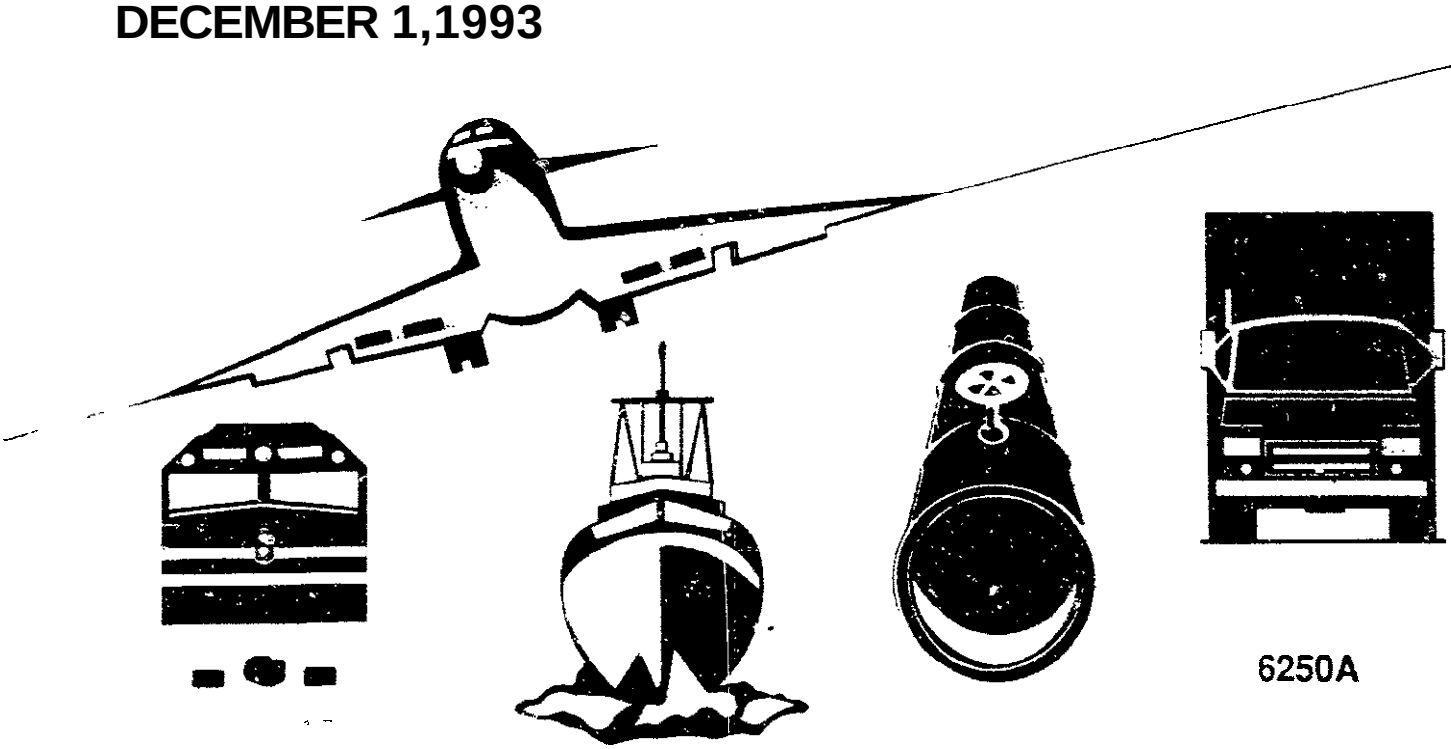
PB94-910407
NTSB/AAR-94/05

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

CONTROLLED COLLISION WITH TERRAIN
EXPRESS I! AIRLINES, INC./
NORTHWEST AIRLINK FLIGHT 5719
JETSTREAM BA-3100, N334PX
HIBBING, MINNESOTA
DECEMBER 1,1993



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DECEMBER 1, 1993

Adopted: May 24,1994
Notation 6250A

Abstract: This report explains the crash of Northwest Airlink flight 5719, a Jetstream **BA-3100,** while the airplane was on the localizer back course approach to runway 13 at Chisholm-Hibbing Airport, Hibbing, Minnesota, on December 1, 1993. The safety issues in the report focused on pilot training and procedures, company oversight of flight operations, and surveillance by the Federal Aviation Administration. Recommendations concerning these issues were made to the Federal Aviation Administration.

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EXECUTIVE SUMMARY

On December 1, 1993, Express II flight 5719, a Jetstream BA-3100, registration N334PX, was operating as a regularly scheduled flight under 14 Code of Federal Regulations, Part 135, from Minneapolis/St. Faul International Airport, St. Paul, Minnesota, to International Falls, Minnesota, with an en route stop at Ebbing, Minnesota. The flight was operated by Express Airlines II, Inc., under the terms of a marketing agreement with Northwest Airlines, Inc., as Northwest Airlink. About 1950 central standard time, the airplane collided with terrain while on the localizer back course approach to runway 13 at Ebbing. The 2 flightcrew members and all 16 passengers were fatally injured in the accident. The airplane was destroyed.

The National Transportation Safety Board determines that the probable causes of this accident were the captain's actions that led to a breakdown in crew coordination and the loss of altitude awareness by the flightcrew during an unstabilized approach in night instrument meteorological conditions. Contributing to the accident were: The failure of the company management to adequately address the previously identified deficiencies in airmanship and crew resource management of the captain; the failure of the company to identify and correct a widespread, unapproved practice during instrument approach procedures; and the Federal Aviation Administration's inadequate surveillance and oversight of the air camer.

Safety issues discussed in the report include pilot training and procedures, company oversight of flight operations, and Federal Aviation Administration surveillance of the company operations. Safety recommendations concerning these issues were made to the Federal Aviation Administration. Also, as a result of the investigation of this and other commuter airline accidents, on March 17, 1994, the Safety Board issued Safety Recommendations A-94-70 through -72 to the Federal Aviation Administration that are intended to improve the current system of implementing and verifying actions resulting from Air Carrier Operations Bulletins.

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1. FACTUAL INFORMATION

1.1 History of the Flight

On December 1, 1993, Express II flight 5719, a Jetstream BA-3100, registration N334PX, was operating as a regularly scheduled flight under 14 Code of Federal Regulations (CFR), Part 135, from Minneapolis/St. Paul International Airport, St. Paul, Minnesota (MSP), to International Falls, Minnesota (INL), with an en route stop at Hibbing, Minnesota (HIB). The flight was operated by Express Airlines II, Inc., under the terms of a marketing agreement with Northwest Airlines, Inc., as Northwest Airlink. About 1950 central standard time (CST), the airplane collided with terrain while on the localizer back course approacn to runway 13 at HIB. The 2 flightcrew members and all 16 passengers were fatally injured in the accident. The airplane was destroyed.

The crew of flight 5719 began their duty day at 1325,[1] when the captain and first officer reported to the Express II[2] operations office in MSP. The captain and first officer traveled as nonrevenue passengers on a Northwest Airlink flight to INL and flew the same airplane, on a scheduled flight, back to MSP. The crew's schedule thereafter was to fly to HIB, continue on to INL, remain overnight in INL, and return to MSP as nonrevenue passengers on the first flight out of INL the following day.

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[1] All times are Central Standard Time (CST) based on the 24-hour clock, unless otherwise indicated.

[2] Express Airlines II, Inc. may be referred to as Express II.

Neither the captain nor the first officer were scheduled to take this trip sequence. They had flown together on October 11, and on November 22, 1993. The captain was informed that he was to fly this mp sequence on November 30, 1993, and the first officer was notified on November 27, 1993. Several witnesses reported that the captain told them he was unhappy with the trip schedule change because he would be working on December 2, a day that he was scheduled to be off. After the accident, an Air Line Pilots Association (ALPA) grievance work sheet that had been filled out by the captain concerning working on December 2, was found in his residence.

Before departing MSP to travel to INL, the captain was involved in a disagreement with a customer service agent (CSA) concerning his authorization as a nonrevenue passenger. His authorization had not come with the other trip paperwork, and he had insisted that the agent stop her other duties and call dispatch to obtain his authorization. Her previous experience was that pilots called dispatch themselves; therefore, she asked him to take care of it. He indicated that this was not satisfactory to him and left the area. The captain then contacted his chief pilot and was told to allow the chief pilot to handle the situation. Several minutes later, when the flight was close to scheduled departure time, the service agent queried the captain and learned that he had not obtained the authorization. Despite her workload, she obtained the authorization so the captain would not miss the flight and thereby cause a later flight cancellation. The captain's demeanor and actions prompted the CSA's supervisor to insist that the agent prepare a formal complaint against him. According to the CSA, she and the captain were involved in an unpleasant incident about 1 month earlier when he yelled at her in the office. She said that since the captain later apologized, she did not write a report about the earlier incident.

The captain reached the airplane within a few minutes of its departure from the ramp. The flightcrew had already closed the passenger entrance door and had started the number two engine. The door had to be reopened and the passengers and crew waited as the captain boarded, removed and hung up his coat, and took his passenger seat. The first officer for flight 5719 was already on board the airplane. Despite this delay, the airplane departed 2 minutes earlier than scheduled at 1424.

Cabin seating constraints precluded the flightcrew from conversing with the deadheading captain and first officer while en route to INL. After arriving at INL, the flightcrew departed for their residences. They reported that they last

observed both the previously deadheading captain and first officer performing the exterior preflight of the airplane at the same time.

The captain and first officer departed INL at 1610 to fly to MSP as flight 5718. Other company pilots who knew the captain and were flying into MSP at the same time remembered hearing his voice on the MSP approach control frequency. By company practice, this would indicate that the first officer was flying this leg and that the captain was performing the duties of the nonflying pilot, such as reading the checklists and making the radio transmissions.

After arriving at MSP, the captain and first officer changed airplanes for flight 5719 to HIB. On two occasions, ramp service agents (RSAs) approached the captain and asked him if they could board passengers onto the airplane. He told them that they could not. Another RSA, who was acquainted with the captain and first officer, boarded and was cleaning the airplane assigned as flight 5719. He stated that he overheard the captain tell the first officer that the first officer had done the exterior preflight incorrectly. The captain told the first officer that he had not checked the exterior lights. The first officer replied that he had intended to do so from the cockpit. The captain said that was not the right way; he then turned on the lights, went outside and checked their operation. The captain found that the landing lights were inoperative, and he returned to the terminal.

The RSA said that the captain's tone of voice was angry, and that the first officer appeared embarrassed. The RSA indicated that he had previously thought of the captain as a nice person, and that he had never seen him act like this before.

Inside the terminal, the captain spoke with another Express TI captain, a line check airman, who had last flown the airplane. This captain said that he expected him to "chew me out" for not writing up the landing lights. Instead, the captain appeared to be in good spirits. The tight bulbs on the landing lights were subsequently replaced by maintenance personnel prior to the airplane departing the ramp area.

The captain returned to the airplane at the same time that the RSA arrived with the passengers. According to the RSA, the captain stopped him from boarding the passengers. The RSA stated that while he and the passengers waited on the ramp, the captain stood in the passenger entrance door, and hung up his coat, and then allowed them to board.

The RSA gave a copy of the load report to the first officer and made the passenger announcement. The captain followed him to the back of the airplane and closed the passenger entrance door. As the RSA walked around to the front of the airplane, the captain "yelled out the window" that the airplane was 130 pounds over the allowable takeoff gross weight. The passenger door was reopened, the first officer corrected the load report for the RSA, and a passenger voluntarily deplaned.

The scheduled departure time was 1810. However, fight 5719 departed at 1852 due to the late arrival of the aircraft, the replacement of the landing light bulbs, and removal of a passenger. The flightcrew reported the flight's departure time as 1858.

The 1754 weather observation for HIB was:

> sky partially obscured; estimated ceiling 600 feet overcast; visibility 1 1/2 miles, light snow, fog; temperature 28° F; dew point 25° F; wind 180° at 8 knots; altimeter 29.89 inches Hg.

The HIB forecast valid for the projected arrival time for flight 5719 was:

> ceiling 800 feet overcast; visibility 3 miles, light freezing drizzle, occasional visibility 1 mile, light snow, fog: wind 180° at 12 knots.

The weather package provided io the pilots of flight 5719 did not contain the airman's meteorological information (AIRMETs) valid for the time that the airplane would be landing.

As flight 5719 approached the HIB very high frequency omnidirectional radio range (VOR), the Duluth (DLH) approach cantroller provided the pilots with the HIB weather and cleared the flight for the instrument landing system (ILS) approach to runway 31. The cockpit voice recorder (CVR) transcript reveals that the pilots discussed the need to land on mway 13 because there was a tail wind on the ILS approach to mway 31 and the runway was contaminated. (A British Aerospace Service Letter, dated January 13, 1988, entitled "Operation From Precipitation Covered Runways," advises that landings should not be attempted in a tailwind when the runway is covered with precipitation). The captain requested and received clearance for the localizer back course approach to runway 13 (see figure 1). The flightcrew initiated the approach procedure by joining the HIB 20 DME

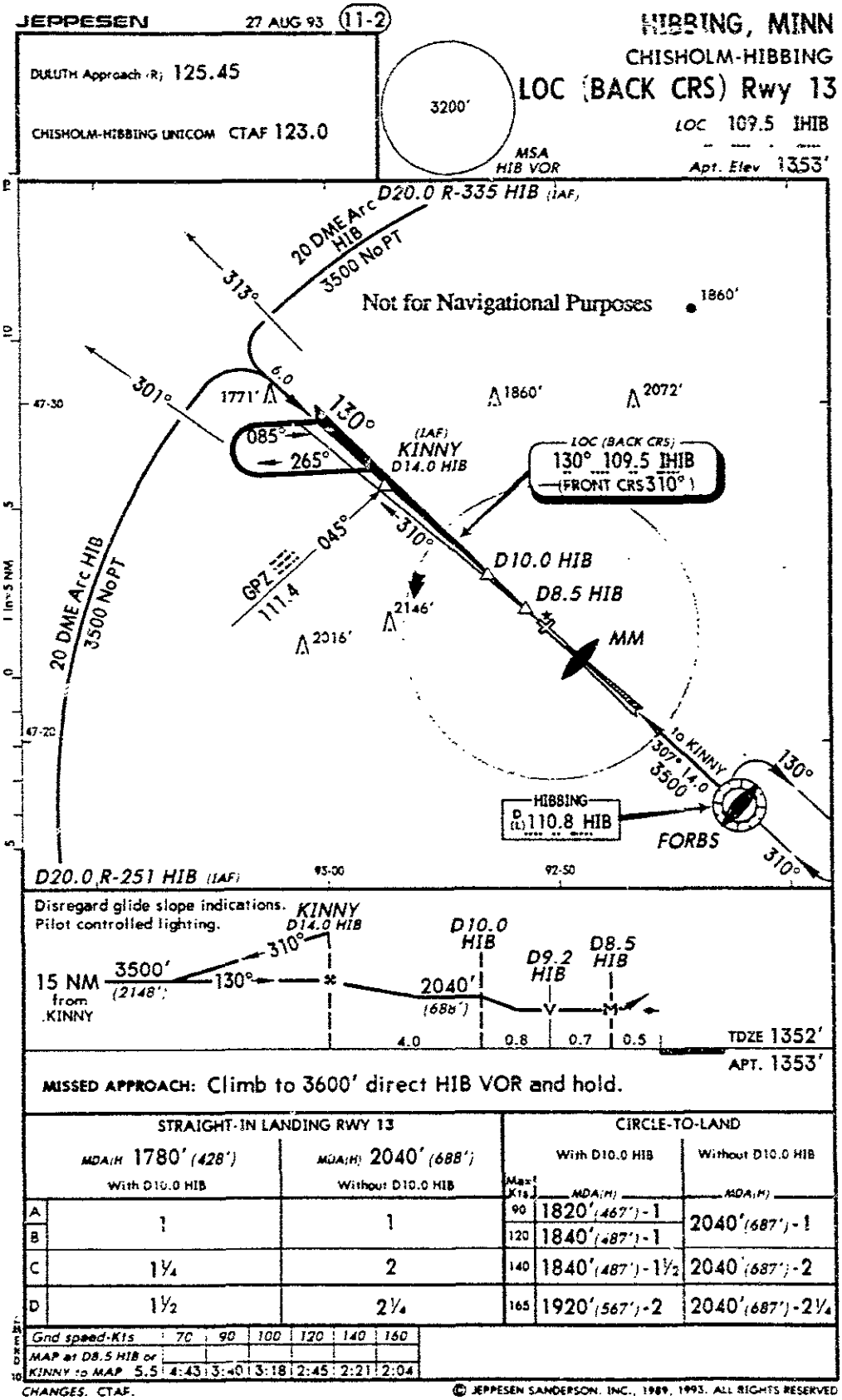

Figure 1.--HIB approach chart.

[distance measuring equipment] arc from the HIB VOR and intercepting the localizer at 8,000 feet mean sea level (msl).

The HIB weather observation at 1950 was reported as follows:

> sky partially obscured, estimated ceiling 400 feet overcast, visibility 1 mile, light freezing drizzle, light snow, fog, temperature 29° F, dew point 27° F, wind 180° at 10 knots, altimeter 29.85 inches of Hg, fog obscuring 5/10ths of the sky, light freezing drizzle began 1 minute after the hour.

The flightcrew contacted Express II's HIB station at 1936 to report that they were in range. The station agent stated that he knew the captain but that he did not hear what he considered to be his distinctive New York accent on the radio. Therefore, he concluded that the first officer made the call and that the captain was flying the airplane. During the in-range call, the flightcrew told the station agent that the airplane would need fuel after arrival. They did not request weather information or request that deicing equipment be available after landing.

The airplane should have arrived within 15 minutes of the in-range call, at around 1950. Around 2010, the station agent felt that something was wrong, began to make calls, and put the Express II emergency plan into effect.

The fallowing information was obtained from the CVR transcript, which contains both the intra-cockpit and air-ground communications from the latter portion of the flight (see appendix B).

At 1944:03, Duluth approach control told the flight that "I show you established on the two zero mile arc, you're cleared for the localizer back course one three approach to Ebbing. Change to advisory approved, cancel with me on one two seven point four." The last recorded transmission came from the first officer of flight 5719 when he responded by repeating the clearance.

At 1944:32, the captain of flight 5719 stated to his first officer "Okay put one down there to show we're cleared for the approach and since we're established what altitude can we go down to?" The first officer responded with "Thirty-five hundred." One second later the captain said "Okay, put that in there." Nine seconds later the first officer asked "Just..you just gonna stay up here as long as you can?" The captain replied "Yes." Radar data show that the airplane

remained at 8,000 fee; until 194754 (see figure 2), when the airplane intercepted the localizer approximately 19 nautical miles (nmi) from the HIB VOR.

Prior to the descent, conversation within the cockpit centered around getting the airplane ready for the before-landing checklist. The propeller RPM's were increased, both Hibbing localizers were identified, the flaps were set to 10, the radio frequency was changed, the gear was lowered, the flaps were lowered to 20, and the first officer asked the captain if he wanted the checklist.

At 1949:13, the captain stated "Before landing...well let's wait for the time when you call final approach fix [FAF] altitude, instruments cross check, times noted, that's when I'll call for checklist." Sixteen seconds later the first officer stated "final approach fix, instruments cross check, no flags, times noted." The captain responded "Okay, before landing checklist to the box." The first officer stated "Landing gear down, three green, hydraulic pressure, brakes, two thousand, tested." The captain repeated "Two thousand, tested, left." Radar data showed that the airplane descended at an average vertical speed of 2,250 feet per minute (fpm), and was 1,200 feet above the minimum altitude when it passed over the final approach fix (Kinny) at 1949:30. At 194944.3, while inside the final approach fix, the first officer stated "Prop sync's off, prop sync's off, speed levers high, a hundred percent, boost pumps are on, before landing checklist to the box."

At 1950:10, while at 3,000 feet msl, the first officer stated "One to go." Four seconds later, the captain responded "To what alt- to twenty forty, okay." At 1950:15.5, the first officer stated "Twenty forty to ah ten point oh." About 11 seconds later, the captain stated "Did you ah click the ah airport lights, make sure the co- common traffic advisory frequency is set." The airplane descended through the 2,040-foot step down altitude at 1950:30, at a point approximately 11.6 nmi from the HIB VOR. The final recorded radar data point shows the airplane descending through 1,800 feet msl at 2,500 fpm at a point approximately 11.35 nmi from the HIB VOR. Figures 2 and 3 contain the plan and profile views of the approach, respectively, as reconstructed from radar data.

At 1950:40.3, the captain asked the first officer "Click it seven times?" About 2 seconds later, the first officer responded with "Yup yeah I got it now." Approximately 1/2 second later, sounds similar to scraping were heard for 3.0 seconds until the end of the recording.

