Six Hours and 26 Minutes into a Four Hour, 40 Minute Flight

The stage is set for disaster when a weary international crew assumes that air traffic control is aware that a fuel emergency exists.

by
Capt. Tom Duke
Aviation Safety Writer

"On January 25, 1989, at approximately 2134 eastern standard time, Avianca Airlines flight 052 [AVA 052], a Boeing 707-321B with Colombian registration HK 2016, crashed in a wooded residential area in Cove Neck, Long Island, New York. [U.S.] AVA 052 was a scheduled international passenger flight from Bogotá, Colombia, to John F. Kennedy International Airport [JFK], New York, with an intermediate stop at Jose Maria Cordova Airport, near Medellin, Colombia. Of the 158 persons aboard, 73 were fatally injured." So began the accident summary of the U.S. National Transportation Safety Board (NTSB) in its report of an aircraft accident that would highlight numerous safety issues.

Because of poor weather conditions in the northeastern United States, AVA 052 was placed in holding patterns three times by air traffic control (ATC) for a total of approximately one hour and 17 minutes. During the third holding pattern, the flight crew reported that the airplane could not hold longer than five minutes, that it was running out of fuel and that it could not reach its alternate airport, Boston Logan International in Massachusetts. Subsequently, after being cleared for an approach, the flight crew executed a missed approach to JFK. While returning to the airport, the airplane experienced a loss of power to all four engines and crashed approximately 16 miles from the airport.

Problems Accumulated Early

The following is a brief reconstruction from the accident report of how the crew's problems accumulated.

- The captain ordered approximately 6,000 pounds of fuel, or a possible 30-45 minutes of extra flight, added prior to departure from Medellin. This raised the aircraft's takeoff weight to the airfield performance limit. If the flight had experienced no delays, it would have landed at JFK with more than 20,000 pounds, or approximately two hours flight time of fuel remaining.

- The weather data provided to the flight crew before departing Medellin was nine to 10 hours old. It indicated that JFK had weather no worse than a 400-foot

ceiling, one mile visibility and winds gusting to 25 knots with light rain. The alternate, Boston, however, was reported as intermittently below legal minimums for filing as an alternate airport.

- Except for the short leg from Bogotá to Medellin, the captain had not flown previously with either the first officer or engineer. He chose to fly the leg to JFK. According to the cockpit voice recorder (CVR), the first officer made all the radio calls in English and repeated air-ground communications to the captain in Spanish.

- The engines of the aircraft had been modified with hush kits that, along with other factors such as age and cumulative wear and tear on the aircraft's aerodynamics and powerplant efficiency, degraded fuel consumption approximately 10 percent; this was considered in the fuel planning. Landing procedures for this aircraft call for the use of only 25 degrees of flaps during landing for noise tolerance except when authorized for emergency procedures. However, use of the autopilot during approaches with 25 degrees of flaps is not allowed below 500 above ground level (agl). Coupled autopilot approaches with 40 to 50 degrees of flaps are certified to 62 feet agl but because of the noise limitation, may only be used in an emergency.

- Aircraft records indicated recurring autopilot problems. A captain who had flown this aircraft on the flight just prior to the accident flight indicated there was a problem with the flight director in the approach mode. The NTSB report stated the belief that AVA 052 might have been flown manually from Colombia and that the approach was flown without the aid of a flight director.

The crew ... might not have been aware of the deteriorated weather conditions ... .

- The crew of AVA 052 did not use available flight dispatch services to update weather and alternate airport information and might not have been aware of the deteriorated weather conditions at JFK by the time they reached Norfolk.

- The flight plan showed that AVA 052 was early by approximately eight minutes at Norfolk and had used up much of the extra fuel loaded at Medellin. This may have been the result of flying faster, heavier and at a lower altitude than the original flight plan. After holding at Norfolk for 19 minutes before heading toward JFK, the aircraft departed 37,000 feet with 17,000 pounds of fuel at 1942 hours, approximately 20 minutes behind scheduled flight plan "top of descent" time. The required 10 percent reserve fuel and extra 6,000 pounds was almost gone. Without further delay, AVA 052 could expect to land at JFK with 14,500 pounds of fuel. This would be sufficient for about one hour and 30 minutes of flight at approach altitudes and still leave slightly more than the 12,400 to 14,100 pounds required to go to the Boston alternate and hold for 30 minutes before running out of fuel.

- At 1943, near Atlantic City, N.J., at Boton intersection, AVA 052 was held again, for 29 more minutes. While holding at Boton, the flight crew received several altitude change clearances to 19,000 feet and two expect further clearance (EFC) changes. The crew requested information about Boston delays from Washington Center and were informed that Boston was accepting traffic and that JFK would have to hold them "at most 30 more minutes." Three minutes after hearing that news at 2006, the AVA 052 crew informed ATC that they wanted to proceed to JFK, not Boston. At that time, they might have had approximately 14,000 pounds of fuel remaining.

By accepting the clearance to JFK with

the prospect of a 30-minute hold, the AVA 052 crew accepted the fact that they would not have enough fuel for any subsequent holding en route to Boston. With no more than a 30-minute hold, they could forecast about 4-5,000 pounds of fuel, less than 30 minutes of flight, on landing. At this point, the decision to land at Kennedy was the least-worst choice because, as the NTSB report stated, the airplane did not have sufficient fuel to fly to its alternate airport. The flight crew never informed Avianca's contract dispatcher at Kennedy of their fuel situation or asked for assistance. The weather at nearby Philadelphia, Pa., closer than Boston, was no lower than 700 foot ceilings and one half mile visibility during this time period and for the remainder of the flight.

" ... we think we can't do it now we, we, don't, we run out of fuel now."

- AVA 052 then held at Camrn intersection, 39 miles south of JFK, for 29 minutes from 2018 to 2047. At 2031, it was cleared to JFK and descended to 11,000 feet. However, because of missed approaches ahead of it, the aircraft was sent back to Camrn at 2037. At 2044, without a new EFC, AVA 052 asked for "estimates" and in the next minute ATC first cleared it to Kennedy, then gave it an EFC of 2105. The AVA 052 crew then stated, "Well I think we need priority..." and ATC asked them how long they could hold and what was their alternate. At 2046, the crew told JFK they could hold five minutes that their alternate "was Boston but we think we can't do it now we, we, don't, we run out of fuel now."

  Twenty three seconds later, AVA 052 was cleared to Kennedy. It was told to switch frequency to Kennedy approach control and was in contact by 2047. No information about remaining fuel in minutes was offered by the flight crew or requested by ATC. Apparently assuming they had asked for priority traffic handling, and therefore had declared an emergency, the Avianca flight crew did not use the words "emergency" or "Mayday." By now, they probably had less than 10,000 pounds — less than an hour — of fuel remaining.

  The aircraft manufacturer suggests landing the 707-321B with no less than 7,000 pounds, but some airlines and the U.S. Federal Aviation Administration (FAA) treat that as informational and not a required minimum amount. It is likely AVA 052 would now be landing with less than 7,000 pounds of fuel remaining even if there were no further delays.

  [Avianca's route manual on the subject of flight crew and ATC procedures for a minimum fuel situation requires pilots to: (1) Advise ATC of your minimum fuel status when your fuel supply has reached a state where, upon reaching destination, you cannot accept any undue delay. (2) Be aware this is not an emergency situation but merely an advisory that indicates an emergency situation is possible should any undue delay occur. (3) Be aware a minimum fuel advisory does not imply a need for traffic priority. (4) If the remaining usable fuel supply suggests the need for traffic priority to ensure a safer landing, you should declare an emergency, account low fuel, and report fuel remaining in minutes.]

- Approach control directed AVA 052 to slow to 180 knots and cleared it to Deer Park Intersection for a runway 22L approach and to descend to 7,000 feet at 2048. The cockpit voice recorder (CVR) follows the scenario at 2053 for the next 40 minutes to the crash. Because the controller for Camrn did not hear part of the transmission about "we run out of fuel now," he did not pass that critical information to approach control. The

use of the term "priority" by the Avianca first officer did not key a thought process connoting "critical situation" or "emergency" to ATC. Approach control gave AVA 052 routine handling while the flight crew members apparently believed they were known to be needing priority treatment, or no further delays. They were given another six- to eight-minute delaying vectored circle and a long 15-mile final approach leg, but did not complain. The flight engineer briefed for an emergency low-fuel missed approach procedure as required when there is less than 1,000 pounds of fuel per main tank (4,000 pounds total) remaining.

