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Pilot's Inadequate Altitude Monitoring During Instrument Approach Led to CFIT

The pilot hand-flew an unstabilized approach below the glideslope and continued the descent until the Piper Chieftain struck terrain. New Zealand investigators cited high workload and possible distraction by a cellular telephone call as factors in the controlled flight into terrain.

FSF Editorial Staff

At 1907 local time on June 6, 2003, a Piper Chieftain operated on a charter flight by Air Adventures struck trees and terrain during an instrument approach to Christchurch (New Zealand) Airport in nighttime instrument meteorological conditions. The pilot and seven passengers were killed; two passengers received serious injuries. The aircraft was destroyed.

The final report by the New Zealand Transport Accident Investigation Commission (TAIC) said, "The accident probably resulted from the pilot becoming distracted from monitoring his altitude at a critical stage of the approach. The possibility of pilot incapacitation is considered unlikely but cannot be ruled out."

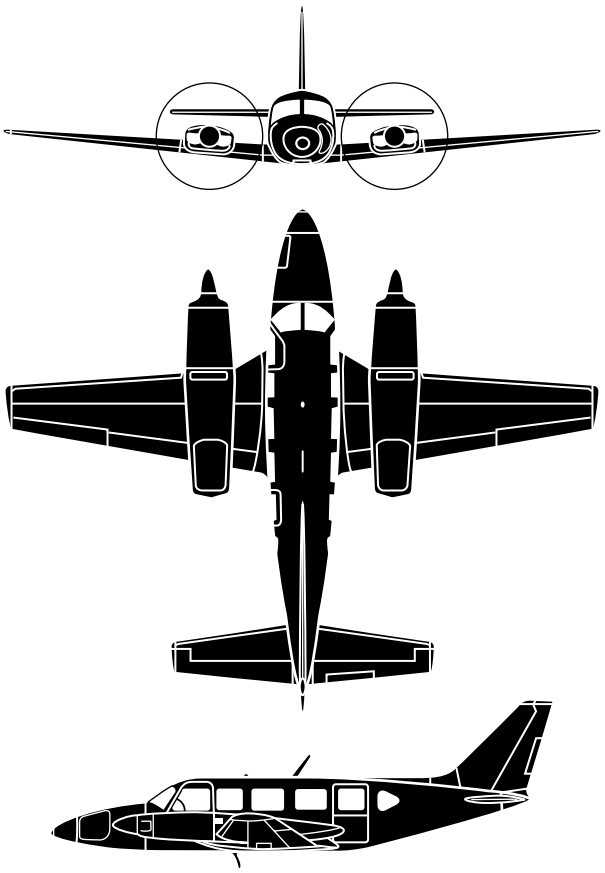
The aircraft was chartered by an agricultural-research company to transport senior staff members from Christchurch to Palmerston North and to return them to Christchurch the same day.

The pilot, 52, held a commercial pilot license and an instructor rating. He had 4,325 flight hours, including 1,191 flight hours in multi-engine airplanes, 820 flight hours in type, 151 instrument flight hours and 24 nighttime flight hours.

The pilot and another person founded Air Adventures in 1994 to conduct sightseeing flights in single-engine aircraft. In 1998, Air Adventures acquired another company that conducted sightseeing flights and charter flights in multi-engine aircraft.

In May 2000, the New Zealand Civil Aviation Authority (CAA) conducted a spot check of Air Adventures after receiving complaints by current company pilots and former company pilots about being pressured to conduct flights under visual flight rules (VFR) in weather conditions that were unsuitable for VFR flight.

"CAA analyzed the company operational risk as 'high' at that time," the report said. "A spot check a year later found improvements, and a subsequent risk assessment was 'moderate.'"[1]



Piper PA-31-350 Chieftain

The Chieftain is a derivative of the PA-31-300 Navajo and the PA-31-310 Turbo Navajo, both introduced in 1967 with naturally aspirated 300-horsepower (224-kilowatt) Lycoming IO-540 reciprocating engines and turbocharged 310-horsepower (231-kilowatt) TIO-540 engines, respectively.

Piper Aircraft Co. developed several other versions of the airplane, including the PA-31P Pressurized Navajo in 1970 and the Navajo C/R, which has counter-rotating propellers, in 1974. The Navajo's airframe also was used in the development of the twin-turboprop PA-31 Cheyenne, introduced in 1973.

