenger-pilot with mountain-flying experience said that he felt uncomfortable and apprehensive during his flight with the accident pilot.

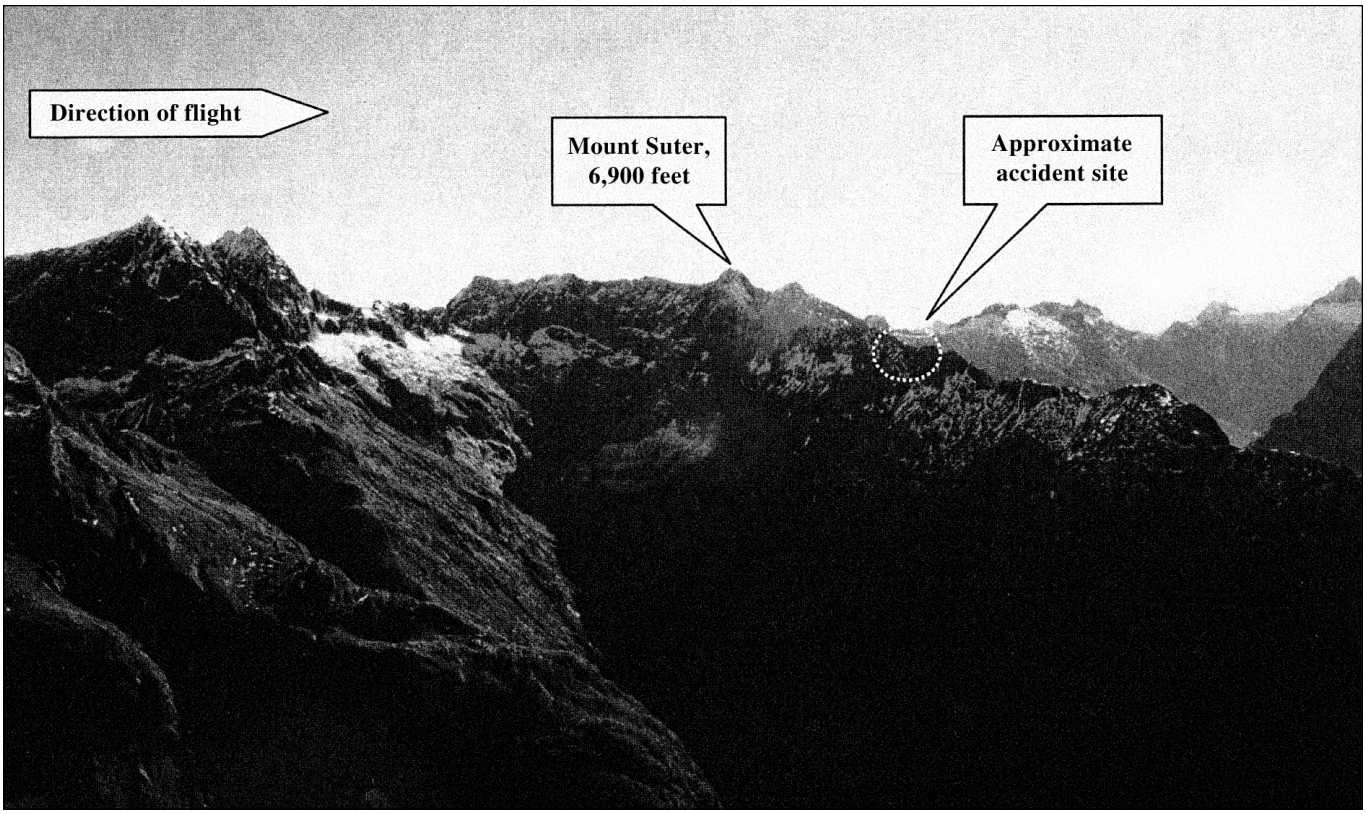
"The passenger said the pilot flew straight at ridges at right angles and crossed them close to their tops," the report said. "He said the pilot climbed directly toward ridges and then crossed them close to their tops, rather than orbiting to gain altitude first. During descent, the pilot approached straight at ridges perpendicularly, at a fast speed, and crossed them close to their tops."

A pilot who flew in the area and knew the accident pilot said that he became increasingly concerned about the floatplane operation.

"He believed that the pilot flew with 'little margin,'" the report said. "He said other people who knew the pilot well had expressed concerns to him over the pilot's flying and the floatplane operation."

The report said, "Other pilots and other personnel working in the aviation industry, who had either observed the pilot's flying or worked with him, reported that the pilot had a tendency for low flying and would often fly low and close to terrain and other obstacles."

The pilot's widow and the operator said that the pilot did not fly low unnecessarily.