The first officer repeated all ATC instructions to the captain in Spanish; the captain apparently had difficulty hearing him because he requested several repeats. The CVR conversation contained ample evidence of fatigue and stress, and indications of flight director and ILS radio tuning and setting problems. The engineer was asked to set power using rpm setting, an indication that the captain might have had a problem with throttle alignment and insufficient time to cross check power settings.

The CVR conversation contained ample evidence of fatigue and stress ... .

The Automatic Terminal Information Service (ATIS) recording indicated "200 sky obscured visibility 1/4 mile" and a 17-knot, slightly left crosswind. [Parallel runway 22R was below its 250-3/4 minimums.] The runway visual range (RVR) was 6,000 feet (more than the 2,000 feet required), and a moderate 10-knot windshear was reported to an aircraft closely following AVA 052. However, the latest RVR and the windshear report were not directed to AVA 052 by the local control tower operator.

- There are no conversations on the CVR indicating that the autopilot was in use. Manual elevator trim inputs were heard on the CVR transcript. On final approach, the crew had problems maintaining airspeeds requested by the tower controller. The final approach was very unstable. The captain used 50 degrees of flaps. That setting causes higher fuel burn but the aircraft is easier to handle than with the normal 25-degree flap setting. At three miles from the runway, the aircraft rapidly went above glidepath and then well below, possibly from a windshear. At 2.3 miles from the runway, with the ground proximity warning system (GPWS) repeatedly sounding "whoop whoop pull up," the crew leveled the aircraft at 200 feet and began looking for the runway lights.

  At 2123:23 the captain asked, "The runway, where is it?"

  At 2123:27 the first officer responded, "I don't see it, I don't see it."

  At 2123:28, after eight-seconds of flying 200 feet above the populated area below, they began a missed approach .8 mile short of the missed approach point. The urgency of the GPWS alarms added to the crew's other stresses and could have made them anxious to expedite a missed approach, which decreased their opportunity to see the runway environment. There was no communication from the control tower concerning their dangerously low altitude and below-glideslope condition.

- From missed approach to fuel exhaustion was approximately 10 minutes. During the initial stage of the missed approach, the captain told the first officer, "Tell them we are in emergency."

  The first officer then told ATC, " ... we'll try once again we're running out of fuel."

  The tower responded, "Okay."

The captain then asked the first officer, "What did he say?"

The first officer repeated his own transmission to the tower in Spanish.

The captain again said, "Advise him we are emergency." Then he asked, "Did you tell him?"

The first officer, possibly preoccupied with a windshear report being given to another aircraft on the radio, responded, "Yes, sir. I already advised him."

The word "emergency" or "Mayday" was still not stated or transmitted by the first officer. The crew was told to continue the left turn to 150 degrees.

- After vectoring the aircraft away from the field, at 2124:39 the tower switched AVA 052 to approach control. When changing frequency to approach control, the first officer reported "… we've missed … and we're maintaining 2,000 ..."

  The new controller gave no indication that he was aware of the urgency of the situation and did not inquire if they were in an emergency status as he cleared them to climb to 3,000 feet.

  The captain again ordered the first officer, "Advise him we don't have fuel."

  The first officer radioed, "Climb and maintain 3,000 and ah we're running out of fuel."

  Approach responded, "Okay, fly heading zero eight zero."

  The first officer read back the clearance and told the captain, "Three thousand feet, please" without advising the captain of the heading change.

The new controller gave no indication that he was aware of the urgency of the situation … .

He incorrectly responded "one hundred eighty" upon inquiry of the captain about the new heading.

The captain again challenged the first officer, "Did you already advise that we don't have fuel?"

The first officer responded in Spanish, "Yes sir, I already advise[d] him hundred and eighty on the heading we are going to maintain three thousand and he's going to get us back."

The captain said, "Okay."

- The flight had proceeded south, away from the airport, for more than a minute before approach control gave AVA 052 a new heading to 070 and transmitted "I'm gunna bring you about fifteen miles north east and then turn you back onto the approach is that fine with you and your fuel?"

  The first officer responded, "I guess so thank you very much."

  The Captain asked, "What did he say?"

  The flight engineer said, "The guy is angry."

  The first officer said, "Fifteen miles in order to get back to the localizer." The time was 2126:47, less than six minutes to fuel exhaustion.

- At 2129:11, when they were approximately abeam the outer marker, AVA 052 asked approach control, "Can you give us a final now?"

  Approach responded, "Affirmative sir turn left heading 040." This new heading was the reciprocal of the landing runway and would take the aircraft for a long 15-mile final, not a shortened approach. A minute later at 2130:14, approach cleared another aircraft for a "left turn two five zero and … cleared for ILS."

Avianca's first officer read back the clearance as if it had been meant for AVA 052. The captain made the turn, left altitude and then AVA 052 was told to "… climb and maintain 3,000 feet" by approach control.

At 2130:36, the first officer told approach, "Negative sir we just running out of fuel..."

Approach then turned AVA 052 to a heading of 310 degrees, perpendicular to final course, then to a heading of 360 degrees with the explanation that "you're number two for the approach I just have to give you enough room so you make it without … having to come out again."

"We just … lost two engines and … we need priority please."

At 2132:11, approach turned AVA 052 to 330 degrees and seconds later the engine flameouts began. At 2132:49, the first officer reported, "We just … lost two engines and … we need priority please."

Approach turned them left to 250 degrees to intercept the localizer and at 2133.04 stated, "Avianca zero five two heavy you're one five miles from the outer marker maintain two thousand until established on the localizer cleared for ILS two two left."

The first officer responded, "Roger, Avianca." It was their last transmission. The CVR tape's power was lost 12 seconds later.

In very low ceilings, driving rain and gusty winds during darkness, AVA 052 glided to a crash landing in a wooded neighborhood. The upslope impact in trees was gentle enough for 85 of the 158 persons on board to survive the impact forces. From the appearance of the cabin, none of the passengers was warned of the impending crash. There was no last minute electrical power available to the cabin speaker system.

- At 0234:00 the final controller called, "Avianca zero five two you have uh you have enough fuel to make it to the airport?" It was too late.

- At 2135, just after AVA 052 had disappeared from radar, a special weather observation indicated improvement to 300 foot ceiling and 3/4 mile visibility, RVR (runway visual range) 5,500-6,000 feet.

- In retrospect, the flight might have been able to receive a shortened approach and perhaps have returned after the missed approach had the flight crew openly stated they had a fuel emergency, used the word "Mayday" or refused the climbs and vectors. New York's controllers never became aware of the extreme urgency, did not volunteer to ask the flight crew if they had an emergency fuel situation or ask if they had enough fuel until they heard the word "flameouts." "We're running out of fuel sir," did not elicit a sense of extreme urgency on the part of the controller, according to the taped conversation.

- This accident reflects the combination of multiple events that eventually become overwhelming and result in a disaster. There was a long string of air-ground miscommunications and unverified misunderstandings, poor flight planning decisions, poor crew coordination, poor company dispatch and avionics support procedures and rules, worse than forecast weather and an unexpected number of delays. The result was extreme crew stress and fatigue that led to inadequate communications and a poorly executed approach and missed approach circuit … and ultimately fuel exhaustion.

AVA 052 had been a challenge from the beginning; a four hour 40 minute flight ended six hours and 26 minutes later on a wooded hillside. As the report succinctly states, "If the flight

crew of AVA 052 had been able to complete the first ILS approach and land successfully, the accident would not have occurred … ."

Background Details Set Scene

The goal of the AVA 052 flight crew was to complete a safe, on-time flight to JFK. Their scheduled arrival time was during busy international arrival hours in the early evening when many domestic feeder airlines are also making connections. As part of the U.S. National Airspace System (NAS), a Central Flow Control Facility (CFCF) located at FAA Headquarters in Washington, D.C., attempts to manage the flow of traffic into especially busy airports throughout the country such as JFK. Domestic flights headed for airports experiencing landing delays are held by CFCF on the ground at the U.S. departure airports until the threats of inflight holding dissipate. This is a fuel-saving procedure and an excellent safety practice. Foreign arrivals, however, are not subject to CFCF ground delays and are fed into the system while airborne.