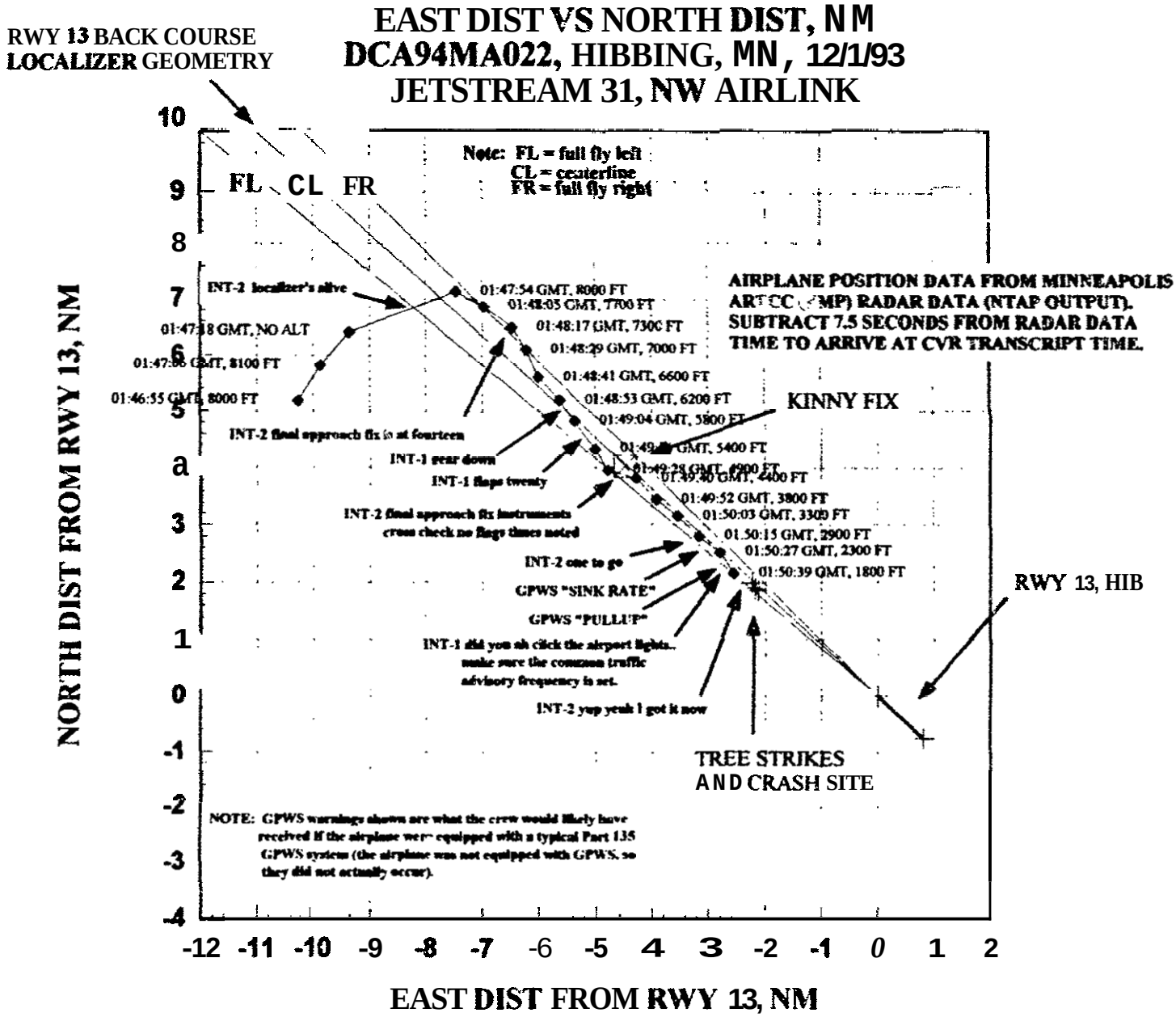

Figure 2.--Plan view of HIB approach.

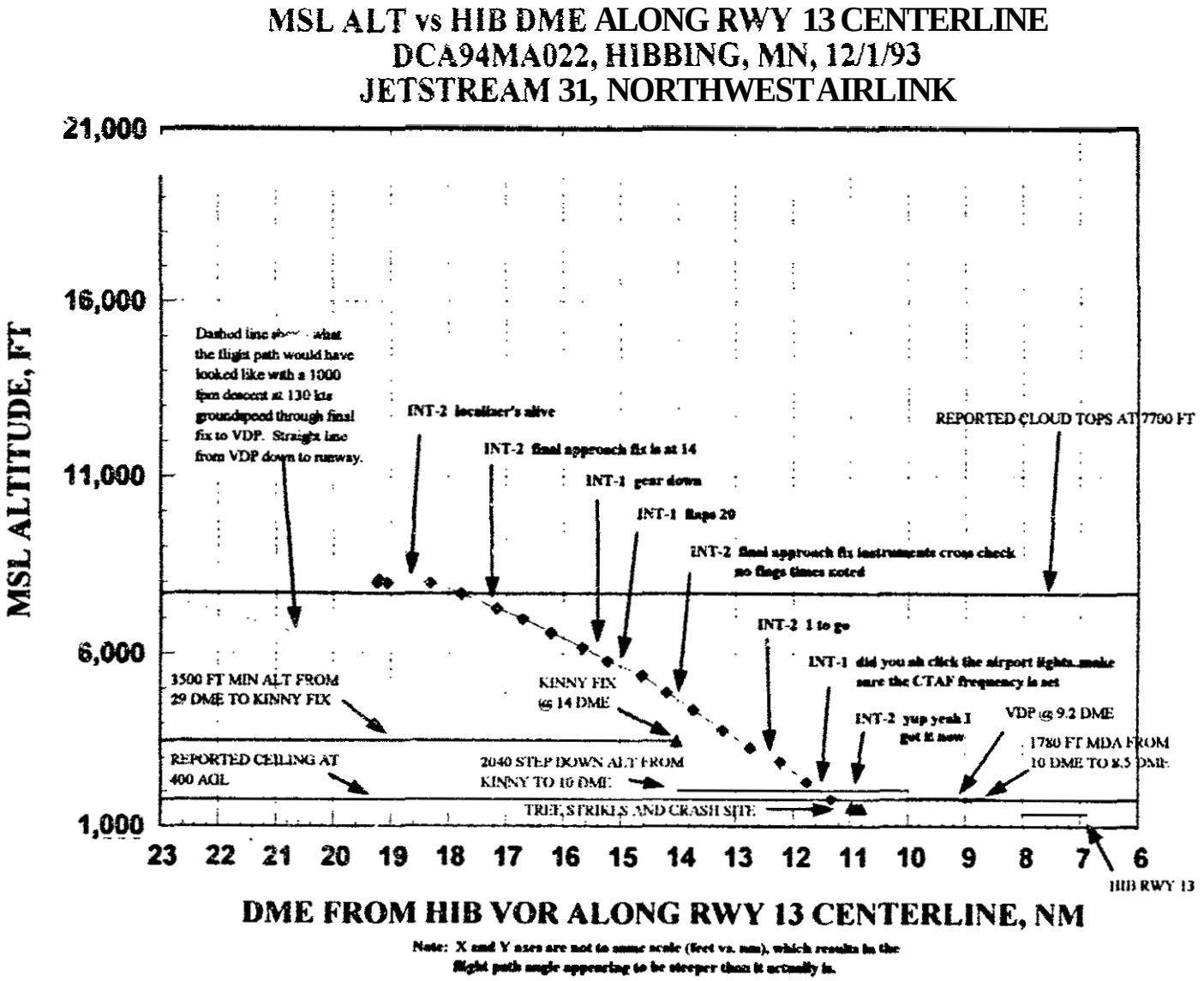

Figure 3.--Profile view of HIB approach.

The accident occurred about 1950, and the airplane was found 2.89 nmi northwest of the HIB runway 13 threshold. A special weather observation was taken at 2028 that reported

> indefinite ceiling 300 feet obscured, visibility 3/4 of a mile, light freezing drizzle, light snow, fog, wind 180° at 7 knots, altimeter 29.84" of Hg.

A pilot departing HIB 30 minutes after the accident said that the reported Kavoris[3] weather was 600 feet overcast with 1 1/2 miles of visibility. He observed the bsse of the overcast to be 400 to 500 feet and said that the visibility was at least 1 mile. The forecast called for light to moderate ice, but he said that he only collected light rime ice. He stated that it was not enough to require activation of the deicing boots. He departed on runway 13 and turned to the south. He observed the tops of the clouds at 8,200 feet.

The accident occurred daring the hours of darkness, at 47° 25 21" north latitude and 92° 53' 59" west longitude.

1.2 Injuries to Persons

Injuries	Crew	Passengers	Others	Total
Fatal	2	16	0	18
Serious	0	0	0	0
Minor	0	0	0	0
None	0	0	0	0
Total	2	16	0	18

1.3 Damage to Aircraft

The airplane was destroyed by the impact with terrain. The airplane's value was estimated at around $3.85 million.

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[3] Privately owned weather service located in Minneapolis, Minnesota, which utilizes both private and National Weather Service (NWS) observations to provide weather products to commercial users.

1.4 Other Damage

Numerous trees and small bushes were destroyed or damaged by the impact of the airplane.

1.5 Personnel Information

1.5.1 The Captain

The captain, age 42, had been hired by Express I on August 7, 1987, the day that he successfully completed his initial first officer's check ride. He held an airline transport pilot (ATP) certificate with ratings and limitations for airplane multiengine land, BA-3100, SF-340, and commercial pilot privileges for single-engine airplanes. He also possessed a flight instructor certificate with ratings and limitations for airplane single and multiengine, instrument airplane. His total pilot time was 7,852.6 hours, and he had accumulated 2,266.7 hours in the BA-3100, all of which were as captain.

Before being employed by Express I, the captain flew as a charter pilot and fight instructor. Previous to that, he was employed as a reactor officer on a nuclear submarine in the U.S. Navy and as a second mate aboard tankers in the Merchant Marine. He had a Bachelor of Science degree in Meteorology.

The captain was originally hired as a first officer on the Saab SF-340 and upgraded to captain on the BA-3100 in April 1989. In September 1990, he became rated as captain on the SF-340. When the company began to base pilots at out stations, he returned to the BA-3100 as a reserve captain in November 1992. According to peers, he accepted that assignment to avoid being based away from MSP.

Express I was divided into two companies, Express I and Express II, in early 1993. The captain had been based in MSP for his entire career with Express I and continued to be based there while flying for Express II. His most recent 14 CFR Part 135 proficiency check was on November 11, 1993, and his last line check occurred on October 6, 1993. On both of these check rides, his performance was found satisfactory.

The captain possessed a first ckss medical certificate issued on November 12, 1993, with the limitation, "Holder shall wear correcting lenses while

exercising the privileges of his airmen's certificate." The captain's distant vision for the right eye was listed as 20/25 and as 20/20 for other measurements. Eyewitness accounts and evidence from the captain's overnight bag indicated that he did not wear correcting lenses on the day of the accident.

On May 20, 1993, the captain failed a proficiency check given in the BA-3100 simulator in Atlanta, Georgia. The items that .the check airman found unsatisfactory were "crew coordination, command-judgment, holding, approach to stalls, and stall warning." He was retrained to proficiency and checked as satisfactory the same day by the same check airman who had found his previous performance to be unsatisfactory.

The check airman who administered the May 20, 1993, proficiency check recalled that the captain's crew coordination and command-judgment were unsatisfactory because he did not properly verify his first officer's actions during a simulated engine fire. The holding procedure was unsatisfactory because the captain entered a holding pattern with excessive entry speed, which the first officer did not point out. Approach to stalls and stall warnings were unsatisfactory because the captain did not know the proper recovery procedure.

This proficiency check was given in Atlanta, and pilot training records are kept in Memphis. Therefore, the captain's training record was not available in Atlanta for reference by the check airman.

On August 11, 1992, the captain failed a captain's proficiency check given in the SF-340 simulator in San Antonio, Texas. The items that the check airman found unsatisfactory were "crew coordination, powerplant failure, rapid depressurization-emergency descent." The check airman's remarks were, "captain seemed rushed on emergency descent - did not fly proper profile, captain allowed f/o [first officer] to bring engine to feather - engine ran through landing, crew coordination weak - most contributing factor to problems during flight." He was retrained to proficiency and checked as satisfactory the same day by the same check airman who had found his previous performance to be unsatisfactory.

On August 17, 1988, the captain failed to successfully complete a first officer's proficiency check given in the SF-340 aircraft in INL. In this proficiency check ride, the check airman occupied the captain's seat while the captain (then first officer) demonstrated maneuvers from the right seat. The items that the check airman found unsatisfactory were, "judgment, takeoff with a simulated powerplant

failure, powerplant failure, emergency procedures, and NDB/ADF [nondirectional radio beacon/automatic direction finder] instrument approach procedures."

He was retrained to proficiency and checked as satisfactory the same day by the same check airman who had found his previous performance unsatisfactory. This check airman is no longer employed by Express I or II. When contacted after the accident, he was not able to recall any details concerning this check ride.

On August 7, 1987, the captain failed the oral examination portion of his initial second-in-command check. He was rechecked satisfactorily the same day by the same check airman who had found his previous performance unsatisfactory.

The captain's records for transition captain training on the SF-340 contained the following remarks for day 2 and day 4: "Poor communication with PNF [pilot not flying]." The instructor who performed this training was able to recall most of what transpired.

He said that he enjoyed working with the captain but that he was difficult to train because he was "head strong, argumentative, and thought that he was always right." He characterized the captain's crew resource management (CRM) skills as "weak." During the course of the training, the captain shut down the incorrect engine and, in another instance, shut off the incorrect generator because of poor crew coordination. He was not responsive to inputs from the first officer.

The instructor said the first officer candidate seemed to be intimidated by the captain. He said that the captain was extremely overbearing and it took three simulator periods (12 hours) for the first officer to get used to him.

He said that the captain had to be trained to slow down and work with the first officer. The instructor said that the captain appeared to be receptive to crew coordination mining at the time, but the instructor was not sure if this training was to "cooperate and graduate" or if the training "would stick." He said that the captain performed satisfactorily at the end of the training but that he required all 5 days of it.

A search of Federal Aviation Administration (FAA) records showed that the captain had no accident or violation history but that he was involved in two

incidents. On December 2, 1989, the Waterloo, Iowa, tower advised him that the BA-3100 he was flying was trailing smoke after takeoff. He returned, landed, and determined that it was an engine malfunction. On April 18, 1990, he made a precautionary in-flight shutdown of an engine on a BA-3100 because of a propeller malfunction and landed in Rhinelander, Wisconsin.

A search of the captain's FAA certification records showed that in 1980, he failed his initial attempts to pass flight test portions of both his commercial and flight instructor's certificates.

The captain's last trip before the accident was on Saturday, November 27. His father had spoken by telephone with the captain for several minutes that evening and said that he sounded fine. Later that evening, the captain met a friend at a sports bar and stayed out until after midnight. The friend, a company pilot who was flying for a major airline, said the captain's mood was very good, and that they were happy to be together again. The Safety Board was unable to determine the captain's activities on November 28 and 29.

On Tuesday morning, November 30, the captain attended a company grievance arbitration hearing. Afterwards, he had lunch with a friend, another captain who had attended the hearing, and they were joined briefly by the union lawyer. The friend indicated the captain seemed unusually upset. The captain suggested that he had been targeted heavily for attention by company management in the past 2 months and gave examples of problems he had recently experienced with the company. He indicated that he was pursuing jobs with other companies and that he would consider leaving aviation if conditions did not improve. The friend and the captain said good bye at about 1315.

On Wednesday morning, around noon, the captain ate lunch at a bagel restaurant he frequented. A waitress at the restaurant said that the captain, who was dressed in uniform, joked with workers but seemed a little depressed. She indicated that the captain seemed rested. A pilot, who was present in the pilot lounge at the airport, said that the captain was unhappy when he arrived, and that he stated loudly, "they violated my contract again." Details of the captain's personal history are included in Appendix C.

1.5.2 The First Officer

The first officer, age 25, was hired by Express II on September 26, 1993, the day that he successfully completed his initial first officer's check ride. He held an ATP certificate with ratings and limitations for airplane multiengine land, and commercial pilot privileges for airplane single-engine land. He also possessed a flight instructor certificate with ratings and limitations for airplane single- and multiengine, instrument airplane. His total pilot time was 2,019 hours, of which 65 hours were in the BA-3100. He had not been assigned to a crew base.

Before becoming employed by Express II as a BA-3100 first officer, he gained flight experience by flying while reporting rush hour traffic and flight instructing for a Fixed Base Operator (FBO) in the MSP area. He had previously been employed as a flight instructor while attending the University of North Dakota. He had a Bachelor of Science degree in Aeronautical Studies.

The first officer had paid $8,500 to Flight Safety International, Inc. (FSI) for his BA-3100 training to become an Express II first officer. His ground school and BA-3100 simulator training were conducted in St. Louis by FSI.

There were six other first officer candidates in his class at FSI. The training records indicate that he was the only candidate in his class to pass the simulator check ride on the f i t attempt. This proficiency check took place on September 16, 1993, with the aircraft portion being completed on September 26. The first officer's initial operating experience (IOE) was on October 6 and 7, 1993. The check airman, who administered the TOE, said that he flew the BA-3100 very well and that he was familiar with line operating procedures, even though he was new.

A set of hand-written index cards containing aeronautical data for Express II destination airports was found in the first officer's flight case. No card for HIB was found in the totally destroyed cockpit area.

The first officer's first class medical certificate was issued on August 4, 1993, with the limitation, "Holder shall wear correcting lenses for distant vision while exercising the privileges of his airmen's certificate." A pair of prescription eyeglasses and two empty contact lens holders were found in the first officer's overnight bag.

A search of FAA records showed that the first officer had no accident, incident, or violation history. His FAA certification records indicated that in 1985 he failed his initial attempts to pass the oral and fiight test portions of his private certificate, as well as the flight test portion of the flight instructor's certificate in 1987.

A review of the 72-hour history of the first officer did not reveal any activities that would have affected his performance on the flight. An acquaintance of the first officer, who was also a pilot, stated that the first officer was excited about his upcoming trip. He described the f i t officer's mood as cheerful, noting that the first officer was happy to fly since he had flown only 10 to 12 hours in the past several weeks.

1.5.3 Express 1 Principal Operations Inspector (POI)

The POI for Express I holds an ATP certificate for multiengine airplanes and is type rated in the SF-340. He is a licensed flight instructor and gained much of his flight experience giving general aviation instruction in Chicago. Additionally, he was a contract flight instructor for the U.S. Army, Fort Rucker, Alabama. He joined the FAA in St. Petersburg, Florida, in 1970. He came to the Memphis, Tennessee, Flight Standards District Office (FSDO) as an aviation safety inspector in 1980.

Express I received its operating certificate in 1985. The POI was assigned to Express I in February 1986. At the time of the accident, he had not yet attended the FAA POI training course. In Aprii 1988, he attended 68 hours of BA-3100 aircraft systems ground school, but he failed the written test. Despite 5 additional hours of training, he failed the test a second time.

1.5.4 Express II Principal Operations Inspector

"he POI for Express E joined the FAA in the Des Moines (DSM), Iowa, FSDO in 1985. He holds an ATP certificate for both single- and multiengine airplanes, and rotorcraft - helicopter. He is type rated in the Bell 206 and 222 and the Cessna CE-500 Citation. He also holds commercial privileges for single-engine seaplanes and is a flight instructor. He is not rated in the BA-3100 or SF-340. His aviation experience came from flight instructing, crop dusting, and flying Part 135 "on demand" charter airplanes. He has not flown for a Part 135 scheduled air carrier.

1.6 Aircraft Information

The airplane was manufactured in May 1986 by British Aerospace (BAe) at its factory in Prestwick, Scotland, as a model 3100 Jetstream, serial number 706. It was given a certificate of airworthiness for export to the United States on August 14, 1986, where it was accepted by Express I and operated under the terms of a marketing agreement as Republic Express. Its U.S. registration number was N334PX. Republic merged with Northwest *Airlines*, and Express I entered into a marketing agreement with Northwest Airlines as Northwest Airlink. The Meridian Trust Company was listed as the registered owner of N334PX with an exclusive lease to Express II Airlines, Inc. Express II Airlines evolved from Express I Airlines. The U.S. standard airworthiness certificate was issued by the Civil Aviation Authority of the United Kingdom (U.K.) on behalf of the FAA.

The airframe manufacturer has since changed its name to Jetstream Aircraft Limited, which is a subsidiary of BAe. The airplane was configured to accommodate 19 passengers with a minimum flightcrew of two. It was equipped with two Garrett TPE-331-10 turbopropeller engines. At the *time* of the accident, the airplane had logged about 17,162 flight hours and 21,593 cycles. It had a maximum takeoff weight of 15,212 pounds.

The airplane had been maintained in accordance with an FAA-approved continuous maintenance program. All periodic and nonroutine inspections bad been completed. There were no "open" discrepancies, and there were no repetitive discrepancies noted in the records.

The records showed that Airworthiness Directive (AD) 91-08-01, issued by the FAA on June 10, 1991, regarding methods to preclude sudden uncommanded pitch down tendencies from tailplane icing, had been complied with on N334PX. AD 93-01-02, issued by the FAA on January 22, 1993, regardiig the prevention of tailplane deice system malfunctions, also had been complied with.