The accident airplane was in straight-and-level flight when it struck a 6,400-foot ridge approximately 60 feet (18 meters) below the crest. (Photo: New Zealand Transport Accident Investigation Commission)

"The pilot's widow [provided] character references and reports from some other people who had flown with the pilot, worked with him or knew him personally," the report said. "The operator provided a character reference.

"The references and reports indicated that the pilot was held in high regard as a person and for being a competent pilot. These reports and references did not indicate that the pilot carried out any unnecessary low flying."

An off-duty CAA safety-information officer, during a private function in 1993, viewed a videotape recorded by two passenger-pilots during a charter flight with the accident pilot.

"The CAA officer gave credence to the passengers' concern [about the pilot flying too close to terrain] and contacted the operator's chief executive, advising him to speak to the pilot about the report," the report said. "The chief executive indicated that he would talk to the pilot, so the CAA officer took no further action."

The chief executive of Waterwings Airways also was the company's owner, operations manager, chief pilot and maintenance director. In addition to the accident aircraft, the company operated two Cessna 207s and a Cessna 172 from the main base in Queenstown.

"The operator's operations manual included sections on weather and terrain-clearance minima," the report said. "Terrain clearance was to be not less than the minima specified by civil aviation regulations, which included flying no lower than 500 feet above terrain unless taking off or landing, during emergency situations or being caught in deteriorating weather conditions."

The operator's training manual included information on mountain flying.

"The mountain-flying section included discussion on meteorological effects in the mountains, such as wind," the report said. "The manual stated that the basic rule for safe ridge crossing was to cross a ridge diagonally so an aircraft could turn away should it be carried below the ridge crest by downdrafting air or experience a loss of power. Ample clearance above the ridge crest was to be maintained.

"The [training manual] stated that the golden rule for flight in the mountains was that the aircraft must never be placed in a position that, in the event of engine failure or encountering strong downdrafting air and turbulence, some option was not left open to the pilot to either recover the situation or to at least force-land the aircraft.

"A pilot was to fly at a safe height where possible and avoid crossing all features at right angles so that, in the event of

trouble, the aircraft could be turned away towards lower ground."

The report said that an examination of company operating procedures produced the following findings:

- "There was no evidence that the operator was routinely carrying out an analysis of the risks associated with the floatplane operation;
- "There was no evidence that the operator was maintaining effective defenses to minimize the likely risks to the floatplane operation;
- "Enforcement of safe flight operation procedures appeared to have been casual or ad hoc;
- "Supervision practices appear to have been nonexistent with the floatplane operation;
- "There did not appear to have been any training of significance;
- "There was evidence of an anti-CAA culture resulting in an overt policy of minimal compliance with civil aviation legislation; [and,]
- "The reported instance of the pilot flying unsafely was either ignored or dismissed."

The report said, "With regard to the operator's training manual, the chief executive said that the pilots were presented with their own copy of the manual and taken through it over an hour or so. When … asked about pilot refresher training, the chief executive indicated that he did not have the capacity to carry out refresher training."

A CAA audit of the operator in March 1999 showed six "noncompliances" (failures to comply with civil aviation regulations). The noncompliances involved deficient records of pilot flight-times and duty times; no records of pilot route and airport qualifications; no pilot signatures on load sheets; no records of aircraft centers of gravity; and no record that the chief executive had completed a biennial flight review.

"The audit report recorded that the operator had taken action to rectify the findings by the time the report was finalized on 20 April 1999, but follow-up action by CAA auditors the following month showed that some findings had not been corrected," said the report.

The March 1999 audit report included an "occurrence summary" prepared by the CAA in July 1998.

"The occurrence summary stated that the CAA had received an anonymous complaint that the operator's … chief executive was rarely on the job and away a lot of the time, leaving the aircrew unsupervised," the report said. "The operator said that it had not been advised of this report."

The accident report said that CAA auditors were concerned about the chief executive's attitude and the operation's safety culture but did not record their concerns in audit reports.

"The CAA said that the chief executive showed hostility toward its auditors and that he generally displayed aggression towards the CAA …," the report said. "The CAA said that it had not received complaints about the pilot low flying. The auditors were unaware of reports of the pilot low flying and risk taking."

The report said, "The accident circumstances suggest that the pilot probably flew in a manner similar to reports of some of his previous low flying. Turbulence or a sudden downdraft encountered by the aircraft as it was about to cross the ridgeline may have caused it to impact the ridge. The high inertia of the aircraft due to its fast groundspeed would have afforded the pilot little or no opportunity to react and prevent the impact."

The report said that the floatplane might have encountered localized tail winds up to 70 knots and that terrain features might have caused the pilot to misjudge the height of the ridgeline.

"Mount Christina, a prominent mountain reaching some 8,200 feet, was situated directly ahead of the aircraft and some four kilometers [two nautical miles] north of the accident site," the report said. "The visual effects of the mountain in the background blending with the foreground and some recent snow in the area, or shadow, might have combined to create an optical illusion obscuring the top of the ridgeline.

