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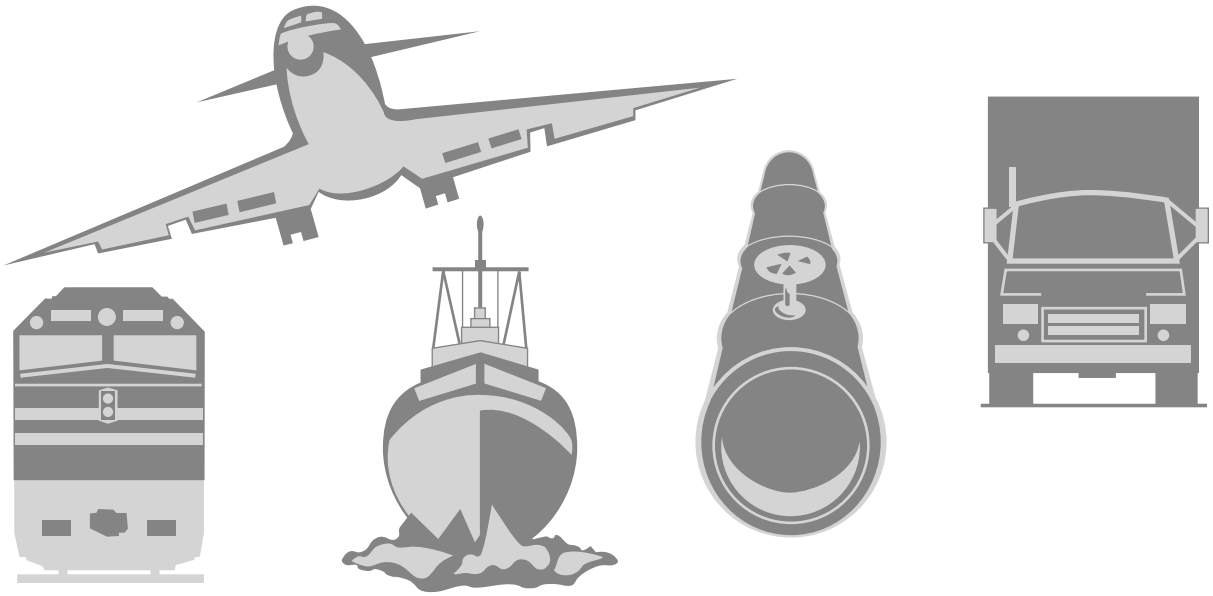
NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

SAFETY RECOMMENDATIONS

ADOPTED JUNE 2002



National Transportation Safety Board
Washington, D.C. 20594
Safety Recommendation

Date: June 13, 2002

In reply refer to: A-02-12

Honorable Jane F. Garvey
Administrator
Federal Aviation Administration
Washington, D.C. 20591

On March 29, 2001, about 1902 mountain standard time (MST),[1] a Gulfstream III, N303GA, operated by Avjet Corporation, crashed into sloping terrain about 2,400 feet short of runway 15 at Aspen-Pitkin County Airport Sardy Field (ASE), Aspen, Colorado. The 3 crewmembers and all 15 passengers were killed, and the airplane was destroyed. The flight was operating under the provisions of 14 *Code of Federal Regulations* (CFR) Part 135 as an on-demand passenger charter flight from Los Angeles International Airport (LAX), Los Angeles, California, to ASE.

Background

N303GA departed LAX about 1611 Pacific standard time (1711 MST) and entered the Aspen terminal area about 1843.[2] According to the cockpit voice recorder (CVR) recording, the flight crew had been planning a visual approach to runway 15; however, as the airplane descended toward the airport, clouds and snow showers increased, obscuring the field. The automatic terminal information service information in effect during the final approach indicated that the weather conditions were wind 250º at 3 knots; visibility 10 miles; light snow; few clouds at 1,500 feet; broken cloud ceiling at 2,500 feet; and broken cloud ceiling at 5,000 feet. As N303GA continued toward the airport, ASE air traffic controllers provided arriving airplanes with vectors for the VOR/DME-C instrument approach procedure to the airport.[3]

About 1845, the crew of a Canadair Challenger 600, N527JA, executed a missed approach because of limited visibility. About 1853, another Canadair Challenger 600, N898R, also executed a missed approach. About 1856, the accident airplane was cleared for the

[1] Unless otherwise noted, all times in this letter are MST, based on a 24-hour clock.