1.6.1 Airframe Ice Protection

The FAA type certificate data sheet states that compliance has been demonstrated with the requirements of 14 CFR Section 25.1419, Ice Protection. The BA-3100 was approved for operation in icing conditions. The approved flight manual (AFM) defines atmospheric parameters that indicate icing conditions and provides limitations for the anti-icing/de-icing system.

FAA Advisory Circular (AC) 00-45 defies the intensity levels of icing conditions. They are listed as trace, light, moderate, and severe. Neither the FAA approval of the BA-3100 nor the AFM restricts the aircraft from operating in any of the listed icing conditions. However, the Express 11 general operations manual prohibits operation of their aircraft in forecast or reported severe icing.

The airframe deice system consists of inflatable boots on the leading edges of the outboard wing panels, horizontal stabilizers, and vertical stabilizer. There are no deice boots on the leading edge of the wings between the engine nacelles and fuselage. The controls and indicators for the BA-3100 airframe deice system are located on a panel mounted in front of the captain's right knee. The Express II BA-3100 fleet is configured with one ice observation light installed on the left side of the left engine nacelle.

The AFM System Operation section contains the foilowing precautions concerning the Ice Protection System:

> CAUTION: Freezing rain, freezing drizzle and mixed conditions may result in extreme ice build-up on protected surfaces exceeding the capability of the ice protection system. Freezing rain, freezing drizzle, mixed conditions and descent into icing clouds from above freezing temperatures may result in runback ice forming beyond protected surfaces. This ice cannot be shed and it may seriously degrade performance and control of the airplane.

1.7 Meteorological Information

The 1800 National Weather Service (NWS) surface weather analysis chart depicted the center of a low pressure area over north-central Minnesota. A weak, occluded front extended southward and became a cold front over central Iowa. The chart indicated widespread overcast cloud conditions over Minnesota and showed snow, freezing drizzle, and drizzle east of the front over central and eastern Minnesota. The 2100 NWS surface weather analysis indicated little movement of the low pressure center. The 1900 NWS weather depiction chart showed widespread instrument meteorological conditions over Minnesota. The NWS radar summaries for this period showed no precipitation echoes over Minnesota.

AIRMET advisories for occasional instrument meteorological conditions (IMC), moderate turbulence below 10,000 feet, and moderate rime/mixed icing below 15,000 feet were in effect for Minnesota. No SIGMET advisories were valid around the time of the accident.

The NWS terminal weather forecast for Hibbing issued at 1439 and valid for the period of the accident flight was, in part:

> Ceiling 1,000 feet overcast, visibility 3 miles, light freezing drizzle and fog, wind 170 degrees at 12 knots; occasional ceiling 600 feet overcast, visibility 1 mile, light freezing rain, light snow and fog.
>
> After 1800:
>
> Ceiling 800 feet overcast, visibility 3 miles, light freezing drizzle, light snow and fog, wind 180 degrees at 12 knots; occasional visibility 1 mile, light snow and fog.
>
> The surface weather observation taken at Hibbing at 1950 showed:
>
> Type--Record; sky partially obscured, estimated ceiling 400 feet overcast, visibility 1 mile, light freezing drizzle, light snow and fog, temperature 29 degrees F, dewpoint 27 degrees F, winds 180 at 10 knots, altimeter setting 29.85 inches of Hg; Remarks--5/10's of sky obscured by fog, freezing drizzle began at 1901.

There were several pilot reports (PIREPs) for the general location and time of the accident at Hibbing. The captain of another Express II flight that arrived at Hibbing about 1640 reported that he encountered continuous light and occasional moderate rime icing in the Hibbing area and that the cloud tops were between 8,500 feet and 9,000 feet. The pilot of a Beechcrafi Queen Air airplane that departed Hibbing about 2020 stated that he encountered light rime icing in the clouds with cloud tops at around 8,200 feet.

1.8 Aids to Navigation

There were no reported difficulties with the navigation aids used by the flight at the time of the accident. A postaccident flight and ground check of the navigational aids found no malfunctions with the equipment.

1.9 Communications

There were no known air-to-ground communications difficulties.

1.10 Aerodrome Information

The Chisholm-Hibbing Airport is 4 miles southeast of Ebbing, Minnesota, at an elevation of 1,353 feet The airport has two runways: 31-13, which is 6,758 feet long by 150 feet wide; and 22-04, which is 3,075 feet long by 75 feet wide. Runway 22-04 does not have an approved instrument approach. Runway 31-13 is served by an ILS approach to runway 31, a localizer back course to 13, and VOR approaches to both runways 31 and 13. The approach end of runway 13 is 8 nmi northwest of the HIB VOR on the 307-degree radial.

The airport does not have a control tower and is served by a common traffic advisory frequency (CTAF) on frequency 123.0 megahertz (MHz). Air traffic instrument approach services to the airport are provided by Duluth approach control. The high intensity runway lighting is activated by pilots keying the CTAF frequency 7 times within 5 seconds.

The localizer back course approach to runway 13 is a nonprecision approach with no glidepath signal. The published approach procedure provides the precaution, "Disregard glideslope indications."

1.11 Flight Recorders

The airplane was equipped with a CVR, which was recovered from its standard mounting located in the rear of the cabin floor area under a metal cover. It was sent to the Safety Board's laboratories in Washington D.C., for readout.

The CVR was a Universal solid-state type recorder, serial number 6323. It was the first solid-state CVR that the Safety Board has had the opportunity to read out for an investigation. The crash case and the recording medium showed no significant damage. The playback time of the recording was approximately 30 minutes and 1 second (30:01).

A flight data recorder (FDR) was not installed, nor was it required to be installed, according to the existing regulations. Although Federal regulations require that Part 135 airplanes, containing between 10 and 19 seats that entered U.S.

registry after October 11, 1991, be equipped with FDRs, there is no plan to require retrofits of airplanes that were entered on the registry prior to October 11,1991.

1.12 Wreckage and Impact Information

The fiit impact was with the top of a tree about 1,200 feet northwest of where the main wreckage came to rest. The tree had been cleanly severed about 23 feet above the ground. The diameter of the tree top was about 2 inches at the point where it was severed. The next impact occurred 634 feet from the first one, and 36 feet lower (3° down), along a 143° magnetic ground track, and involved the clipping of a group of aspen trees. A piece of the right wing leading edge was found 41 feet farther along the flightpath embedded in the side of a large aspen tree 29 feet above the ground. A section of aileron and right wing tip were found 13 feet west of the aspen.

The next impact occurred at the top of a ridge, 10 feet above the group of clipped aspens and 451 feet from the piece of right wing leading edge imbedded in the tree. The major ground scar from the impact consisted of a 66-foot long by 5-foot wide scrape mark in the ground, with fragments of the left wing tip and wing found at the beginning of the scrape mark and along its full length. At the end of the 66-foot scrape, the airplane struck the base of a second ridge displacing a considerable amount of soil. The main wreckage came to rest directly above and slightly beyond this ridge with wreckage scattered 62 feet along it. All tree strikes and the crash site were within the fly left/right boundaries of the back course localizer to runway 13.

The fuselage came to rest at 1,533 feet msl[4] on a heading of 220 degrees, 2.81 nmi from the HIB runway 13 threshold. All other airplane control surfaces and components were located adjacent to the main wreckage, with the exception of the right outboard wing. The remaining sections of right outboard wing were located in the valley southeast of the clipped aspens.

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[4] Ground elevations and positions were acquired using standard surveying techniques and the global positioning system (GPS). An electronic triangular measuring device (theodolite) was used to determine elevations of the pine and aspen trees by a method called "stadia reduction," which takes into account distance and vertical angle.

The airplane's fuselage came to rest inverted and lying on its right side. The right side of the fuselage sustained severe crushing damage and was destroyed from the nose radome to the aft fuselage area.

The nose gear sustained Severe loading in the aft direction, consistent with being down and locked at impact. The left landing gear remained attached and was found in the down-and-locked position with the gear door intact and open. The gear actuator was also found intact. The right landing gear strut, sway brace, and actuator were found separated from the wing, forward of the gear trunnion: however, the aft trunnion remained attached. The right gear strut was found failed at the forward bearing, and exhibited severe loading in the aft direction, showing that it was down and locked at impact.

All flight control surfaces were accounted for along the wreckage path and at the main accident site.

Both flaps are powered by a single actuator, which is located in the lower portion of the fuselage center section. The actuator rod extension length was 16.2 inches from end to end. According to data provided by Jetstream, this corresponded to a flap angle of 20 degrees. Witness marks on the flap handle also indicated a 20-degree position at impact. This airplane had been modified to limit maximum flap deflection angle to 35 degrees.

1.13 Medical and Pathological Information

According to his medical records, the captain had undergone a radial keratotomy operation on each eye in 1986. This is a surgical procedure used to reduce myopia (nearsightedness) that involves incisions in the central optical zone of the eye.

Postmortem examinations of the flightcrew of the airplane were conducted by the Mesabi Regional Medical Center, Hibbing, Minnesota. The examinations found no preexisting conditions that contributed to the accident.

Urine and organ samples obtained posthumously from the captain were tested by the Toxicology and Accident Research Laboratory of the FAA Civil Aeromedical Institute (CAMI). The urine sample tested negative for alcohol and other major drugs of abuse.

Blood, urine, vitreous fluid, and organ samples were obtained posthumously from the first officer and were tested by **CAMI.** The blood tested negative for carbon monoxide and cyanide, and urine tested negative for alcohol, other major drugs **of** abuse, and medications.

Examinations of the passengers indicated that all injuries were due to multiple extreme blunt **force trauma.**

1.14 Fire

There was no evidence of in-flight fire. Small postcrash fires occurred along the crash path.

1.15 Survival Aspects

The accident was not survivable due to the longitudinal impact forces and breakup **of** the airplane.

1.16 Tests and Research

1.16.1 Systems Teardown and Examination

1.16.1.1 Ice and Rain Protection System

The Jetstream **3101** ice and rain protection system consists of

1) Wing and tail leading edge deicing
2) Engine anti-icing with continuous ignition
3) Propeller anti-icing
4) Windshield heating
5) Stall vane and pitot probe heating

The wing leading edges outboard **of** the nacelles and leading edges of the vertical and horizontal tails are fitted with rubber boots that inflate to break **off** accumulated ice. The leading edges of the elevator horns are electrically heated. Engine bleed air **is** used **to** inflate the boots. The air passes through a pressure regulator whish reduces pressure to approximately 18 pounds **per** square inch (psi). From there, the air is directed to a distribution valve which controls boot inflation. An ejector valve provides a negative pressure to hold the boots along the leading

edge when they are not inflated. Two pressure switches—one located in the wing and one located in the tail--activate green status lights in the cockpit whenever at least 15 psi air pressure is working to infiate the respective boots.

The boots can be operated manually or in an automatic mode. In manual mode, the boots inflate only when a crewmember is holding down the WINGS or TAIL switch. In automatic mode, an airframe deice timer controls boot inflation in the following 1-minute sequence (which repeats automatically): wing boots inflate for 6 seconds, tail boots inflate for 4 seconds, then there is no inflation for 50 seconds.

Engine anti-icing is provided by muting hot air to the air inlet ducts, A continuous ignition system is provided for use when there is a danger of ice ingestion. The flightcrew can sekct either engine anti-icing only or engine anti-icing and continuous ignition. Status lights iliuminate to indicate which systems are operating.

Control switches and status lights for all ice and rain protection systems are on the left and right skirt panels located below the control columns at each crewmember station.

Both skirt panels were recovered from the main wreckage and examined at the Safety Board. The face plates of both panels were destroyed. The switches are white bars that are pushed at the top or bottom to activate. All of them were damaged, some to the point where only the plastic back case remained. Ice protection switch position prior to impact could not be determined from available evidence.

The status lights remained attached to the skirt panels. An examination of the filaments from these status lights was performed. The light bulbs filaments from the WINGS and TAIL legends did not appear stretched. Each status light for the left and right engine anti-ice and continuous ignition contains two bulbs on the top, which illuminate the ENG legend indicating that inlet heat is on, and two bulbs on the bottom, which illuminate the legend IGN when continuous ignition is selected. All four bulbs from the left engine status light exhibited filament stretching. Three bulbs from the right engine status light were recovered, and they all exhibited filament stretching consistent with being on at impact.

Propeller anti-icing is provided through rubber mats containing electrically heated elements which are attached to the root area of each blade. The skin panel has two ammeters which indicate the amount of current drawn by the mats when propeller anti-icing is activated. The needles on these ammeters indicated 20 amps on the left propeller and 10 amps on the right propeller, although it is unclear if these readings are valid when power is removed.

The following components of the wing and tail deice system were recovered in the wreckage and examined: deice distribution valve; pressure regulator; ejector valve; timer; and the tail pressure switch. The wing deice pressure switch was not recovered.

The ejector valve, distributor valve, and pressure regulator were examined by the Safety Board at the E.F. Britten & Co., inc., a subcontractor for Lucas Aerospace, Cranford, New Jersey, on January 12,1994.

The ejector valve (P/N 19E26-1A) and pressure regulator valve (P/N 38E59-1D) were bench tested and found functional. The ejector valve created a vacuum pressure of 10.3 inches Hg, which exceeded the company acceptance test minimum of 10.0 inches Hg. The pressure regulator valve reduced an inlet pressure of 30 psi to 19.1 psi, slightly higher than the company acceptance test range of 17 to 19 psi. Company personnel indicated that this was not unusual for a unit which was manufactured 10 years ago.

The distributor valve (P/N 1532-3C) did not function during testing; therefore, a teardown inspection was performed. Both shuttle valves (which route air pressure to either the wing or tail deice boots) were free moving with no evidence of binding or contamination that may have caused sticking. When 28V power was applied, both solenoids (which control the opening and closing of the shuttle valves) functioned normally. There was no evidence of preexisting failure of any of these components.

The deice timer and tail pressure switch were examined at the B.F. Goodrich facility in Akron, Ohio, on January 21, in the presence of an FAA inspector. The tail pressure switch was functional and activated per specification at a pressure of 15 psi. A teardown inspection of the deice timer showed that the mechanical stepper switch was in the off position. This suggests that the automatic mode of deice boot inflation was not selected at the time of impact.

1.16.1.2 The Altimeters

The cockpit had sustained Severe impact damage that precluded complete documentation at the accident site. Therefore, it was examined once the wreckage was moved to the hangar at HIB.

The altimeters were recovered and examined by investigators at the B.F. Goodrich Component Overhaul & Repair Facility, Austin, Texas, on January 13, 1994. Both units were manufactured by the Kollsman Corporation and had a part number of B45152-10-004. Attempts were made to bench test both units prior to performing a teardown inspection.

1.16.1.2.1 Captain's Altimeter (S/N 60251B)

The reading obtained at the accident site was 1,190 feet with a setting of 29.90 inches Hg. The face plate was intact, the barometric adjustment dial was bent and immovable, and the case was cracked and leaking. Attempts to seal the leaks with putty were unsuccessful and vacuum pressures below ambient could not be sustained within the unit. The vibrator and lights were functional.

During disassembly, the face plate was removed, but the cover had to be cut off in order to completely disassemble the unit. No witness marks from the needles were apparent. The optical encoding disk was shattered into many pieces. Both rocking shafts were separated from the diaphragms. One diaphragm was bent and punctured. This damage seemed consistent with impact. The pivot was examined under a microscope, and no evidence of wear or contamination was seen.

1.16.1.2.2 First Officer's Altimeter (S/N 6084)

The reading obtained at the accident site was 1.490 feet with a setting of 29.84 inches Hg. The vibrator and lights were functional. The encoder output read -00.1. The pointer and counter drum did not move when the barometric adjustment window was changed. Upon vacuum testing, the counter drum showed slight movement although not enough to correspond to the selected rate of climb. The unit did not hold vacuum pressure and leaked at the rate of 4,500 feet in 30 seconds.

During disassembly, the upper handstaff was found to be dislodged, causing the counter drum to be free floating. No witness marks from the needles

were apparent. The pivot was broken and a small piece was lodged inside the jewel. The pointer needle was no longer staked on the pivot point and was free floating. This damage was consistent with impact. Microscopic examination did not reveal any evidence of wear or contamination.

1.16.2 Miscellaneous Items

Two stall warning systems (left and right) activate an audio warning horn and stick shaker to alert the crew of approach to a stall. The activation is triggered by using wing-mounted vanes that measure the local angle of attack at the wing. Red warning lights on the panel illuminate to indicate which system has sensed an impending stall. When both systems reach stall identification, the stall protection stick pusher is activdted. The stick pusher is a hydraulically driven jack located at the base of the vertical tail, which is connected to the pitch control cables. When activated, the stick pusher provides a nose-down pitch.

A visual inspection of the stick pusher actuator was performed, and all control cables and mountings appeared normal. The filaments of the stall warning lights on the CAP panel did not appear stretched. The CVR group was able to confirm that no activation of the stick shakers or stall warning horn was recorded on the CVR. Therefore, no further examination of the stick shaker motors was performed.

The airplane was equipped with a Collins DME-42 transceiver, which was damaged by impact. The manufacturer confirmed that the unit does not contain any nonvolatile memory. No further testing was performed.

One pitot probe (from the upper right fuselage location) was recovered. It was bent and cracked about 1 inch from the tip. The heating elements were visible through the crack and appeared normal. The probe was examined by the Safety Board. The fracture appeared typical of overstress; however, it was not possible to determine if the probe material was hot at impact.

The airplane was equipped with a Sperry FZ-500 flight director, which provides information for controlling the aircraft through the climb, cruise, descent, and approach phases of flight. The information is displayed in the form of pitch and roll commands on the gyro horizons for reference by the flightcrew as they manually fly the airplane. There was no autopilot system installed.

The flight director operates in lateral modes of heading, navigation, approach, back course, VOR approach, and vertical modes of altitude, vertical speed, and indicated airspeed. Modes are selected via buttons on the flight director mode selector panel that is mounted above the center console. When a mode is selected, the button illuminates and a corresponding legend on the flight director mode indicator (located on the left main instrument panel) also illuminates.

The mode selector panel was brought to the Safety Board, and all light bulbs were examined. The filament from one of the two vertical speed mode push-button light bulbs exhibited stretching. No other light bulb filaments appeared stretched.

The flight director mode indicator face plate remained attached to the instrument panel. However, all light bulbs were destroyed, and no filament analysis was possible.

1.16.3 Wing Leading Edge Ice Observation Eight

The airplane was equipped with one wing leading edge ice inspection light which illuminated the left wing leading edge. Jetstream offered a right wing leading edge ice observation light as an option; however, it was not installed. There were wiring and structural provisions for a second light to illuminate the right wing leading edge. The bulb from the wing ice inspection light was recovered and examined in the Safety Boards laboratory.

The filament of the wing leading edge ice observation light was not found; however, an examination of the ends of the separated filament revealed evidence of melting and material flow, consistent with being hot (on) at impact. According to the flight manual for the Jetsaream Model 3101, visual inspection of ice accumulation by means of the ice observation light is critical to proper operation of the ice protection system. The flight manual contains the following instruction:

> Operate the airframe de-icing system only when a significant build-up of ice has occurred. The optimum thickness for ice shedding will vary depending OR the nature of the ice, but 0.5 in. of ice should be allowed to accumulate on the wing boots before operating the airframe de-icing system.

The manufacturer is concerned that operating the airframe deice system without the accumulation of ice may result in bridging. Bridging is a potentially dangerous situation that occurs when ice forms over the inflated shape of the deice boots. When this happens, the ice cannot be removed, and airplane performance may be seriously degraded. To alert pilots of this potential, the following caution appears in the flight manual:

> If the airframe de-icing system is operated ***before*** a significant ice build-up, the ice may only flex and bridge over the inflated **boots.**

The Safety Board learned that similar twin-engine turbopropeller airplanes with pneumatic deice boots, such as the Beech 1900, Embraer EMB-110, and Fairchild SA-227, are configured with two ice observation lights as standard equipment.

The current airworthiness standards contained in the Federal Aviation Regulations (FARs) are not specific about requiring two leading edge ice observation lights for airplanes certificated for two-pilot operations. 14 CFR Part 23, Airworthiness Standards: Normal, Utility, Acrobatic, and Commuter Categories, section i419 (Ice Protection) states:

> (dj When monitoring of the external surfaces of the airplane by the flightcrew is required for proper operation of the ice protection equipment, external lighting must be provided which is adequate to enable the monitoring to be done at night.

1.17 Additional Information

1.17.1 Corporate History

Express Airlines I, Inc., and Express Airlines II, Inc., are owned by Phoenix Airline Services, Inc., of Atlanta, Georgia. Express I's principal base of operations is Memphis, Tennessee, and Express II's is MSP. Together, the companies have 390 pilots, 55 aircraft and operate the BA-3100 and the SF-340 out of 52 cities in 17 states.

