



Descent Below Minimum Altitude Results in Tree Strike During Night, Nonprecision Approach

After descending below the published minimum descent altitude for the nondirectional beacon (NDB) approach, the commander began a missed approach as the aircraft struck trees. A three-foot section of the right wing was torn away; the crew diverted the aircraft to another airport, where they landed safely.

—
FSF Editorial Staff

At 1857 local time Dec. 1, 2000, a Piper PA-31-350 Chieftain operated on a positioning flight by Smålandsflyg was substantially damaged when it struck a tree about the same time that the crew began a missed approach during a nondirectional beacon (NDB) approach to the Ljungby/Feringe (Sweden) airport. The flight crew reported to air traffic control (ATC) that they had a flight control problem and diverted to Halmstad, where they landed at 1927.

The Swedish Board of Accident Investigation said, in its final report, that the causes of the accident were the following:

- “The commander [captain] erroneously reported that the aircraft had passed the outer locator and reset both ADFs [automatic direction finders] to the inner locator, resulting in the copilot’s [first officer’s] initiation of the final descent approximately one minute too early;
- “During the final approach phase, the pilots had inadequate monitoring of the aircraft’s position and altitude;



- “A misunderstanding arose between the commander and the copilot about who was flying the aircraft; [and,]
- “The aircraft descended below the minimum [descent] altitude [MDA] and collided with trees.”

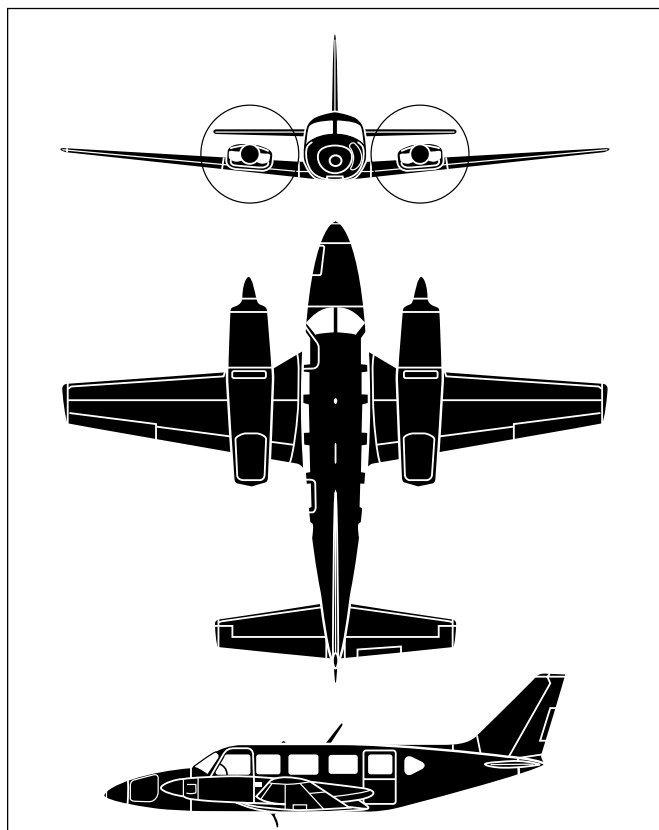
Smålandsflyg began operations in 1993 and, at the time of the accident, operated three Piper PA-31 series airplanes in nonscheduled commercial service. The company had nine pilots, who were paid for the days they flew, and was based in Feringe.

The Swedish Civil Aviation Administration (CAA) conducted annual operational inspections of the company through 1997.

“Criticism has been directed at the [company’s] operations manual, self-inspections and follow-up of how the pilots live up to stated routines,” the report said. “Because of new rules and regulations that have been implemented within Swedish aviation during the past few years, [CAA] has not had the resources to perform operational inspections to the extent that was intended.

“The critique documented during the latest operational inspection in 1997 mainly concerned changes in the operations manual. A revision of the appropriate areas was issued during February 1998.”

The Piper Chieftain is certified for single-pilot operation; nevertheless, the company required two pilots during passenger flights in the airplane.



Piper PA-31-350 Chieftain

Piper Aircraft introduced the Chieftain in 1972 as a lengthened version of the Navajo C/R and with more powerful engines than the Navajo C/R. At 34.6 feet (10.6 meters), the Chieftain's fuselage is two feet (0.6 meter) longer than the Navajo C/R's fuselage. Each of the Chieftain's Lycoming TIO-540-J2BD turbocharged, piston engines produces 350 horsepower (260 kilowatts) and drives a three-blade, constant-speed Hartzell propeller. (The Navajo C/R has 325-horsepower [241-kilowatt] engines.)