Because the weather situation at JFK on that January day became worse than predicted and the wind conditions and low ceilings did not allow the use of two runways for landings, the expected airport acceptance rate of 33 aircraft arrivals per hour became drastically reduced and arrivals began backing up. Routing for AVA 052 placed the aircraft on an arrival route from the south where it was placed in a trail of other traffic and held with many domestic carriers originating from points south of Norfolk, Virginia.

The Avianca flight was to become one of 22 missed approaches … .

The main impediment to AVA 052 arriving on time was excessive holding caused by earlier missed approaches by other aircraft at JFK due mainly to difficulties pilots were having with windshear, low ceilings and visibility. Air traffic controllers were also having trouble keeping proper aircraft separation because there were strong and varying tailwinds of approximately 70 knots on the downwind leg and headwinds of 30 knots or more on final that were forcing "breakouts," or ATC-directed missed approaches. The problem was not only one of maintaining aircraft spacing in sequence for aircraft arriving from many directions but one of fitting missed approach aircraft back into the traffic pattern. This caused further delays that resulted in extra holding times for others following in sequence. For example, the aircraft landing just ahead of AVA 052 had been worked back into the pattern after an ATC-directed missed approach, when the captain expressed concern about low fuel; he successfully made his second approach using the autopilot.

The Avianca flight was to become one of 22 missed approaches that afternoon and evening at JFK. At least 23 other flights were diverted to other airports. Each missed approach accounted for a three- to an eight-minute extra hold for other aircraft heading to JFK. The NTSB report did not mention how long other arriving flights were held or delayed.

This unanticipated situation caused AVA 052 to hold three times beginning at Norfolk for a total of one hour, 17 minutes plus another eight-minute vectored circle after the crew told controllers they were then so low on fuel that they could not go to their alternate. The ATC controllers were busy with rapidly changing situations and they did not hear everything that flight crews were transmitting, or pass all information on to the next controller in the sequence. Flight separation requirements varied from 20 miles en route to five-miles on final. There was little time for interruptions or extra clarification by air traffic controllers.

As a result of this hectic situation, by the time of their first approach to Kennedy, the flight crew of AVA 052 had logged six hours, 17 minutes on a planned four hour, 40-minute flight. The NTSB stated that it believes that AVA 052 and its dispatcher should have kept each other more informed before the emergency situation developed.

In order to make a decision to go to an alternate when the destination is at or near mini-

mums, one of the facts a captain wants to know is when to expect to land. The only hard information the AVA 052 flight crew was able to obtain was EFC times which ATC must give crews in the event of lost communications. Because of the dynamics of the situation that evening, an expected landing time could not be predicted by either the crew or ATC. One of the variables was the number of aircraft ahead of AVA 052 that would miss their approaches and how many of them that would proceed to their alternate airports. The flow plan did not adequately consider extra approaches.

Probable Cause Determined

The NTSB determined that the probable cause of this accident was the failure of "the flight crew to adequately manage the airplane's fuel load, and their failure to communicate an emergency fuel situation to air traffic control before fuel exhaustion occurred." Contributing to the accident according to the board, was "the flight crew's failure to use an airline operational control dispatch system to assist them during the international flight into a high-density airport in poor weather. Also contributing to the accident was inadequate traffic flow management by the [U.S.] Federal Aviation Administration [FAA] and the lack of standardized understandable terminology for pilots and controllers for minimum and emergency fuel states."

The board also determined that windshear, crew fatigue and stress were factors that led to the unsuccessful completion of the first approach, and thus contributed to the accident.

Numerous safety issues were raised in the NTSB report. They include:

- Pilot responsibilities and dispatch responsibilities regarding planning, fuel requirements and flight following during international flights;

- Pilot to controller communications regarding the terminology to be used to convey fuel status and the need for special handling;

- ATC flow control procedures and responsibilities to accommodate aircraft with low fuel states; and,

- Flight crew coordination and English language proficiency of foreign crews.

Recommendations concerning these issues were addressed to the FAA and the Director, Departmento Administrativo de Aeronautico Civil (DAAC), Colombia.

Conclusions Reviewed

It is appropriate for this discussion to review all of the 24 findings listed in the NTSB report. In parentheses following some findings are the person(s) and main category of human performance factor or error. The findings are below:

1. The accident occurred when the airplane's engines lost power as a result of fuel exhaustion while the flight was maneuvering for a second instrument approach to JFK airport.

... failure ... to adequately manage the airplane's fuel load, and ... to communicate an emergency fuel situation ... .

2. Examination of the airplane revealed no malfunction of the engines or fuel system components that could have caused a premature fuel exhaustion.

3. The flight crew was not provided with, and they did not request before departure, the most current weather forecast available for the destination or selected alternate airport. (captain, flight planning/dispatcher, flight planning)

4. The alternate airport selected for the flight at the time of departure did not meet the prescribed weather criteria for an alternate based on weather information provided to the crew at the time of departure. The weather conditions worsened at both the destination and alternate while the flight was en route. (captain, flight planning/airline dispatcher, flight planning)

5. The flight plan for AVA 052 did not reflect the most current upper air data or the actual gross weight of the aircraft upon departure from Medellin. (captain, flight planning/dispatcher, flight planning)

6. The flight crew had received appropriate flight and ground training for the flight, and they possessed appropriate flight and medical certification required by the government of Colombia.

7. The flight crew was experienced in conducting Boeing 707 flights from Colombia to the United States.

8. There was no flight following or interaction with the Avianca Airlines dispatcher for AVA 052 following takeoff from Medellin. None was required by the airline's operations specifications issued by the FAA under 14 Code of Federal Regulations (CFR) 129, the U.S. regulation that covers non-U.S. air carriers operating into the United States. (dispatcher, flight planning/DAAC rulemakers, organizational oversight/airline operations, organizational oversight)

9. There is no record that while en route the flight crew requested updated weather information from any source regarding the destination or alternate airport. (captain, flight planning)

10. The flight crew did not adequately communicate the increasingly critical fuel situation to the controllers who handled the flight. (captain, communications/first officer, communications)

11. The first officer, who made all recorded transmissions to U.S. controllers, was sufficiently proficient in English to be understood by air traffic control personnel.

12. The first officer incorrectly assumed that his request for priority handling by air traffic control had been understood as a request for emergency handling. The captain experienced difficulties in monitoring communications between the flight and air traffic control. (captain, communications/first officer, communications)

13. The controllers' actions in response to AVA 052's requests were proper and responsive to a request for priority handling. They did not understand that an emergency situation existed. (ATC, communications)

The first officer ... never used the word "emergency" ... .

14. The first officer, who made all recorded radio transmissions in English, never used the word "emergency," even when he radioed that two engines had flamed out, and he did not use the appropriate phraseology published in U.S. aeronautical publications to communicate to air traffic control the flight's minimum fuel status. (first officer, communications)

15. The weather conditions at JFK were worse than forecast. (weather/ATC, communications)

16. The captain did not fly the ILS approach in a stabilized manner, which led to a serious deviation below the glideslope and to his initiation of a go-around. (captain, procedural behavior)

17. A windshear on the approach path may have contributed to the captain's poor performance on the ILS approach. Although other flights successfully completed the approach through the same wind conditions, the captain's performance on the approach was probably degraded by fatigue after the long flight and by his reliance on raw glideslope position data rather than on autopilot or flight director guidance. (captain, physiological/airline maintenance, organizational oversight/captain, decision making)

18. The FAA traffic management programs failed to effectively manage the traffic volume at JFK, leading to excessive delays and airborne holdings, including more than one hour for AVA 052. (FAA, organizational oversight)

19. The FAA's traffic management programs for JFK did not adequately account for overseas arrivals and missed approaches at JFK. (FAA, organizational oversight)

20. Cabin crew members and passengers were not warned of the impending crash landing, which may have contributed to the severity of the injuries sustained. (captain, procedural behavior/second officer, procedural behavior/senior flight attendant, procedural behavior)

21. The serious and fatal injuries were the result of blunt force trauma because of high vertical and longitudinal deceleration forces during the impact sequence.

22. The emergency evacuation slides were inoperative because of the lack of appropriate floor attachment hardware. (DAAC, organizational oversight/maintenance, organizational oversight/senior flight attendant, procedural behavior)

23. There were no shoulder harnesses or inertia reels installed on captain's and first officer's seats. (company, organizational oversight)

24. The response of fire and rescue personnel was timely and effective, and the use of helicopters by the Nassau County Police Department probably saved lives.