Express I was started in June 1985 to provide service PO passengers for Republic Airlines in Memphis and MSP. When Northwest Airlines purchased Republic Airlines in 1986, Express I began doing business as Northwest Airlink

For a time, Express I was operated under 14 CFR Part 121 but returned to Part 135 operations in December 1990.

Express I has had two previous accidents. The first occurred on December 14, 1987 in Joplin, Missouri, with a BA-3100.[5] The second was on January 2, 1993, in HIB with a SF-340.[6] There were injuries but no fatalities in the accident at Joplin. There were no injuries or fatalities in the SF-340 accident at HIB. However, both the aircraft were destroyed.

In early 1992, Phoenix Airline Services, Inc., management decided to split Express I into two companies. The Memphis based portion continued as Express I, and the MSP based portion became Express II. Phoenix Airline Services, Inc., requested that the MSP FAA Certificate Management Office (CMO) issue the operating certificate for Express II. The CMO declined so certificate Express II in June 1992, citing the difficulties anticipated in surveillance of remote operations.

In early 1993, Express II became certificated by the Memphis FAA FSDO. The POI accomplished the FAA approval of operations specifications and flight training. At the time of Express II's certification, the POI was not rated to fly either the BA-3100 or the SF-340.

The certificate was transferred to the Des Moines FAA FSDO. FAA maintenance and avionics responsibilities were transferred concurrent with Express II's certification. Operations responsibility for the Express II certificate was given to a Des Moines FSDO Inspector in June 1993. He is not rated to fly the BA-3100 or the SF-340. He had no previous experience as a pilot for a scheduled 14 CFR Part 135 air carrier and had not been a POI of a scheduled 14 CFR Part 135 air carrier, prior to king assigned to Express II.

Neither Express I nor Express II flies to Des Moines. In order to accomplish surveillance on Express II's flight operation, Des Moines FSDO inspectors must travel either 200 miles from Des Moines to Sioux City, Iowa; 128 miles to Cedar Rapids, Iowa; 97 miles to Fort Dodge, Iowa; 121 miles to Mason City, Iowa; or 108 miles to Waterloo, Iowa. The only other method of surveillance

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[5] Aircraft Accident Report, Express Airlines I, Inc., dba Northwest Airlink flight 2525, Joplin Municipal Airport, Joplin, Missouri, December 14,1987 (NTSB/MKC88FM027)

[6] Aircraft Accident Report, Express Airlines I, Inc., dba Northwest Airlink flight 5719, Chisholm-Hibbing Airport, Hibbing, Minnesota, January 2,1993 (NTSB/CHI93MA061)

available to the POI would be to ride on another air carrier to Minneapolis, Minnesota, and to conduct inspections from there. However, geographic surveillance was provided by other FSDO offices, including the MSP FSDO. The MSP FSDO conducted several ramp and en route inspections in the months before the accident.

Express II has 130 pilots, seven SF-340 aircraft, and nine BA-3100 aircraft. It operates 135 daily flights and flies to 16 cities in 4 states. Sioux City, Iowa, is Express II's largest crew base with 32 pilots. It is also the main maintenance base. However, Minneapolis is the principal base of operation. Both of the key management personnel required by 14 CFR 135, the Director of Operations (DO) and the Chief Pilot (CP), are based in Minneapolis.

Express II contracts with Express I for crew scheduling, system (operational) control, and training. All of this is accomplished in Memphis. Human resources, accounting, and financial planning are performed by Phoenix Airline Services, Inc., in Atlanta.

Pilots can bid back and forth between Express I and Express II and are covered by the same Air Line Pilots Association contract. Before September 1992, pilots were based in Minneapolis and Memphis. Since that time, most pilots have been domiciled at outstation destination airport cities, and a smaller number of pilots have been based in Minneapolis and Memphis.

Training records for the entire pilot group are kept in Memphis at Express I's training facility. Simulator training and checking is accomplished in Atlanta, St. Louis, and San Antonio at Flight Safety International, Inc. Ground school is held in both Minneapolis and Memphis.

Operational control is the responsibility of the DO or the CP. Operational control is delegated and exercised through Express I, System Control in Memphis. Weather information is disseminated to the crews through the PARS[7] computer system, flight service stations, qualified weather observers and any other computer system that derives its weather information from the NWS or FAA sources.

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[7] Pan Am Reservation Service

PARS is a computer software system that allows Express I and II to customize their weather request to the weather provided by the NWS. It enables pilots, systems controllers, or customer service agents to obtain a computer weather package for destinations with very few computer keyboard key strokes.

Airport aeronautical data is provided through the Jeppesen Airways Manual for Express I and II. This subscription service is provided only to the Captains.

1.17.2 Crew Procedures

1.17.2.1 Crew Duties

The general operations manual for Express Airlines II, Inc., dated March 1,1993, contains the following excerpts:

4.20 Crew Duties/Procedures **(FAR 135.100)**

A. The Captain is responsible for the following duties:

1. Preflight Duties:

(g) At least one flight crewmember will be on board the aircraft with all prefight duties complete, 20 minutes prior to scheduled departure time in order to permit passenger boarding. If the Captain anticipates a delay due to mechanical, weather or ATC problems, he will inform the gate agent and request delay in boarding, if necessary.

2. Enroute Duties:

(c) Share enroute and terminal Jeppesen charts with the First Officer to ensure that he is fully briefed on the flight plan and approach.

B. The First Officer is responsible for the following duties:

1. **Preflight** Duties:

(1) Same as Captain's duties, except:

(a) On initial check-in, after ensuring that all crewmembers have reported for duty, or after reporting a late report to Crew Scheduling, proceed to the aircraft as soon as possible, review the aircraft maintenance log, and perform the aircraft preflight inspection.

2. Enroute Duties:

(1) Same as Captain's duties, except:

(a) To maximize fight efficiency and/or passenger comfort, he will offer suggested alternate courses of action that the Captain may not have considered.

(b) He will take an active role in suggesting to, or reminding the Captain of, checklist items to be completed.

...The First Officer will assist the Captain in the completion of his duties, will back him up, and will immediately bring to his attention any discrepancies or deviations from normal flight.

4.24 Pilot-in-Command Familiarity with Weather Conditions

No pilot-inamnand wiil begin a flight unless he is thoroughly familiar with reported and forecast weather conditions over the route to be flown..

4.26 Weather Reports and Forecasts **(FAR 135.213)**

Aeronautical weather data is collected from the NWS and disseminated to the crews through the PAWS [Pan Am Reservation Service] computerized weather service.

A. For IFR [instrument flight rules] operations, i.e., takeoff, approach, and landing, the visibility values contained in the weather reports are controlling. Any written or oral report of RVR [runway

visual range] or R W [runway visibility value], issued by the Control Tower for a specific runway, is controlling. (FAR 135.225)

4-31 Icing Conditions Limitations

B. No person will allow an Express aircraft to fly into severe icing conditions or icing conditions which adversely affect the safety of the flight

C. Reports of severe icing by Express Part 121 or Part 135 air carrier aircraft, or other aircraft of comparable size and equipment, shall be sufficient to suspend the use of that route until conditions change.

1.17.2.2 Approach Procedures

The standard operating practices manual for the BA-3180 for Express Airlines II Inc., dated January 1,1993, contained the following information:

3.10 Climb and Descent Crew Coordination

3.10.2 Description....

3. During descent, the PNF [pilot not flying] will call out altitudes as follows:

a. One thousand and three hundred feet above all assigned altitudes.

4. Prior to reaching initial approach segment, the PF [pilot flying] will conduct a comprehensive approach briefing, the PNF will review the approach with the PF, confiiing:

a. Approach facility to be used,

b. Minimum and mandatory altitudes,

c. Approach course,

d. Time for fix, as applicable,

e. Missed approach procedures, and

f. Airfield information.

5. The Inrange and Before Landing checklists will be completed, as appropriate.

6. During descent to initial approach altitude and/or during IFR and VFR approaches, the PNF shall call out altitudes and sink rates, as applicable.

NOTE: Sink rate should be called out any time it exceeds 1,000 fpm after reaching initial approach altitude.

a. 1,000 feet and *300* feet above each altitude assigned during the approach descent, including initial approach altitude.

b. 1,000 feet above field elevation (VFR approaches only).

c. Final fii inbound €or altimeter and instrument cross check and flap warnings. "FINAL FIX ALTITUDE ALIVE INSTRUMENT CROSS CHECK - NO FLAGS."

d. 500 feet above DH [decision height] or MDA [minimum descent altitude] for recheck of Item c above, and ensure Before Landing Checklist is completed except for final flap setting.

e. 500 feet above field elevation (VFR approaches only).

f. 100 feet above DH or MDA.

g. When executing a precision approach, "DECISION HEIGHT, RUNWAY IN SIGHT ___ O'CLOCK / RUNWAY IN SIGHT" shall be announced by the PNF. If the runway is not m sight or not in position to land the PF will call "Executing Missed Approach."

In the case of a non-precision approach, upon arrival at minimum descent altitude, the PNF shall announce "MDA," the PF shall announce "MAINTAINING MDA" and will do so until the PNF announces "FIELD IN SIGH?"' or until arrival at the missed approach point is confirmed by time, DME [distance measuring equipment], or other means. Upon arrival at the MAP without transition to visual references, the PF shall announce "EXECUTING MISSED APPROACH."

7. 1,000 feet per minute will be considered the maximum usable rate of descent inside the final approach fix. Excessive rates of descent shall be cause to abandon the approach.

8. Airspeed call outs will be made at any time the PF is not maintaining +/-10 knots outside the FAF, +10/-0 knots imide the FAF. Additionally, after the PF has transitioned to visual reference for landing, *the* PNF should monitor airspeeds to touchdown.

9. *On* precision approaches, the PNF will call "LOCALIZER ALIVE" when the localizer course is intercepted; when the glide slope is intercepted, the PNF will call "GLIDE SLOPE ALIVE." On nonprecision approaches, the PNF will call "COURSE ALIVE" when the final approach course is intercepted, the PNF will call one dot deviation from course centerline and/or one dot deviation from glide slope; the PF will correct the deviation and call "CORRECTING."

3.13 Nonprecision Straight In, Two Engine Approaches (Localizer Back Course/VOR/NDB Approaches)

Two engine nonprecision approaches, straight in, are presented in this section.

3.13.1 Localizer Back Course

To fly a typical localizer back course approach, set the course selector to the front course heading to ensure that the sensing of the lateral deviation bar in the course indicator will not be reversed.

The back course approach is a nonprecision approach and procedures on final are similar to other nonprecision approaches.

3.13.2 Objective

This maneuver affords practice in terminal area arrivals utilizing the localizer/VOR/NDB approaches for the final approach portion.

3.13.3 Description

NOTE: For procedures pertaining to circling or missed approach, refer to the appropriate section/chapter of this manual.

NOTE: For procedures pertaining *to* briefings and crew coordination, refer to the climb and descent crew coordination section of this manual.

The "Inrange" Checklist and approach briefing will be completed prior to reaching the initial approach fix. Maneuvering airspeed between the initial and final approach fix will be a minimum of V_{app} [approach speed] for aircraft weight- A thorough review and understanding of the approach and missed approach is absolutely essential, as a successful nonprecision approach quires maximum concentration and effort.

After intercepting the final approach course inbound, if not previously selected, call "SPEEDS 100%, SPEED CHECKS, FLAPS SELECTED 10"; flap position shall be confirmed by the PF. At the final approach inbound, the time should be noted by both pilots and the PF should call "GEAR DOWN." When the landing gear is down and locked, call "FLAPS 20."

The PF should then call for the Before Landing Checklist items to the box. During descents, the power should be reduced to maintain a descent rate of at least 1,000 fpm and an airspeed of 120 KIAS minimum, to the published MDA or step down fix. The PNF will make altitude calls in accordance with the procedures outlined in the briefings and crew coordination section.

When the aircraft is at the visual descent point, or in a position to make a normal visual descent, the PF should call for the "BOXED ITEMS." The power should be reduced (as required) to maintain a normal approach descent and transition to V_{ref}. (See figure 4).

1.17.3 FAA Surveillance

The following sections are interview summaries of the Express I and Express II POIs. The subject of the interviews was FAA surveillance.

An interview with the Express II POI revealed the following:

He said that he was not involved in the initial FAA certification of Express II. The Memphis FSDO approved the training program and the general operations manual. Express II has had no accidents, incidents, or violations and they have no exemptions to the FARs. The Express II certificate came to the Des Moines FSDO because its maintenance base was in Sioux City, Iowa. The Express 11 POI requested the POI position in July 1993 because he felt it would be good for his FAA career development. He is responsible for 24 other certificates.

To accomplish surveillance, he said that he drives to Mason City, Iowa, or Cedar Rapids, Iowa, to catch Express II flights. At the time of the accident, the POI said he had performed four en route inspections of Express II. He said that he was not aware that Express II pilots were making rapid descents to avoid spending time in icing conditions until he was advised of this problem by Safety Board investigators.

He had never visited the Minneapolis principal base of operation or personally met the DO. He believed that Express 11 management was helpful and cooperative, but stated that he has not observed any of their training. He said that he believed it to be acceptable to oversee training and operation from his remote base. He said that he depended on the geographic units of other FSDOs for direct oversight of these activities.

He did not know if the DO had a method of complying with his responsibility to monitor pilot training, given that such training is done away from Minneapolis and that the records are kept in Memphis. He was not aware that the captain of the accident airplane had failed a number of check rides or that the DO was unaware of this fact. He stated that he was familiar with guidance in the Air

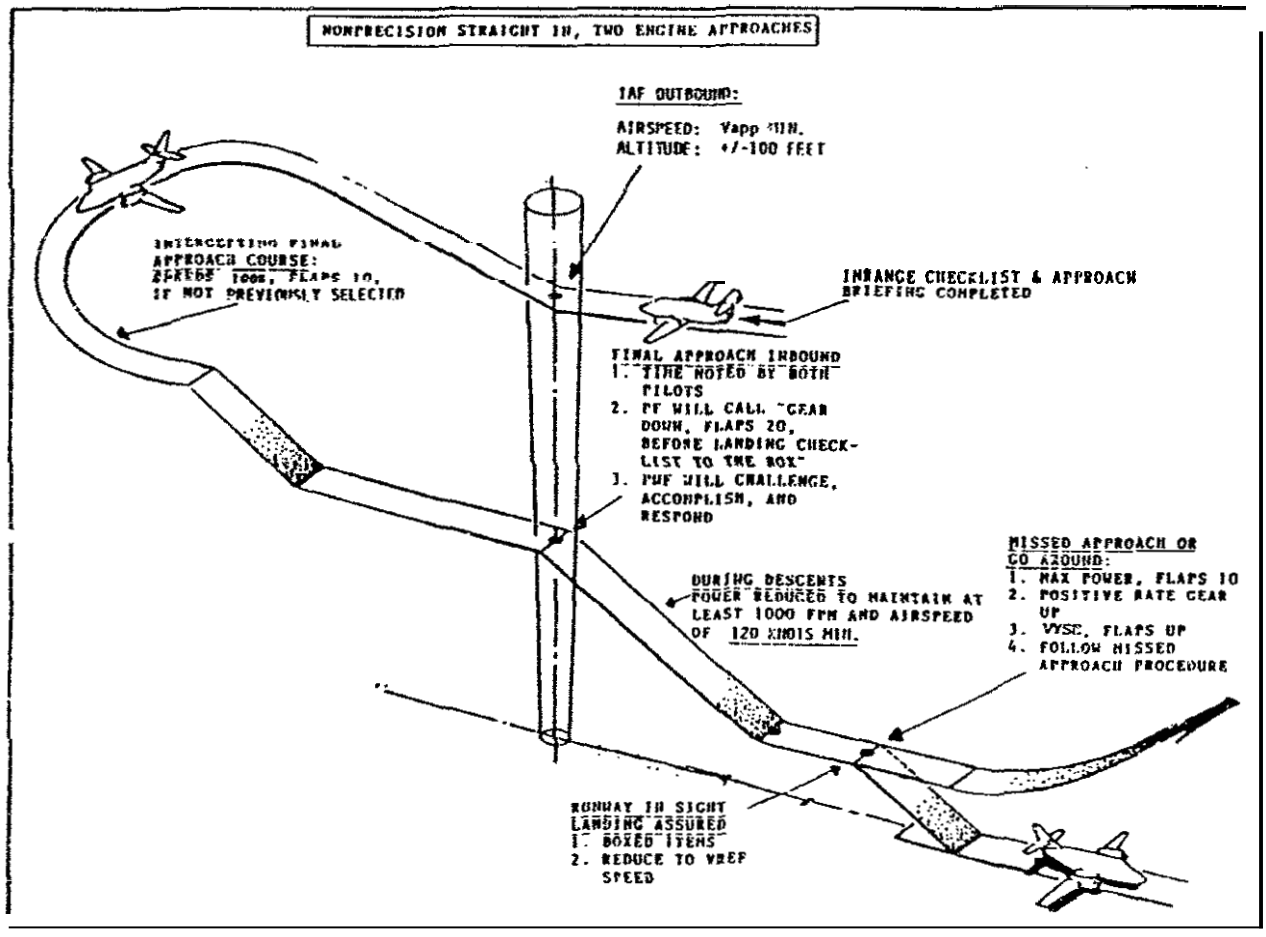

Figure 4.--Nonprecision straight in, two-engine approaches.
(From BA-3100 manual on standard operating practices)

Transportation Operations Inspector's Handbook, FAA Order 8400.10 and its bulletins.

The POI of Express II said that the Des Moines FSDO received Air Carrier Operations Bulletin (ACOB) 8-93-4 on November 6, 1993, and that he sent a copy of it to Express H.8 He could not recall the name of the person that he sent it to. He said that Express II had sent him a copy of an Express I and 11 Winter Operations Manual that showed they had followed the ACOB.

Express I is under contract to perform Express II's training and check rides. The POI for Express I designated all of the check airmen for both Express I and 11 on both the BA-3100 and the SF-340.

An interview with the Express I POI revealed the following:

He said that he spends a lot of time with each check airman to ensure that they understand their responsibilities. The POI said that there is an agreement between the two FAA offices (Memphis and Des Moines) and companies to keep the training standardized. When he was asked how he would coordinate with the Express 11 POI, to change training as indicated by an ACOB, the POI for Express I said that he would not contact the Express II POI because he "did not want to tell him how to run his certificate."

He stated that he performed surveillance on SF-340 simulator mining. Concerning icing training/checking in the SF-348, he said that he set up the simulator with conditions that were conducive to icing. He then observed whether the pilots took the appropriate action. He said that even though he approved training on the BA-3100, he was not familiar with the systems or icing characteristics.

The POI for Express I said that he believed that the management personnel from Express E were safety conscious and corrected things that he brought to their attention. Express I's last National Aviation Safety Inspection Program

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[8] The ACOB resulted from Safety Board safety recommendations for the following accidents: NFA Inc., dba United Express, Right 2415, a British Aerospace BA-3101 Jetstream, N410UE, Tri-cities Airport, Pasco, Washington, December 26, 1989 (NTSB/AAR-91/06); and CC Air British Aerospace BA-3101 Jetstream, N167PC, Beckley, West Virginia, January 20, 1991.

(NASIP) examination was in 1989. There were only two operational findings. One was a violation of one pilot's flight/duty time, and the other was a mistake in weight and balance calculations caused by Express I maintenance providing operations with an incorrect aircraft basic operating weight.

The POI for Express I was asked if he was familiar with ACOB 8-93-4 and he said "no." He said that he felt overloaded with FAA information. He couldn't remember if he sent the carrier a copy of this ACOB. He said that he might have done so. A copy of the ACOB was provided to him, and he was asked how he would implement the paragraphs that began with "The POI shall determine...." The POI for Express I said that he would do so by giving the ACOB to the carrier.

1.17.3.1 FAA Air Carrier Certification

The FAA has both a FSDO and a CMO in Minneapolis, Minnesota. The CMO holds certificate responsibility for Northwest Airlines and other 14 CFR 121 air carriers. The FSDB holds certificate responsibility for many 14 CFR 135 air carriers, flight schools, repair stations, mechanic's schools, and various airmen certification functions. Both offices have managers and unit supervisors.

Express II approached the Minneapolis CMO for certification of Express II in early 1992. The manager of the Minneapolis CMO declined the certification in a letter dated June 12,1992 stating:

> **A.** Inspectors of the Minneapolis CMO would not have the necessary access to all management personnel, and their staff personnel, who are in positions to make decisions regarding maintenance, operations, training, quality control, etc....
>
> **B.** Effective regulatory oversight of Express Airlines II by the Minneapolis CMO would not be possible with the principal base of operations and principal business offices located in Memphis, Tennessee, and half the maintenance organization in Sioux City, Iowa.

Express II became certificated by the Memphis FSDO in April 1993 and transferred the certificate to the Des Moines FSDO in June or July 1993. The Memphis FSDO is the responsibility of the FAA's Southern Region, the Minneapolis

CMO is that of the FAA's Great Lakes Region, and the Des Moines FSDO is that of the FAA's Central Region.

