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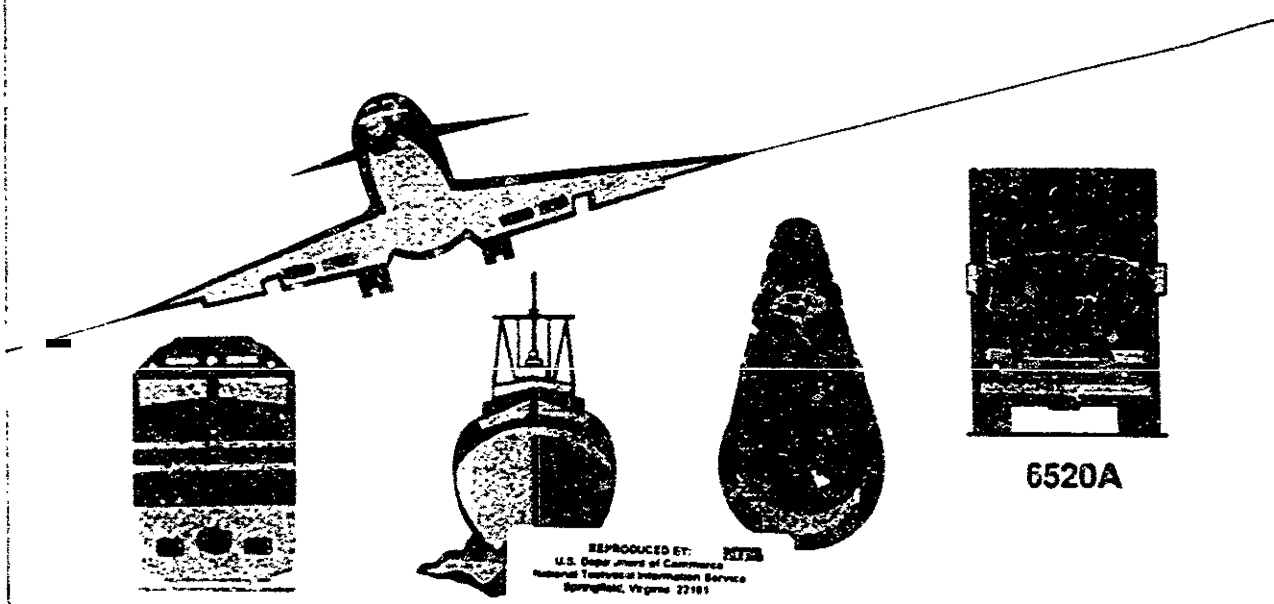
NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

UNCONTROLLED COLLISION WITH TERRAIN
FLAGSHIP AIRLINES, INC., dba AMERICAN EAGLE
FLIGHT 5379, BAe JETSTREAM 3201, N918AE
MORRISVILLE, NORTH CAROLINA
DECEMBER 13, 1994



6520A

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DECEMBER 13, 1994**

**Adopted: October 24, 1995
Notation 6520A**

Abstract: This report explains the accident involving American Eagle flight 3379, a BAe Jetstream 3201, which crashed about 4 nautical miles southwest of the runway 5L threshold during an instrument landing system approach to the Raleigh-Durham International Airport on December 13, 1994. Safety issues examined in this report include flightcrew decisions and training, air carrier organization, hiring and recordkeeping practices, Federal Aviation Administration surveillance of AMR Eagle/Flagship, and the flight profile advisory system. Safety recommendations concerning these issues were made to the Federal Aviation Administration.

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EXECUTIVE SUMMARY

On December 13, 1994, at 1834, American Eagle (AMR) flight 3379 crashed about 4 nautical miles southwesf of the runway 5L threshold during an instrument landing system approach to the Raleigh-Durham International Airport. Thirteen passengers and the two crewmembers were fatally injured, and the other five passengers survived. The airplane was destroyed by impact and fire. The weather at the time of the accident was ceiling 500 feet, visibility 2 miles, light rain and fog, temperature 38° F, and dew point 36° F. This was a regularly scheduled passenger flight under 14 Code of Federal Regulations, Part 135.

The National Transportation Safety Board determines that the probable causes of this accidens were: 1) the captain's improper assumption that an engine had failed, and 2) the captain's subsequent failure to follow approved procedures for engine faiiure, single-engine approach and go-around, and stall recovery. Contributing to the cause of the accident was the failure of AMR Eagle/Flagship management to identify, document, monitor, and remedy deficiencies in pilot performance and training.

Safety issues examined in this report include flightcrew decisions and mining, ai- carrier organization, hiring and recordkeeping practices, Federal Aviation Administration surveillance of AMR Eagle/Flagship, and the flight profile advisory system. Safety recommendations concerning these issues were made to the Federal Aviation Administration.

NATIONAL TRANSPORTATION SAFETY BOARD
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UNCONTROLLED COLLISION WITH TERRAIN FLAGSHIP AIRLINES, INC., dba AMERICAN EAGLE FLIGHT 3379, BAe JETSTREAM 3201, N918AE MORRISVILLE, NORTH CAROLINA DECEMBER 13, 1994

1. FACTUAL INFORMATION

1.1 History of Flight

On December 13, 1994, at 1834[1], a Flagship Airlines Jetstream 3201, doing business as (dba) American Eagle (AMR) flight 3379, crashed about 4 nautical miles southwest of the runway 5L threshold during an instrument landing system (ILS) approach to the Raleigh-Durham International Airport (RDU). The flight was a regularly scheduled passenger flight under 14 Code of Federal Regulations (CFR), Part 135. Thirteen passengers and the two crewmembers were fatally injured, and the other five passengers survived. The airplane was destroyed by impact and fire. The weather at the time of the accident was ceiling 500 feet, visibility 2 miles, light rain and fog, temperature 38° F, and dew point 36° F.

The crew of flight 3379 arrived at company operations about 1300, prior to the scheduled check in time of 1311, on December 13, 1994. They were scheduled for a 2-day trip, which included three flights the first day, an overnight stay in Greenville, North Carolina, and five flights the second day, ending at RDU at 1555.[2] N918AE, a British Aerospace Jetstream 3201, arrived at RDU at 1213 on December 13, 1994. The terminating crew reported that the aircraft performed normally, and there were no writeups on the aircraft during the four flights they had made in it. At 1411, the accident crew departed RDU on time in N918AE, as flight 3416, and arrived in Greensboro, North Carolina, (GSO) at 1449, 2 minutes ahead of schedule. After the passengers deplaned, they taxied the aircraft to Atlantic Aero, a fixed-base operator (FBO) on another part of the airport, to allow other flights to access the gate. The crew entered the FBO facility at 1530 and remained

[1]All times herein are eastern standard time (est), in accordance with the 24-hour clock.
[2]The crew had never flown together prior to this trip sequence.

in tne "break room." About 1620. the customer service *agent* discussed the fuel requirements for the tlight with the captain. He advised that they had about I,000 pounds of fuel on arrival, and would take 700 additional pounds for departure. The fueler distributed 50 gallons on each side of the airplane for a total fuel load of 1,700 pounds. as requested. The crew left the FBO building about 165u, and the airpiane taxied from the ramp abut 1700.