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 20,000 feet and 75 percent power is 221 knots. Cruise speed at 12,000 feet and 75 percent power is 205 knots. Stall speed with flaps extended is 74 knots.♦

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

The commander, 55, had a commercial pilot license and 9,890 flight hours, including 300 flight hours in type. He served as a pilot in the Swedish air force from 1965 to 1979 and flew for several scheduled aircraft operators and unscheduled aircraft operators until he was employed by Smålandsflyg on Nov. 13, 2000.

During a proficiency check by the Smålandsflyg chief of flight operations on Nov. 13, 2000, the commander conducted “a few” NDB approaches to the Ljungby/Feringe airport.

“There was nothing to criticize about his flying,” the report said. “Rather, the chief of operations was impressed with the precision that the commander had during the flight.”

The report said, “Professionally, the commander was through the years considered to be proficient in handling aircraft. However, points of view have been presented concerning his method of communicating and conducting himself ... as a crewmember.”

The report said that interviews with pilots and managers at companies that previously employed the commander indicated that the commander was considered a “lone wolf” who “had certain difficulties with cooperation within two-pilot systems.”

“He has had difficulties in following flying procedures during instrument flight, shown deficiencies in space conception during flight and deviated from company routines,” the report said. “He has had his own ideas and has gotten caught up in his own thoughts. Taken together, this was the reason for the short duration of the [commander's] employment at these companies.”

The CAA in January 1999 appointed the commander as an inspector qualified to conduct pilot proficiency checks.

“Considering the inadequacies that were disclosed concerning both his theoretical and practical competence for [instrument] flying and his shortcomings as a commander, it can be questioned whether he was suitable for this task,” the report said.

The commander had a hearing deficiency, for which he was granted hearing-standards exemptions by the CAA beginning in 1979. A physical examination conducted Nov. 20, 2000, showed that his hearing had deteriorated substantially.

“[The] hearing impairment was such that the experts at [the CAA] agreed that measures must be taken before the commander could be given continued exemption,” the report said.

The copilot, 24, had a commercial pilot license and 660 flight hours, including 352 flight hours in type. He earned his commercial pilot license in the United States in 1998 and converted the U.S. license to a Swedish license in January 1999.

He received flight training and studied commercial aviation theory at the College of Commercial Flight Training in Sweden. He was hired by Smålandsflyg in February 2000.

“The copilot has been described as a young, ambitious pilot with a nonchalant attitude at times,” the report said. “He had significantly less experience of life than the commander and had, in comparison to him, modest experience of flying [and of flying in] a two-pilot system.”

The accident airplane was manufactured in 1973 and had accumulated 8,842 flight hours. A maintenance check was conducted 39 flight hours before the accident. Both Textron Lycoming TIO-540 reciprocating engines had accumulated about 6,000 operating hours. The left engine had accumulated 815 hours since overhaul; the right engine had accumulated 276 hours since overhaul.

The commander and copilot conducted their first flight together two days before the accident. The copilot arrived at the Ljungby/Feringe airport after the scheduled departure time for the first leg — a positioning flight to Kalmar, Sweden, to pick up seven passengers for a charter flight to Riga, Latvia.

The copilot told investigators that, earlier that day, the company asked him to drive from Feringe to Gothenburg and to fly a company airplane back to Feringe. Because weather conditions at Feringe were below landing minimums when the pilot arrived at Gothenburg, the pilot drove back to Feringe. The copilot said that his late arrival for the flight to Kalmar “irritated” the commander.

The commander said that he became irritated when he found that there were no approach plates or passenger meals aboard the airplane. The airplane departed from Feringe at 1616 — one hour and 16 minutes after the scheduled departure time. The copilot was the pilot flying [PF] during the flight to Kalmar.

The commander was the PF during the flight from Kalmar to Riga.

“[The copilot said that] several misunderstandings and sources of irritation arose between the two pilots during the flight and during the ground stop in Riga,” the report said. “The copilot felt that the commander had problems in the use of the radio and the navigation instruments. [The commander] used a different phraseology during the flight than that which the copilot was accustomed to, and they had different working methods.

“The copilot called the office from Riga and informed the president that they had experienced problems with cooperation, and [the copilot] was told that it would be looked into when they returned to Feringe.”

The crew remained in Riga and flew the passengers back to Kalmar on the day of the accident.