The Air Carrier Operations Inspector's Handbook, Vol. 2, Chapter 1, Section 3, is entitled Assignment of Responsibilities for Part 121 and Part 135 Certificates and Certification Projects. Paragraph 27 states, in part, "Regional Flight Standards Divisions are in the best position to know the capabilities of their district offices and assigned personnel. Consequently, Regional Flight Standards Divisions must be responsible for assigning certification projects and certificate holding responsibilities to district offices."

The FAA's Southern, Great Lakes, and Central Regional Flight Standards Managers were asked the following questions by Safety Board investigators:

> Did the Regional FSDO become involved with assignment of the certification project or assignment of Express II certificate holding responsibilities? Did the Regional Office make an assessment of Express II's operation to determine that the assigned district office was the best suited to fulfill certificate responsibilities? What factors were considered?

The FAA's Southern and Central Regional night Standards Division Managers responded by drafting letters of reply that addressed the questions asked.

The AGE-260 division of the Great Lakes Region, Des Plaines, Illinois, initially answered the Safety Boards inquiry by faxing a copy of the Minneapolis CMO's letter chat denied Express II certification. Eater, the Great Lakes Regional manager sent a letter to the Safety Board that stated that there had been coordination between the Minneapolis CMO and the Southern Region night Standards Division during the certification project to assign Express II's certificate to the Des Moines FSDO.

Express II's principal base of operation, listed in its FAA-approved operations specification, is Minneapolis, Minnesota. Air Carrier Operations Inspector's Handbook, Vol. 2, Chapter I, Section 3, paragraph 29, is entitled Principal Base of Operations. It states, in part, "When designating a principal base of operations, the prospective certificate holder's or existing certificate holder's needs and recommendations should be carefully considered. The final decision,

however, is the responsibility of the FAA. The district office having responsibility for the geographic area in which the principal base of operations is located shall be assigned certificate holding district office (CHDO) responsibility."

1.17.4 Ground Proximity Warning System (GPWS)

A GPWS provides alerts and warnings to the flightcrew for inadvertent flight into terrain. Various warning modes are available, based on airplane configuration and phase of flight. The accident airplane was not equipped with a GPWS nor was it equipped with a radio altimeter.

As a result of numerous accidents and resulting Safety Board recommendations, the FAA required, through 14 CFR 135,153, that all turbine-powered airplanes with 10 or more seats be equipped with the Administrator-approved GPWS by April 20, 1994. Express I. was in the process of equipping its airplanes with the GPWS at the time of the accident.

A GPWS computer simulation was performed using Sundstrand[9] software to determine if GPWS warnings would have been provided to the crew. The simulation required information related to airplane configuration, airplane speed and flightpath, and terrain elevation data along the route of flight.

The GPWS simulation results indicdte that if the accident airplane had been equipped with a radio altimeter and typical commuter airplane GPWS (such as the Sundstrand MK-VI), the crew would have received a GPWS Mode I "SINK RATE' aural (via cockpit public address system) and visual (via GPWS alert lamp) warning starting approximately 33 seconds prior to the impact with terrain. The airplane would have been at approximately 2,600 feet msl, 1,120 agl and descending at 3,000 fpm. The Mode 1 "SINK RATE" warning would have continued for approximately 12 seconds (until around 2,100 feet msl, or just above the 2,040-foot step down altitude), at which time the crew would have received an urgent GPWS Mode 1 "PULL UP" warning. The Mode 1 "PULL UP' warning is the "urgent" decibel level.[10] The Mode 1 urgent "PULL UP" warning would have continued for approximately 15 seconds, until around 1,550 feet msl, which is just about the point at which the right propeller severed the top of the first evergreen tree.

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[9] Sundstrand is one manufacturer of GPWS equipment,

[10] The Mode 2 "PULL UP' warning is less urgent.

1.17.5 Tailplane Icing

The Safety Board has investigated two BAe Jetstream BA-3101 accidents[11] in which tailplane icing was suspected to have resulted in loss of control during the final approach to landing. On July 22, 1992, the Safety Board issued Safety Recommendations A-92-60 and A-90-62 addressing tailplane icing. A-92-60 recommended that operators be alerted to the danger of unanticipated and abrupt tailplane stall during changes in **flap** configurations as a result of horizontal stabilizer ice accumulations. A-92-62 recommended that the manufacturer further test an approved modification limiting flap deflections to 35 degrees.

In the Beckley accident, the airplane was operating in icing conditions. The pilot recalled that he was at 130 knots indicated airspeed **(KIAS)** when the first officer selected 50 degrees of flaps. The airplane buffeted and pitched into a steep dive. Aerodynamic theory show that high flap settings and high speeds produce large negative angles of attack (AOAs) on the horizontal tail surfaces. Right tests have shown that, with ice present on the leading edge of the horizontal tail, the high negative AOAs may result in tailplane stall. Airframe buffet, forward control column forces, and sudden nose-down pitch attitudes may develop if the tailplane stalls.

Jetstream 31 airplanes have encountered tailplane stall when the airplane was operating at above **130** KIAS and 50 degrees of flaps were selected. As a result of the accidents, the flap extensions of Jetstream **31** airplanes were limited to 20 degrees when ice was visible on any part of the airplane. The limitation could **be** lifted if modification kits were installed that limited flap extensions to 35 degrees.

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[11] *See* footnote number **8.**

2. ANALYSIS

21 General

The flightcrew was properly certificated and qualified in accordance with applicable regulations to conduct the flight. The captain had a substantial amount of experience in the aircraft and in the type of flight conditions that existed at the time of the accident.

The airplane was properly certificated and had been maintained in accordance with the company's and FAA requirements. There was no evidence of any mechanical failures of the structure, systems, or engines that contributed to the accident.

Air traffic control services provided to the flight were appropriate and did not contribute to the cause of the accident.

Although the cloud ceiling was near minimums and ice may have accumulated on the airframe, the conditions were substantially as forecast and should nor have presented any significant difficulties to the flightcrew during the approach and anticipated landing.

The evidence indicates that the captain of flight 5719 delayed initiating the descent. This action created the need for a very steep rate of descent to complete the approach. The steep descent rate was continued past the FAF at a value of more than twice the maximum specified by the airline procedures. The high rate of descent was not arrested by the captain, and the airplane passed through the step down fix altitude and MDA and crashed well short of the airport.

The circumstances of this accident indicate that the flightcrew experienced a loss of altitude awareness that led to a controlled collision with terrain. Consequently., the investigation focused on why the airplane was operated at a high rate of descent, why it descended through minimum altitudes, and why critical altitude call outs were not made. Flightcrew mining, flight standards, and crew resource management (CRM) were also examined. Lastly, oversight cf line operations by Express II and the FAA were evaluated.

2.2 The Approach

Although ATC cleared the flight for the ILS precision approach to runway **31,** the evidence showed that the crew initiated an IFR nonprecision back course localizer approach to runway **13** because of a restriction against landing with a tail wind on a contaminated runway. The airplane manufacturer had advised by bulletin that the airplane not be landed with a tail wind when the runway **is** covered with precipitation.

The approach to runway i3 was initiated from the southwest on a clockwise, 20 mile distance measuring equipment (DME) arc at about 8,000 feet msl. The airplane intercepted the runway **13** localizer and then descended from 8,000 feet **msl** down to **1,800** feet msl at vertical speeds between 2,000 and 3,000 fpm and an average flightpath angle of about 8.3 degrees down. During **this** time, the airplane passed the **FAF** about 1,200 feet above the minimum altitude of **3,500** feet. Within the next 2.5 nmi, the airplane descended below the subsequent 2,040-foot step down fix altitude.

The airplane's rate of descent and downward flightpath angle were significantly decreased after **it** passed through 1,800 feet msl (the last radar hit) and the **point** where it impacted the stand of trees that severed the right wing section. The change in flightpath indicates that the flightcrew was applying nose-up elevator and that the airplane was responding in a positive manner. The tree strikes, where the right wing was severed, and the final impact point were perceptible on the CVR. The timing and distances were consistent with an impact speed of about 120 knots. Although the captain apparently decreased the rate of descent between **1,800** feet and the point where trees were struck, there was no indication of this recorded on the **CVR.**

The reported ceiling was 400 feet agl, and the MDA was 428 feet agl. Twenty minutes before the accident, the captain told the first officer that it would be a "tight" approach. Forty-five seconds later, after taking with air traffic control, he briefed the approach. In doing so, he associated the DME distances with the FAF altitude, an intermediate minimum altitude associated with the step down fix and the MDA. He stated the **MDA** three times during the briefing, Fwice in MSL and once in AGL, suggesting that he was fully aware of its value before initiating the approach.

The FAF, a step down fix, the missed approach point (MAP), and the visual descent point (VDP) were all identified by DME values on the approach chart. It was estabtished through CVR information that the aircraft had an operable DME, yet the aircraft continued to descend and crashed 0.98 mile outside the 10 DME fix, 2.89 miles from the threshold of runway 13.

2.3 Airframe Ice

The Safety Board considered whether airframe icing might have contributed to the descent of the airplane through the step down fix altitude and the subsequent crash. Conditions at the time of the accident, with visible moisture present from the surface to 8,000 feet and a ground level temperature of 29° F, could have caused ice to accumulate on the airplane at a moderate rate. However, evidence does not indicate that the airplane accumulated sufficient ice *to* have led *to* the accident.

The configuration and performance of the airplane, the on-scene examination of the wreckage, and the CVR transcript indicate that neither tailplane icing nor wing icing, nor other forms of aircraft icing directly contributed to the accident. Tailplane icing is characterized by an uncommanded pitchover at high speeds and high flap settings, usually just after increasing the flap setting or commanding a nose-down pitch. The flaps were set at an intermediate 20-degree setting, the airspeed was appropriate for the configuration, about 120 tu 130 knots, the rate of descent was substantially decreasing, indicating elevator/horizontal stabilizer effectiveness, and the CVR provided no indication of forward stick forces or loss of pitch control. Wing icing is characterized by positive stall at speeds higher than clean wing stall speed. Other forms of icing, such as pitot/static system and engine icing, are characterized by unusual fluctuation in altitude and airspeed values and loss of engine performance. Airplane performance data and the CVR indicated normal functioning of the airplane. Consequently, the Safety Board ruled out airframe icing as a factor in the accident.

2.4 Pilot Actions

2.4.1 High Descent Rates on Approach

The reports of light to moderate icing conditions in the clouds around Hibbing appear *to* have influenced the captain's decision to stay abc.. the clouds. and above icing conditions, until he was closer to the airport. The captain's

probable intention was to descend at higher than normal rates of speed to minimize the time in icing conditions. The investigation revealed that this inappropriate practice was widely used within the airline and probably at other airlines.

Although the BA-3100 is certificated for continued operation into known icing conditions, all of the Express II pilots interviewed indicated that it was common practice for them to descend rapidly though icing conditions. This procedure was contrary to the manufacturer's and Express II's guidance and violated the concept of flying stabilized approaches.

In this case, the initial approach fix was at 20 DME on the 251 degree radial from the Hibbing VOR. After turning inbound and intercepting the localizer, the airplane descended at an average vertical speed of 2,250 fpm and continued at this rate inside the FAF. This action was nor in compliance with Express II guidance contained in the standard operating procedures and the FAA-approved training program.

The Climb and Descent Crew Coordination guidance, contained in Express II's manual, progressively describes the duties of the flying and nonflying pilots from the top of the descent to the runway-in-sight or missed approach point. It states that during descents. the pilot not flying (PNF) will call out 1,000 feet and 300 feet above all assigned altitudes. This guidance further states: "Sink rate should be called out any time it exceeds 1,000 fpm after reaching initial approach altitude." In order to adhere to the 1,000-fpm maximum descent rates established by Express II's guidance, the crew would have had to descend to 6,400 feet msl or lower once on the 20-DME arc prior to intercepting the localizer and initiating their descent.

The Climb and Descent Crew Coordination section further requires the PNF to call out 500 feet and 100 feet above DH or MDA. The MDA for the approach was 1,780 feet, although at the position where the airplane struck the ground, the minimum altitude was 2,040 feet. When they were interviewed, Express II pilots expressed some confusion concerning callouts for this approach because an intermediate step down altitude inside the FAF is not addressed in the Descent Crew Coordination section of the guidance. They were unsure whether the PNF should have called 500 feet and 100 feet, or 300 feet, above the 2,040-foot step down altitude. or above the MDA. in this accident, however, the PNF made none of these calls. Nor did he call out the MDA altitude when the airplane passed through it.

The Climb and Descent Crew Coordination section clearly states:

> 1,000 feet per minute will be considered the maximum usable rate of descent inside the final approach fix. Excessive rates of descent shall be cause to abandon the approach.

However, the guidance that Express Airlines provided to its pilots in the Nonprecision Straight In Two Engine Approach section of the Standard Operating Procedures and the FAA-approved training program conflicts with the above statement. It states:

> During descents, the power should be reduced to maintain a descent rate of *at least* 1,000 fpm...(emphasis added).

Since the accident, Express Airlines has revised this guidance by deleting the words "at least."

The Safety Board believes that the guidance to maintain at least 1,000 fpm was probably intended to permit pilots to expedite their descents during progressive step down nonprecision approaches so that they would reach the MDA in a position to assure visual acquisition of the airport environment while at a distance from where a normal final approach path could be established. However, the Safety Board notes that a rate of descent in excess of 1,000 fpm is not necessary in order to adhere to the step down profile for the Hibbing localizer (back. course) runway 13 approach. Additionally, the use of an excessive descent rate increases the pilots' workload and increases the possibility that a proper level off altitude will be missed.

Even though there was conflict between the two sections in the manual. the strongly worded Climb and Descent Crew Coordination statement that specified both 1,000 fpm as the maximum, and that excessive descent rates are a reason to abandon the approach, should have prompted the flightcrew to favor this guidance over the other. Nonetheless, when the captain continued to descend in excess of 2,000 fpm inside the FAF, the first officer did not remind the captain of the excessive descent rate, nor did he call for him to execute a missed approach, or otherwise act in an assertive manner.

The Safety Board believes that the captain was not confident that the airplane could safely encounter icing conditions and developed his own procedure to

minimize the time in icing conditions by flying at an excessive descent rate. The captain failed to consider the consequences of such actions and further did not take appropriate precautions during the descent. Once the decision was made to fly at the excessive descent rate, the flightcrew should have carefully and consistently monitored the altitude. The investigation found that there were serious deficiencies in the flightcrew's operating practices and their failure to monitor altitude was a primary reason for the accident. Consequently, the Safety Board believes that the FAA should direct its POIs to reemphasize the need to adhere to proper descent rates during instrument approaches; specifically, to restrict the descent rate to a maximum of 1,000 fpm inside the final approach fix.

2.4.2 Performance History of the Captain

The investigation revealed that the captain had failed three proficiency check flights. In those checks, his judgment was fisted as unsatisfactory. Two of these flight evaluation writeups fisted his crew coordination as unsatisfactory. These unsatisfactory check flights occurred at 6 months. 15 months, and 5 years prior to the accident.

In addition to the deficiencies noted OR these check rides, there were apparent problems concerning the captain's demonstration of crew coordination during his training after he had flown as a BA-3100 captain and transitioned to an SF-330 captain in 1989. One instructor said that the captain appeared to be receptive to crew coordination mining, bur the instructor also stated that he was not sure whether this was to "cooperate and graduate" or whether he would continue to use the crew coordination that he hsd been taught.

The captain was described as being angry with the company. Although he had been with Express II for more than 6 years, he had to give up his captain's position on the larger SF-340, as well as 12 percent of his salary, and fly the BA-3100 in order to remain based in Minneapolis. He was described as highly intelligent, but five of six pilots interviewed who had flown as his first officer said that they were intimidated by him. His fellow pilots said that he operated by the book, but the failed check rides and evidence from the accident flight showed that not to be the case. His personnel file showed that he violated the company's policies on sexual harassment, sleeping in flight, and flying with mechanical irregularities. One first officer described being struck by this captain when he had mistakenly left the intercom on. This first officer had described this experience to the first officer of the accident flight.

The captain, as pilot-in-command, had the responsibility to foster and maintain effective crew coordination. His earlier unsuccessful proficiency checks and difficulty in training, as well as his other disciplinary history, showed a behavior pattern that was also evident in his substandard performance during the time leading up to the accident. Therefore, the Safety Board concludes that the captain's poor attitude and lack of adherence to standard operating procedures were major factors in the cause of the accident.

2.4.3 Inaction of the First Officer

The first officer did not make the required company callout that the rate of descent was greater than 1,000 fpm after crossing either the initial or final approach fixes. He made the standard callout when they crossed the FAF and called "one to *go*" about 1,000 feet above the 2,040-foot step down fix altitude. Radar data show that the airplane was at 12.3 DME and 3,000 feet when the "one to *go*" call was made. The crew should then have maintained 2,040 feet or greater until reaching the 10 DME fix. The first officer did state "2,040 to ten point oh' after he said "one to go." He did not make the standard company call for 500 or 100 feet above 2,040 feet or call out that they had descended below this altitude before the 10 DME fix. Further, he did not alert the captain about their descenr below the MDA, probably because he was performing other duties, as directed by the captain.

The first officer was a recently hired probationary employee who had just spent $8,500 of his own money *to* be trained for a job that provided an annual earning potential of $18,000. His flying skills, knowledge of the aircraft, and knowledge of Express II were *described* as *excellent* by both *captains* and check airmen. Customer service agents, ramp service agents, and pilots who were interviewed remarked about his positive attitude. He was said to have described Express II as his "dream job." The first officer stated in his Express II employment applicatcn "Ail my previous employers will state that I am a hard working, very dependable employee who takes pride in the company he works for and hopes for *its success.*"

The evidence suggests that the first officer, because of his probationary status and the captain s intimidating reputation. may have been reluctant *to* challenge the captain's decision to perform the approach in a manner contrary to Express II's guidance or to call out the need to execute a missed approach. Moreover, given his career *aspirations and* the *extent* to which *he* endeavored to achieve those aspirations. the first officer may have perceived that challenging the judgment of

such a captain could indeed jeopardize his career with the airline. In addition, the captain's directing him to key the microphone to switch on the lights while they were approaching an altitude limit interfered with the first officer's ability to monitor the descent. Nevertheless, Express II procedures were definitive in the callouts required of nonflying pilots. Had he made them, despite the reputation of the captain and his own probationary status, his actions would have been consistent with company expectations of a nonflying pilot and a probationary f i t officer. As a result, the Safety Board believes that his inaction with regard to callouts contributed to the breakdown in crew coordination that led to the accident.

2.4.4 Approach Briefing

The captain's approach briefing contained all of the items required by Express Airlines standard operating procedures but it did not cover expectations for handling deviations from standard operating procedures. Additionally, the captain did not specify how he expected the first officer to set up the DME, the navigational radios, the VOR lead-in radial, or when the first officer was to select the CTAF and turn on the runway lights.

Had the captain briefed the first officer on his expectations, it would have eliminated the captain's need to provide the first officer with the continuous instructions that are apparent in the CVR transcript. Further, if the captain had explained his intentions more clearly, the first officer would have been better prepared to assist during the approach. This would have reduced the captain's workload. Knowing what the captain expected of him would have allowed the first officer to be proactive rather than reactive.

Although the CVR transcript showed that the captain briefed "top of the approach is three thousand five hundred to[till] we're established...inbound on the approach at which point we still maintain three thousand five hundred to K i y intersection...," he did not fly according to this plan. Rather, 11 minutes after the briefing, the first officer asked the captain whether he intended to "stay up here," apparently questioning the delayed initiation of the descent. The captain responded in the affirmative, joined the localizer at 8,000 feet, and crossed Kinny at 4,700 feet, 1,200 feet higher than briefed. The Safety Board concludes that the captain's deviation from standard procedures and from his prebriefed intention left the first officer "out of the loop" and further contributed to the lack of crew coordination.

2.4.5 Crew Coordination

Express Airlines provides approach charts to captains only. After briefing the approach, the captain told the first officer to place the approach plate on his clip board and furnish him with information when he needed it. When the first officer called "one to go" the captain questioned "to what alt[itude]?-to twenty forty ...okay." The question suggested that he may have been confused about the airplane's altitude. Additionally, the question indicated that the captain did not have the approach chart in front of him. He needed the first officer to guide him through the approach.

The Safety Board believes that the practice of having only one set of approach charts available in the airplane is not in the best interests of flight safety. The Safety Board previously addressed this issue in its investigation of the accident involving Bar Harbor Airlines flight 1808.[12] As a result of that investigation, on October 9, 1986, the Safety Board issued Safety Recommendation A-86-106, which asked the FAA to:

> Amend 14 CFR 135.83 to require that all required crewmembers have access to and use their own set of pertinent instrument approach charts.