The gate agent responsible for flight 3379 estimated that the aircraft returned to the gate area about 1715. She gave the dispatch papers to the captain, and 18 passengers boarded the flight. The baggage and cargo were loaded onto the airplane, and she gave the captain the load manifest. The captain indicate6 that ihere was a problem with the weight distribution. and they discussed *the* options to remedy the problem. Two bags were removed from the aft cargo compartment, and rhe flight taxied out *8* minutes late. at 1753.

About 1818. the agent requested the departure times from flight 3379, and the first officer advised her that they used 53 and 03 (taxi out at 1753 and takeoff at 1803). The delay was reportedly due to baggage rearrangement. The agent. who had previously met both pilots. reponed they wire in good moods. She described the captain as typically quiet and the firs; office: as outgoing.

The fright pla c le : for a cruise altitude of 5,000 fee;. and the time en route was 23 minutes. F 3379 was assigned a cruising altitude of 9,000 feet.[3] The crew contacted RDU approach control at 1814, and advised that it had received Automatic Terminal Information Service (ATIS) "Sierra." The controller advised the crew to expect runway 5L. Following some discussion about the arrival clearance. the controller stated. "Eagle flight 379 reduce speed to uh ...one eight zero then descend to six thousand The crew received continuing vectors and were switched *to* the final ndar control position at 1825. The final controller instructed them to. "...reduce to one seven zero then descend and maintain three thousand." At 1828. the controller cautioned them about wake turbulence from a B-727 that thev were following and assigned them a heading of 190°. At 1530. the final controller advised. "Eagle flight 9 eight from BARRT [the final approach fix] turn left heading zero seven zero join the localizer course at or above two thousand one hundred cleared ILS five left." line crew acknowledged the clearance, and the subsequent change to the tower frequency.

[3]Based on the information from the cockpit voice recorder, the captain was the flying pilot, and the first officer was the nonflying pilot.

They contacted the tower at 1832. and were told "...cleared io land wind zero one zero at eight traffic three and a half mile final a seven twenty seven." At 1832:25, the crew acknowledged the clearance, "Cleared to land five left 379." This was the last known transmission from the flight. At 1834:17, an unintelligible noise was heard on the frequency.

Data from the flight data recorder (FDR). cockpit voice recorder (CVR), and the RDU radar plot were correlated for the last minute of flight to reconstruct the approach. (See figure I). There was a change in engine noise similar to an increase in engine RPM at 1833:28.7, seconds after the captain requested "speeds high." This was followed immediately by a call for. "gear down and flaps 20." Flight 3379 crossed slightly right of BARRT, the final approach fix. while descending through 2.100 feet and slowing below 160 knots about this time. At 1833:33.3, the captain asked. "Why's that ignition light on? We just had a flameout?" For the next seconds. the crew discussed the engine anomaly as the airplane heading drifted to the left at approximately 2/3 of a degree per second and eventually crossed the localizer centerline at 1833:45. At this time. flight 3379 was approximately 38 miles behind the preceding B-727.

For the next several seconds. the airplane remained relatively level at approximately 1,800 feet, as the airspeed decreased from 140 knots to 122 knots, when the captain decided. "Let's go missed approach." In less than 2 seconds, at 1834:05.3, two momentary stall warnings occurred as the captain called. "Set max power," and the left turn rate increased. The first officer called, "Lower the nose, lower the now. lower the nose." but the airplane remained at about 1,800 feet, and the airspeed continued to decay to approximately 119 knots as the left turn rate increased to about 5° per second.

At 1834:09.4, a stall warning horn started again. and was followed at 1834:09.6 by the dual stall warning horns. At this time. the airplane was still at 1.775 feet, and the airspeed had slowed to 111 knots. The first officer inquired. "You got it?," and the captain responded. "Yeah." The airspeed decreased to 103 knots at 1834:12, and the first officer said. "Lower the nose." At 1834:13.2, the first officer said. "It's the wrong, wrong foot, wrong engine." About this time, the rate of descent increased rapidly to more than 10,000 feet per minute. The rate of turn increased to about 14° per second at 1834:16, as the airspeed increased rapidly. There were several significant normal accelerations during this period. The airplane finally stabilized the last few seconds before impact at an airspeed of about 170 knots, a normal acceleration of 2.5 G absolute. and a heading of 290°.