Human Factors Were Significant

This accident investigation is a human performance investigator's cornucopia. A scan of the NTSB's 24 findings uncovers 17 findings that directly or indirectly identify 31 individual human performance errors by the flight crew, air traffic controllers, weather services, government oversight agencies, company dispatch, maintenance and management (Table 1).

The parties to the investigation, especially Avianca Airlines, were all very cooperative during the year-long investigation. A public hearing held in Long Island, N.Y., in June 1990, brought out many of the international airline pilots' and human factors research community's assessments of the problems highlighted in this accident. However, because the flight crew did not survive the accident, an in-depth human factors investigation was not possible to help explain why the flight crew's decision-making process broke down. Stress and fatigue are illusive causal factors based on intuitive information and the experiences of the past. How the flight crew got into this tragic situation and what was happening on the ground are not likely to be fully understood.

Recommendations Reveal Concerns, Offer Solutions

The NTSB made several recommendations as a result of this accident investigation, both to the FAA and to the DAAC of Colombia.

Table 1
Summary of Human Performance Errors

Person (Total)	Flight Planning	Communications	Procedural Behavior	Physiological	Decision Making	Organization Oversight
Capt (10)	4	2	2	1	1	
F/O (4)		4				
F/E (1)			1			
Sen F/A (2)			2			
Dir Maint(2)						2
Dir Ops (2)						2
Dispatch (4)	4					
DAAC (2)						2
ATC Cont (1)	1					
Weather (1)		1				
FAA Mgt (2)						2
TOTALS (31)	8	8	5	1	1	8

Recommendations to the FAA

- Develop in cooperation with the International Civil Aviation Organization (ICAO) a standardized glossary of definitions, terms, words, and phrases to be used that are clearly understandable to both pilots and air traffic controllers regarding minimum and emergency fuel communications.

- Conduct a comprehensive study of the central flow control facility and the traffic management system, by the agency's Office of Safety/Quality Assurance, to determine the effectiveness and appropriateness of training, responsibilities, procedures and methods of application for the traffic management system.

- Require that transport category airplane flight manuals include procedures specifying minimum fuel values for various phases of airline flights at which a landing should not be delayed and when emergency handling by ATC should be requested. The manual requirement and associated amendments to regulations and procedures should include criteria for when ATC must be notified that the airplane must be en route to its destination or alternate airport via routine handling, and when emergency handling is required.

- Incorporate into air route traffic control centers equipment to provide a recorded broadcast of traffic management information that can be monitored by all aircraft within each center's boundaries to provide pilots with early indications of potential delays en route.

- Prior to the release of the final accident report, the NTSB had made three earlier safety recommendations to the FAA. These concerned notifying all domestic and foreign air carriers to be familiar with the U.S. National Airspace System and its rules and procedures, and for air traffic controllers to request clarification whenever a possible emergency situation is occurring and offer assistance. [These recommendations were published by Flight Safety Foundation, *Accident Prevention Bulletin*, April 1990.]

Recommendations to the DAAC, Colombia

- Review policies, procedures, training and oversight activity to ensure that adequate emphasis is being placed on the dual responsibility that flight dispatchers and flight crews have in keeping each other informed of events and situations that differ from those mutually agreed upon in the dispatch release.

- Require that Avianca Airlines incorporate cockpit resource management (CRM) and line oriented flight training (LOFT) concepts into its flight crew training program.

Report Included Dissents

In a dissenting statement, NTSB Member Jim Burnett supported the causes and recommendations, but listed four specific unsatisfactory services provided to AVA 052 in holding, weather information, passing on the fuel situation to other controllers and updating the JFK ATIS. He further stated that the FAA allowed more aircraft into the system than it could safely handle.

Member Christopher Hart stated that the Avianca crew should have known to use the words "Mayday" or "emergency" to communicate their dangerous situation to ATC and that a lack of standardized terminology is not a contributing factor.

Also, the DAAC stated that there were many inadequacies and ambiguities on the part of U.S. ATC procedures that misled the Avianca flight crew into thinking they were receiving special handling when they were not. It stated that they were given holding after telling ATC they could not make their alternate and were given a normal long landing pattern after telling ATC they were running out of fuel. DAAC also stated that EFC times should include in-

formation on when a pilot can expect to land. The agency said ATC should require an active flight following system with landing delay information for international flights not subject to ground holds. ♦

About the Author

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Duke spent 30 years in the U.S. Air Force. He was director of safety of the Air Force Reserve, and managed a worldwide investigative and accident prevention program that won several awards. He has more than 11,400 hours of military and airline flying and more than 16 years of active safety management.

Aviation Statistics

Worldwide Passenger Traffic and Air Carrier Safety Calendar Year 1991

by
Shung C. Huang
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Worldwide Passenger Traffic Declines

The Persian Gulf War and the threat of greatly increased terrorism influenced a slowdown in worldwide passenger air traffic in 1991. When the hostilities ended in the spring of 1991, it was expected by most industry observers that there would be a resurgence in worldwide air travel. However, even the quick end of the war, followed by peace negotiations between the Arab States and Israel, failed to stimulate a favorable environment for worldwide pas-

senger traffic. On the contrary, the aftereffects of the war, including the political stalemate in the Gulf area, the standstill in the world economic recovery and continuing concerns about the potential effects of terrorist attacks upon the safety of flight continues a severe decline in both international and U.S. domestic air travel.

As a result of the negative forces, the worldwide air carrier industry experienced its first decline in passenger traffic in two decades during 1991. Preliminary estimates from the International Civil Aviation Organization (ICAO) indicate that worldwide total passenger and cargo ton-kilometer figures will show a decline of four percentage points in 1991 compared to the previous year. The annual distribution of worldwide airline passenger-kilometers for the past 10 years is shown in Figure 1.

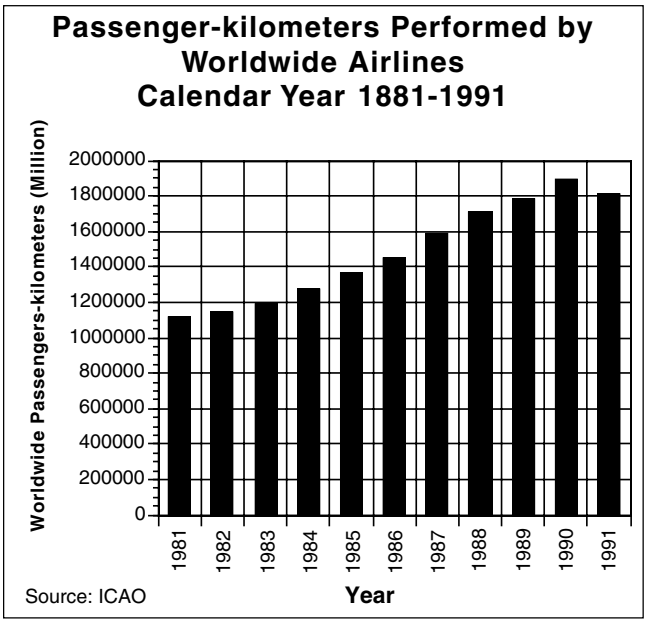


Figure 1

Decline in U.S. Passenger Traffic

The decline of passenger traffic in the United States, which accounts for more than 40 percent of worldwide passenger traffic, was even more severe than the international decline. In 1991, the number of passengers carried by U.S. airlines for the first 11 months dropped to 418 million from 436 million in 1990, a decline of 4.5 percent; the passenger-miles flown dropped from 433 billion to 422 billion, a reduction of 2.7 percent. The monthly comparison of passengers carried and passenger-miles flown by U.S. airlines for 1990 and 1991 is shown in Table 1. Note that during the 11-month period for which information is available, in not a

Table 1
Passengers Carried and Passenger-miles Performed
U.S. Airline all Operations
Scheduled and Non-scheduled Services
1990 vs. 1991

	Passengers Carried (000)			Passenger-miles (Million)		
Month	**1990**	**1991**	**Change**	**1990**	**1991**	**Change**
January	35,548	34,897	-1.8	35,153	34,828	-.09
February	34,790	32,063	-7.8	32,965	29,610	-10.2
March	41,996	37,637	-10.4	39,993	36,142	-9.6
April	39,560	37,803	-4.4	37,987	36,951	-2.7
May	39,492	38,623	-2.2	38,419	38,789	+1.0
June	42,419	40,334	-4.9	42,819	41,675	-2.7
July	43,618	42,885	-1.7	45,770	45,269	-1.1
August	46,316	44,677	-3.5	48,763	48,104	-1.4
September	37,073	36,010	-2.8	38,173	37,578	-1.6
October	39,599	38,426	-3.2	39,051	38,925	-0.3
November	37,525	35,614	-5.0	35,699	34,367	-2.7
December	37,330	not available		37,331	not available	
January-November Total	436,525	418,971	4.5	433,792	422,238	-2.7

Source: Air Carrier Traffic Statistics Monthly, Calendar Year 1990 and 1991 Research and Special Programs Administration, U.S. Department of Transportation.