The Navajo Chieftain was introduced in 1972 with a fuselage that is two feet (0.6 meter) longer than the fuselage of the Navajo, Turbo Navajo and Navajo C/R, and with 350-horsepower (261-kilowatt) TIO-540 engines driving three-blade, constant-speed, counter-rotating Hartzell propellers. "Navajo" later was dropped from the Chieftain's name.

Six seats are standard; 10 seats were available as an option. Maximum takeoff weight and maximum landing weight are 7,000 pounds (3,175 kilograms). Maximum rate of climb at sea level is 1,120 feet per minute (fpm). Maximum single-engine rate of climb at sea level is 230 fpm.

Maximum certified altitude is 24,000 feet. Cruise speed at 75 percent power is 221 knots at 20,000 feet and 205 knots at 12,000 feet. Stall speed with landing gear and flaps extended is 74 knots.♦

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

CAA records included three incidents involving instrument flight rules (IFR) operations conducted by the pilot in the accident aircraft and in a Piper Navajo operated by the company.

"Two of these involved a transition to IFR on VFR flights returning to Christchurch, and the third, in January 2002, involved the pilot twice failing to establish the aircraft on the Christchurch [Runway] 20 ILS [instrument landing system] approach, with [air traffic control (ATC)] intervention being required each time," the report said. "A visual approach was subsequently successful. The pilot was flying [the Navajo] for the first time and was unfamiliar with the avionics [equipment], which led to his difficulty with systems management during the approach."

The company discontinued single-engine-aircraft operations in August 2002 and reduced its fleet to one aircraft — the accident aircraft — in January 2003. At the time of the accident, the pilot served as Air Adventures' chief executive, director of operations, chief pilot and instructor.

The pilot had flown the accident aircraft exclusively since October 2002. He primarily conducted sightseeing flights in daytime visual meteorological conditions. During the 90 days preceding the accident flight, he had accumulated 3.3 instrument flight hours, seven instrument approaches and 3.2 nighttime flight hours. He had conducted ILS approaches to Christchurch twice during the period.

The aircraft was manufactured in the United States in 1974 and imported into New Zealand in 1990. Aerodynamic modifications, including the installation of vortex generators on the wings to improve the aircraft's stall characteristics and single-engine flight characteristics, were incorporated in 2000. The aircraft had accumulated 13,175 flight hours as of May 30, 2003.

"A review of maintenance documents showed that all scheduled maintenance had been recorded," the report said. "The only outstanding item recorded on the aircraft technical log was the cabin heater, which was signed off on 18 March 2003 as 'unserviceable' and 'deferred' by the maintenance engineer. … However, other pilots who had flown [the aircraft] in May reported the heater to be serviceable."

The report said that after the cabin heater was disabled by the maintenance engineer, it probably was returned to service by the pilot, although the tests required to return the cabin heater to service had not been performed.

"The heater is a practical necessity for IFR operations, especially in winter, and should have had priority maintenance," the report said. "Tests after the accident showed that it was in good condition and therefore not a potential source of carbon monoxide poisoning."

Other pilots who recently had flown the aircraft said that the flight director, the no. 2 navigation radio and the radio altimeter were unserviceable. New Zealand Civil Aviation Rules (CARs)

required that all instruments and equipment be in serviceable condition unless an approved minimum equipment list (MEL) provided for operating the aircraft with unserviceable items under specific conditions. Air Adventures did not have an approved MEL for the aircraft.

The report said that the aircraft had sufficient serviceable equipment for IFR flight, "though with reduced options in the event of further equipment failure." If the radio altimeter had been serviceable and used correctly, it might have provided a warning to the pilot when the aircraft descended to the published minimum approach altitude.

The aircraft departed from Christchurch at 0729 and arrived at Palmerston North at 0930.

"During the day, the pilot remained at Palmerston North Aerodrome to await the passengers' return for the flight back to Christchurch, which was planned to depart at 1730," the report said. "At about 1430, the pilot refueled the aircraft with 350 liters [92 gallons] of avgas from the installation on the aerodrome. At 1702, he obtained by telephone an updated weather briefing on Christchurch."

The briefing indicated that weather conditions at Christchurch temporarily would be below the published minimums for the ILS approach.