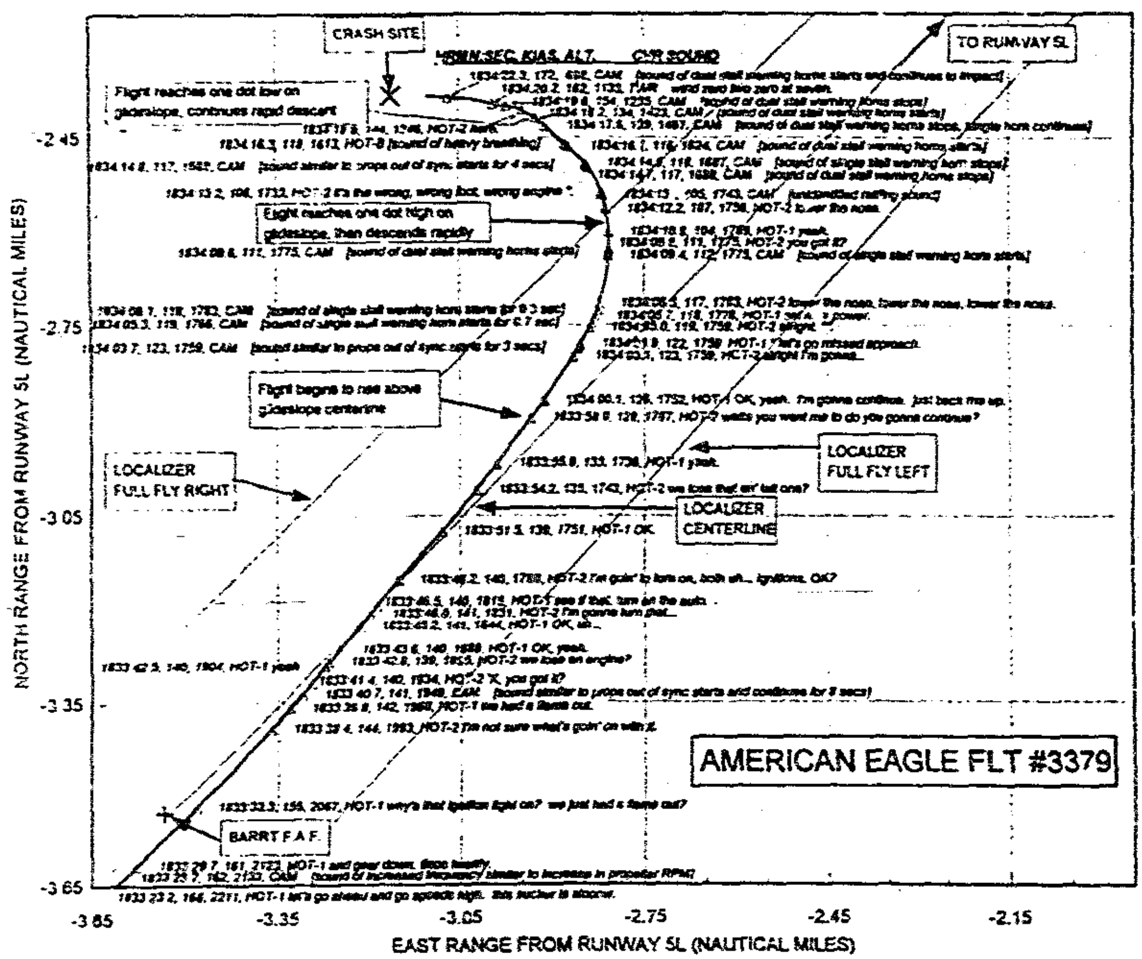

Figure 1.--Airplane ground track.

The accident occurred during hours of darkness, at 35° 50' 5" north latitude and 78" 52' 1" west longitude.

1.2 Injuries to Persons

Injuries	Flightcrew	Cabincrew	Passengers	Other	Total
Fatal	2	0	13	0	15
Serious	0	0	5	0	5
Minor	0	3	0	0	0
None	0	0	0	–	0
Total	2	0	18	0	20

1.3 Damage to Airplane

The airplane was destroyed by impact and fire. It was insured for $4,130,626.

1.4 Other Damage

The aircraft crashed through a stand of trees on private property. A dirt road approximately 1.5 miles long was constructed to allow travel to and from the site. There was no other property damage.

1.5 Personnel Information

1.5.1 Pilot in Command

The captain, age 29, was hired by Flagship Airlines on January 7, 1991, as a first officer on the J-3201. He held airline transport pilot certificate No. 471629922, with ratings for BAe-3100, Shorts SD-3, airplane multiengine land, and commercial privileges for airplane single-engine land. He also held a ground instructor certificate with ratings for advanced ground instructor and instrument ground instructor. He received his initial type rating in the BAe-3100 on October 13, 1992, and his last proficiency check on July 6, 1994. His last Federal Aviation Administration (FAA) first-class medical certificate was issued on July 18, 1994, with the limitation that, "Holder shall wear correcting lenses while exercising the privileges of his airman certificate." At the time of the accident, company records indicate that he had accumulated 3,499 total flying hours, of which

2,294 hours were in turboprops, and 457 hours were accumulated in the J-3201 as a pilot-in-command.

The captain began flying in 1985, was eventually hired by Comair on January 8, 1990, and flew as a first officer on the Saab SF-340. He failed the first second-in-command check on February 10, 1990. The failed items included takeoff with simulated engine failure, ILS approach-normal, ILS approach-manual, no flap approach, crosswind landing, landing from an ILS, no flap landing, and judgment. He received an additional hour of instruction the following day, and was retested on February 12. He satisfactorily completed that check and was assigned to line flying. After observing four regular line flights in the jumpseat, on February 17, he performed his initial operating experience (IOE) with a company check airman. The IOE was accomplished between February 21 and March 7, during which he accumulated 31 hours in 30 flights. Written comments by the check captain on the IOE form included the following:

> Feb. 23 - ...still needs some work on his landings and operational procedures. Not ready for SIC [second in command].
>
> Feb. 27 - ...all non-flying pilot duties OK...still having some problems judging approach and landing procedures. Final approach is weak and landing flair (sic) needs a lot of work...recommend several more landings with check airman before signoff....
>
> Mar. 6 - ...concentrated on landings and approaches. Still a little weak on visual approaches.
>
> Mar. 7 - ...meets minimum qualifications for SIC.

It was Comair's policy to obtain written evaluations of probationary first officers from line captains. The Comair records contained three evaluations of the accident captain, serving as a first officer, on the SF-340 during his probationary year. The first, in April, based on a month of flying together, indicated that the line captain had some concern about his flight skills. He noted that he "most always" on instrument approaches made some abrupt inputs that produced departures from altitude or heading. He also noted that "he becomes distracted because he gets upset with his performance." The captain's recommendation was that he remain first officer for at least a year. In June, the second evaluating captain made no specific negative comments and rated him above average in overall job performance;

however, he responded "no" to the question of whether he would feel comfortable as a passenger if the first officer was the captain. The third line captain, who flew with him for two days in December, described him as average in job knowledge; equipment knowledge, and job performance. He commented that he would think twice before asking for something, and that he was moody and unpredictable. In response to a postaccident inquiry, the third line captain also indicated that based on a private conversation they had, personal problems, in combination with the difficulties he was having at Comair, were creating pressures and taking a toll on him. Finally, "...after much careful thought..." the third line captain had recommended that he be dismissed from the company. According to the Comair Vice President of Operations, the accident captain was allowed to resign from Comair in lieu of termination.

In response to a Safety Board request for any additional comments from Comair pilots who had flown with the accident captain, the line captain who provided the April 1990 evaluation stated:

> [He] had below average piloting skills that required my constant attention, especially in the terminal area. The evaluation reflects that [he] was a concern to me because of his timeliness in performing tasks. [He] was frequently "behind the airplane" and often lost situational awareness. While [he] and I never experienced any emergencies together, I was somewhat concerned that [he] may freeze up or get tunnel vision in an emergency situation.

AMR Eagle recruitment files, which were not made available to the Safety Board until April 28, 1995, indicated that the captain applied to Flagship Airlines on October 3, 1990. The stated reason for his interest was to live in Nashville, Tennessee. The captain completed other employment forms intended to facilitate inquiries into his background. One form was entitled "American Eagle Previous Employment Inquiry," which listed Comair as his current employer. This form included a civil release, which was signed by the job applicant. Among the questions, a previous employer was asked to grade the employee's job performance, and whether they would reemploy him. AMR Eagle records reveal the word "HGLD written on the captain's application forms and they had no record that the inquiry form was ever sent to Comair. However, Comair officials indicated that even with a civil release, company policy limits release of airman/employee information to dates of employment and aircraft operated. On October 24, 1990, the captain completed a 1-day interview process that included medical, general and professional interviews, and a simulator evaluation. He was sent an offer of employment by Flagship Airlines on December 19, 1990, which placed him in class 91-01, to commence on January 7, 1991. The captain accepted the offer, by letter. on December 24,1990.