[2] There were no reports from the airplane or air traffic control (ATC) of any abnormalities during the en route portion of the flight.

[3] VOR/DME stands for very high frequency omnidirectional radio range/distance measuring equipment. The "C" in the approach title indicates that the approach does not include straight-in landing minimums because it does not meet the criteria for course alignment and/or the maximum descent gradient.

VOR/DME-C approach course, and the captain was notified that visibility north of the airport was reduced to 2 miles. About 1858, N527JA executed another missed approach because the captain could not see the airport.

At 1900:27, after the airplane had passed the final approach fix, the captain of N303GA asked the local controller, "are the runway lights all the way up?" The local controller stated, "affirmative they're on high." At 1900:43, the captain asked the first officer, "you see the runway," and, at 1900:46, "you see the highway?"[4] At 1900:49, the Aspen local controller asked the flight crew of N303GA, "you have the runway in sight?"[5] At 1900:51, the first officer stated, "affirmative," and, at 1900:52, he transmitted to the controller, "runway in sight."[6] According to the controller, less than 1 minute later, she observed N303GA emerging from a snow shower at a low altitude and not aligned with the runway. Radar data show that about this time, the airplane started maneuvering to the runway, entering a steep left turn for final runway alignment. While in this turn, the airplane impacted terrain to the right of the extended runway centerline, 100 feet above the runway 15 threshold elevation and 2,400 feet short of runway 15. The approach end of runway 15 is at an elevation of 7,674 feet mean sea level (msl), and the opposite end of the runway is at an elevation of 7,815 feet msl, resulting in an upward slope.

Flight Crew Coordination

The Avjet Operations Manual in effect at the time of the accident was dated July 15, 2000. Page 4-4 indicates that, during the descent, the captain is responsible for conducting an approach briefing after leaving 18,000 feet but before reaching 10,000 feet. The manual instructs the captain to emphasize the following: configuration; approach speed; final approach fix altitude; MDA; visual descent point; circling maneuver; missed approach heading, altitude, and intentions;[7] runway information; and abnormal conditions. Although the CVR recorded the captain briefing a visual approach, the CVR did not record the captain briefing the instrument approach procedure or any of the instrument approach briefing information required by Avjet.

Pages 4-4 and 4-5 of Avjet's Operations Manual indicate the flight crew callouts that are required during the final approach segment of an instrument approach. The captain is responsible for announcing his intentions after the decision height or missed approach point (MAP). The first officer is responsible for several callouts, including the following:

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[4] During the approach, the highway was located slightly to the right of the extended runway centerline. Radar data indicate that about this time, N303GA descended about 200 feet below the minimum descent altitude (MDA) depicted on the approach chart for its position.

[5] According to postaccident interview statements, ASE controllers are trained to closely monitor the progress of airplanes executing the VOR/DME-C approach and to immediately advise a pilot if his or her aircraft passes below a required minimum altitude. Most controllers reported that, if they observe an aircraft's altitude to be about 200 feet lower than published minimums, they will ask the pilot if the runway is in sight.

[6] Radar data indicate that about this time, N303GA was about 450 feet below the MDA depicted on the approach chart for its position.

[7] Early in the CVR recording, the captain discussed the possibility that the airplane might have to go to an alternate airport because of a landing restriction that required the airplane to land within a 1/2 hour after sunset at ASE. Because the airplane departed LAX 41 minutes later than scheduled (due to the late arrival of passengers) and, as a result, was estimated to arrive at ASE about 12 minutes before the curfew, the captain should have included a missed approach briefing.

- At 1000 feet above minimums: Call "1000 to go, no flags."
- At 500 feet above minimums: Call "500 to go."
- At 100 feet above minimums: Call "Approaching minimums."
- At MDA (Non-precision): Call "At minimums (time) (distance) to go."
- At MAP (Non-precision): Call "Missed approach point, runway in sight" or "Missed approach point, runway not in sight."