In its reply of September 15, 1987, the FAA stated that it believed that a second set of charts would not serve to improve cockpit efficiency. In response to the recommendation, the FAA issued a bulletin that directed all POIs to ensure that flight crewmembers receive initial and recurrent training on the crew concept with respect to the use of pertinent instrument approach charts and crew briefings prior to all approaches. The Safety Board found that there was considerable merit in the FAA's bulletin to improve crew coordination during instrument approaches. However, the Safety Board found that such a bulletin would not provide the same safety benefits as each pilot having access and use of his own *set* of approach charts. Therefore, on November 27, 1987, the Safety Board classified Safety Recommendation A-86-106 "Closed--Unacceptable Action."

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[12] See Aircraft Accident Report--"Bar Harbor Airlines, Right 1808, Beechcraft B-99, N30WP, Auburn-Lewiston Airport, Auburn, Maine, August 25, 1985" (NTSB/AAR 86/06)

The Safety Board again addressed this issue in its investigation of the accident involving GP Express Airlines flight 861.[13] As a result of that investigation, on Aprii 2,1993, the Safety Board issued Safety Recommendation A-93-35, which asked the FAA to:

> Require that all pilots operating aircraft under 14 CFR 135 have access to their own set of instrument approach charts.

In its reply of June 16, 1993, the FAA agreed that both pilots should have access to an approach chart during the instrument approach, but that this can be accomplished either by both pilots having their own set of approach charts or by both pilots having immediate access and use of a shared approach chart. The Safety Board continues to believe that the FAA is still not addressing the intent of this safety recommendation, and that the practice of having only one set of approach charts available in the airplane is not in the best interest of aviation safety. Therefore, on November 19, 1993, the Safety Board classified Safety Recommendation A-93-35 "Open--Unacceptable Response" and asked the FAA to reconsider its position.

Based on the events that led to the accident involving Express Airlines II, flight 5719, the Safety Board reiterates Safety Recommendation A-93-35.

The BA-3100 does not have an altitude alert system with an aural warning. Therefore, the nonflying pilot, in this case the first officer, becomes the altitude alert system. The first officer called the "one *to* go" alert. Despite the confusion expressed by the captain at the "one to go" call, he did not immediately reduce the rate of descent. Instead, the captain gave the first officer a task that distracted both of them from altitude monitoring duties--selecting the CTAF frequency and keying the microphone to turn on the runway lights.

This task should have been covered in the approach briefing and should have been accomplished much earlier in the approach. The Safety Board concludes that the captain's actions of instructing the first officer to perform functions to turn on the runway lights late in the approach distracted the first officer from his duties of monitoring the approach, and caused the captain to become distracted at a critical

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[13] See Aircraft Accident Report--"GP Express Airlines, Inc., Flight 861, Beechcraft C99, N118GP, Anniston, Alabama, June 8, 1992" (NTSB/AAR-93/03)

phase of the approach. These actions are manifestations of poor judgment and poor crew coordination on the part of the captain.

Before they began to descend, Duluth approach control gave flight 5719 the most recent weather report available for Hibbing but did not tell them exactly when the observation was made. The captain told the first officer to call the Hibbing station and advise that they were in range and would need fuel. After the first officer had done so, the captain asked him if the Hibbing station had given him weather information. The CVR dearly showed that Hibbing had not provided him with such information; however, after a 3-second pause, the first officer told the captain that Hibbing had given him weather information.

The CVR transcript showed that most of the captain's communication with the first officer was either to correct him or to tell him what to do. The captain told the first officer how to put the approach plate into the yoke clip, how to set up the radios, how to put the altitude on the standby frequency of the ADF, how to call the station, and when to do the checklist. Qthers who had flown with this first officer indicated that he performed these routine pilot duties without difficulty. At the time the airplane began to collide with the trees, the captain was telling the first officer how to accomplish a task common to m y of the airports they utilized: that was to key the microphone to turn on the runway lights.

The statements of the first officer on the CVR suggest a tense and almost reserved attitude toward the captain. Information provided by the first officer to the captain was couched in a questisning manner rather than as an assertion. He mentioned where the airplane was supposed *to* stop descending on the flightpath but did not assert concerns. In contrast, the actions of the captain, as recorded on the CVR, indicate an aggressive, less than receptive tone that resulted in his improper management of the flight.

In conclusion, the actions of the captain led to a steep approach and distractions of the f i t officer from his primary tasks at a critical phase of the approach. His actions also led to a breakdown of crew coordination. As a result, the pilots experienced a loss of altitude awareness and failed to correct the situation before ground contact was made. The Safety Board believes that these events were fostered by the captain's poor airmanship and poor interpersonal skills.

14 CFR 135 does not currently require CRM training, but Express II did include it in its FAA-approved training program. However, this training

consisted largely of a handout and a discussion of accidents that involved other air carriers. The training did not provide for interaction of the crewmembers as described in AC 120-51A Crew Resource Management Training.

The Safety Board first addressed the subject of CRM training for Part 135 operators in Safety Recommendation A-90-135, issued on November 21, 1990, in connection with its investigation of an accident involving an Aloha IslandAir DHC-6 that crashed in Hawaii on October 28, 1989.[14] In correspondence between the Safety Board and the FAA regarding A-90-135, the FAA has expressed plans to require Part 135 operators to follow Part 121 regulations for CRM training, once the requirements for Part 121 operators Rave been established. The Safety Board has classified A-90-135 "Opes-Acceptable Action," pending the adoption of the final rules.

2.5 Oversight by Express II

The pilot training provided by Express II met all applicable FAA requirements. Although Express II had begun training its newly hired pilots at Flight Safety International, Inc., the captain had been exclusively trained by Express Airlines.

Express II's general operations manual clearly outlines the duties and responsibilities of the DO. He is responsible for monitoring pilot training and training records. The DO worked at the principal base of operations in Minneapolis. The training records were kept in Memphis. When interviewed, the DO stated that he had nor set up a method for accomplishing the task of monitoring pilot training. and he was unaware of the captain's training history.

Notwithstanding the lack of a structured program for monitoring pilot performance, the evidence indicates that the captain's record and performance history with Express II should have been well known to all personnel involved in the company's oversight of its pilots. The record includes:

- o Multiple check ride failures,

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[14] See Aircraft Accident Report--"Aloha IslandAir, Inc., Flight 1712, De Havilland Twin Otter, DHC-6-300, N707PV, Halawa Point, Molokai, Hawaii, October 28, 1989" (NTSB/AAR 90/05)

- Difficulties during transition and upgrade training,
- Letters of complaint and reprimand for his behavior toward company employees,
- Allegation of sexual harassment toward female employees, and
- A reputation among first officers as an intimidating captain.

Given the nature of the evidence regarding the captain, his piloting abilities and his behavior both in and out of the cockpit, the Safety Board believes that, at a minimum, Express II should have monitored the captain more closely. Such monitoring could have included additional observational flights by management pilots, and a more intense scrutiny of his behavior toward first officers. The record indicates that these actions were not taken, and that the company management did not provide additional oversight of the captain.

The nature of the captain's directions toward the first officer during the accident flight, as indicated by the CVR, illustrates the type of intimidating behavior that company first officers had previously recognized and discussed among themselves. He directed the first officer using minimal expianations, and provided little if any insight into the way in which he would conduct the approach. Further, he distracted the first officer from performing his duties during a critical phase of flight with duties that should have been performed earlier. This distraction directly led to the first officer's failure to monitor the captain's approach.

The captain was a "reserve" pilot, which meant that he was assigned trips when other captains were unavailable. The nature of the reserve position meant that he frequently flew with junior fit officers who were also on reserve status. Some of the other first officers the captain flew with were also on probation because they were newly hired. Unsatisfactory performance reports from captains could impact a first officer's ability to retain his job. In light of these circumstances, it is difficult to understand what the DO expected to hear from first officers about the captain when he stated, "His CRM must have been pretty good because nobody said anything to the contrary."

Yet the DO said he was unaware of problems with the captain, even though he had frequently counseled the captain for personal problems. These

problems included the captain's conduct, sexual harassment, and his disagreements with crew scheduling personnel and maintenance personnel.

A captain's CRM performance can be observed on a line check. The DO's verbal policy toward line check rides was that he encouraged the check airman to displace the first officer and fly the entire day with the captain. This is an excellent method of determining a captain's ability to fly the airplane. However, the check airman has the authority to ground the captain; therefore, the captain may treat the check airman in a more deferential manner than he would a line first officer. Conduct of a check ride without a line first officer may not give a check airman an accurate picture of how the captain fosters and maintains effective crew coordination.

The check airman who had performed the captain's line check, which occurred within 2 months of the accident, occupied the right seat to accomplish the check ride. He found the captain's performance satisfactory, but stated "his attitude bothered me."

The CP said that he knew that the captain had difficulties dealing with people. He had counseled the captain for problems with mechanics. He had heard complaints about the captain but they were related to getting along with him. No one complained about his technical competence as a pilot.

Both the DO and the CP were rightfully focused on competence. However, the BA-3100 is certificated for two pilots and Express II operations are predicated on two pilots working together effectively as a single flightcrew to operate each airplane safely. If a competent pilot cannot coordinate with the other required pilot, safety is likely to be compromised, as it was in this accident. The statements and actions of Express II's managers suggest that they did not fully recognize the implications of this concept, nor did they ensure that their flightcrews adhere to it.

Express Airlines FAA-approved check airmen training program lists "detection of personal characteristics that could adversely affect safety" as a learning element. This *training* is a requirement of 14 CFR 135.339. The FAA *Air* Transportation Inspector's Handbook, FAA Order 8400.10, further requires "CRM principles and techniques, including identification of personal characteristics that could adversely affect safety." This CRM training was not included in Express Airlines FAA-approved check airman training.

The check airman who conducted the captain's last line check and the DO (who was also a check airman) had both attended Express Airlines check airman mining. The check airman expressed concern about the captain's attitude. The DO described numerous difficulties with the captain that were related to his ability to get along with other people. The fact that these management pilots allowed the captain to continue to fly without taking appropriate remedial actions indicates that they did not evaluate the extent to which the caprain's personal characteristics could adversely affect safety or his ability to manage his crew resources adequately.

The facts and circumstances surrounding this accident suggest a captain with weak piloting abilities, little appreciation for CRM, and an intimidating and overbearing demeanor toward junior flight crewmembers. These traits should have been identified by the company and acted upon. Because of the company's failure to do so, they allowed this captain to continue to act as pilot in command, despite considerable evidence questioning his competence in that role. Consequently, the Safety Board concludes that the failure of Express II's management to monitor and act upon the captain's deficiencies as a pilot contributed to the cause of the accident.

2.6 FAA Oversight

The Safety Board found several deficiencies in the oversight of Express II by the FAA. These deficiencies pertain to the FAA-approved training program and the geographic location of the FSDO and the POI overseeing Express II's flight operations. Additionally, the dissemination of safety information contained in ACOB 8-93-4, related to airframe icing, was deficient.

2.6.1 FAA-Approved Training Program

The current FAA Air Transportation inspector's Handbook, FAA Order 8400.10, contains a single paragraph on evaluation of an operator's training program with little qualitative information. It contains no guidance whatsoever for FAA inspectors or POI surveillance of contract training of 14 CFR 135 flightcrews that are not employed by the air carrier until *after* they pass their check rides. The Safety Board believes that specific guidance for such programs should be developed and incorporated into FAA Order 8400.10.

The FAA-approved Express II training program is virtually identical to Express I's training program. The certification of Express II and the FAA approval of its training program was accomplished by personnel from the Memphis FSDO, including the POI for Express I.

Although the current regulations do not require that pilots operating under 14 CFR 135 be trained in CRM, the Express I POI did include limited CRM training in the Express Airlines FAA-approved mining program for captains arid fiit officers. However, CRM principles and techniques were not included as a training element in the FAA-approved check airman program as required by FAA Order 8400.10. The *purpose* of such training for check airmen is *to* give them the insight to be able to identify and correct poor CRM traits of pilots they ckeck. Without that insight, the check airmen may not be prepared to critique abnormal CRM, such as exhibited by the captain of the accident flight.

Both the Express I and Express II training programs contained "Nonprecision Straight In Two Engine Approach" sections. These training programs were approved by the FAA with sections that contained the statements "During descents, the power should be reduced to maintain a descent rate of at least 1000 fpm." (emphasis added) *This* statement conflicts with the stabilized approach concept, as defined in the FAA's Air Transportation Inspector's Handbook, FAA Order 8400.10. This conflict was not identified by the Express I or Express II POIs, and it was not rectified until the accident investigation brought it to light.

The Express I POI had been responsible for the operator's certificate since. 1984. In 1988, he failed to satisfactorily complete BA-3100 type rating school. This individual failed the systems ground school twice. Further, as of the date of the accident, and despite his 24-year tenure with the FAA, he had never attended the FAA's POI course. In spite of these circumstances, FAA management allowed him to remain assigned to the certificate, and he continued to be responsible for approval of B A-3100 training.

The POI for Express II did not have industry or FAA experience with scheduled FAR Part 135 air carriers and was not qualified to fly either model of airplane that Express Airlines operated. It is questionable whether the Express II POI had the knowledge to provide the necessary oversight of the DO and CP, even if he were closes geographically. The POI's geographic location and lack of experience concerning the duties and responsibilities of the DO precluded the opportunity to exercise quality control. Although the location and qualifications of

the POI are questionable, the fact remains that only the **POI** can provide the continuity of oversight necessary to maintain effective ongoing surveillance. Air carriers have different procedures and requirements from each other. In order to ensure compliance and safety, as well as "foster" and "promote" their operation, the POI must have the experience, training, and opportunity io do his **job.**

2.6.2 Geographic Oversight

The Safety Board believes that the effectiveness of *the* FAA's "Geographical Concept" as applied to operator certification and surveillance is limited by personnel and financial resources. The distance between Des Msines, Minneapolis, and Memphis placed an additional f i i c i a l burden on the **FSDOs. While** the continued growth of the commuter industry probably increases the need **to** rely on geographic surveillance, the findings of this accident indicate a need for the development of more realistic procedures and guidance. A higher minimum level of surveillance of the principai base of operations and familiarity with management personnel should be maintained by the FAA. The number of certificates a principal inspector is required to hold, **his** training **and** experience with respect to these certificates, and the required level of staffing to execute such **a** program also should be identified.

Although FAA inspectors were performing geographic en route surveillance and training surveillance, **FAA** oversight of the DO and **CP** in the accomplishment of their duties and responsibilities listed in the FAA-approved general operations manual was nonexistent. The **POI** was located in **Des** Moines, Iowa, but **Express** II did not **fly** to **Des** Moines. Although the **POI** had been responsible **for** its certificate for 6 **months** at the time of the accident, he had not visited its principai base of operations in Minneapolis. The POI had telephone contact with the DO but had never met him.

There are two FAA Right Standards offices located in Minneapolis, Minnesota: the Minneapolis **FAA** CMO and the Minneapolis **FSDO.** The CMO manages Northwest Airlines and two other FAR **Part** 121 air carriers, and the FSDO oversees all other Flight Standards responsibilities in the area. When Express II management personnel approached the Minneapolis CMO for the certification, the **CMO** declined to certificate Express II in June **1992,** citing difficulties anticipated in surveillance of remote operations and management.

The letter in which the CMQ denied the certification indicated that the principal base of operation requested by Express II at that time was Memphis. According to the guidance in the FAA Handbook, this is a legitimate reason for the Minneapolis CMO to deny certificate holding responsibility. However, when certification of Express II was accomplished in early 1993 by a combined effort between the Memphis and the Des Moines FSDOs, the principal base of operations that these FAA offices approved for Express 11 was Minneapolis.

FAA Order 8400.10 states, "Regional Flight Standards Divisions must be responsible for assigning certification projects and certificate holding responsibilities to district offices.... The district office having responsibility for the geographic area in which the principal base of operations is located shall be assigned certificate holding district office (CHDO) responsibilities." It seems obvious that since Express II's principal base of operations was Minneapolis, the certificate holding office should have been one of the Minneapolis FAA offices.

Central, Southern, and Great Lakes Regional Flight Standards Divisions were queried by the Safety Board as to what part they played in decision making regarding the assignment of FSDO oversight of Express II.

The reply received from the Southern Flight Standards Division indicated that they had reviewed FAA Order 8400.10 and had determined that Express II's certificate should not be held in their region. They further indicated that they were aware that the Minneapolis CMO had declined the certificate but that the Des Moines FSDO wanted Express II certificate responsibility.

The Central Right Standards Division's reply showed no indication that FAA Order 8400.10 criteria were considered, except that it acknowledged that a large part of Express II's flying was in Iowa. Central Region's letter indicated that there had been coordination between the Central and Southern Regions in the assignment of the certificate.

While the Southern Right Standards Division reply noted the Minneapolis CMO's denial of Express II certification, neither the Central nor Southern Division's reply indicated that the Great Lakes Region's Flight Standards Division had participated in the determination of where the certificate was to be held.

Great Lakes Region's initial response to the Safety Board's query concerning its Right Standards Division management's participation was a copy of the Minneapolis CMO manager's letter denying Express II certification. Later, the Safety Board received a letter from the Great Lakes Regional Manager that indicated that Regional management's participation consisted of coordination between the Minneapolis CMO and the Southern Region Flight Standards Division.

The Safety Boara believes that all three Regional Right Standards Divisions failed to follow the FAA Order 8400.10 requirement that the FAA certificate holding office be geographically responsible for the location in which the principal base of operations is designated. Southern and Central Regions designated Minneapolis as Express II's principal base of operations but neither of these regions was geographically responsible for Minneapolis.

2.6.3 Air Carrier Operations Bulletins

As the result of issues that were revealed about Air Carrier Operations Bulletin (ACOB) 8-93-4 regardmg air camer operations in conditions conducive to airframe icing, on March 17, 1994, the Safety Board issued three safety recommendations that urged the FAA to:

A-94-70

Conduct an in-depth review of its policies and procedures for the processing of ACOBs, and develop a system to ensure that the safety information contained therein is acted on in a timely and accurate manner. The system should include a process to verify that the actions contemplated by the ACOB are effectively implemented.

A-94-71

Issue immediate guidance to all POIs to verify that the intended safety-related actions contained in ACOB 8-93-4 have been accomplished for air carriers under their jurisdiction.

A-94-72

Take the appropriate actions to verify that ACOBs issued in the past few years have been implemented as intended.

The complete text of the recommendation letter is contained in appendix D. In general, the recommendations were issued as the result of findings during this investigation that revealed that POI actions specified in ACOB 8-93-4 had not been taken.

Examination of the FAA *ACOB* system uncovered substantial inadequacies. The ACOBs are published as FAA Order 8430.17. There is nothing in the Forward or Introduction of this Order that would lead a person to believe that these bulletins are *to* be considered optional. Further, FAA Order 1320.50 equates an FAA Handbook with an Order or Directive. It states, "Directive information is information that is considered directive in nature and will contain terms such as "shall", "must" and means *that the* actions are MANDATORY."

Yet, FAA personnel who briefed the Safety Board regarding the FAA's ACOB program indicated that ACOBs are not mandatory. Although an air camer may not be required to comply with an ACOB, the Safety Board would expect that the FAA POIs would be required to review the operation of their assigned air carriers with regard to the infomation contained in the ACOB and at least encourage compliance with it. Evidence produced during the course of this accident investigation shows that this is not consistently being accomplished.

In this case, there was an AIRMET concerning icing that the accident flight did not receive. While this was not a contributing factor to the accident, it suggests that the POIs had not reviewed the weather services that Express Airlines computer software produced in the pilot weather packages. This issue was determined to be a factor in the Beckley, West Virginia, BA-3100 accident and precipitated the recommendations that led to ACOB 8-93-4.

The FAA Air Carrier Operations Indoctrination Course, offered *at* the FAA's Mike Monroney Aeronautical Center, does not list ACOBs on its course syllabus. Further, the ACOBs have no subject index, and the numbering is difficult to use. There is no method provided for the inspector to contact the author of the ACOB if he/she does not understand it or needs further information.

In summary, while the FAA frequently satisfies the Safety Board's recommendations by publication of ACOBs, FAA inspectors are neither taught nor required to refer to them. The numbering and lack of alphabetical subject index make the ACOBs difficult for both FAA and air carriers to use.

The Safety Board has addressed the subject of inadequate FAA oversight and surveillance in numerous accident reports and safety recommendations over the past 10 years. As the result of many of those recommendations, the FAA has implemented new programs, policies, and procedures, and it has published considerable guidance to inspectors to enhance surveillance of air carriers. However, in this case, the inadequacy of the FAA surveillance of Express II does not necessarily involve lack of established guidelines; rather, it reflects a failure to follow such guidelines.

Finally, the Safety Board concludes that the oversight and surveillance of Express II Airlines was inadequate. The Safety Board believes that the FAA should take specific actions to bring the circumstances and findings of this investigation to the attention of all flight standards inspectors and managers by means of a directive that emphasizes the need for close adherence to existing criteria for certification and surveillance of air carriers.

27 Ground Proximity Warning System

If a GPWS had been installed, the pilots would most likely have been sufficiently alerted to their situation by a GPWS "SINK RATE" warning 33 seconds prior to the crash and an urgent "PULL UP" warning 21 seconds prior to the crash. The Safety Board concludes that this accident, like many others, could have been prevented if an operable GPWS had been installed. The Safety Board acknowledges that effective April 20, 1994, all turbopropeller aircraft operating under 14 CFR 135 with 10 or more passenger seats were required to have an FAA-approved GPWS installed.