The captain resigned from Comair on January 3, 1991, and was hired by Ragship Airlincs on January 7, 1991. He was assigned to J-3201 training as a first officer. and completed it on March 13, 1991. He served as a first officer until January 20, 1992, when he was eligible for captain upgrade training in the Shorts SD3-60. After ground school, he received 4 hours of cockpit procedures training, and 32 hours of simulator time, of which 16 hours were as pilot-in-command. He also received 18 hours mining in the airplane between February 19, 1992, and April 30. 1992, with several interruptions due to student backlog and availability of airspace in the Philadelphia area. Flagship training records indicate that on March 24, 1992, ihe instructor indicated that he had unsatisfactory progress on single-engine, nonprecision approaches. Comments on April 5, 1992, indicated improved airspeed control on ILS approaches, and he recommended him for a check ride. However, 2 days before the check ride, on April 29, 1992, he was graded unsatisfactory on crosswind takeoffs and landings, engine failures, and single-engine missed approaches. He was given an additional training period on April 30, 1992, and successfully passed the initial type rating proficiency check on May 1, 1992. He accomplished his IOE between May 7 and 10, 1992, accumulating more than 21 hours and 11 landings. He did not receive a line check from an FAA inspector until May 28. 1992, and, at that time, he was assigned to line operation.

On September 7, 1992, the captain began captain upgrade training in the J-3201. He satisfactorily completed the ground school and oral examination on September 24, 1992. From September 28 through October 5, 1992, he received 14 hours of mining in the simulator; however. on October 6, 1992, he failed the type rating check. He received an additional training period, and successfully passed the recheck from the same FAX inspector on October 13, 1992. He accumulated 13.9 hours and 8 landings on his IOE, and received a line check from the FAA on October 21,1992.

The captain was displaced from captain to first officer on the J-3201 on May 1, 1993, because of a reduction in the number of clots in the domicile. He requalified as captain on the J-3201 on January 26, 1994, and was serving in that capacity continuously until the accident. He received recurrent crew resource management (CRM) training on October 24,1994.

The RDU Base Manager stated that about 1 month before the accident, he became aware of a first officer who was reluctant to fly with the captain, "because of things she had heard." After discussions with the Base Manager, the first officer agreed to fly with the captain, and to provide feedback on his performance as pilot-in-command. The first officer later advised that everything had gone well. This first officer was interviewed after the accident, and she attributed her apprehension to the fact that she was operating on "emotion and rumor control." She did not divulge the specifics of the mors, but she added that the captain had asked her about mors concerning him, and that she had advised him to ignore them. She considered the captain's flying skills average and his decision-making, command ability. and leadership skills below average.

Two days later, the captain called the Base Manager at home and expressed concern about his reputation at tile airline. They discussed the subject again ai the office, and the captain explained that he'd had a bad day, and that me experiences on that day may have prompted mors about his ability. The captain also felt that he was not flying as much as others because he was on reserve.[4] The Base Manager offered to assist him secure training time in the simulator. but the captain declined the offer. Several days after these discussions, the Base Manager was advised by another captain that several first officers said that the accident captain, "...had flying deficiencies." The Base Manager further described the event as follows:

> I related [to the captain who advised him of first officer concerns] the events of the past few days regarding the first officer who balked, then flew, with [the accident captain] and subsequently reponed everything normal. I advised him to tell any first officers who flew with [the accident captain] and felt there were reasons to doubt his performance to come forward to me. Since that time, no one came forward and I don't recall nearing of my other instances relating to [the accident captain].

[4]A classification for line pilots who are unable to hold a regular scheduled line of flying because of seniority.

1.5.2 First Officer

The first officer, age 25, was hired by Flagship Airlines on December 6, 1993, as a first officer on the J-3201. He held airline transport pilot certificate No. 473907365, with ratings for airplme multiengine land and airplane singleengine land and sea. He also possessed a flight instructor certificate with ratings for airplane single and multiengine, and instrument airplane. His most recent FAA first-class medical certificate was issued on October 6, 1994, with no limitations. Company records indicate that he had accumulated 3,452 total flying hours, of which 677 hours were in the J-3201.

He attended an airline pilot qualification course at the American Airlines Flight Academy, Fort Worth, Texas, from October 14, 1991, to November 1, 1991, which included training in a Cessna Citation CE-500 simulator. He was subsequently hired, and began ground school on the J-3201 on December 6, 1993. He completed the ground training, including CRM, on January 5, 1994. He passed an oral examination on January 6,1994, and completed the simulator training on January 25, 1994. A training lesson and proficiency check were completed in the airplane on January 31. 1994. He performed his IOE from February 4 through 6, 1994, during which he accumulated 12 hours and 10 landings. Check airmen, line captains, and peers described him as an above-average pilot. Although he was based in Miami, Florida, he was temporarily assigned to the RDU domicile to cover flying for the month of December.

1.5.3 Flightcrew Activities and Flight/Duty Times

There was no record of the captain's activity on December 8 and 9, 1994. Company records indicate that the captain was on sick leave on December 10 through 12,1994. His two roommates were interviewed following the accident. They were out of town the weekend before the accident. but both described him as behaving normally when they returned on Sunday evening, December 11, 1994. They stated that they had each had a cold the week before, but neither could explain why he called in sick. The captain reponediy spent most of the moming of December 12, 1994, studying for an economics final examination,[5] and was apparently out "running errands" until about 1700. He watched a football game Monday night with one of his roommates, and discussed the impending RDU

[5]The captain was enrolled in part-time studies at North Carolina State University, Raleigh, North Carolina.

base closure with him. The captain indicated that he did not want to be transferred, and was considering resigning from the airline. Hc told the roommate that the next day's trip might be his last. The captain and his roommate prayed about the situation. and he went to bed between 0045 and 0130 on December 13, the day of the accident, and got up between 0815 and 0830. He went to the campus, and returned between 1030 and 1045. He went to the airport between 1130 and 1200.

Company records indicate that the first office: was off duty on December 8 and 9. The following table reflects his company activity for several days prior to the accident:

Date	Start Duty	Flight Time	Actual Duty Time	Trips	End Duty
12/10	1311	1:59	8:59	3	2210
12/11	0640	3:29	10:46	4	1726
12/12	0555	6:10	12:46	7	1841

The first officer was domiciled temporarily in a company-provided hotel. The hotel driver remembered taking him and other pilots to the airport between 1230 and 1300 on the day of the accident. The hotel front desk clerk remembered seeing him around 1245, and described his mood as average.

1.6 Aircraft Information

1.6.1 General

N918AE, a British Aerospace Jetstream Aircraft Ltd. J-3201. S/N 918. received an FAA Standard Airworthiness Certificate on January 11, 1991. in the commute: category. The aircraft was approved to ope-ate in day or nigh: visual flight rules (VFR). instrument flight rules (IFR), and in known or forecast icing conditions when the appropriate equipment was Installed and operable. It was equipped with a CVR, FDR, and a fight profile advisory (FPA) system, similar to the ground proximity warning system (GPWS) used on other aircraft. At the time of the accident. it had been operated a total time of 6,576.9 hours.