About one meter (three feet) of the Piper Chieftain's right wing separated during the tree strike. The aileron was torn from its hinges but remained attached to the wing by its actuating rod.
(Photo: Swedish Board of Accident Investigation)

The copilot told investigators that the commander rotated the airplane too early for take off from Riga, and the stall-warning system activated.

“The copilot pointed out to the commander that he should not maintain such a nose-up attitude during the climb, which [the commander] did not bother to change,” the report said.

The crew departed from Kalmar at 1817 to fly the Chieftain to Feringe. The copilot was the PF.

The commander said that, because of the weather conditions at the Ljungby/Feringe airport, the crew carried “a little extra fuel for the flight” and included Ängelholm and Halmstad, both in Sweden, as alternate airports on their flight plan.

The company's operations manual said that the PF operates the flight controls and gives orders to the pilot not flying (PNF), who “performs all instrument selections and switching.” The manual said that in an emergency situation, a commander serving as PNF “has the right to take over the role as [PF] and subsequently give orders to the [PNF]. To avoid possible misunderstandings, standard [English] phraseology shall be used.”

The manual said that a commander serving as PNF must say “my controls” when he or she takes control of the airplane from the PF; the PNF must then acknowledge by saying “your controls.”

The cruise segment of the flight was conducted at 6,000 feet. Near the Ljungby/Feringe airport, the crew was told by ATC to descend to 2,000 feet and to establish radio communication with Feringe Automatic Flight Information Service [AFIS].

The Feringe AFIS operator recommended that the pilots use Runway 19. He said that the surface wind was from 170 degrees at eight knots, visibility was 1,500 meters (0.9 statute mile) and cloud cover was eight-eighths with bases 400 feet above ground level. He asked the crew to report crossing the outer

locator for the NDB approach to Runway 19. (Two NDBs were used for the approach — one for the outer locator, the other for the inner locator.)

The copilot conducted an approach briefing and said that the MDA for the approach was 940 feet (402 feet above runway touchdown zone elevation). The outer locator, which serves as both the initial approach fix and final approach fix, was selected in both ADFs and in the global positioning system (GPS) receiver.

After the airplane crossed the outer locator at about 2,600 feet, the copilot conducted a teardrop entry to establish the airplane on the final approach course (196 degrees) and flew the airplane to 1,800 feet, the minimum altitude for that segment of the approach.

The commander and the copilot gave investigators different accounts of what followed. The commander said that before the airplane crossed the outer locator inbound on the final approach course, the copilot transferred control of the airplane to the commander and entered waypoint data in the GPS receiver.

“[The commander said that] this took only a moment, and then the copilot took over the controls again,” the report said.

The commander said that he asked the copilot if he wanted the landing gear extended, and the copilot said “gear down.” The commander extended the landing gear and continued

conducting the checklist. He then told the copilot that the airplane was “somewhat left of the inbound track.”

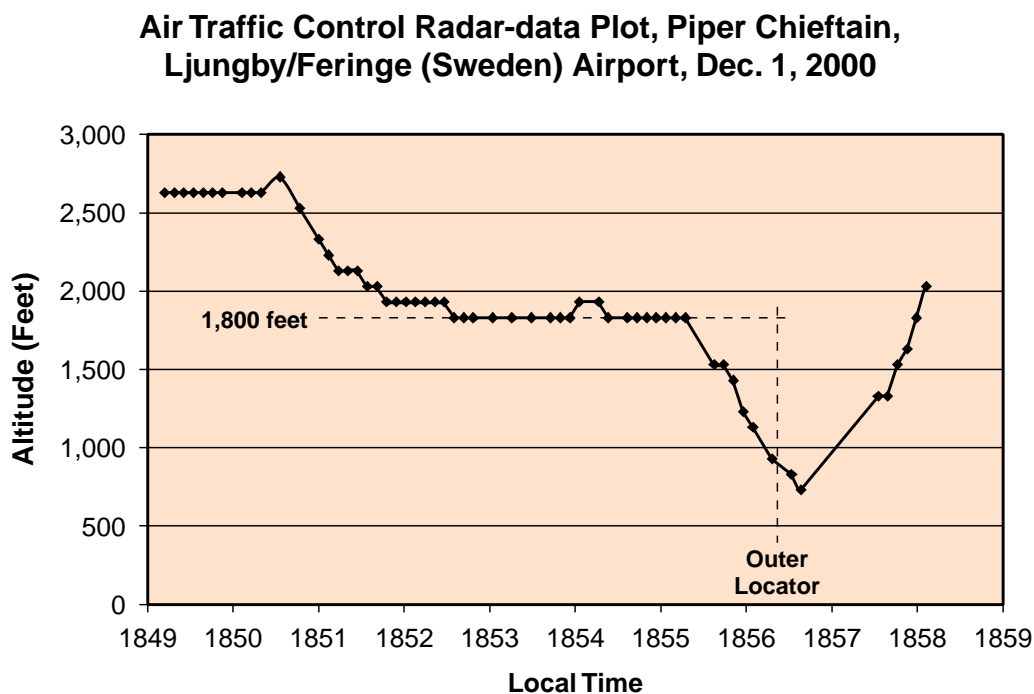
The commander said that he received outer-marker annunciations — an audio alert and a blue light on the instrument panel — when the airplane crossed the outer locator inbound. The report said, however, that the outer locator was not equipped to transmit electronic signals that activate onboard annunciators.