28 Ice Lights

The airplane had one ice light on the captain's side of the airplane. The one light configuration makes it necessary for the captain to perform ice accumulation inspections, as was the case on the accident flight. The captain was the flying pilot for this nonprecision, ILS back course approach, at night, in instrument meteorological conditions, with reports of light to moderate icing. If he

had elected to check the ice on the wing, the light configuration might have interrupted his instrument scan and diverted his attention from flying the airplane to performing any ice accumulation inspections. The condition of the ice light bulb suggested that it was on at impact. It was not apparent when the light was turned on: however, it was probably turned on at the beginning of the descent from 8,000 feet.

The Safety Board believes that a wing ice observation tight installed on the right side of the airplane would have allowed the first officer to perform ice accumulation inspections while the captain remained focused on his flying duties. The Safety Board has previously addressed the subject of wing ice observation lights OR Jetstream model 3100/3200 airplanes. In the previously cited accident involving USAir Express flight 4743, the airplane crashed on its final approach to mway 19 at Beckley Airport, West Virginia The airplane hit the mway after a steep descent and was destroyed. The 2 crewmembers and 17 passengers survived, but some of them sustained serious injuries. As a result of this investigation, the Safety Board issued the foilowing recommendation to the FAA:

A-92-65

> Issue an Airworthiness Directive applicable to two-pilot airplanes operating under the provisions of 14 CFR Part 135 that use leading edge ice detection lights, such as the BA-3100 and BA-3200, requiring that leading edge ice detection lights be installed to illuminate both wings. Require that models of these airplanes requiring two pilots be retrofitted with this modification.

The FAA responded on October 16, 1992, stating than an additional wing leading edge ice observation light would not have altered the course of events and saw no justification to mandate this action. The Safety Board classified this recommendation "Open--Unacceptable Response" and requested that the FAA reconsider its position. No further response from the FAA has been received.

In light of the circumstances of this investigation, the Safety Board is reclassifying the status of recommendation A-92-65 from "Open--Unacceptable Response" to "Closed--Unacceptable Action/Superseded," and again urges the FAA to require ice detection lights on both wings of aircraft operated by two pilots under the provisions of Part 135. A retrofit program for such airplanes should be required and the applicable certification regulations should be modified for new airplanes.

2.9 Radial Keratotomy

The captain's medical records indicate that he had undergone a radial keratotomy procedure to correct his myopia and improve his distant vision. The fact that he did not inform his employer of this procedure is consistent with his demonstrated tack of regard for the company and its policies.

The procedure requires radial incisions around the lens of the eye. Among the side effects that have been reported, especially for procedures performed a few years ago, are glare and variations in visual acuity. Reports from patients who have undergone the procedure indicate that when glare is reported, it is inconsistently experienced. Thus, given the evidence, the Safety Board could not determine whether, at the time of the accident, the captain was encountering glare as a result of his having undergone a radial keratotomy procedure.

The weather conditions for the approach, combined with darkness, were conducive to glare, had a bright exterior light, such as a landing light from the airplane, been turned on. However, any external glare would not likely have affected the captain's ability to focus on the airplane's flight instruments. Therefore, the Safety Board believes that the radial keratotomy procedure performed on the captain did not contribute to his errors that led to the accident.

3. CONCLUSIONS

3.1 Findings

1. The airplane was certificated, equipped, and maintained in accordance with Federal Aviation Regulations and approved procedures.

2. The flightcrew was properly certificated and qualified for their duties according to company procedures and Federal Aviation Regulations.

3. There was no evidence of any mechanical failures of the structure, systems, or engines that contributed to the accident; and certification issues were not raised by this accident.

4. The weather was essentially the same as forecast by the National Weather Service, and the pilots were apprised of the current weather conditions.

5. Light to moderate icing conditions existed during the approach to Hibbing; however, airframe icing was not a factor in the cause of the accident.

6. A right wing ice observation light would aiiow the first officer to inspect for ice accumulation.

7. Air traffic services were appropriate and did not contribute to the cause of the accident.

8. The captain was flying the airplane during the approach and delayed the start of the descent that subsequently required an excessive descent rate to reach the final approach fix and minimum descent height for the nonprecision approach.

9. The captain's decision to initiate the excessively steep approach may have been prompted by a desire to minimize time in icing conditions.

10. The captain did not exercise proper crew coordination during the approach, and his actions led to distractions during critical phases of the approach.

11. The first officer did not adequately monitor the approach and alert the captain of the unstabilized nature of the approach and of the descent.

12. The flightcrew lost altitude awareness and allowed the airplane to descend below mandatory level off points, including the minimum descent altitude for the approach, and the airplane descended into the ground short of the runway.

13. The captain's record raised questions about the adequacy of his airmanship and behavior that suggested a lack of crew coordination during flight operations, including intimidation of first officers. Company management did not address these matters adequately.

14. The first officer was distracted from his duties of monitoring the altitude as a result of untimely and poorly planned instructions from the captain.

15. A GPWS would have provided timely warning to the crew and should have prevented this accident.

16. The airline's fight operations management failed to implement provisions to adequately oversee the mining of their flightcrews and the operation of their aircraft.

17. FAA oversight of the airline was inadequate.

18. FAA guidance provided to FAA inspectors concerning the implementation of Air Carrier Operations Bulletins is inadequate and has failed to transmit valuable safety information as intended to airlines.

32 Probable Cause

The National Transportation Safety Board determines that the probable causes of this accident were the captain's actions that led to a breakdown in crew coordination and the loss of altitude awareness by the flightcrew during an unstabilized approach in *night* instrument meteorological conditions. Contributing to the accident were: The failure of the company management to adequately address the *previously* identified *deficiencies* in airmanship and crew *resource* management of the captain; the failure of the company to identify and correct a widespread, unapproved practice during instrument approach procedures; and the Federal Aviation Administration's inadequate surveillance and oversight of the air carrier.

4. RECOMMENDATIONS

As a result of its investigation of this accident, the National Transportation Safety Board makes the following recommendations:

--to the Federal Aviation Administration:

Develop specific guidance for the evaluation and oversight of contract training programs used by air carriers and incorporate such guidance into FAA Order 8400.10 for FAA principal inspectors to use in approving training programs. (Class II, Priority Action) (A-94-113)

Issue an Air Carrier Operations Bulletin directing principal operations inspectors to advise *air* carriers to reemphasize in pilot training materials the necessity for adhering to the maximum descent rate of 1,000 feet per minute after passing the final approach fix, regardless of the existence of icing conditions. (Class II, Priority Action) (A-94-114)

Based on the circumstances and findings of the investigation of the Express II Airlines accident at Hibbing. Minnesota, on December 1, 1993. develop a clear and specific directive to Flight Standards inspectors and managers that emphasizes the need for compliance with existing FAA Orders, Directives, and other guidance material during the certification and surveillance of commuter air carriers. (Ciass II, Priority Action) (A-94-115)

Issue an Airworthiness Directive requiring operators of two pilot airplanes, inciudiig the Jetstream 3100/3200, presently equipped with only the left wing ice observation light to install a right wing ice observation light. (Ciass II, Priority Action) (A-94-116)

Amend 14 CFR Part 23.1419, Section (d), to require that airplanes certificated for two-pilot operation be configured with ice observation lights illuminating both wings. (Class II, Priority Action) (A-94-117)

Also, as a result of the investigation of this accident, the Safety Board reiterates Safety Recommendation A-93-35, as follows:

> Require that all pilots operating aircraft under 14 CFR 135 have access to their own set of instrument approach charts.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

Carl W. Vogt
Chairman

James E. Half
Vice Chairman

fohn K. Lauber
Member

John Hammerschmidt
Member

May 24,1994

5. APPENDIXES

APPENDIX A

INVESTIGATION AND HEARING

1. Investigation

The National Transportation Safety Board was notified of the accident about 2233 Eastern Standard Time, on December 1, 1993. An investigative team was dispatched from Washington, D.C., early the next morning. It was composed of the following groups: operations, air traffic control, weather, structures, system, powerplants, survival factors, human performance, and maintenance records. In addition, specialist reports were prepared for the CVR and aircraft performance.

Parties to the field investigation were the FAA, Jetstream Aircraft Limited, Express Airlines II, ALPA, Dowty Aerospace, and Allied Signal Corporation. The Air Accident Investigation Branch (AAIB) of the U.K. was notified of the accident and was granted status in this investigation in accordance with Annex 13 to the Convention on International Civil Aviation.

2. Public Hearing

A public hearing was not held regarding the accident.

APPENDIX B

COCKPIT VOICE RECORDER TRANSCRIPT

Legend of communication descriptions, abbreviations, acronyms and symbols used in the attached CVR transcript:

CAM	Cockpit area microphone
INT	Intra-cockpit intercom system
-1	Voice (or position) identified as Captain
-2	Voice (or *position)* identified as Firs? Officer
-?	Unidentifiable voice
ZMT	Minneapolis Air Route Traffic Control Center
DLH	Duluth Approach Control
COM	Incoming radio transmissions to accident aircraft from sources other than those *listed* below
OPS	Hibbing Company Operations
FA	Aircraft public address system
▪	Unintelligible word
#	Expletive deleted
...	Pause
()	Questionable *text*
[]	*Editorial insertion*
-	Break in continuity

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	**CONTENT**	**TIME & SOURCE**	**CONTENT**
1920:45 INT-1	ah you park right up next **to** it your door you walk in .. its got like ten units and a candy machine.		
1920:58 INT-1	never stayed in International Falls7		
1921:01 INT-2	no I've only been out **of** town once.		
1921:04 INT-1	oh where?		
1921:05 INT-2	**Waterloo.**		
1921:06 INT-1	ah.		
1921:06 INT-2	that's **a** pretty nice place down there.		
1921:08 INT-1	well it's not like that.		
192'1:11 INT-2	• .		
1921:12 INT-1	they **got** little electric heaters that you put around the bed to keep you warm.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	*CONTENT*	**TIME & SOURCE**	**CONTENT**
1921:15 INT-2	it's not the Radisson or anything?		
1921:16 INT-1	yeah right.		
1921:19 INT-2	no are you serious with this thing .. • travel?		
1921:21 INT-1	no **I'm** kidding it's the Holiday Inn,		
1921:23 INT-2	they have a Holiday Inn in .. in ah I' **Falls?**		
1921:51 INT-2	**so** then **I** assume they have a bus?		
1921:54 INT-1	they have **a** van.		
1921:56 INT-2	and they **ah** don't care **if** it's a four o'clock ah **.**		
1922:00 INT-1	nope because they're also taking our people **to** the airport besides us.		
1922:04 INT-2	ah (that's right).		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1922:08 INT-2	do we get our own room?		
1922:10 INT-1	no you're going to have to room with me and it's only a single bed so there's a little carpet at the base of my bed and you can curl up at the base of my bed .. course you get your own room ... you're under contract now ... this is ALPA contract.		
1922:31 INT-1	why you didn't get your own room in Waterloo ... a couple rampers wanted to sleep with you?		
1922:36 INT-2	no I I ah I didn't dead head with anybody else ... somebody was sick.		
1922:46 INT-1	how come we're doing this trip?		
1922:50 INT-2	why are we doing this ... I don't know why are we?		
1922:53 INT-1	I don't know somebody sick intorface what?		
1922:57 INT-2	I have no idea.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1923:09 INT-1	what time were we out of the gate.		
1923:12 INT-2	fifty-two.		
1923:14 INT-1	okay.		
1923:23 INT-1	according to your watch or according to the clock?		
1923:28 INT-2	ah well it's the same.		
1923:29 INT-1	oh okay.		
1923:30 INT-2	I think I'm showing the same .. yeah.		
1923:38 INT-2	is that what you got?		
1923:41 INT-1	whatever you call it.		
1924:19 INT-2	what's the shortest route we have is it that Fort Dodge Mason City?		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1924:24 INT-1	no Appleton Green Bay twenty miles.		
1924:37 INT-2	what's the time on that?		
1924:40 INT-1	air time they give you twenty-five minutes block to block but I've done it in twelve ... but that's on a SAAB ... I think I've done in fifteen on a Jetstream.		
1924:55 INT-2	there is no Jetstream routes out to Green Bay other then SAAB is there?		
1925:00 INT-1	they used to .. I don't think they do it anymore I'm not sure.		
1925:07 INT-2	is Hibbing no that's a Jetstream usually?		
		1925:11 ZMT	Twin City seven nineteen contact Duluth Approach one two five point four five.
1925:11 INT-1	what?		
		1925:16 RDO-2	twenty-five forty-five twin city seven nineteen.

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1925:22 INT	[sound similar to that of radio frequency change tone]		
1925:23 INT-1	what did you say?		
1925:25 INT-2	ah is this a normal leg for the Jetstream .. to Hibbing.		
1925:29 INT-1	what ... yes this is a I' Falls trip,		
1925:32 INT-2	thinking it was maybe a SAAB.		
1925:34 INT-1	no this is an International Falls trip.		
1925:39 INT-2	Duluth?		
1925:41 INT-1	Duluth approach.		
		1925:47 RDO-2	Duluth approach twin city seven nineteen is with you ah level one three thousand.

INTRA-COCKPIT COMMUNICATION

TIME & SOURCE	CONTENT
1926:19 INT-1	take the controls.
1926:21 CAM	[Unidentifiable snap sound]
1926:22 INT-2	my my controls.
1926:28 INT-2	ILS three one he said ... there's just one ILS?
1926:30 INT-1	we can't take the ILS three one.
1926:31 INT-2	is that the only approach in there?

AIR-GROUND COMMUNICATION

TIME & SOURCE	CONTENT
1925:52 DLH	twin city seven nineteen Duluth. approach good evening expect vector for the ILS three one final approach course at Hibbing .. Hibbing weather sky partially obscured estimated ceiling four hundred overcast visibility one light freezing drizzle fog wind one eight zero at one zero altimeter two niner eight six we're carrying a NOTAM for Hibbing braking action poor.
1926:17 RDO-2	okay thanks a lot ah twin city seven nineteen.

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1926:42 INT-2	that's because the contaminated runway?		
4926:51 INT-1	what?		
1926:56 INT-2	because the con- contaminated runway that's why right can't land in a tail wind with a contaminated runway?		
1927:01 INT-1	I don't like to land with a tail wind anyway.		
1927:12 INT-2	what else what else they *got* in there ... back course?		
1927:16 INT-1	shh .. circle to land we got the localizer back course .. that requires four hundred twenty-eight feet .. tell 'em we'll take the localizer back course to one three.		
1927:31 INT-2	okay .. what's the ah see that falling star?		
1927:40 INT-1	either that or a falling Cessna.		
1927:43 INT-2	that's what it looks like ... so you want the back course to one three.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1927:48 INT-1	right.		
		1927:51 RDO-2	approach ah twin city seven nineteen,
		1927:53 DLH	twin city seven nineteen Duluth.
		1927:55 RDO-2	yeah we'd like the ah back course up them to ah one three.
		1928:00 DLH	twin. city seven nineteen roger proceed direct the Hibbing VOR I'rn not going to be able to vector you for the back course cause of my radar coverage plan to shoot it via procedure turn on your own.
		1928:10 RDO-2	okay direct to the VOR and ah we'll do it our own nav twin city seven nineteen.
		1928:15 DLH	twin city seven nineteen in the Duluth area the tops have been running seven thousand seven hundred there's been light to moderate mixed ice of varying intensity all the way through the ah cloud layers bases were at three hundred feet AGL.

INTRA-COCKPIT COMMUNICATION

TIME & SOURCE	CONTENT
1928:31 INT-1	let me go to the back a minute you got it all ... I left my weather in my coat ,, you got the controls and the airplane.
1928:39 INT-2	okay.
1928:49 INT-2	tell 'em you're going to tha bathroom.
1928:54 CAM	[unidentifiable sound of click]
1928:57 CAM-?	it's too cramped back here.
1929:00 CAM-?	[intermittent unintelligible voices in background]

AIR-GROUND C

TIME & SOURCE	CONTENT
1928:29 ADO-2	okay thank you sir.
1929:42 DLH	twin city seven nineteen traffic is a ah metro liner at your twelve o'clock and five miles southwest bound at one zero thousand.
1929:50 RDO-2	okay he's in sight ah twin city seven nineteen.

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1929:58 CAM-?	[intermittent unintelligible voices in background]		
1930:17 CAM	[unidentifiable click sounds]		
		1931:02 DLH	twin city seven nineteen descend at pilots discretion maintain seven thousand.
		1931:07 RDO-2	pilot's discretion seven thousand twin city seven nineteen.
1931:12 INT-1	okay my controls pilot'e discretion what?		
1931:15 INT-2	seven seven thousand.		
1931:17 INT-1	okay.		
1931:19 INT-2	and they're getting ah reports the tops are seven point seven over (in) Duluth.		
1931:23 INT-1	okay.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1931:26 INT-2	and it's direct to the VOR you know all that right?		
1931:29 INT-1	okay let me brief you on it ... it's gonna be ə t gm approach ... since it's four hundred and one -		
		1931:42 DLH	twin city seven nineteen you can plan the localizer back course either via VOR procedure turn or you can ah join the twenty mile arc ah which ever one you like just advise.
1931:52 INT-1	(we'd) like the twenty mile arc.		
1931:53 INT-2	you want the arc?		
1931:54 INT-1	yes .. twenty mile arc.		
		1931:56 RDO-2	seven nineteen will take the ah twenty mile arc.
		1931:59 DLH	twin city seven nineteen roger ah continue on your present heading ah join the twenty mile arc localizer back course.

INTRA-COCKPIT COMMUNICATION

TIME a SOURCE	CONTENT
1932:14 INT-1	okay localizer back course it's ah ... one three zero on the tail .. three ten on the head .. top of the approach is three thousand five hundred to we're established .. inbound on the approach at which point we still maintain three thousand five hundred to Kinney intersection which is fourteen point oh DME and we can go down Ro twenty forty to the ten point oh DME ... visual descent point at nine point two DME ... missed approach is at eight point five DME ... ah without DME .... we can only go to seventeen eighty .. which is what we can go to anyway .... oh I get it can't go below twenty forty without DME .. well forget the timing cause we we're gonna have a clock I mean a DME .. a hundred and twenty knot ground speed two minutes and forty-five seconds anyway .. that's easy to remember ... MDA is one thousand seven hundred and eighty which is four hundred and twenty feet eight feet above the airport elevation of thirteen fifty-three . missed approach climb to three thousand six hundred straight ahead direct to the Hibbing VOR and hold southeast ... here you can take a look at it.
1933:51 INT-2	okay ... you got it you've got nine miles to the ah arc.
1933:53 INT-1	my controls.

AIR-GROUND COMMUNICATION

TIME a SOURCE	CONTENT
1932:06 RDO-2	roger we'll join the ah twenty mile arc present heading twin citv seven nineteen.