"However, because this was a forecast of temporary weather, and the prevailing forecast was better, and also because the alternate aerodrome [Woodbourne] had suitable weather, it was appropriate for the flight to commence," the report said.

The passengers arrived at the airport soon after 1700. During his preflight briefing, the pilot told the passengers that they could use their cellular (cell) phones and computers during the flight.

Before starting the engines, the pilot was told by an airport tower controller that a special aerodrome report (SPAR) had been issued for Christchurch. The SPAR indicated that visibility was 800 meters (2,625 feet) and that the airport had scattered clouds at 200 feet and an overcast at 400 feet.

As the pilot taxied the aircraft to the runway, the controller told him that another SPAR had been issued for Christchurch and that the terminal area forecast (TAF) had been revised. The SPAR indicated that visibility was 800 meters, decreasing to 500 meters (1,641 feet) in drizzle, and the airport had scattered clouds at 100 feet and an overcast at 400 feet.

The TAF called for 15 kilometers (nine statute miles) visibility in light drizzle, scattered clouds at 400 feet and a broken ceiling at 1,800 feet. The forecast indicated that temporary conditions between 1700 and 2200 would include visibility of 500 meters in fog and a broken ceiling at 200 feet.

The published procedure for the ILS approach to Runway 20 at Christchurch included a decision altitude of 295 feet (202 feet above runway touchdown zone elevation) and a minimum visibility of 800 meters. The published minimums for the localizer approach to Runway 20 were 470 feet and 1,500 meters (4,922 feet).

The aircraft departed from Palmerston North at 1739. The passenger in the copilot's seat told investigators that during cruise flight at 10,000 feet, the pilot told him that the weather conditions in Christchurch were poor and that, if the conditions deteriorated, they might have to land at Woodbourne.

"The passenger said that the flight seemed to be smooth and uneventful, with the heater maintaining a comfortable temperature in the cabin," the report said. "The other passengers passed round some snacks and drinks, including wine and beer, but neither [the front-seat passenger] nor the pilot had anything to drink."

If the radio altimeter had been serviceable and used correctly, it might have provided a warning to the pilot when the aircraft descended to the published minimum approach altitude.

The front-seat passenger said that the pilot flew the aircraft on autopilot until crossing the shoreline north of Christchurch. The passenger told investigators that he observed low clouds obscuring the town and the airport; the passenger recalled nothing thereafter about the flight.

The passenger seated behind the front-seat passenger said that the pilot pushed one earphone of his headset from his ear to use his cell phone late in the flight. The passenger said that the pilot had used his cell phone during the flight from Christchurch to Palmerston North and that other passengers had used their cell phones and computers during both flights.

The aircraft was about 64 nautical miles (119 kilometers) from the airport at 1846 when the pilot began the descent. Christchurch Control told the pilot that Runway 20 was in use and that new automatic terminal information service (ATIS) information soon would be broadcast. The controller issued the current altimeter setting for the airport.

The ATIS broadcast said that surface wind was from 030 degrees at three knots, visibility was 500 meters in drizzle and that the clouds were scattered at 200 feet and overcast at 700 feet.

At 1855, the pilot was told to fly to the Woodend nondirectional radio beacon (NDB), which was on the localizer course and was an initial approach fix for the ILS/localizer approach to Runway 20. The aircraft was at 4,000 feet and 37 nautical miles (69 kilometers) from the airport.

The aircraft was 16 nautical miles (30 kilometers) from the airport at 1902 when the controller told the pilot to descend to 2,000 feet and cleared him to conduct the ILS approach to Runway 20. Groundspeed was 202 knots as the aircraft was flown through 2,400 feet; the controller told the pilot to reduce speed to less than 175 knots. The report said that this instruction likely was issued to provide adequate separation between the Chieftain and a Boeing 737 that preceded it on the approach.

At 1904, the pilot acknowledged the instruction and told the controller that the aircraft was established on the approach and was slowing. The controller told the pilot to establish radio communication with Christchurch Tower.

The B-737 was landed on Runway 20 at 1904. During the approach, the controller had told the crew that visibility near the runway threshold was at least 1,400 meters (4,593 feet) and that the surface winds were southerly at four knots. The B-737 crew told investigators that they descended into a cloud layer at about 600 feet but observed the runway approach lights from about 200 feet above the decision altitude. The report said that the crew had "no problem with the ILS approach."