Both pilots said that the commander selected the inner-locator frequency on both ADFs.

The copilot, who was flying the airplane on autopilot, said that the commander announced that they had crossed the outer locator. The copilot then programmed the autopilot for a descent at 400 feet per minute to 500 feet per minute.

ATC radar data indicated that the airplane began to descend from 1,800 feet about 2.5 kilometers (1.4 nautical miles) from the outer locator (see Figure 1).

“The copilot cannot recall that he saw an indication of [outer-locator] passage on the ADF needles or the GPS,” the report said. “[The copilot said that] he asked the commander to set the airport coordinates into the GPS, which was still set [to the outer locator]. The commander had difficulties in inserting the coordinates, so the copilot said something like ‘take over, and I will insert it instead.’ He thought that it would be quicker if he programmed [the GPS receiver].”



Source: Swedish Board of Accident Investigation

Figure 1

The report said that the pilots did not use correct phraseology for transfer of control, and that transferring control and reprogramming the GPS at this stage of the approach was inappropriate.

The copilot said that the commander acknowledged the transfer of control, but the commander then said that they were five degrees off course and asked him (the copilot) to turn five degrees right.

“Simultaneously as [the copilot] had the thought that it really was not he who was flying, the commander applied full throttle and the sound of an impact was heard in the aircraft,” the report said.

The commander said that after he selected the inner-locator frequency on both ADFs, he briefly looked outside to see if the approach lights were in sight.

The report said that because of the misunderstanding between the pilots about who was flying the airplane, neither pilot likely was flying the airplane when it descended below 940 feet. The report said that the commander’s hearing deficiency might have contributed to the misunderstanding.

The commander said that he had looked at the instrument panel and observed the altimeter indicating 700 feet and the vertical-speed indicator showing a descent.

“He then simultaneously advanced both throttles to full power and rotated the nose to 10 [degrees] to 15 degrees nose-up ... to initiate a climb,” the report said. “At the same instant, a bang was heard, and the aircraft [began to roll right].”

The airplane was at about 600 feet when its right wing struck trees about 3.5 kilometers (1.9 nautical miles) north of the airport.

“Pieces of the wing tip were recovered at the site, but the majority of the wing section that was torn off was found about ... 20 kilometers [11 nautical miles] south of the impact site,” the report said. “Signs of impact on spruce [trees] and pine trees, at a height of about 20 meters [66 feet] above the ground, were found at the accident site.”

About one meter (three feet) of the right wing separated from the airplane. The aileron separated from its hinges but remained attached to the wing by an actuating rod.

“The commander related that they were forced to constantly maintain large left-rudder input [and left-aileron input], that they were in a 45-degree bank and that they [had] difficulties maneuvering the aircraft,” the report said. “It was so strenuous for the commander to fly the damaged aircraft that he experienced muscle pain for several days.”

The report said that the crew made a “rapid and unclear report on the frequency [that] sounded somewhat like ‘yes 302, new approach.’” (The airplane’s call sign was Gordon 302.)

The AFIS operator asked the crew if they preferred to fly to Ängelholm or Halmstad, rather than conducting another NDB approach at the Ljungby/Feringe airport. The commander said that they would fly to Ängelholm. The AFIS operator told the crew to climb to 5,000 feet, fly directly toward Ängelholm and change to the radio frequency for Malmö Control.

The copilot told Malmö Control that the airplane was three nautical miles (5.6 kilometers) south of Feringe and requested radar vectors for the shortest route to Ängelholm because of control problems. He said that the airplane’s left wing had been damaged.