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1933:56 INT-1	okay.		
		1934:28 DLH	twin city seven nineteen descend at pilot's discretion maintain five thousand.
		1934:34 RDO-2	five thousand pilot's discretion twin city seven nineteen.
1934:37 INT-1	just put it up on your clip board and talk me through it when I need information okay?		
1934:42 INT-2	okay.		
1934:44 INT-1	no this thing that's what this is for.		
1934:54 INT-1	okay in range what are the speeds?		
1935:02 INT-2	speeds are thirty-eight thirty-throe twenty-eight and twelve.		
1935:07 INT-1	thirty-eight thirty-three twenty-eight and twelve set left.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	**CONTENT**	**TIME & SOURCE**	**CONTENT**
1935:09 INT-2	set right,		
1935:10 INT-1	briefing complete in range checklist ... ah maybe **you** should call company first and tell them positive **fuel** then come back.		
1935:16 INT-2	okay thirty-one (thirty-five)?		
1935:17 INT-1	no twenty-nine eight.		
1935:20 INT-2	oh okay **I'm off** one.		
1935:23 INT-1	okay.		
		1935:28 RDO-2	Hibbing ops ah seven nineteen.
1936:00 INT-2	not picking up anybody on that .... how bout ah -		
1936:03 INT-1	oh ah thirty-one twenty-five **I'm** sorry.		
		1936:10 **COM**	[sound similar to frequency change tone]

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1936:14 RDO-2	ops ah seven nineteen's in range.
1936:25 INT-1	say Hibbing.		
		1936:26 OPS	Hibbing (go ahead).
		1936:28 RDO-2	yeah Hibbing this is ah seven nineteen ah in range positive fuel.
		1936:33 OPS	okay in range positive fuel see ya in a bit.
1936:35 INT-1	saying ops they're not gonna answer because whose supposed to answer Sioux City ops Hibbing ops Duluth ops.		
1936:42 INT-2	right.		
1936:49 INT-1	okay go ahead and make your passenger announcement and in range checklist.		
1937:27 CAM	[sound of PA tone]		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1937:28 PA-2	ladies and gentlemen we've begun our final descent in for landing at Hibbing and ah just lika to make sure you have your seatbelt on and check around your seat to make sure that any carry on baggage is stowed at this time .. looks like overcast skies in ah Hibbing at this time for those passengers continuing on to International Falls it'll be a few minutes on the ground and we'll be off shortly .. thanks for ah * *.		
1937:59 INT-2	okay back on one.		
1938:00 INT-1	okay * * in range checklist.		
1938:09 INT-1	in range checklist.		
1938:18 INT-2	okay .. pressurization .... pressurization set altimeter's two niner ah eight six set right.		
1938:45 INT-1	set left.		
1938:45 INT-2	passenger briefing's complete seatbelt sign's on utility ... landing lights are on .. fuel crossfeed is normal .. briefing and V speeds is complete .. in range checklist is complete.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1939:06 INT-1	now is that the **ah** latest altimeter setting we **got** from Hibbing **or was** that the Duluth altimeter setting?		
1939:15 INT-2	**I'll call** and **get** ?he.. **I** don't know.		
1939:17 INT-1	did Hibbing give **you** the weather?		
1939:20 INT-2	yeah they did.		
1939:21 INT-1	well what did you write down7		
1939:26 INT-2	two nine eight six.		
1939:27 INT-I	okay.		
1940:01 **CAM**	[sound similar to fluctuation in prop rpml		
		1941:07 COM	[sound **of** Hibbing VOR morse code identifier)
1941:30 INT-1	is there **a lead** in radial **on** this thing7		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1941:33 INT-2	yeah there is the ah three oh ones.		
1941:35 INT-1	okay.		
		1942:52 COM	[sound of Hibbing VOR morse code identifier1
1943:04 INT-1	okay let's set up the we'll put the VOR in yours -		
1943:09 INT-2	okay.		
1943:09 INT-1	and put the localizer on mine.		
1943:12 INT-2	alright ,.. there's the localizer.		
		1943:16 COM2	[sound of static]
1943:20 INT-1	DME on three.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1944:03 DLH	twin city seven nineteen I show **you** established **on** the **two zero** mile arc you're cleared for the localizer back **course one** three approach to Hibbing change **to** advisory approved cancel with **me on one two** seven point four.
		194414 **RDO-2**	okay cancel **on one** two ***seven*** point four we're cleared **for** the localizer back course approach twin city seven nineteen.
1944:32 **INT-1**	okay put one down there to show we're cleared **for** the approach and since **we're** established what altitude can we **go** down to?		
1944:43 INT-2	thirty-five hundred.		
1944:44 INT-1	okay put that in there.		
1944:55 INT-2	just .. you just gonna stay up here as long as you can?		
1945:00 INT-1	yes.		
1945:35 INT-1	guard the hor- I mean ah speeds one hundred,		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1945:42 CAM	[sound of increase in prop rpm frequency]		
1945:51 INT-2	speeds a hundred.		
1947:07 INT-2	there's the lead in.		
		1947:15 COM2	[sound of entire Hibbing localizer morse code identifier]
		1947:22 COM2	[sound of Hibbing localizer morse code identifier through "HI"]
1947:24 INT-1	guard the horn.		
1947:26 INT-2	both loc- both localizers identified.		
1947:34 INT-1	flaps ten.		
1947:38 INT-2	speed check flaps selected ten and indicating ten.		
1947:42 INT-1	verified.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1947:44 INT-2	localizer's alive,		
1948:09 INT-2	final approach fix is at fourteen.		
1948:12 INT-1	"roj".		
		1948:36 COM2	[sound of frequency change tonal
1948:49 INT-1	gear down.		
1948:52 INT-2	speed checks gear down.		
1948:58 INT-1	flaps twenty.		
1949:00 INT-2	speed checks flaps twenty.		
1949:06 INT-1	verified verified.		
1949:12 INT-2	checklist?		

INTRA-COCKPIT COMMUNICATION

TIME & SOURCE	CONTENT
1849:13 INT-1	before landing .. well let's wait for the time when you call final approach fix altitude instruments cross check times noted that's when I'll call for checklist.
1949:29 INT-2	final approach fix instruments cross check no flags times noted.
1949:33.1 INT-1	okay .. before landing checklist to the box.
1949:39.5 INT-2	lending gear down three green hydraulic pressure brakes two thousand tested.
1949:43.0 INT-1	two thousand tested left.
1949:44.3 INT-2	prop sync's off • • • prop sync's off speed levers high a hundred percent boost pumps are on ... before landing checklist to the box.
1950:10.0 INT-2	one to go.
1950:14.0 INT-1	to what alt- to twenty forty .. okay.

AIR-GROUND COMMUNICATION

TIME & SOURCE	CONTENT

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1950:15.5 INT-2	twenty forty ...to ah ten point oh.		
1950:27.3 INT-1	did you ah click the ah airport lights .. make sure the co- common traffic advisory frequency is set.		
		1950:35.7 COM2	[sound of seven microphone clicks]
1950:40.3 INT-1	click it seven times?		
1950:42.1 INT-2	yup yeah I got it now.		
1950:42.5 CAM	[momentary sound of scrape lasting for .1 secsl		
1950:42.9 CAM	[sound of raspy grind lasting far .7 secsl		
1950:43.0 CAM	[sound of faint metallic clicking starts and lasts, intermittently, through remainder of recording1		
1950:43.5 CAM	(sound similar to increase in prop rpm frequency]		
1950:43.8 CAM	[momentary sound of raspy grind lasting for .2 secsl		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1950:45.3 CAM	[momentary sound of raspy grind lasting for .2 secs]		
1950:45.5 CAM	[END OF RECORDING]		

APPENDIX C

THE CAPTAIN'S PERSONAL HISTORY

The captain, age 42, grew up in New York City, New York. He was interested in aviation as a child but was deterred from entering it as a profession because of poor eyesight, according to his father. After graduating from the New York State Maritime College, the captain served in the U. S. Navy (1973-1977) as a reactor officer on a nuclear submarine. He completed his private pilot license during this time, and continued flying as a charter pilot and flight instructor while living in Florida and working as a second mate in the Merchant Marine (1977-1987). In 1986, the captain underwent a radial keratotomy operation on both eyes that greatly reduced his myopia. He was hired as an airline pilot by Express Airlines I (the predecessor to Express Airlines II) in August 1987, and he moved to his assigned base in Minneapolis.

The captain was described as having an outgoing personal style that many people associated with people from New York and that was noticeably different from the personal styles of people raised in the Midwest. According to friends, the captain enjoyed living in Minneapolis and had developed a group of close personal friends among other company pilots with whom he socialized regularly. He lived alone in a two-bedroom apartment that was described as nicely furnished and immaculately clean. He had never married, and, according to friends, had not been involved in a significant romantic relationship for several years preceding the accident. The captain's most recent vacation was a one-week cruise earlier in the year that the captain was said to have enjoyed. People described the captain as very intelligent and as having a ready, sarcastic wit. The captain enjoyed dining at restaurants. Pilots who flew with the captain indicated that he did not eat while flying but that he often dined at restaurants between trips. The captain's overnight bag contained menus for restaurants located near airports served by the airline. The captain's salary at the time of the accident was $34.63 per hour of flying time with a guaranteed minimum of 70 hours per month. However, friends indicated that the captain was financially secure as a result of his earlier work in the Merchant Marine.

According to friends and colleagues, the captain's morale was adversely affected by the company's decision in October 1992 to implement an outstation policy in pilot basing. To remain based at Minneapolis with his seniority, the captain chose to downgrade from being a captain on the SF-240 airplane to

being a reserve captain on the BA-3100 airplane. This change caused a pay cut of about 12 percent in his hourly salary. He also missed friends who had moved from Minneapolis as a result of the policy and felt a loss in personal time that resulted from the extensive deadheading demanded of him as a reserve pilot. The captain was vocal in expressing his opposition to the company outstation policy. According to one pilot, the captain "took to heart the pressures from the company in the last year more than anyone else." The DO described the captain as "very outspoken," and indicated he wished more pilots would come to his office like the captain did to vent their concerns. The captain served as union strike coordinator until several months before the accident, preparing a strike manual to be used if contract negotiations proved unsuccessful and a pilot strike was called. The pilot group sought union representation in August 1988, and in November 1993, began negotiations to establish a new contract with the company, negotiations that were ongoing at the time of the accident.

Company records indicate that the captain was involved in a hard landing incident in the SF-340 airplane in October 1987 while he was the first officer and flying pilot. The captain's personnel record contained four letters concerning sexual harassment from 1988 and 1989, including a severe warning. The DO indicated that female employes complained of being touched excessively, but that the captain may have been a very physical person who did not appreciate the problems 'wing caused. In September 1989, the captain was subject to a 3-day suspension for negative reports related to his performance, including: starting an engine without proper verification from the ramp agent while another agent was standing near the propeller; accepting an aircraft when the air cycle machine shroud had not been reinstalled by maintenance; delaying the start of a flight to finish breakfast; destroying a cargo load report with which he was unhappy; and sleeping in the cockpit during a flight (according to a passenger complaint). In Marcn 1991, the captain was subject to an irregularity report for declining to fly an airplane unpressurized. In December 1992, the captain was subject to a verbal warning for complaints from maintenance concerning his maintenance write-up reports. In May 1993, he was subject to an irregularity report plus a letter from the chief pilot for delaying a flight excessively due to a hydraulic check. In August 1993, he was subject to an irregularity report plus a letter from the chief pilot for causing a flight cancellation by calling in sick under suspicious circumstances. On the day of the accident, the captain was subject to an operations irregularity report from a customer service ;-,presentative.

Records of the Air Line Pilots Association indicate that three grievances were filed on behalf of the captain. In July 1992, the captain grieved a 1-day suspension concerning allegations that he had made inappropriate comments. The grievance was settled, and the company withdrew the suspension and expunged its records of the incident. In October 1993, the union filed a grievance concerning upbid eligibility requirements after the captain was judged ineligible to bid on an opening in September 1993 for a SF-340 captain at the outstation in Pensacola, Florida. The grievance was subsequently withdrawn. In November 1993, a grievance was filed concerning changes to a particular trip assignment that may have inappropriately extended the duty day. This grievance was pending at the time of the accident. Finally, the captain completed a grievance worksheet on the accident trip that was found in his personal possessions. It concerned the requirement that he deadhead back to Minneapolis at the end of the trip on December 2, despite this being a scheduled day off. The facts of this issue were amended after the accident into a grievance filed previously by the union.

A representative of the unions Professional Standards Committee indicated that the committee had received no adverse reports concerning the captain.

The captain held a valid driver's license with no record of violations in the past 5 years, according to records of the Minnesota Department of Public Safety. Records of the Federal Bureau of Investigation's National Crime Information Center (NCIC) indicate no criminal history.

APPENDIX D

SAFETY BOARD RECOMMENDATIONS

ON AIR CARRIER OPERATIONS BULLETINS

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

Date: March 17, 1994

In reply refer to: A-94-70 through -72

Honorable David R. Hinson
Administrator
Federal Aviation Administration
Washington, D.C. *20591*

On November 21, 1991. as the **result** of the investigation **of** two commuter airline accidents,[1] the National Transportation Safety Board adopted *Safety* Recommendation A-91-122, which urged the Federal Aviation Administration **(FAA) to:**

> Issue an Operations Bulletin to the Principal **Operations Inspectors** (POIs) of **I4** Code of Federal Regulations (CFR) 121 and Part 135 air carriers to **verify** that air carriers **have** established procedures for flightcrews **to** take appropriate actions when **they have** encountered icing conditions during a flight, **to** check for **the** presence of, and to rid **airplanes of** accumulated airframe ice **prior** to initiating final approach, in accordance with the airplane manufacturers' recommendations on the **use** of deice *systems.*

Also as the result of **the** investigation **of** the same two accidents, on **July** 22, 1992, the Safety Board adopted Safety Recommendations A-92-59, -60, **and** -61, which urged the **FAA to:**

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[1] NPA Inc., d/b/a United Express. flight 2415. a British Aerospace BA-3101 Jetstream, N410UE, Tri-Cities Airport, Pasco, Washington. December 26 1989 (NTSB/AAR-91/06); and CC Air British Aerospace BA-3101 Jetstream, N167PC. Beckley. West Virginia, January 11, 1991.

A-92-59

Amend FAA Order 8400.10, Volume 3, Chapter 7, Section 2, Parts 121/135, "Weather Information Systems," Paragraph 1425, to specify that POIs ensure that operators under 14 CFR Part 135, who elect to use a weather information system, make available to flightcrews, as well as to dispatch and/or flight control personnel, weather products listed under Section 2 that are appropriate to their flight operations. POIs should *ensure that initial and recurrent flightcrew training include the use of* computerized weather systems, if such systems are a source of flightcrew information.

A-92-60

Issue an Air Carrier Operations Bulletin (ACOB) directing all POIs having *surveillance responsibility* of operators of *BA-3100 airplanes to alert* operators of the danger of unanticipated and abrupt tailplane stall during changes in flap configuration as a result of horizontal stabilizer ice accumulation.

A-32-61

Issue an ACOB directing all POIs to examine the meteorological training curricula of 14 CFR Part 135 operators under their purview and ensure that they provide adequate infomation regarding icing conditions and cold weather operating limitations applicable to their particular aircraft, as well as preflight and in-flight deicing procedures.

The FAA agreed with Safety Recommendation A-91-122 in a letter to the Safety Board, dated January 31,1992, adding that an ACQB was being prepared to address the subject. On April 10, 1992, the Safety Board classified A-91-122 as "Open--Acceptable Response," pending the issuance of the ACOB, On October 16, 1992, the FAA responded that it agreed with Safety Recommendations A-92-59, -*60,* and -61 and that it would handle the issues in the ACOB, which was being drafted. On April 16, 1993, the Safety Board classified these recommendations, "Open--Acceptable Response."

On December 9,1993, the FAA advised the Safety Board that OR October 19, 1993, the FAA had issued ACOB 8-93-4, entitled, "Flight in Potential Icing Conditions and the Avoidance, Recognition, and Response to Tailplane Ice," which was responsive to A-91-122 and A-92-59,-60, and -61. The FAA enclosed a copy

of the ACOB that contained specific actions for the POIs to take regarding air carriers under their jurisdiction.

The Safety Board finds the stated actions by the FAA contained in ACOB 8-93-4 to be responsive to the intent of A-91-122 and A-92-59, -60, and -61. The specific guidance to POIs and the actions directed of them are consistent with the Safety Board's safety recommendations to improve commuter airline safety. However, information gathered during two recent commuter aircraft accident investigations has revealed that the actions directed by the ACOBs have not been accomplished as intended,

On December 1, 1993. a Jetstream 31 operated by Express II Airlines, d/b/a Northwest Airlink, crashed during a back course localizer approach to runway 13 at Hibbing, Minnesota. The 2 pilots and 16 passengers aboard died when the airplane crashed about 3 miles short of the runway. The investigation of that accident is continuing and the probable cause(s) have not been determined.

On January 6, 1994, e Jetstream 41 operated by Atlantic Coast Airlines, d/b/a United Express, crashed during an instrument landing system (ILS) approach to runway 28L at Port of Columbus Airport, Columbus, Ohio. The two pilots, one flight attendant, and two passengers died in the accident. Three passenger: escaped from the airplane, which had crashed about. 1.2 miles from the airport. The investigation is continuing and the probable cause(s) have not been determined.

Both accidents occurred at nigh in instrument meteorological conditions. Although icing conditions existed at the time in the area of both accidents, no conclusions have been drawn to suggest that airframe icing was the reason for the accidents. Nevertheless, during the investigations of these two accidents, Safety Board investigators have determined that the intent of ACOB-8-934 has not been satisfied.

Although the POI for Express II had received the ACOB, there was no clear evidence that he had fully accomplished the actions directed by it. Specifically, with regard to certain provisions of the ACOB, which address Safety Recommendation A-82-59 on training and accessing computerized weather information systems, the Express II POI stated that he had referenced the carrier's Operations Specifications, as well as the General Operations Manual, to determine adequacy. However, neither of these documents provide guidance on training and accessing computerized weather information systems. Further, an the accident flight, there

was an AIRMET [airman's meteorological infomation] issued for icing that was not part of the computerized weather package because of peculiarities in the carrier's weather access system. Also, during an interview with the POI of Express I, the "sister" carrier, it was determined that although a copy of the ACOB was available in the POI's office, he had not accomplished the items directed by it. In addition, during the interview with the POI for Atlantic Coast Airlines, the POP stated that he thought the ACOB pertained only to Jetstream 31 airplanes. As a result, he had not accomplished the actions contained in the ACOB with the carrier that operated Jetstream 41s.

Consequently, the Safety Board believes that the FAA should reevaluate its process €or the dissemination of the information contained in ACOBs to verify that the intended and directed actions contained therein are actually taken.

The Safety Board has addressed previous problems with the distribution of ACOBs as the result of the Delta Air Lmes Boeing 727 accident in Dallas, Texas, on August 31,19882 Specifically, in Safety Recommendation A-89-128, the Safety Board recommended that the FAA:

> Modify the ACOB distribution procedures to expedite the approval and transrnission of ACOBs to the principal operations inspectors and airline officials.

In that investigation, the Safety Board found *that* the FAA had issued ACOB-8-88-4 as the result of a takeoff accident in 1987 involving a DC-9-82.[3] The ACOB specified actions for POIs *to* take regarding procedures at their airlines *to* prevent attempted takeoffs with the flaps retracted. That investigation revealed that the ACOB had been approved by FAA Headquarters staff *in* June 1988, and the FAA Flight Standards District Office (FSDO) responsible for oversight of Delta Air Lines had received it on August 30, 1988. The POI for Delta Air Lmes did not receive the ACOB until September 5, 1988, and it was not mailed to the airline until September 14, 1983, two weeks following the accident, which involved a takeoff attempt with the flaps retracted.

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[2] For more detailed information, read Aircraft Accident Report--Delta Air Lines, Inc., Boeing 727-232, N473DA, Dallas/Fort Worth International Airport, Texas, August 31, 1988. (NTSB/AAR-89/04)

[3] For more detailed information, read Aircraft Accident Report--Northwest Airlines, Inc., McDonnell Douglas DC-9-82, N312RC, Detroit Metropolitan/Wayne County Airport, Romulus, Michigan, August 16, 1987. (NTSB/AAR-88/05)

On April 12, 1990, the FAA advised the Safety Board that it had established a priority system to reduce the time for the printing and distribution of ACOBs to within two weeks after adoption. As a result of that action, on October 22, 1990, the Safety Board classified A-89-128 as "Closed--Acceptable Action."

Nevertheless, the two recent investigations illustrate what appears to the Safety Board to be serious deficiencies in the FAA's system of communicating important safety-related material to air carriers that is contained in ACOBs. The Safety Board is concerned that the system of processing the information contained in ACOBs is not being given sufficient emphasis by the Flight Standards personnel responsible for the oversight of airline safety. Although the inadequate processing of ACOB 8-93-4 by the FSDOs has not been determined to be a factor in the recent accidents, apparently, neither the content of the ACOB nor the intent of its content has been satisfied. Therefore, the Safety Board urges the FAA to direct immediate guidance to all POIs that requires verification that the actions contained in ACOB 8-93-4 have been taken, Also, with the issuance of Safety Recommendation A-94-71, which is contained herein, the Safety Board has classified Safety Recommendations A-91-122, A-92-59, A-92-60, and A-92-61 as "Closed--Acceptable Action/Superseded."

The Safety Board is also concerned that other ACOBs issued in the recent past might not have resulted in the intended corrective actions. Many of the Safety Boards previous safety recommendations have urged corrective actions that were reportedly implemented by means of ACOBs that directed POIs to accomplish specific tasks. In most cases, the Safety Board has classified such recommendations as "Closed--Acceptable Action," based on a review of the guidance contained in the published ACOBs and assuming that the actions directed at POIs had been accomplished. The Safety Board has not previously attempted to verify whether the actions directed by the ACOBs had actually been taken. In view of the findings of the current investigations, the Safety Board believes that the FAA should undertake a program to review all ACOBs that have been issued in the past few years to ensure that the intended actions have actually been taken.

Therefore, the National Transportation Safety Board recommends that the FAA:

> Conduct an in-depth review of its policies and procedures for the processing of ACOBs, and develop a system to ensure that the safety information contained therein is acted on in a timely and accurate manner.

The system should include a process to verify that the actions contemplated by the ACOB are effectively implemented. (Class II, Priority Action) (A-94-70)

Issue immediate guidance to all POIs to verify that the intended safety-related actions contained in ACOB 8-93-4 have been accomplished for air carriers under their jurisdiction. (Class II, Priority Action) (A-94-71)

Take the appropriate actions to verify that ACOBs issued in the past few years have been implemented as intended. (Class II, Priority Action) (A-94-72)

Chairman VOGT, Vice Chairman COUGHLIN, and Members LAUBER, HAMMERSCHMIDT, and HALL concurred in these recommendations.

By: Carl W. Vogt
Chairman

*U.S. G.P.O.:1994-300-644:80043