Soon after the B-737 was landed, the Chieftain pilot told the tower controller that the aircraft was established on the ILS. The controller told the pilot to continue the approach and that the B-737 was on the runway. The Chieftain was descending through 2,100 feet and was seven nautical miles (13 kilometers) from the runway threshold.

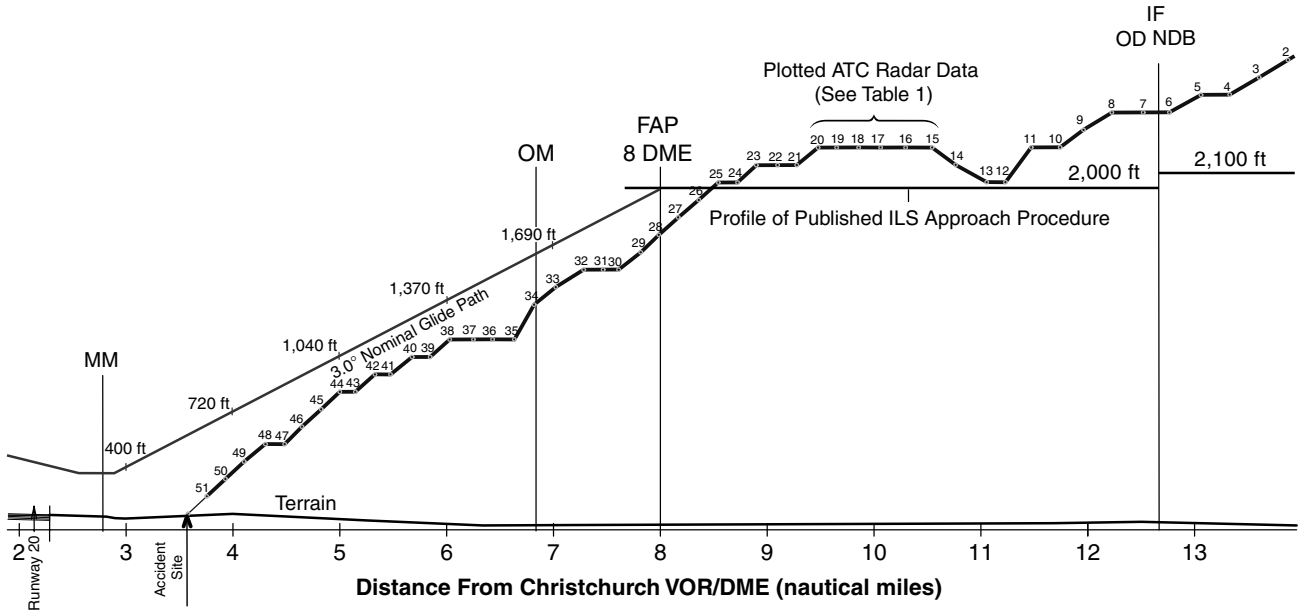
The published ILS procedure indicated that glideslope interception would occur at 2,000 feet and 5.7 nautical miles (10.6 kilometers) from the runway threshold. The pilot began the descent from 2,000 feet about 6.2 nautical miles (11.5 kilometers) from the runway threshold (Figure 1; Table 1, page 5). The aircraft then was flown 200 feet to 300 feet below the glideslope for the remainder of the flight.

"The aircraft's descent, which began before reaching the glideslope and continued below the glideslope, resulted either from a faulty glideslope indication or from the pilot flying a localizer approach instead of an ILS approach," the report said. [The published procedure for the localizer approach included a descent from 2,000 feet to 720 feet, beginning 5.7 nautical miles from the runway threshold, and a further descent to 470 feet, the minimum descent altitude, beginning at the outer marker.]

The pilot did not tell air traffic control that he was conducting the localizer approach, rather than the ILS approach. The report said that if the pilot had conducted a localizer approach, the weather conditions would have required him to conduct a missed approach at the missed approach point.