Table 2
U.S. Accidents, Fatalities and Rates
Air Carriers and General Aviation 1991
(Preliminary Data)

	Accidents		Total	Aircraft		Accident Rates Per 100,000 Aircraft Hours		Per 100,000 Departures	
	Total	Fatal	Fatalities	Hours Flown	Departures	Total	Fatal	Total	Fatal
Air Carriers Operating Under 14 CFR 121									
Scheduled	26	4	62#	11,250,000	7,500,000	0.231	0.036	0.347	0.053
Nonscheduled	1	0	0	580,000	270,000	0.172	0	0.370	0
Air Carriers Operating Under 14 CFR 135									
Scheduled	22	8	99#	2,100,000	2,700,000	1.048	0.381	0.815	0.296
Nonscheduled*	84	26	69	3,270,000	n/a	2.57	0.80	n/a	n/a
General Aviation+	2,143	414	746	30,760,000	n/a	6.90	1.35	n/a	n/a

Exposure data estimate source: U.S. Federal Aviation Administration (FAA).

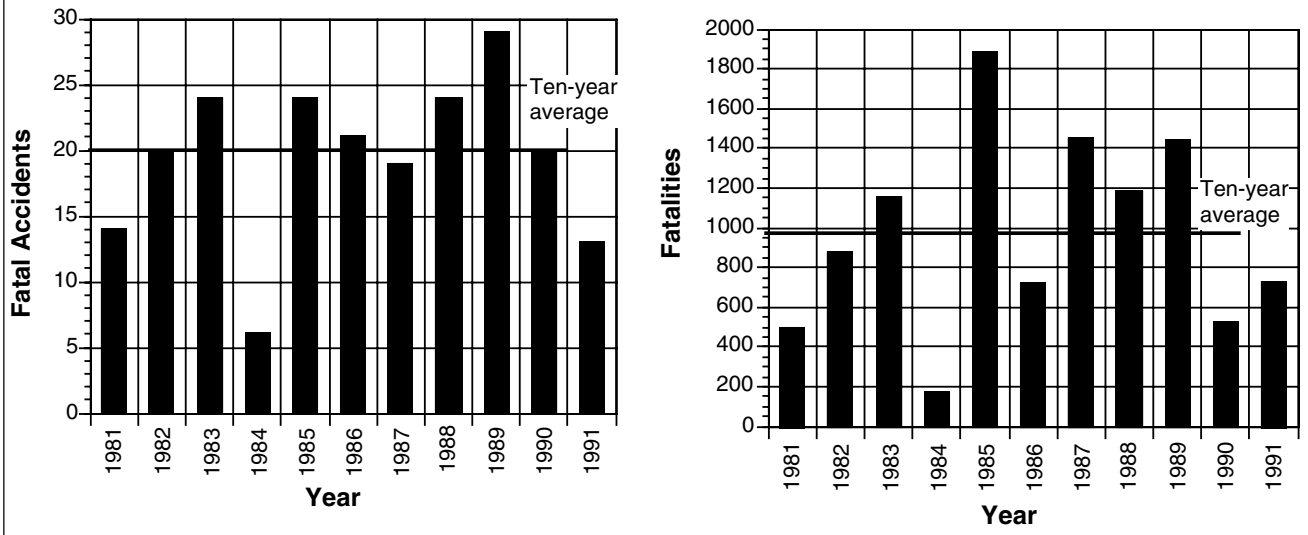
Both of these fatality totals include the 12 persons killed aboard a Skywest commuter aircraft (Scheduled 14 CFR 135) and the 22 persons killed aboard the USAir airliner (Scheduled 14 CFR 121) after the two aircraft collided.

* Accidents on non-U.S. soil and in non-U.S. waters are excluded.

\+ Includes accidents involving U.S. registered civil aircraft flown under rules other than 14 CFR 121 and 14 CFR 135. Accidents on non-U.S. and in non-U.S. waters are excluded.

n/a Data not available.

Worldwide Airline Fatal Accidents and Fatalities



Source: FSF *Flight Safety Digest* 1981-1990

Figure 2

single month in 1991 was the passenger traffic higher than that in the corresponding month of 1990.

Air Traffic Declines in The Former Soviet Union

The Mideast crisis might not have caused significant negative effects on former-Soviet air passenger traffic, but news reports have noted that air passenger traffic in 1991 worsened in grim parallel with the deterioration of U.S.S.R. political and economic systems during the transition to the Commonwealth of Independent States (CIS). As a result of a decreasing supply of fuel from the state energy monopoly, an estimated 40 percent of Aeroflot planes were grounded at one point. In late December 1990, the transport minister reported that Aeroflot operations could be off by as much as 50 percent for that month.

Airline Safety Figures Reflect A Good Year

During 1991, worldwide airlines operating large aircraft were involved in 13 fatal accidents that accounted for 760 fatalities. Fourteen jet transport aircraft used by worldwide airlines were totally destroyed. Figure 2 shows the annual numbers of fatal accidents and fatalities involving worldwide airlines for the period 1981-1991. It shows that in 1991 worldwide airlines recorded fewer fatal accidents and fatalities than those in most prior years, and fewer than the average of the past 10 years. To be exact, the average for fatal accidents is 20 and that for fatalities is 989 as indicated on

Table 3
Worldwide Airline Fatal Accidents and Jet Transport Hull-losses
Calendar Year 1991

Date	Location	Aircraft	Damage	Fatalities	Phase	Remark
1/2	Los Angeles, Calif., U.S.	B-737	Destroyed	34	Takeoff	Collided with other aircraft on runway after landing
2/17	Cleveland, Ohio, U.S.	DC-9	Destroyed	2	Takeoff	Crashed out of control
2/20	Puerto Williams, Chile	BAe 146	Destroyed	20	Landing	Overran the runway and crashed into sea
3/3	Colorado Springs, Colo., U.S.	B-737	Destroyed	25	Approach	Crashed on approach loss of control
3/5	Trujillo, Venezuela	DC-9	Destroyed	43	Approach	Crashed into high ground in low visibility
3/12	New York, N.Y., U.S.	DC-8	Destroyed	none	Takeoff	Aborted takeoff, rupturing fuel line. Fire after impact.
3/23	Tashkent, Russia	An-24	Destroyed	31	Landing	Veered off runway and crashed into concrete blocks
5/23	St. Petersburg, Russia	TU-154	Destroyed	10	Landing	Crashed on Landing
5/26	Suphan Buri, Thailand	B-767	Destroyed	223	Cruise	Loss of control; malfunction of thrust-reversers
6/26	Sohoto, Nigeria	BAC 1-11	Destroyed	3	Landing	Crashed on emergency landing in adverse weather
7/11	Makhackala	Yak-40	Destroyed	34	Approach	Crashed into high ground on approach
8/16	Imphal, India	B-737	Destroyed	69	Approach	Crashed on approach
11/7	Jeddah, Saudi Arabia	DC-8	Destroyed	261	Takeoff	Crashed on emergency landing shortly after takeoff
12/7	Tripoli, Libya	B-707	Destroyed	none	Takeoff	Crashed on takeoff run
12/27	Stockholm, Sweden	MD-81	Destroyed	none	Takeoff	Engine failure/crashed on emergency landing
12/29	Shienchu, Taiwan	B-747	Destroyed	5	Approach	Crashed on emergency landing due to engine failure

Source: News reports compiled by author.

Figure 2 by horizontal lines. Note that the annual distribution of fatal accident and fatalities appears to be random.