N918AE was equipped with two Garrett TPE-331-12UHR turbopropeller engines installed as follows:

Position	Serial No.	Installed	Time Since Last Visit (Hours)	Cycles Since Last Visit	Total Time (Hours)
No. 1	P66241	11/22/94	44.3	60	5,735
No. 2	P66236	08/04/94	501.9	695	5,431

The Jetstream Series 3200 night Manual, used by Flagship Airlines, contained the following maximum limitations:

Ramp Weight	16314 Pounds
Takeoff Weight	16,204 Pounds
Landing Weight	15,609 Pounds
Cargo Hold	62E Pounds
Baggage Pod[6]	435 Pounds

The allowable takeoff weight for the accident flight was restricted at GSO because of the en route fuel bum and the allowable landing weight at RDU. In this case, the allowable takeoff weight was 15,952 pounds, but the calculated weight was 15,998 pounds. The captain advised the ramp agent that a weight calculation adjustment must be made, either by removing two bags from the aft cargo compartment, or by transferring five carry-on bags from the pod to underseat stowage.[7] The latter would not have affected the actual weight of the aircraft, but would have changed the computational weights assigned to the bags. The agent could not find five bags in the pod that would fit under the seats, and removed two bags from the aft compartment instead. The captain's computation of tile takeoff weight was based on the agent changing the location of the bags, rather than removing two bag;. The result was that the calculated takeoff weight of 15,948 pounds, recorded on the departure form, was 3 pounds tighter than the actual airplane weight. Tie calculations used by the crew were as follows:

---

[6]The aircraft was fitted with an external baggage pod attached to the fuselage belly 10 supplement the internal baggage compartment.

[7]The operator was authorized to compute the aircraft weight by using average weights. The average weight allowed for passengers, 175 pounds for winter, included 10 pounds for carry-on baggage. All checked lugs were assigned an average weight of 23.5 pounds, and all plane-side checked bags (those which cannot fit in approved bins or under the seat) were assigned a weight of 10 pounds. Thus, the 46-pound excess calculated weight would be corrected by either removing two of the checked b y from the aft cargo compartment (a 47-pound reduction), or hy moving five of the plane-side checked bags from the baggage pod to underseat stowage (a 50-pound calculation change).

Basic Operating Weight	10,455 pounds
18 Pax @ 175 Pounds Each	3,150
Cargo (Aft=470, Pod=221)	691
Fuel	1,700
Ramp Weight	15,996 pounds
Taxi Bum	- 48
Takeoff Weight	15,948 pounds
En **mute** Fuel Bum	- 352
Landing Weight	15,596 pounds

The center of gravity (CG) *Emit* range, expressed in index units, was -13.8 *to* -1.2. The discrepancy in baggage resulted in a planned CG of 4.6, but the actual calculation should have been -5.4 index units. The zero fuel, ramp, takeoff, and landing weights, and the CG of the aircraft were all within limits throughout the flight.

1.6.2 Cabin Configuration

The flight deck had the standard seating arrangement for a captain, left sick, and a first officer, right side. There was no observer seat. The cabin was configured with 19 passenger *seats*, 7 single seats on *the* left side and 6 double seats on the right side. A lavatory was installed on the right side opposite the main entry door at the rear of the aircraft.

1.6.3 Maintenance Records Review

Flagship Airlines maintains the Jetstream 3201 fleet under an FAA-approved 14 CFR Part 121, Subpart L, continuous airworthiness maintenance program.[8] The maintenance instructions for the program are contained in the BAe Jetstream 3201 maintenance manuals and in work cards provided in the American Eagle Maintenance Check Manual (MCM). The program incorporates the following recurrent inspections:

<u>Periodic Service Checks (PS-1 and PS-2)</u> - ground level walkarounds, performed by maintenance personnel every two flying

[8]Technically, the airplane did not have to be maintained under the Part 121 program; however, AMR Eagle elected to use the more stringent program, instead of that required under 14 CFR 135.

days (defined as a 24-hour period, midnight to midnight) and seven calendar days, respectively.

Phase Checks - servicing and inspection checks, requiring the opening of panels, and a detailed inspection of specific components and zones. There are 24 checks, in numerical order, performed in sequence at 150 flight hour intervals.

Main Base Visits (MBV) - consists of "C" type maintenance checks that are not normally covered at phase check intervals. Modifications and other optional work are normally accomplished at this time to take advantage of the down time. The interval is 1,800 flight hours

Intermediate Main Base Visits (IMBV) - mostly "C" type, or higher, maintenance checks which would not normally require inspection at MBV intervals. The IMBV is accomplished at 3,600 flight hour intervals.

Heavy Main Base Visit (HMBV) - includes MBV and IMBV type items, and additional "C" type or higher maintenance checks. The interval for the HMBV is 7,200 flight hours.

All inspections are required to be performed using work cards that provide instructions to the mechanic or inspector, including location of the task, panels involved, special tools or equipment required, and a step-by-step process for performing each task. There is a signature block to be signed when each step is completed. All scheduled maintenance is recorded and tracked on a computerized system (DASH). Complex or time intensive nonscheduled maintenance and special inspection items, such as lightning strikes, severe turbulence, and hard landing inspections, also have work cards. Age exploration program inspections are accomplished in conjunction with other maintenance checks whenever possible, but they may be accomplished separately.

At the time of the accident, Flagship Airlines used contract maintenance for all MBV, IMBV, and HMBV inspections. Most checks were performed by Eagle Aviation Services, Inc., Little Rock, Arkansas, a 14 CFR 145 repair station owned by AMR Corporation. Occasionally, FFV Aerotech, Inc., Nashville, Tennessee (BNA) performed MBVs to meet schedules. Additional contract maintenance was performed at most outlying stations by local fixed-base operators; however, if major repairs or component changes were needed, Flagship maintenance personnel were dispatched to the site.

Deferred maintenance procedures are contained in the company General Procedures Manual. They require that deferred items be identified, verified for FAA compliance, and documented on the Maintenance Item Control (MIC) sheet. Minimum Equipment List (MEL) items, Configuration Deviation List (CDL) items, and Deferred Maintenance Items (DMI) are all transferred to the MIC sheet, located in the front of the active aircraft logbook.

Copy pages of the aircraft maintenance logbook are collected and turned in at the end of the day, or at the first maintenance base stop the next day. The sheets are reviewed at the base where they are turned in, and then they are express mailed to maintenance operations at BNA. As part of its continuing analysis and surveillance program, under 14 CFR 121.373, Flagship collects data from the pilot writeups, scheduled inspections and checks, and nonroutine maintenance to discover negative trends, and to determine corrective actions.

N918AE received a phase 16 check at the Flagship Maintenance Base in BNA on October 19, 1994. This was one of the six phase checks (phase checks 4, 8, 12, 16, 20, and 24) requiring inspection of the stall warning system components. The records showed that the three applicable routine work cards 2373, 0373, and 0383 were executed and properly signed off at that time. No nonroutine work cards were generated during the inspection process. Additionally, a check of the maintenance logs for a 2-month period prior to the accident revealed that there were not any pilot-noted discrepancies related to the stall warning system. The stick pusher received a 50-hour operational check on November 6, 1994.