"The pilot's experience in mountain flying and his familiarity [with] the route and its features, however, make this an unlikely occurrence."

The report said that the sun did not affect the pilot's forward vision. The sun was 60 degrees left of the aircraft heading and 22 degrees above the horizon.

The report said that the pilot might have been distracted.

"Pilots can be distracted pointing out some features of interest to passengers," the report said. "This is a possible explanation for the pilot not being aware of how quickly the aircraft was approaching terrain."

The report said, "The accident occurred because the pilot probably performed an unsafe act of unnecessary low flying. However, the operator probably contributed to the accident or increased the likelihood of the unsafe act occurring by not establishing or maintaining an ongoing program of active pilot supervision and control, by not monitoring the pilot's

performance and compliance with relevant safety requirements, and by not independently investigating an allegation of the pilot low flying several years before the accident."

The findings of the accident investigation included the following:

- "The pilot was appropriately licensed, authorized and fit to conduct the flight;
- "The pilot was experienced on scenic and other flying operations over and around the Fiordland region;
- "The aircraft was approved for the type of operation being conducted;
- "The aircraft had a valid certificate of airworthiness, and its records indicated that it had been maintained appropriately, was airworthy and [was] operating within the required maintenance period;
- "The weight and the balance of the aircraft were within limits;
- "There was no evidence that an aircraft-systems failure or a loss of control contributed to the accident;
- "There was no evidence that the pilot had attempted any evasive maneuver to prevent the aircraft from striking the ridge;
- "The evidence indicates that the aircraft was in controlled straight-and-level flight at the time of impact;
- "The weather was suitable for scenic flying;
- "The accident circumstances indicate that the accident occurred because the pilot probably carried out an unsafe act of low flying and attempted to fly across the ridge too close to its crest;
- "Local environmental factors, the speed of the aircraft or pilot distraction may have contributed to the accident;
- "The accident probably would not have occurred if the pilot had maintained a suitable height margin and used a proper ridge-crossing technique;
- "The pilot on occasion had carried out unnecessary low flying and risk taking with passengers on commercial operations;
- "There was no obvious mechanism for passengers to report unsafe acts to the CAA;
- "The operator had not established a proper safety culture;
- "The operator had not carried out an ongoing analysis of the foreseeable risks of the operation and had not maintained effective defenses to counter the risks;
- "The operator had not established an ongoing program for active pilot supervision, control and performance-and-compliance monitoring;
- "The chief executive, as the operator's aviation-document holder, seemed unaware of his responsibilities under section 12 of the Civil Aviation Act;
- "The chief executive did not discharge his responsibilities properly and, therefore, probably contributed to the accident; [and,]
- "Had the CAA auditing process systemically examined the operator's organizational functioning and culture, and required the chief executive to show how he was meeting his responsibilities, the organizational and safety-culture shortcomings that probably contributed to the accident might have been identified and rectified."

Based on these findings, the TAIC on Oct. 19, 1999, made the following recommendations to the chief executive of Waterwings Airways:

- "Implement, without delay, effective pilot supervision, training, performance and safety-compliance monitoring of the day-to-day flight operations (047/99); and,
- "Develop proactive monitoring strategies such as occasionally using passengers to carry out spot, passive checks to report on the conduct of flights (048/99)."

The report said that the chief executive of Waterwings Airways on Oct. 27, 1999, responded to the TAIC recommendations as follows:

- "Safety recommendation 047/99. Our operation is at present under the old regulations and is monitored constantly by the CAA. We are an approved training organization. For the last eight years, we have been trying to gain compliance under the new rule system. As you will well understand, this has been a very frustrating process as the goal posts keep getting shifted. We are, this week, finally, able to submit a formal application that we believe will document how our operations have been run to date.

  "The main difference once the approval is received, I think, will be in the documenting of systems already in place that we implemented, updated and improved upon in terms of our specific operations; [and,]

- "Safety recommendation 048/99. One system that we are proud of and have had in force for many years is our

monitoring of pilot [performance]. We see this as vital to a people-oriented operation.

"Our pilots have a business-type card that they have to give to every passenger carried by them. As you can see [from an enclosed example], the pilot is not only identified by name but also by his photograph; the company name and address, and contact telephone number are clear, and even the aircraft … is depicted. To my knowledge, we are the only operator who [does] this.

"In over 30 years of flying, you can imagine I have flown every relative of mine [and] many hundreds of friends — and indeed since 1982 Waterwings has had a stated policy of all [local residents] fly free.

"Our pilots continually fly my friends, acquaintances, relations, many local people and overseas visitors to my home. Whenever this happens, I always ask, 'What was the trip like?' and 'What was the pilot like?'