Therefore, when the airplane reached altitudes of 11,200, 10,700, and 10,300 feet, Avjet's Operations Manual required the first officer to call out, "1000 to go [until landing minimums]," "500 to go," and "approaching minimums," respectively. However, the CVR did not record him making any of these callouts.[8]

According to an airplane performance study conducted by the Safety Board, at 1900:39, the airplane leveled off at an altitude of 10,100 feet, 300 feet below the minimum specified altitude required for the airplane's position at the time. Further, as noted previously, at 1900:46 (about the time the captain was asking the first officer if he had the highway in sight), N303GA had descended about 200 feet below the MDA, and, at 1900:52 (about the time the first officer responded to the Aspen tower controller that he had the runway in sight),[9] it had descended about 450 feet below the MDA. The first officer should have called out these deviations to the captain, but the CVR did not record him making these callouts or challenging the captain about operation of the airplane below the MDA, and radar data indicated that the captain did not correct the descent.

At 1901:21, when N303GA was about 900 feet above the airport elevation, the CVR recorded a configuration deviation warning that lasted for 9 seconds. This warning indicated that the captain had deployed the spoilers after the landing gear had been extended and landing flaps selected in the full-down position (39°), which is prohibited by the FAA-approved aircraft flight manual (AFM).[10] Further, when the captain deployed the spoilers, the engine power was set to about 55 percent N_2.[11] The AFM states that the minimum engine power setting on final approach should be 64 percent N_2.[12] CVR evidence indicated that the captain did not include the first officer in his decision-making process regarding spoiler deployment and power setting and that the first officer did not question or challenge the captain about either item.[13]

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[8] The first officer was also required to call out course, fix, and altimeter information, but the CVR did not record him making any of these callouts.

[9] Evidence suggested, however, that the flight crew did not actually have the runway in sight or had it in sight at that point only briefly. Specifically, the CVR did not record any previous independent indication from either flight crewmember that he had visually identified the runway. Also, the CVR did not record any further discussion throughout the rest of the flight that would be consistent with a flight crew that could see a runway.

[10] Spoilers are extendable panels located on top of the wings that are deployed to decrease the speed of the airplane or increase its rate of descent. It is likely that the captain deployed the spoilers on short final in an attempt to increase the airplane's rate of descent to get below the local snow showers and visually locate the runway.

[11] N_2 is the rotational speed of the high-pressure spool in a gas turbine engine.

[12] Sixty-four percent N_2 allows for minimum engine spool-up time in the event of a missed approach.

[13] The deployment of the spoilers at the incorrect power setting for final approach placed the airplane in a potentially unsafe and destabilized condition.

At 1901:36, N303GA passed the MAP about 485 feet above field elevation rather than the specified 2,385 feet. The first officer was required to call out, "missed approach point, runway in sight," or "missed approach point, runway not in sight," and the captain was required to announce his intentions. However, the CVR did not record either of these callouts or any evidence that the captain or the first officer understood that they were flying at too low an altitude.

About the same time as the airplane passed the MAP, the captain asked, "where's it at?" This statement suggests that the captain had not identified, or had lost visual contact with, the runway. At this point, the captain should have abandoned the approach or the first officer should have called for a go-around, especially because the airplane was close to the ground in mountainous terrain. The first officer stated, "to the right," about 6 seconds after the captain's query. Even if the first officer did in fact have the runway in sight at this point, the captain, as the flying pilot, should not have been relying on the first officer for directional guidance during the visual transition from the instrument approach to the landing.

Conversations recorded by the CVR during the last 2 minutes of flight suggest that the flight crew was preoccupied with looking outside the cockpit in an attempt to visually locate the airport. As a result, the captain continued flight below the authorized MDA after failing to establish or maintain visual contact with the runway. The first officer did not challenge the captain's actions.[14]

Crew Resource Management Training and Regulatory Guidance

Crew resource management (CRM) training, which focuses on interpersonal skills, leadership style, communication, crew coordination, planning, briefing, workload management, decision-making, error management, risk identification, and management techniques in the cockpit, was developed by the National Aeronautics and Space Administration between the mid-1970s and early 1980s[15] to integrate human factors concepts into flight crew training. CRM training was developed in response to several Safety Board investigations of flight crew-related aircraft accidents[16] and statistical data that indicated that a large percentage of air carrier accidents are flight crew related. Most air carriers have several days of dedicated CRM training at which accidents are reviewed and, in some cases, pilots examine their own communication styles to determine specific strengths and weaknesses that may affect crew coordination in the

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[14] A 1994 safety study noted that a crewmember's failure to monitor or challenge another crewmember's error was a common causal or contributing factor in major flight crew-related accidents. For more information, see National Transportation Safety Board. 1994. *A Review of Flightcrew-involved Major Accidents of U.S. Carriers 1978 through 1990*. Safety Study. NTSB/SS-94/01. Washington, DC.