N918AE entered an HMBV on November 11, 1994, at the Eagle Aviation Services, Inc., facility in Little Rock, Arkansas, and completed the visit on December 1, 1994. Following the aircraft's return to service, the right propeller was twice written up for fluctuation in flight and failure to maintain selected RPM on December 6, 1994. This discrepancy could not be duplicated on the ground, and a functional check flight (FCF) was performed on December 7, 1994. This resulted in changing the right propeller governor, and another FCF on December 8, 1994. When this FCF was unsatisfactory because of propeller RPM fluctuation, the right propeller assembly was removed and replaced. On December 9, 1994, the aircraft passed an FCF, with no propeller fluctuation. There were no further reports of RPM fluctuation.

However, on the same flight that cleared the propeller fluctuation problem, there was a writeup for an engine torque split of 10 percent at flight idle (LH torque 8 percent, RH torque 18 percent). Interviews with the crew on the FCF revealed that this was discovered during an ILS approach at the end of the flight when the captain retarded the power levers to flight idle one last time to see if the propeller would fluctuate. The captain pointed out to the technician on board that this could possibly cause asymmetric thrust problems for pilots during landing flare and reverse power application. The technician noted that the fuel flows at the time were 219 and 221 pounds per hour on the left and right engines, respectively. The captain did not experience any directional control problems on landing, but he did record the torque split in the aircraft log. The technician noted that the fuel flows were still nearly equal after landing, and he then checked and adjusted the right propeller flight idle blade angle. He adjusted the beta tube pin one hole (the smallest adjustment possible), and then checked the blade angle to confirm that it was still within limits. The blade adjustment, engine fuel flow, RPM, and torque were checked while both engines were ground run at flight idle. The aircraft was then released to line operation on December 9, 1994.

The Flagship maintenance manual had an established procedure to adjust engine torque. This flight idle torque test required specified conditions of altitude, airspeed, airframe configuration, bleed switch position, propeller RPM, and power lever position. The torque values obtained should be 10, plus or minus 2 percent between 3,000 and 5,000 feet; and 9, plus or minus 2 percent between 5,001 and 9,000 feet. A note in the procedure specifies that, "Difference between left and right engine torque must not exceed 2 percent." If the torque differential during the test is greater than 2 percent, the maintenance manual refers the mechanic back to the established procedure for adjusting torque.

On December 11, 1994, an entry in the aircraft log reported that the left engine did not indicate 100 percent RPM on takeoff. A screw "x" adjustment[9] was made, and a ground run was satisfactorily completed. There were no repeat squawks on this problem.

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[9]Screw "x" is one of four adjustment screws on the concentric shaft assembly. It provides for the adjustment of the propeller governor high RPM setting, which is specified to be 100.5 percent ± 0.5 percent RPM. Rotation of the screw clockwise increases the RPM, and counter-clockwise rotation decreases RPM.

A PS-1 inspection was completed at BNA on December 12, 1994. No subsequent aircraft maintenance log sheets were available for inspection.

1.7 Meteorological Information

Surface weather observations at RDU are taken at the National Weather Service (NWS) observing facility, located in the Air Cargo Building at the airport. The NWS observer was notified of a possible accident at 1840. The pertinent surface observations were as follows:

> 1751--Record--measured variable ceiling 500 feet overcast, visibility 2 miles, light rain, fog, temperature 37° F, dew point 35° F, wind 010° at 8 knots, altimeter setting 30.31 inches of Hg, Remarks--surface visibility 3 miles, ceiling 300 feet variable 600 feet, drizzle ended 1740, rain began 1740.

> 1841--Local--measured variable ceiling 500 feet overcast, visibility 2 miles, light rain, fog, temperature 38° F, dew point 36° F, wind 010° at 8 knots, altimeter setting 30.31 inches of Hg, Remarks--surface visibility 3 miles, ceiling 300 feet variable 600 feet.

The NWS weather observer described the weather as steady, consistent, and uneventful.

The pertinent NWS surface weather observation at GSO was as follows:

> 1750--Record--measured ceiling 1,100 feet broken, 2,500 feet overcast, visibility 7 miles, temperature 37° F, dew point 30° F, wind 040° at 10 knots, altimeter setting 30.28 inches of Hg.

Weather radar data showed widespread light rain in the region. Radar indicated that the cloud tops were uniform at 12,000 feet.

The nearest rawinsonde[10] station was located at the GSO NWS office. The regular balloon launch at 1804 recorded a freezing level about 7,703 feet msl, and the temperature at 9,000 feet msl was about -3° C.

The following pilot reports were received in the general area. at the times indicated:

> 1625--single engine BE-36 about 20 miles north of RDU at 7,000 feet reported no icing (+2° C), tops at 7,500 feet.
>
> 1649--twin engine CE-500 abour 20 miles west of Greenville, at 14,000 feet, reported light to moderate rime icing between 9,000 and 13.000 feet during climbout. Tops were at 13,000 feet.
>
> 1725--unknown aircraft over RDU at 10,000 feet reported light icing.
>
> 1815--twin engine CE-402 over GSO reported moderate rime icing at 9,000 feet. but none below 8,000 feet during descent.
>
> 1850--single engine BE-36. 35 miles west southwest of GSO at 9,000 feet, reported light cicar icing.

The crew of a company flight. being vectored for an approach at the time of the accident. stated that they encountered a trace of icing between Richmond, Virginia, and RDU at 10,000 feet. The ice came off in the descent above 8,000 feet. They were diverted to GSO at 9,000 feet after the accident and did not encounter my ice.

The RDU terminal forecast for the period, 1300 December 13 through 1300 December 14. was. in pan. as follows:

> Ceiling 200 feet overcast, visibility 2 miles, light rain, fog; wind 360° at 9 knots: occasional ceiling 800 feet overcast, visibility 5 miles. light rain, fog. 1900 Ceiling 800 feet overcast. wind 030°

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[10] A method of upper air observation consisting of an evaluation of the wind speed and direction, temperature, pressure, and relative humidity aloft by means of a balloon-borne radiosonde tracked by a radar or radio direction finder.

at 10 knots: occasional 800 feet scattered, ceiling 2,000 feet overcast: chance visibility 4 miles light rain, fog.

At 1858, the RDU forecast office issued an amended forecast reflecting the expected continuance of lower weather conditions at the airport.

1.8 Aids to Navigation

Runway 5L is served by an ILS with distance measuring equipment (DME). BARRT, the outer compass locator, and the middle marker are 5.0 and 0.6 miles, respectively, from the runway threshold. The lighting system consisted of high intensity runway lights, runway centerline lights, a medium approach lighting system with runway end identifiers, touchdown zone lighting, a precision approach path indicator on the left side of the runway (set at 3°), and a runway visual range.

The ILS was flight checked on December 14, 1994, and all components were operating within prescribed tolerances.

1.9 Communications

There were no reported communications difficulties or outages reported at RDU at the time of the accident.