The report said that the pilot deviated from "good practice" by not setting the reported altimeter setting in the altimeter on

Flight Path of Air Adventures Piper Chieftain; June 6, 2003



ATC = Air traffic control DME = Distance-measuring equipment FAP = Final approach point ft = Feet IF = Initial fix
ILS = Instrument landing systems MM = Middle marker OD NDB = Woodend nondirectional beacon OM = Outer marker
VOR/DME = Very-high-frequency omnidirectional radio/DME

Source: Adapted from New Zealand Transport Accident Investigation Commission

Figure 1

Table 1
Air Traffic Control Radar Data; Air Adventures Piper Chieftain; June 6, 2003 (As Plotted in Figure 1)

	Time	Altitude (feet)	Groundspeed (knots)
1	1903:26	2,800	186
2	1903:31	2,700	191
3	1903:36	2,600	195
4	1903:41	2,500	197
5	1903:46	2,500	199
6	1903:51	2,400	200
7	1903:55	2,400	202
8	1904:00	2,400	202
9	1904:05	2,300	201
10	1904:09	2,200	199
11	1904:14	2,200	196
12	1904:19	2,000	194
13	1904:24	2,000	192
14	1904:29	2,100	191
15	1904:34	2,200	189
16	1904:39	2,200	186
17	1904:43	2,200	182
18	1904:48	2,200	177
19	1904:53	2,200	172
20	1904:58	2,200	167
21	1905:03	2,100	162
22	1905:07	2,100	159
23	1905:12	2,100	155
24	1905:17	2,000	152
25	1905:22	2,000	150
26	1905:27	1,900	147
27	1905:32	1,800	145
28	1905:37	1,700	143
29	1905:41	1,600	142
30	1905:46	1,500	139
31	1905:51	1,500	137
32	1905:56	1,500	137
33	1906:00	1,400	149
34	1906:05	1,300	140
35	1906:10	1,100	139
36	1906:15	1,100	140
37	1906:20	1,100	146
38	1906:25	1,100	150
39	1906:29	1,000	147
40	1906:34	1,000	145
41	1906:39	900	144
42	1906:44	900	137
43	1906:49	800	134
44	1906:53	800	128
45	1906:58	700	124
46	1907:03	600	127
47	1907:08	500	120
48	1907:13	500	128
49	1907:18	400	139
50	1907:23	300	136
51	1907:27	200	141

Source: New Zealand Transport Accident Investigation Commission

the copilot's panel so that he could cross-check the indicated altitude (the copilot's altimeter read 400 feet high) and by not tuning the two automatic direction finders (ADFs) to the frequency for an NDB southwest of the airport that served as the holding fix for the published missed approach procedure. The report said that the latter indicated "some lack of method in his procedures, or distraction, or possibly an intention to persevere to land from the approach without regard to weather conditions."

The aircraft was at 600 feet and 2.5 nautical miles (4.6 kilometers) from the runway threshold at 1907:01 when the controller cleared the pilot to land. The pilot acknowledged the clearance. No further radio transmissions from the pilot were heard.

The aircraft was at 200 feet and 1.4 nautical miles (2.6 kilometers) from the runway at 1907:26 when air traffic control radar contact with the aircraft was lost. (The report said that the control tower was equipped with radar displays to aid visual control tasks, such as sequencing traffic; tower controllers did not use the radar displays for control purposes.)

The aircraft severed three poplar trees and struck terrain 1.2 nautical miles (2.2 kilometers) from the runway. The accident site was in sparsely populated farmland with limited road access. The search for the aircraft began at 1915. Visibility in the search area was estimated to be from 50 meters to 400 meters (164 feet to 1,312 feet).

"Ground visibility in the area was poor in fog and darkness, and there was no additional position guidance such as [from] witnesses or an emergency locator beacon (ELT) signal," the report said. "A helicopter was on standby, but conditions were unsuitable for a helicopter search."

The aircraft's ELT activated on impact, but the distress signal was not detectable because the antenna detached when the tail section separated. The report said that the search also was hampered when searchers initially were provided incorrect geographical coordinates for the probable accident site.

"There were no witnesses and nothing for searchers to see, hear or smell until close to the accident site in the fog and darkness," the report said.

The wreckage was found at 2124. First aid was administered to the two survivors, who were transported by ambulance from the accident site. Postmortem examinations of the other occupants indicated that they had received multiple injuries that were immediately fatal. The injuries were caused by impact with the trees.

"The blunt-object trauma from these tree impacts probably caused fatal injuries to the occupants directly, rather than flailing or deceleration injuries while restrained within the cabin," the report said. "Some injuries may have resulted from the detachment of

the cabin roof. The two survivors, seated in the copilot [seat] and front-passenger seat on the right, were both outside the intrusive path of the trees and received lesser, but serious, injuries."