The controller told the crew to turn 30 degrees right. He said that the airplane was 40 nautical miles (74 kilometers) from Ängelholm, 23 nautical miles (43 kilometers) from Halmstad and that the Halmstad airport had surface winds from 50 degrees at six knots, six kilometers (four statute miles) visibility with haze and three-eighths to four-eighths cloud cover with bases at 700 feet.

The commander requested radar vectors for a long final approach to the Halmstad airport. He told the controller that he would conduct a high-speed landing and requested aircraft rescue and fire fighting (ARFF) services.

“The air traffic controller vectored him for a 10-nautical-mile (18.5-kilometer) final for an ILS [instrument landing system approach to] Runway 19,” the report said. “[The crew] landed at 1927 hours and were able to taxi the aircraft to a parking stand.

“After the aircraft was parked, both pilots, who were exhausted, were attended to by the [ARFF] services. They met with a crisis-management group prior to being driven home.”

Based on the findings of the investigation, the Board of Accident Investigation made the following recommendations to the CAA:

- “Revise the routines for the supervision of smaller air traffic companies licensed to pursue operational aviation activities; [and,]
- “Revise the routines for the appointment of inspectors.”♦

[FSF editorial note: This article, except where specifically noted, is based on the Swedish Board of Accident Investigation report RL2001:20e, *Accident involving aircraft SE-KGH north of Ljungby/Feringe airport, G county, Sweden, on the 1st of December 2000*. The 32-page report contains appendixes, diagrams and a photo.]



Flight Safety Foundation

present the



14th annual European Aviation Safety Seminar (EASS)

MARCH 11-13, 2002



B U D A P E S T, H U N G A R Y

To receive agenda and registration information, contact Ahlam Wahdan, tel: +1 (703) 739-6700, ext. 102; e-mail: wahdan@flightsafety.org

To sponsor an event, or to exhibit at the seminar, contact Ann Hill, tel: +1 (703) 739-6700, ext. 105; e-mail: hill@flightsafety.org

Want more information about Flight Safety Foundation?

Contact Ann Hill, director, membership and development,
by e-mail: hill@flightsafety.org or by telephone: +1 (703) 739-6700, ext. 105.

Visit our World Wide Web site at <http://www.flightsafety.org>

We Encourage Reprints

Articles in this publication, in the interest of aviation safety, may be reprinted, in whole or in part, but may not be offered for sale, used commercially or distributed electronically on the Internet or on any other electronic media without the express written permission of Flight Safety Foundation's director of publications. All uses must credit Flight Safety Foundation, *Accident Prevention*, the specific article(s) and the author(s). Please send two copies of the reprinted material to the director of publications. These reprint restrictions apply to all Flight Safety Foundation publications.

What's Your Input?

In keeping with FSF's independent and nonpartisan mission to disseminate objective safety information, Foundation publications solicit credible contributions that foster thought-provoking discussion of aviation safety issues. If you have an article proposal, a completed manuscript or a technical paper that may be appropriate for *Accident Prevention*, please contact the director of publications. Reasonable care will be taken in handling a manuscript, but Flight Safety Foundation assumes no responsibility for material submitted. The publications staff reserves the right to edit all published submissions. The Foundation buys all rights to manuscripts and payment is made to authors upon publication. Contact the Publications Department for more information.

Accident Prevention

Copyright © 2001 by Flight Safety Foundation Inc. All rights reserved. ISSN 1057-5561

Suggestions and opinions expressed in FSF publications belong to the author(s) and are not necessarily endorsed by Flight Safety Foundation. Content is not intended to take the place of information in company policy handbooks and equipment manuals, or to supersede government regulations.

Staff: Roger Rozelle, director of publications; Mark Lacagnina, managing editor; Wayne Rosenkrans, senior editor; Linda Werfelman, senior editor; Karen K. Ehrlich, web and print production coordinator; Ann L. Mullikin, production designer; Susan D. Reed, production specialist; and Patricia Setze, librarian, Jerry Lederer Aviation Safety Library

Subscriptions: One year subscription for twelve issues includes postage and handling: US\$240. Include old and new addresses when requesting address change. • Attention: Ahlam Wahdan, membership services coordinator, Flight Safety Foundation, Suite 300, 601 Madison Street, Alexandria, VA 22314 U.S. • Telephone: +1 (703) 739-6700 • Fax: +1 (703) 739-6708.