1.10 Aerodrome Information

RDU is located 9 miles northwest of Raleigh at an elevation of 436 feet. The runway configuration includes two parallel runways (5L/23R and 5R/23L), with offset thresholds, and a perpendicular, but not intersecting, runway (14/32) at midfield. Runway 5L is 10,000 feet long and 150 feet wide, but the usable length beyond the glideslope/runway intercept point was 9,000 feet. There is an upslope from the threshold elevation of 368 feet to 409 feet at the departure end. The surface was grooved.

RDU is required to maintain CFR Index C facilities.[11] However, the airport maintains CFR Index D equipment capability. There was an airport

[11]FAA airport rescue and fire fighting (ARFF) Index C is a category for airports in which aircraft between 126 feet and 159 feet in length are taking off or landing. Index C airports must have at least two vehicles: One vehicle that carries extinguishing agents, and one to two vehicles that carry an amount of water and a

Emergency Plan which met the requirements of 14 CFR 139.55, and was last approved by the FAA on July 14, 1994. The last disaster drill was conducted by RDU on August 4, 1994, as a tabletop exercise (a communication and coordination exercise without the use of physical resources) for an off-airport disaster. A full-scale triennial disaster exercise was conducted on April 3, 1993.

1.11 Flight Recorders

1.11.1 Flight Data Reeorder

The aircraft was ?quipped with a Loral Fairchild Model F800 digital flight data recorder (FDR), Part No. 17M703-274 (S/N 5379).[12] The FDR records pressure altitude. magnetic heading, indicated airspeed, vertical acceleration, and VHF [very high frequency] radio keying data on an elapsed time lie for 25 hours before recording over the oldest data. The recorder was heavily damaged by impact forces, and the exterior casing had to be cut away to remove the crash-survivable memory module. This module was slightly damaged on the inside, but the tape was undamaged. The last 3.5 hours of data were transcribed to a disk file for processing. Figure 2 depicts the last minute of FDR ' VR data.

1.11.2 Cockpit Voice Recorder

The airplane was equipped-c with a Fairchild model A-100A CVR, S/N 59832. The recorder was examined at the Safety Board's audio laboratory, and a transcript was : .de of the entire 31-minute recording. The exterior casing received significant compression of the aft end, and it was necessary Po cut the casing to access the recorder. The recorder module did not sustain any impact or heat damage. The recording was of good quality. Timing was established by reference to an air traffic control transmission. The recording began at 1803:45, as the crew was preparing for departure, and ended with impact at 1834:26.6.

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commensurate quantity of aqueous film-forming foam (AFFF) so that the total quantity of water for foam production carried by the vehicles is at least 3,000 gallons. Index D is a category for airports used by aircraft up to 200 feet in length. They must have at least three vehicles that carry an amount of water and a commensurate quantity of AFFF that will produce 4,000 gallons.

[12] An 11-parameter FDR was required on all commuter-category aircraft equipped with 10 to 19 passenger seats that were U. S. registered after October 11, 1991. N918AE was registered on January 11, 1991, and no FDR was required.

FINAL MINUTE OF FDR/CVR* DATA - FLT 3379

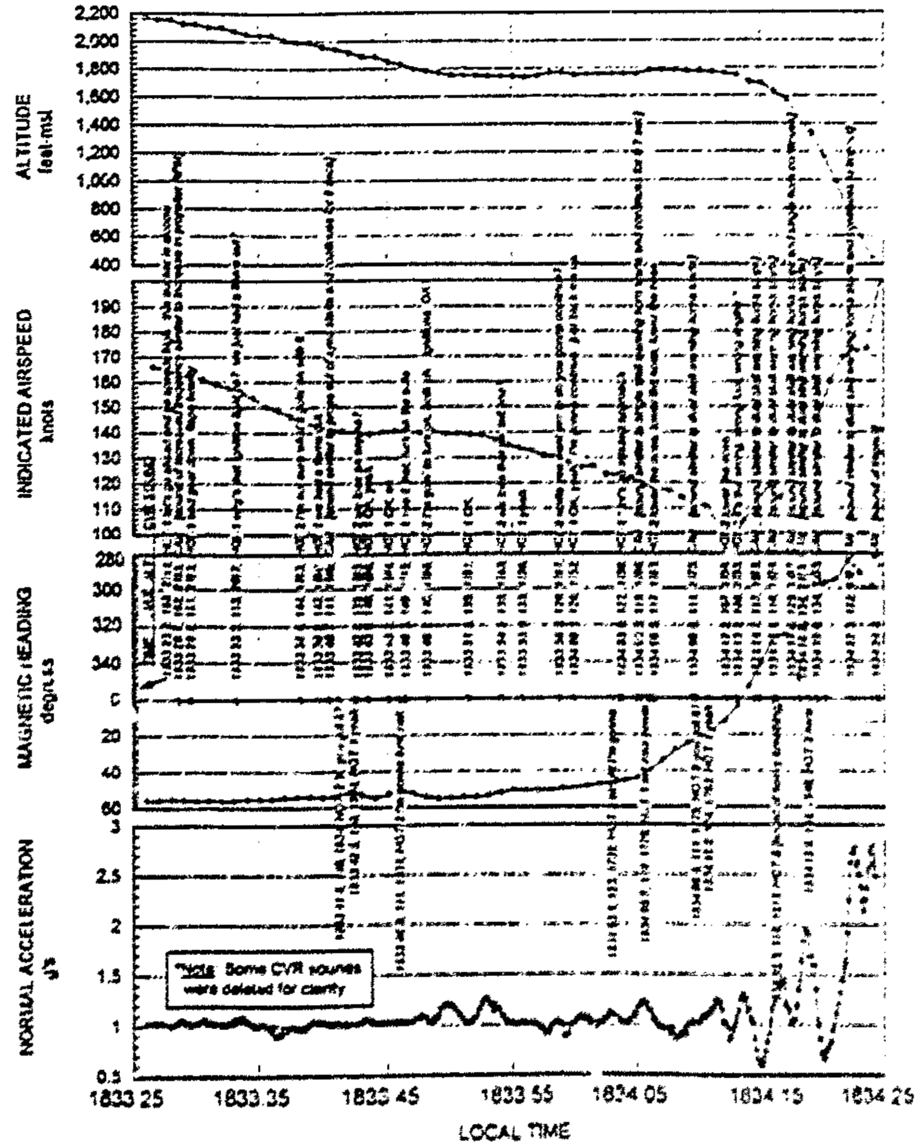

Figure 2. FDR data.

1.11.2.1 CVR Sound Spectrum Study

An acoustic spectral study of the cockpit area microphone (CAM) channel of the CVR was conducted to ascertain acoustic information that might relate to the operation of the engines and propellers. No infornation was derived from acoustic energy generated by the engines, so all data examination was related to the blade passing frequencies (BPF) of the propellers. The spectral study did not produce any traces consistent with the BPF of a propeller that was slowing during an engine shutdown. Further, after the propeller speeds were increased to 100 percent for landing (about 1833:28.7, or about 1 minute before impact), there were two close but distinct frequency traces, consistent with the BPFs calculated for propeller speeds ai 100 percent. The study showed that the RPMs of the propellers were approximately 99 percent. and did not differ by more than 1 percent, except for a brief period starting approximately 9 seconds prior to impact One B?F then decreased slightly for about 4 seconds, producing a maximum difference of about 5 percent (94 percent for one and 99 percent for the other). The lower BPF subsequently increased so that both EPFs were approximately 99 percent for the final 5 seconds before impact.