[15] At that time, CRM was referred to as "cockpit resource management."

[16] For example, see National Transportation Safety Board. 1973. *Eastern Air Lines, L-1011, N310EA, Miami, Florida, December 29, 1972.* Aircraft Accident Report. NTSB/AAR-73/13. Washington, DC; National Transportation Safety Board. 1979. *United Airlines, Inc., McDonnell Douglas, DC-8-61, B8082U, Portland, Oregon, December 28, 1978.* Aircraft Accident Report. NTSB/AAR-79/07. Washington, DC; and National Transportation Safety Board. 1982. *Air Florida, Inc., Boeing 737-222, N62AF, Collision with 14th Street Bridge, Near Washington National Airport, Washington, DC, January 13, 1982.* Aircraft Accident Report. NTSB/AAR-82/08. Washington, DC.

cockpit. These courses also allow participants to interact with each other, obtain feedback, role play, learn strategies to improve workload and error management, recognize leadership qualities, and reinforce effective attitudes and behavior.

As part of a 1994 safety study, the Safety Board issued Safety Recommendation A-94-196, which recommended that the FAA "revise within 1 year the pilot training requirements for scheduled Part 135 operators such that: all pilots are provided mandatory crew resource management training that incorporates the principal components of effective CRM training."[17] In response to this recommendation, on December 20, 1995, the FAA issued the final rule titled, "Air Carrier and Commercial Operator Training Programs," which established a requirement that, after March 19, 1997, 14 CFR Part 135 commuter operators that conduct scheduled operations with aircraft requiring 2 pilots or that have 10 or more passenger seats must establish, among other things, an FAA-approved CRM training program for its pilots in accordance with 14 CFR Part 121, subparts N and O.[18] However, because this requirement did not extend to Part 135 on-demand charter operators, Avjet was not required to establish an FAA-approved CRM training program for its pilots.[19]

The cockpit environments and the duties of multiperson flight crews of Part 135 on-demand charter operations are similar to those of Part 135 commuter operations. Further, many Part 135 on-demand charter operators use sophisticated turbojet and turboprop equipment and can be affected by operational demands similar to those experienced by Part 135 commuter operators (such as, schedule pressure and customer needs), which may influence the aeronautical decision-making process.

The evidence from this investigation has shown that the accident flight crew exercised poor CRM in the following ways: (1) the captain did not brief the instrument and missed approach procedures or any other required information, (2) the flight crew did not make required instrument approach callouts, (3) the captain did not include the first officer in the aeronautical decision-making process, and (4) the first officer did not question or challenge the captain or intervene when he placed the airplane in a potentially unsafe flying condition. The Safety Board is concerned that Part 135 on-demand charter operators, such as Avjet, and other operators that conduct operations with aircraft requiring two or more pilots do not need to meet the CRM training requirements outlined for Part 135 commuter operators.

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[17] For more information, see National Transportation Safety Board. 1994. *Commuter Airline Safety.* Safety Study. NTSB/SS-94/02. Washington, DC. This was not the first time that the Safety Board issued recommendations to the FAA regarding CRM. For example, in response to the October 28, 1989, Aloha IslandAir accident, the Board issued Safety Recommendation A-90-135, which asked the FAA to "require that scheduled 14 CFR Part 135 operators develop and use cockpit resource management programs in their training methodology by a specified date." On July 15, 1996, the Board classified Safety Recommendation A-90-135 "Closed—Acceptable Action."

[18] On July 15, 1996, the Safety Board classified Safety Recommendation A-94-196 "Closed—Acceptable Action" based on the issuance of this rule.

[19] Appendix C of the Avjet Training Manual, pages C-56 and C-58, indicates that CRM is 1 of 13 general operational subjects addressed during Gulfstream G1159 series initial and recurrent ground training. The manual did not indicate any stand-alone CRM module or formal classroom instruction on CRM, which is required for Part 121 CRM training.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Revise 14 *Code of Federal Regulations* (CFR) Part 135 to require on-demand charter operators that conduct operations with aircraft requiring two or more pilots to establish a Federal Aviation Administration-approved crew resource management training program for their flight crews in accordance with 14 CFR Part 121, subparts N and O. (A-02-12)

Chairman BLAKEY, Vice Chairman CARMODY, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in this recommendation.

Original Signed

By: Marion C. Blakey
Chairman