"We have very good procedure-monitoring systems in place, such as regular pilots safety meetings and those set out above. These systems are currently being documented. The CAA in due course ought to be able to provide these to you once the approval has been given.

"Our new, soon-to-be-released (hopefully) exposition very fully sets out the systems by which we will document and implement these. For instance, every time a friend or relation flies with a pilot, their reactions to the above questions will be noted on the individual pilot files that we have always kept.

"My company is a very small operation, and we have always been a very close-knit unit, doing what we do together and always striving to be better.

"We believe we have always adopted these recommendations and acted in accordance with them.

"As stated, we are awaiting approval by the CAA of our documentation, which will be implemented as soon as CAA has appraised it.

"In addition to the above, I would like to point out that the Milford Sound and Queenstown Users Liaison Group (monitored by the CAA at every meeting) have a safety-officer system compiled of one pilot from every company (who cannot be management staff), who form a separate committee to observe and note any incidents or safety issues. These, if serious, are brought to the notice of operators immediately or, if of a less serious nature, are promulgated at regular meetings."

The TAIC on Nov. 2, 1999, made the following recommendations to the Director of Civil Aviation:

- "Examine the CAA auditing process and determine if it needs to be enhanced by periodically, or with reasonable justification, requiring general aviation document holders involved in air transport operations to demonstrate to the auditors how in practice they follow and maintain an appropriate safety-management system (049/99);

- "Consider requiring early recertification under appropriate civil aviation rules (which embody the management system approach to safety) of those general aviation air transport operators which, in his assessment, appear to be at risk because of a poor safety culture, poor attitudes or poor systems or practices, and ensure that there are no undue delays in the certification of other operators (077/99);

- "Emphasize to all senior managers of air transport operations the need for them to be aware of their responsibilities, including:

  – Identifying the foreseeable risks to their operations;

  – Putting in place suitable defenses to minimize those risks, which might go beyond what the generic rules require; [and,]

  – "Maintaining those defenses (050/99);

- "Recommend to all air transport operators that they develop proactive monitoring strategies such as occasionally using passengers to carry out spot, passive checks to report on the conduct of flights (051/99); and,

- "Initiate rule making to require information — to be available and visible to passengers on air transport flights, such as on cards in seat pockets — that outlines the operating standards and how passengers can contact the operator or the CAA if they have any concerns about safety (056/99)."

The report said that the Director of Civil Aviation on Nov. 19, 1999, responded to the TAIC recommendations as follows:

- "I will adopt [safety recommendation 049/99] with the note that the CAA constantly reviews the adequacy of all its processes. In this sphere of activities, the CAA has already initiated changes to the scope and content of its audit process to cover the more integrated and quality system features that will be required of operators when they become certified under Part 119. To that extent, the actions to implement the recommendation have already been taken;

- "I adopt [safety recommendation 077/99]. Note that certification under Part 119's new rules is currently considered by the CAA as a condition for re-entry when holders of transitional certificates are subject to exit action, either suspension or imposition of conditions, under Section 17 of the Act;

- "I adopt [safety recommendation 050/99] and will implement it by writing to the chief executive officers of all air transport operators before the end of the year;

- "I adopt [safety recommendation 051/99] and will address the requirement of the recommendation in the same correspondence as mentioned above for 050/99; [and,]

- "I adopt [safety recommendation 056/99]. Due to the need to consider other rule-writing priorities and the need for extensive consultation, I am unable to specify a time frame to complete the task."

The report said that the CAA in September 1999 introduced an "audit quality index assessment system."

"The system requires auditors to assess an operator's organizational culture and internal functioning in 10 areas and [to] rate the performance of the organization in those areas against a standard scale …," the report said. "The stated aim of the system is to provide a level of confidence in an aviation certificate holder's adherence to rules, regulations and documented procedures."

The report said that by Feb. 28, 2003, operators providing air transport services in New Zealand will be recertified under new civil aviation regulations designed to ensure the following:

- "That a safety policy is in place, including a procedure for safety-occurrence investigations;

- "That personnel [feedback] and customer feedback are monitored to identify existing problems or potential causes of safety problems;

- "That problems or potential problems are corrected and checked to ensure the effectiveness of the correction;

- "That the organization's procedures achieve the aims of its safety policy; [and,]

- "The ongoing management effectiveness, including regular reviews and feedback to personnel."

The report said, "The CAA's operator-recertification program and its audit quality index system, under development at the time of the accident and introduced some months later, could help to address some of the organizational concerns and auditing issues identified during this investigation."♦

[Editorial note: This article, except where specifically noted, was based on New Zealand Transport Accident Investigation Commission *Aviation Occurrence Report 99-04: Cessna 206 ZK-EKJ, Impact With Mountainous Terrain by Mount Suter, 17 Kilometers South of Milford Sound, 18 April 1999*. The 38-page report contains photographs and a map.]

Accident Prevention

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