U.S. Airline Safety Figures Are Mixed

In the United States, the National Transportation Safety Board (NTSB) reported that U.S. airlines operating large aircraft in 1991 were involved in 27 accidents, four of them fatal that resulted in 62 fatalities. This represents two fatal accidents fewer than, but 23 fatalities more than, those recorded in 1990. The NTSB also reported that commuter air carriers were involved in 22 accidents, eight of which were fatal, that accounted for 99 fatalities. In terms of fatalities, 1991 was the worst safety year ever for commuter air carriers. The NTSB accident statistics for U.S. air carriers, commuter air carriers, air taxis and general aviation for 1991 are shown in Table 2.

Former-Soviet Airline Safety Statistics Show Short-term Decline

Because not all aviation accident information involving former-Soviet airlines is reported, complete statistics are difficult to obtain. According to news reports, aviation safety in the Soviet Union eroded badly during the past three years. The news media has reported that Aeroflot, the ex-U.S.S.R. state airline, was involved in 36 accidents in 1991 that accounted for 252 fatalities compared to 27 fatal accidents and 194 fatalities in 1990.

Worldwide Airline Fatal Accidents Listed for 1991

Table 3 is a listing of fatal accidents and jet transport hull-losses involving worldwide airlines that operated large aircraft during 1991. It includes three fatal Russian accidents of the 36 accidents reported by Aeroflot. Information in table 3 is preliminary. ♦

Reports Received at FSF Jerry Lederer Aviation Safety Library

Reference

Updated Reference Materials (Advisory Circulars, U.S. FAA):

Numbers(s)	Mo/Yr	Subject
43-4A		July 1991 Corrosion Control for Aircraft (Cancels AC 43-4 dated May 1973)
150/5200-30A	Oct 1991	Airport Winter Safety and Operations (Cancels AC 150/5200-30 dated April 1988)
150/5200-30A	Nov 1991	Change 1 to Airport Winter Safety and Operations
150/5345-28D	Nov 1991	Change 1 to Precision Approach Path Indicator (PAPI) Systems
150/5345-42C	Oct 1991	Change 1 to Specifications for Airport Light Bases, Transformer Housings, Junction Boxes, and Accessories

National Transportation Safety Board (U.S.) Safety Recommendations:

Number(s)	Mo/Da/Yr	Subject
A-91-104/121	12/03/91	USAir Boeing 737-300 and Skywest Fairchild Metro-liner collision, Los Angeles, California, U.S., February 1, 1991

New Reference Materials:

Advisory Circular 25-17, 11/25/91, Announcement of Availability of Advisory Circular 25-17, Transport Airplane Cabin Interiors Crashworthiness Handbook. — Washington, DC : U.S. Federal Aviation Administration, 1991. 1 p.

Summary: *Advisory Circular* 25-17 provides acceptable certification methods, but not necessarily the only acceptable methods, of demonstrating compliance with the crashworthiness requirements of Part 25 of the Federal Aviation Regulations (FAR) for transport category airplanes. This announcement provides notice that *Advisory Circular* 25-17, date July 15, 1991, is available only as a sale document from the Superintendent of Documents, and is not available from the U.S. Federal Aviation Administration. Copies may be ordered from: Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Stock Number 050-007-00915-1. The cost of AC 25-17 is $11.00 (U.S.) for U.S. orders. Orders for mailing to foreign countries mustinclude an additional $2.75 (U.S.).

Advisory Circular 120-55, 10/23/91, Air Carrier Operational Approval and Use of TCAS II. — Washington, DC : U.S. Federal Aviation Administration, 1991. 31 p. in various pagings.

Summary: This *Advisory Circular* (AC) provides an acceptable means, but not the only means, to address Traffic Alert and Collision Avoidance System (TCAS) issues related to installation and use of TCAS II regarding compliance with Federal Aviation Regulations (FAR) Parts 121, 125, and 129 requirements for air carriers. [Purpose]

Reports

FAA Registry Systems: Key Steps Need to be Performed Before Modernization Proceeds. Report to the Chairman, Permanent Subcommittee on Investigations, Committee on Governmental Affairs, U.S. Senate/ United States General Accounting Office. — Washington, D.C. : General Accounting Office**, [1991]. Report GAO/IMTEC-91-29. 13 p. ; 28 cm.

Key Words
1. United States — Federal Aviation Administration.
2. Airplanes — Inspection — United States.
3. Air Pilots — Drug Use — United States.
4. Air Pilots — Registers — United States.

Summary: GAO reports on the Federal Aviation Administration's (FAA) modernization plans for its airmen and aircraft registry systems. The Anti-Drug Abuse Act of 1988 requires changes to these systems to make them more effective in serving the needs of law enforcement agencies involved in aviation drug interdictions and investigations. GAO found that FAA has not adequately defined users' needs for the system, leaving FAA with little assurance that it has selected the most appropriate technological solution, and increasing the risk of cost overruns and schedule delays. At the conclusion of the GAO review, FAA officials stated that they planned to correct the deficiencies GAO identified. [Modified Results]

The Prevalence of Aphakia in the Civil Airman Population. Final Report/Van B. Nakagawara, Faredoon K. Loochan, Kathryn J. Wood (Civil Aeromedical Institute). — Washington, D.C.: Federal Aviation Administration, Office of Aviation Medicine; Springfield, Va., U.S.: Avail-

able through NTIS*, [1991]. Report No. DOT/FAA/AM-91-14. v, 13 p.: charts; 28 cm.

Key Words
1. Air Pilots — Certification — United States.
2. Air Pilots — Medical Examinations — United States.
3. Aphakia.
4. Eye — Abnormalities.

Summary: Aphakia has become increasingly prevalent in the civil airman population. The FAA allows civilian airmen with aphakia to fly with waivered certificates. The increased application and modification of surgical procedures for cataract extraction, coupled with possible visual complications from these procedures in flight operations, strongly suggests continued specialized aeromedical certification and clinical research review. This study analyzes the distribution of aphakia in the civil airman population by type (unilateral, bilateral), class of airman medical certificate, and gender for a four-year period (1982-1985). [Modified author abstract]

Selection of Air Traffic Controllers: Complexity, Requirements, and Public Interest. Final Report/edited by Hilda Wing (Federal Aviation Administration) and Carol A. Manning (Civil Aeromedical Institute). — Washington, D.C.: United States. Federal Aviation Administration, Office of Aviation Medicine; Springfield, Va., U.S.: Available through NTIS*, 1991. Report DOT/FAA/AM-91/9. v, 38 p.: ill.; 28 cm.

Key Words
1. Air Traffic Controllers — Selection and Appointment — United States.

Contents: Overview of National Airspace Human Resource Management Planning Process/Earl Pence (Fu Associates) and Shelly A. Thomas — Employing Air Traffic Controllers/Jay C. Aul (FAA) — Procedures for Selection of Air Traffic Control Specialists/Carol A. Manning (Civil Aeromedical Institute) — Evaluation Issues in the Selection of Air Traffic Controllers/Hilda Wing and Darlene M. Olson (FAA) — Discussion of Selection of Air Traffic Controllers: Complexity, Requirements, and the Public Interest/Phillip L. Ackerman (University of Minnesota).

Summary: The essays in this report represent presentations made at the 98th Annual Convention of the American Psychological Association, August 10-14, 1990, in Boston, Mass., U.S. The presentations address the diverse process of valid selection for the highly demanding occupation of air traffic control specialists.

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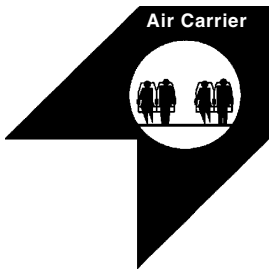
Accident/Incident Briefs

This information is intended to provide an awareness of problem areas through which such occurrences may be prevented in the future. Accident/incident briefs are based upon preliminary information from government agencies, aviation organizations, press information and other sources. This information may not be accurate.



Hurried Departure Goes Nowhere

Boeing 707: Moderate damage to fuselage. No injuries.

The cargo-configured jetliner was parked adjacent to a fixed cargo handling system designed for use with that type aircraft. It had been parked there at 1115 hours for unloading and reloading prior to a scheduled 1330 departure.

The unloading of the cargo was accomplished using a fixed, high-lift pallet loader on the left side of the aircraft that is able to be extended or raised to be aligned with the cargo door of the aircraft. However, loading was delayed unexpectedly and the scheduled departure slot of 1330 was extended two hours to 1530. Although the aircraft was loaded in time for the revised departure, the contracted loading crew members reached the end of their shift a short time before the new departure time and they departed, leaving the tug driver as the only ground crew member with the aircraft. The flight crew was already aboard.