The postmortem examination of the pilot found indications of longstanding, moderately severe coronary artery disease.

"No symptoms of coronary disease had been recorded on his CAA medical file, and none had been reported to his family medical advisers," the report said.

Nevertheless, the pilot's heart disease likely would not have disqualified him from receiving a first-class medical certificate, the report said. The postmortem examination found no indication of cardiac damage.

"Because of this, sudden incapacitation from any cardiac insufficiency is considered unlikely," the report said. "The surviving passengers' accounts of the pilot's activities at the beginning of the approach also indicate that he was not incapacitated at that stage. However, it is not possible to entirely exclude the possibility of a heart attack or transient ischemia [inadequate blood flow] during the instrument approach."

The report said that indications of a heart attack or transient ischemia were not detectable during the postmortem examination.

Investigators determined that the Chieftain's engines and propellers were operating normally when the accident occurred, and that the aircraft likely was not affected by wake turbulence from the B-737. Tests of the pilot's altimeter and horizontal situation indicator (HSI) found that they likely were functioning normally during the approach. The glideslope receiver was damaged severely and could not be tested.

Several cell phone calls had been made during the flight, but the only call made during the approach was from the pilot's cell phone. The call began at 1904:36 and continued until the aircraft struck terrain at 1907:45 (three minutes and nine seconds).

"The call made from the pilot's cell phone to his home while the aircraft was on the ILS approach was not answered but was connected to his voice mail instead," the report said. "His partner listened to the first minute of it shortly afterwards and heard only the steady noise of aircraft engines. She deleted the recording without listening further. She reported that a similar previous call had resulted from an unintended speed-dial selection while the pilot was flying."

The report said that if the cell phone call resulted from unintentional activation of the speed-dial button, it would not have distracted the pilot but could have interfered electronically with the glideslope signal. The report said, however, that the call probably was made intentionally.

"The passenger seated behind the copilot seat had seen the pilot hold his cell phone to his ear fairly late in the flight, and the records showed that the only other call on his cell phone was at 1752 — 62 minutes earlier," the report said. "A deliberate call made … when about to intercept the ILS and just after starting to hand-fly the aircraft would [have been] irresponsible, with the high workload and concentration of the instrument approach about to start."

CARs Part 91.7(a) states: "No person may operate, nor may any operator or pilot-in-command of an aircraft allow the operation of, any cell phone or other portable electronic device that is designed to transmit electromagnetic energy on any aircraft while that aircraft is operating under IFR."

The report said that numerous occurrence reports have identified use of cell phones aboard aircraft as a cause of random interference with the proper functioning of aircraft avionics equipment. The report included some results of laboratory tests conducted in October 2002 by the U.K. CAA of the effects of simulated cell phone transmissions on a very-high-frequency radio, a navigation receiver with HSI and secondary indicators, and a remote gyro compass.[2]

… Interference from the pilot's cell phone might have caused erroneous indications without activating the glideslope warning flag in the HSI.

"At high signal levels, similar to that attainable from a cell phone 30 centimeters [12 inches] from the equipment or its wiring, anomalies were produced on all equipment readings except the glideslope indication," the report said. "These tests [by the U.K. CAA] confirmed onboard cell phones as an interference source and endorsed current legislation restricting their use on aircraft."

A postaccident check of the airport's ILS equipment found no anomalies. The report said that although investigators were unable to determine whether the pilot received a faulty glideslope indication, interference from the pilot's cell phone might have caused erroneous indications without activating the glideslope warning flag in the HSI.

"Although the U.K. CAA tests did not demonstrate interference with the glideslope, they did not rule out the possibility; they did confirm cell phones as an interference source to this general class of avionics equipment," the report said.

In the weather conditions that existed during the approach, flying the aircraft on autopilot would have helped the pilot, the report said.

"The pilot's actions or technique in flying a high-speed, unstabilized instrument approach; reverting to hand-flying the

aircraft at a late stage; not using the autopilot to fly a coupled approach and, if intentional, his cell phone call, would have caused him a high workload and possibly overload and distraction," the report said. "The pilot's failure to stop the descent probably arose from distraction or overload, which led to his not monitoring the altimeter as the aircraft approached minimum altitude."