The tug driver retracted and lowered the loading platform and positioned the tug for the pushback. However, the close proximity of the cargo platform on the aircraft's left, the cargo building in front and a walkway support structure to its right resulted in tight quarters, with scrape marks from previous incidents evident on the cargo building. When the tug driver attempted to connect the towbar, he noticed that the aircraft's nosewheels were slightly to his right of the centerline painted on the ramp, and at an angle to it, which combined with the closeness of adjacent structures, would make any extra maneuvering of the aircraft very difficult. He left to telephone for help from the next ground crew shift because he was aware that there should have been three other ground crew members available to assist him with the pushback.

While the tug driver was away, the aircraft operator's cargo manager arrived to check the aircraft's documentation. He extended the cargo platform to within 18 inches of the fuselage to board it but, on leaving, did not retract or lower the platform, because he saw a man connect the air start unit and then sit on the tug and assumed he would retract the loading platform.

The captain was anxious to meet the revised departure time that was rapidly approaching, so he requested engine start and pushback clearance even though the next shift of ground support personnel had not arrived. One of the carrier's ground technicians assisted with engine start and removal of the ground power units and communicated with the pilot during start and pushback. Neither the technician nor the tug driver accomplished a pre-pushback inspection of the ramp.

The pushback was begun without the full ground crew and with no attempt to control vehicular traffic on the service roads that were located to the rear and the side of the aircraft. After the aircraft had moved approximately five feet, the captain sensed something was not right and ordered the pushback stopped. A check

of the fuselage revealed that the aircraft had struck the protruding cargo loading platform, which had not been retracted after the company's cargo manager left the aircraft.

The aircraft was out of service for 19 days while repairs were effected.

Three Assumptions Lead to Trouble

Airbus A310: Substantial damage. No injuries.

Boeing 757: Substantial damage. No injuries.

The Boeing 757 had taxied for a scheduled departure, but a technical fault had been detected and it had been cleared back to its parking stand by air traffic control (ATC) to have maintenance attend to the problem prior to departure.

The Airbus was being prepared for departure from a parking stand on the opposite side of a taxiway from the parking stand to which the Boeing 757 was returning. Parking was nose-in for both aircraft, with pushback being provided by tugs.

The ground controller observed that the Boeing 757 had passed behind the still parked Airbus, turned onto the centerline of its parking stand and was moving forward into its parking position. The parking stands were on a cul-de-sac to which the controllers had limited vision and having seen the returning aircraft moving into its parking stand, the controller assumed that the parking maneuver would be completed normally. Therefore, he issued a pushback clearance to the Airbus which was ready for departure.

The Airbus began its pushback, supervised by one ground engineer positioned on the left side of the aircraft who was in interphone contact with the cockpit crew. The only other ground crew member was the tug driver, who had very limited vision to the rear of the aircraft. Both ground crew members had observed the Boeing 757 pass behind their aircraft and turn into the centerline of its parking stand. Both assumed, as had the ATC controller, that the Boeing would complete its parking procedure normally.

During pushback of the Airbus, the pilot coordinated startup of the right engine with the ground engineer who then had to divide his attention between observing proper engine fan rotation on the right side of the airplane and monitoring the left wingtip for clearance from the Boeing. (The Airbus was being pushed back in a turn to its right, so the left wingtip would pass behind the tail of the Boeing.)

As the Airbus exited its parking stand, the ground engineer observed that the left wingtip was swinging around toward the tail of the Boeing that had unexpectedly stopped part of the way out of the parking stand. He advised the flight deck over the intercom and tried to signal the tug driver, whose attention was focused on correctly positioning the aircraft's nosewheel.

The left wingtip of the Airbus collided with the underside of the Boeing's tailplane and rear right fuselage, causing substantial damage to that aircraft and damage to the wingtip and trailing edge of the Airbus. There was no fire and passengers of the aircraft were deplaned without further incident by use of mobile stairways.

Investigation revealed that as the Boeing began to enter its parking stand and had been assumed by ATC and the Airbus ground crew to be completing its parking normally, the flight crew realized that the entry guidance system was not illuminated and decided to stop the aircraft until the parking guidance system was illuminated or a ground crew member arrived to provide guidance. The tail of the aircraft was protruding into the taxiway by approximately 69 feet. Because of heavy radio traffic, the flight crew was unable to inform ATC of its predicament immediately. The aircraft was stopped only briefly until the call was made; the Airbus wingtip impacted the Boeing while the captain was transmitting his situation.

Although the company had been advised that the Boeing was returning to the parking stand

after the parking guidance lights had been automatically activated by a timer, the lack of available dispatchers at the time caused a delay in assigning someone to meet the aircraft. The collision had occurred by the time this was accomplished.

Press on Regardless Is Not Prudent Practice

de Havilland DHC-6 Twin Otter: Substantial damage. One serious injury.

The pilot elected to make a short-field takeoff from the 2,400-foot gravel runway. Passengers included four occupants in addition to the pilot and one large dog. The weather was clear and cold with visibility more than 15 miles.

The pilot lost directional control shortly after the takeoff run began. The aircraft veered to the right and then swung back across the runway to the left edge along which the pilot attempted to continue the takeoff. The aircraft lifted off after a ground run of approximately 1,200 feet but the right wing dropped and scraped the ground, after which it touched down on the main gear with the tail skid dragging on the surface. Another change in direction aimed the aircraft to the right again, and it left the runway at an angle of 35 degrees and traveled through brush along the side of the runway.

The pilot continued the attempt to become airborne and the aircraft lifted off again. The left wing collided with the roof of a wooden shed and continued flying a few feet above the ground. After continuing for approximately 400 feet, the aircraft flew over a 50-foot embankment, then rolled to the left and dropped to the ground where it impacted first on the left wing. First the left, then the right wing, broke free from the fuselage. There was no fire. The occupants all evacuated the wreckage without assistance, and the only reported injury was to a passenger who had been in the right cockpit seat.

The investigation revealed that the trail made by the nosewheel indicated that it had not been centered at the start of the takeoff roll. The pattern of runway dirt thrown up by the wheel indicated misuse of nosewheel steering, which can lead to loss of directional control. There had been no attempt to abort the takeoff either when directional control was initially lost or when the right wing hit the ground shortly after the first liftoff. Scrape marks made by the tail skid indicated that the aircraft was forced to lift off at an airspeed that was too low to sustain flight and in a direction not aligned with the runway.

The pilot was cited for misuse of nosewheel steering early in the takeoff sequence and for not aborting the takeoff.

Open Drain Valve Brings Aircraft Down

McDonnell Douglas DC-6: Aircraft destroyed. Fatal injuries to three.

The four-engine aircraft was forced to make an emergency descent because of fuel exhaustion. The late afternoon cargo flight was on instrument flight rules (IFR) in visual meteorological conditions (VMC). One propeller was turning under power while the other three were windmilling as the aircraft neared the ground. On landing, the main gear struck the top of a levee causing the right wing to hit the ground below the levee. The aircraft broke apart and the wreckage came to rest in a drainage canal. The three crew members were fatally injured in the accident.

The aircraft had departed with seven hours of fuel, 2.7 hours of which had been lost because, according to the accident report, there was an open drain valve discovered in the wreckage inside the number four engine nacelle. Inves-

tigators estimated that the valve had been open for an extended time, but no ground personnel reported having seen fuel draining from it prior to the flight.

Engine Stops During Taxiing

Beechcraft B55A Baron: Substantial damage. No injuries.

The pilot, with one passenger aboard, had landed after an international flight and had cleared customs. The control tower cleared the pilot to taxi from the customs parking area to a parking area elsewhere on the airport.

The final portion of the taxi route to the designated parking area required the pilot to negotiate a narrow taxiway that sloped downhill and had vehicles and aircraft parked closely on both sides. Wind speed was calm and the taxiway was dry. Witnesses reported that the aircraft's taxi speed was faster than normal for the prevailing conditions but the pilot said he was taxiing very slowly.

While the aircraft was travelling on the downward sloping portion of the narrow taxiway, the right engine stopped but because both throttles were closed, there was no thrust imbalance to make the pilot aware that an engine had ceased operation. At the bottom of the slope, however, the pilot noticed the stationary right propeller as the thrust from the operating left engine began to veer the aircraft to the right. Application of left rudder and brake had no effect and the aircraft's right wing passed over the fronts of parked automobiles and struck the roof of a van. The impact caused the aircraft to swing sharply to the right where it collided with a parked aircraft which it pushed back into an embankment.