The aircraft's groundspeed was about 150 knots when the pilot began the descent below 2,000 feet. Groundspeed was 141 knots when a loss of ATC radar contact occurred as the aircraft descended below 200 feet. The report said that a "good stabilized approach speed" for a Chieftain is about 110 knots to 120 knots.

The accident aircraft was operated under CARs Part 135, which governs commercial operations of helicopters and small airplanes — those with fewer than 10 passenger seats or a maximum takeoff weight (MTOW) of 5,700 kilograms/12,500 pounds or less. The aircraft was not equipped with, and was not required by Part 135 to be equipped with, a ground-proximity warning system (GPWS) or a terrain awareness and warning system (TAWS).[3]

The report said that the CAA proposed a requirement for TAWS in aircraft operated under Part 125, which governs commercial operations of medium airplanes — those with 10 to 30 passenger seats or a payload capacity of 3,410 kilograms/7,500 pounds or less, and an MTOW greater than 5,700 kilograms.[4] CAA did not propose a requirement for TAWS in aircraft operated under Part 135.

The report said that if the accident aircraft had been equipped with TAWS, the pilot likely would have received three warnings during the approach.

"The first warning would have been a routine '500' call when descending through 500 feet above the runway (about 40 seconds before the first impact); the second, a possible 'sink rate' call if the rate of descent increased above computed criteria; and the third warning, a continuous 'pull up' call starting about nine seconds before impact," the report said.

Based on these findings, TAIC on Feb. 19, 2004, made the following recommendations to the CAA director:

- "Monitor closely the future development of TAWS equipment with a view to amending Part 135 to require its installation in relevant aircraft (063/03);
- "Develop educational material to raise awareness of the rules prohibiting cell phone use on IFR flights (064/03); [and,]
- "Use the circumstances of this accident as education material for single-pilot-IFR operators and pilots in the management of instrument approaches (065/03)."

The CAA director on March 1, 2004, replied as follows:

- "With regard to recommendation (063/03), I accept this recommendation and will monitor closely the future development of TAWS equipment and, if appropriate, amend Part 135 to require its installation in relevant aircraft. No precise time frame can be stated;
- "With regard to recommendation (064/03), I accept this recommendation and will publish an article in *Vector* magazine outlining the differences between VFR and IFR, and the prohibition of cell phones while operating under IFR rules and reminding operators of their obligations under the current rules. This will be completed by July 2004;[5] [and,]
- "With regard to recommendation (065/03), I accept this recommendation and will use this accident as education material in the forthcoming General Aviation Group projects specifically aimed at light-twin multi-engine training and operation. This will be completed by December 2004."♦

[FSF editorial note: This article, except where specifically noted, is based on New Zealand Transport Accident Investigation Commission report 03-004, *Piper PA 31-350 Navajo Chieftain ZK-NCA, Controlled Flight Into Terrain, Near Christchurch Aerodrome*. The 36-page report contains illustrations.]

Notes

1. Peter Nalder, manager of safety analysis for the New Zealand Civil Aviation Authority, said that "risk profiles" are derived during safety audits by assigning scores of zero through 10 in evaluations of an aircraft operator's profile, management, management stability, operational stability, occurrences, noncompliances, financial status, and the last audit quality evaluation. The sum of the scores divided by 80 and expressed as a percentage is the risk-profile value. A risk-profile value less than 25 percent is considered "low"; 25 percent to 40 percent, "moderate"; 40 percent through 55 percent, "high"; and more than 55 percent, "very high."
2. See "Continued Limits Recommended on Use of Cellular Telephones in Aircraft," *Aviation Mechanics Bulletin* Volume 51 (September–October 2003).
3. *Terrain awareness and warning system* (TAWS) is the term used by the European Joint Aviation Authorities and the U.S. Federal Aviation Administration to describe equipment meeting International Civil Aviation Organization standards and recommendations for ground-proximity warning system (GPWS) equipment that provides predictive terrain-hazard warnings; *enhanced GPWS* and *ground collision avoidance system* are other terms used to describe TAWS equipment.
4. The New Zealand Civil Aviation Authority (CAA) on March 25, 2004, amended Civil Aviation Regulations Part 125 to require TAWS equipment aboard all airplanes operated under instrument flight rules by Jan. 1, 2007.
5. An article titled "Cellphones in Flight," was published in the July/August 2004 issue of *Vector*, the CAA's bimonthly magazine, which is available on the CAA's Internet site, <http://www.caa.gov.nz>.

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