There was no fire and the pilot and passenger deplaned through the cabin door without injury. The aircraft sustained damage to the right wing, nose cowling, left propeller and left engine.

Rushed Pilot Loses Track of Altitude

Beechcraft B55: Substantial damage. Fatal injuries to one.

The aircraft was flying under instrument flight rules (IFR) at night on approach to its destination. There were one crew member and one passenger aboard. The pilot had listened to the automatic terminal information service (ATIS) and learned that the nondirectional beacon (NDB) approach to runway 21 was in use.

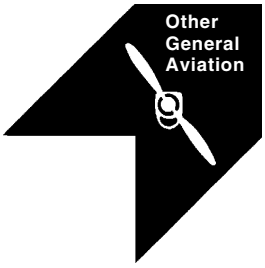
As the aircraft approached the NDB, the pilot was asked by the air traffic controller if he wanted the localizer approach to runway 15 instead of the NDB approach. The pilot chose the localizer approach and was given vectors to intercept it. As the pilot intercepted the localizer course, he was asked by air traffic control (ATC) whether he was inside or outside the NDB fix. The pilot looked at the distance measuring equipment (DME) but was unable to read it because of the glare from a flashlight the passenger was using to prepare charts for landing at an alternate airport if an overshoot was required.

The pilot then looked at the course deflection indicator (CDI) of the number one very high frequency omnidirectional range (VOR) receiver to find his position on the localizer. The needle showed a full deflection to the left, and the pilot replied that he was inside the fix. There was no further contact with the pilot and a search was initiated minutes later. The aircraft was located three and one half hours later, five nautical miles from the threshold of the runway and one-fifth nautical mile west of the NDB fix.

The accident report states that the pilot had prepared himself for an NDB approach. While the pilot was being vectored for the localizer approach to runway 15, he was also selecting and analyzing the approach plates, slowing the aircraft, descending and lowering the flaps and gear. The report states that the speed of the aircraft rushed the pilot. He entered 79 degrees into the omni-bearing selector of the VOR, instead of 75 degrees. When ATC asked the pilot if he was past the NDB fix, the pilot stated incorrectly that he was.

The pilot would be expected to start his descent after crossing the fix from 2,000 feet above sea level (asl); the minimum descent altitude is 1,080 feet asl. However, the report states, because the aircraft was off course to the right, the pilot was probably concentrating on returning to the localizer and was inattentive to altitude. The aircraft flew over a golf course which has an elevation of 920 feet asl and struck the trees.

The aircraft was destroyed, the pilot was seriously injured and the passenger was fatally injured. The pilot was cited for being unsure of his position on the approach; he was unaware that he had descended too low for the approach until the aircraft struck the trees.



Low Clouds, Poor Visibility, Disorientation, No Flight Plan Produce Expected Result

Cessna 175: Aircraft destroyed. Fatal injuries to one.

The pilot arrived at the closed small airport slightly prior to 0800 hours on the early spring day. He had been visiting the area for three days, and took off without having filed a flight plan; a nearby resident heard the aircraft depart and expressed surprise that someone was flying in the low clouds and poor visibility. The pilot was rated for instrument flight.

Approximately an hour into the flight the pilot made his first radio contact, which was to an air traffic control (ATC) facility reporting that he was IMC (in instrument meteorological conditions) without flight information. He was given local weather conditions that included rain, 5/8 cloud coverage at 600 feet and overcast at 800 feet. He was within approximately 30 miles of his intended destination and switched to the ATC unit serving that area for airport and weather information, which was consistent with the previous weather report. There was a one-degree temperature-dewpoint spread.

The pilot was given a clearance and performed a VOR approach. He reported that the aircraft had made the turn to base leg as called for by the procedure. ATC requested that the pilot report when he had the airport in sight and then enter a downwind leg, and the pilot acknowledged. The pilot was advised that the cloud base at 600 feet had become overcast and reported that he could see the ground but not the airport.

A pilot on the ground reported sighting the aircraft between gaps in the clouds northwest of the airport at a height he estimated to be between 200 and 300 feet above the ground. ATC advised the pilot of his location and that the aircraft was headed for high ground. The pilot acknowledged and advised he was making a missed approach, next reporting he was passing through 800 feet.

Shortly thereafter, when ATC requested his intentions, the pilot reported that he had a major problem, that he was suffering spatial disorientation and was "in a loop." This was the last radio transmission from the aircraft. Rescue services were alerted and a helicopter that backtracked the last known course of the aircraft found the wreckage of the aircraft in a field less than 20 minutes after the final radio transmission — the pilot had been killed.

A radar plot of the approach revealed that the aircraft had initially arrived over the VOR station on course but that the approach procedure was not flown accurately in either direction or altitude. It had disappeared temporarily from radar coverage at one point when it was northwest of the airport and subsequently followed an erratic path and made rapid changes in altitude, consistent with the pilot's report of spatial disorientation and perception that the aircraft was in a loop.

The aircraft had struck the ground in a near vertical attitude and at a high airspeed; it was demolished on impact and, although little information could be obtained from the wreckage, no evidence was found of pre-impact problems with the structure or mechanisms. The deviation pointer of the VOR system had had a problem but was repaired some time previously.

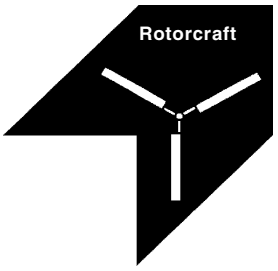
Aircraft Taxis on its Own

Piper J-3 Cub: Extensive damage. Minor injuries to one.

The engine of the two-place, tailwheel aircraft was not equipped with an electric starter and required the propeller to be swung by hand to start it. The passenger for this flight was not a pilot, but had flown with the pilot numerous times and had been trained by him to assist in the engine starting procedure to the extent of holding the control stick back and applying the brakes. He had not been briefed, however, on operation of the magnetos or on the operation of the throttle.

The pilot pumped the throttle and set it to the starting position, switched on the magnetos and went in front of the aircraft to swing the propeller by hand. The passenger held the control column back and applied brake pressure. The engine started on the first swing of the propeller, but operated at a much higher rpm than normal.

The passenger was unable to hold the aircraft stationary with the brakes and did not know how to reduce the engine power. The aircraft began to roll down a slope. The main wheels were stopped by a small ditch and the aircraft nosed over, coming to rest inverted. The passenger was able to evacuate with minor injuries. The aircraft sustained a broken propeller and other damage to the wing leading edges, fuselage frame, engine cowling air intake and windshield.



Two Pilots at One Time Results in Hard Landing

Robinson R22 Beta: Substantial damage. No injuries.

The aircraft was en route to a private landing site. Aboard were the pilot and a passenger, both of whom were private pilots with helicopter ratings; the passenger was the more experienced pilot in this type aircraft.

The pilot decided to make a practice landing in a field prior to arriving at the destination landing site. After accomplishing the landing without incident, the pilot elected to execute a running takeoff. The aircraft slewed slightly to the right during the takeoff. The pilot was not alarmed at this and was satisfied that the aircraft was under control; however, the passenger considered that the situation warranted that he take control. For a short period, both pilots attempted to fly the aircraft. The pilot stated that he did not hand over control of the aircraft to the passenger.

During the confusion, the aircraft made a hard landing. The tail boom and cabin structure were wrinkled and the landing skids splayed outward. There was no fire and no injuries were sustained by the occupants who exited without further incident.

Rocks Hide in Low-lying Mists

Messerchmitt-Bölkow Blohm BK117: Aircraft destroyed. Fatal injuries to 10.

The rotorcraft had departed during the early evening in visual meteorological conditions (VMC) with a crew of two and eight passengers aboard.

During the flight, the weather deteriorated because of an approaching typhoon and an occluded front. The pilot elected to continue the flight to the destination and, under conditions of very little visibility, he descended to a very low altitude. The helicopter collided with a hill covered by fog and mist. The aircraft was destroyed by the impact and all 10 occupants sustained fatal injuries.

Factors cited in the accident included incorrect pilot decisions by not maintaining VMC conditions after the aircraft encountered restrictions to vision, and poor monitoring by the flight service operator. ♦