1.12 Wreckage and Impact Information

1.12.1 General

The aircraft struck a stand of trees and broke into numerous pieces as it continued in a slight right bank, and shallow descent through the trees, on a general heading of 270° true. There was no indication of in-flight fire or separation of pans prior to tree impact. The first tree that was struck was broken 59 feet above the ground, approximately 290 feet from the main wreckage. The elevation in the area was 315 feet mean sea level (msl). The airplane was destroyed by the impact forces and the subsequent fire.

The first significant piece of wreckage, the right wing tip, was found about 28 feet past the initial tree strike. The fuselage separated into three main sections. The first section, from the cockpit to the wing leading edge, sustained heavy fire damage. which consumed most of the structure from the cockpit windows to the front wing spar. This fire zone, tire first evidence of fire-damaged structure, was located approximately 230 feet past the initial tree strike. The second fuselage section, from aft of the overwing emergency exits to forward of the empennage, was In the main wreckage area, approximately 290 feet past the first tree strike. This section was not fire damaged. The third section of the fuselage, from the aft pressure bulkhead to the empennage, was in the same general area. There was light fire damage on the lower right fuselage skin and on the lower portion of the aft pressure bulkhead. The last significant piece of wreckage, a section of inboard elevator, was found 338 feet from the initial tree strike. Other small engine parts were found approximately 27 feet farther along the wreckage path.

Both the left and light wings and associated control surfaces separated into numerous parts. The front, main, and rear spars showed aft bending. Ail fracture surfaces on the wing spars were the result of overload. A layout of both wings indicated that all pieces were recovered.

1.12.2 Engines

The engines and propellers were examined in the field at the crash site, and in a hangar at the airport. Subsequently, the engines, propellers, fuel controls, and propeiier governors were examined in detail upon disassembly at the manufacturers' facilities. The teardowns were conducted under the supervision of ?he Safety Board. These examinations revealed that the damage inside ihe engines, the witness marks on the propellers, and the characteristic bending of the propeller blades indicated rotation and power. and the damage was similar in character and extent, when comparing left and right components. Additionally, the examinations did not reseal any failures or preexisting conditions thzt would have prevented operation of either engine.

The lek engine was found with the wing in the main fuselage section. The engine mounts had failed. but most wires, fluid lines and mechanical connections were intact. The left propeller separated at the flange, and was found approximately 22 feet northeast of the engine. The first stage compressor impeller had leading edge damage on 5 of the 17 blades, and a 0.070-inch-thick piece of sheet metal was wedged between the impeller and the shroud. The damaged blades were bent opposite to rotation of the engine, and the first stage compressor shroud had circumferential rub marks through 360°. The third stage turbine rotor was in operable condition. finely chopped biackencc! bark, wood chips, and organic material had collected inside the turbine assembly.

The right engine separated from the right wing at the engine mounts and was found about 10 feet south of the cockpit. The right propeller separated at the flange and was locaied approximately 56 feet east of the engine. The first stage compressor impeller blade tips were partially melted and bent opposite to engine rotation. The compressor shroud had circumferential galling through 360°. The third stage turbine wheel was heat damaged, but there was no impact damage. There was blackened organic material in the turbine assembly.

All four propeller blades on both engines were recovered in the impact area.

1.12.3 Systems Examination

The ground fire damage in the cockpit area prevented the determination of meaningful data from any gauges, switches, communication/navigation radios, and instruments.

Flight control cables were traced from the respective control surfaces into the cockpit area. There were no signs of preimpact failure of any push-pull tubes, bellcranks, or pulleys. The elevator and rudder cables were intact from the cockpit area to the respective final drive. Control cables to the ailerons, elevator trim, and rudder trim failed in tensile overload tests in the area of the main wing spar carry-through. The rudder *trim* tab position was found at approximately 80 percent of the available nose right input.

The flap selector switch in the cockpit was severely burned, but internal examination at the manufacturer's facility revealed that the switch contacts had melted and fused at the 20° flap position.

All three landing gear were found in the extended position.

The stick pusher was found in the fully extended position.

1.13 Medical and Pathological Information

Toxicological specimens were taken from the bodies of the flightcrew and tested at the FAA Civil Aeromedical Institute (CAMI) in Oklahoma City, Oklahoma. The captain's results indicated 0.519 ug/ml (ug/g) chlorpheniramine[13] in

[13]Chlorpheniramine is an antihistamine, not approved for flying, contained in many over-the-counter medicines. It has the potential effect of reducing alertness, slowing reaction, and altering perception.

the liver, and the same chemical was found in muscle fluid. The first officer's tests did not reveal any evidence of drugs.

The AMR Eagle Flight Manual contained guidance on the use of medicine, in part, as follows:

> **89. Use of medication**
>
> A. FAR 91.17 prohibits acting or attempting to act as a crewmember of a civil aircraft "While using any drug that affects the person's faculties in any way contrary to safety...." Crewmembers who are unsure of the side effecii of a particular prescription or non-prescription drug are advised to consult their FAA Aeromedical Examiner, or the AA Corporate Medical Director....
>
> B. The following mediations are currently approved by the AA medical department:
>
> 1j Pain medications: Aspirin, Tylenol, Bufferin, Anacin, Advil, Motrin, and Nuprin ....
>
> 4)Decongestants: Sudafed (without antihistamines), Afrin Nasal Spray, and Neo-Synephrine.
>
> 5) Throat Lozenges: Chloraseptic (plain), Cepacol (plain), Sucrets (plain).
>
> 6) Cough Syrup: Robitussin (plain) ....

1.14 Fire

There was an intense ground fire in the area of the forward fuselage and wing center section. There was no evidence of preimpact fire.

1.15 Survivai Aspects

Both flightcrew members and 13 passengers received fatal injuries from blunt force trauma, and 11 of them sustained thermal injuries from the postcrash fire. ***Four*** of the five survivors were ejected from the aircraft during impact and breakup of the cabin, and sustained blunt force traumatic **injuries.** The fifth survivor crawled out of the wreckage to a safe distance **from** the fire. He sustained **serious** injuries. The **main entry** do.. was separated **from** the fuselage with the forward hinge attached. The lockin g pins and the **operating** handle were found in the locked position. The overwing emergency exits, located between rows **3** and **4** on each side of the cabin. were in place with the interior trim still attached.

The f i t Apex Rescue Squad units were dispatched at **1847.** They responded with one ambulance and one crash **truck** and arrived at **1853** at Old Maynard Road about 1 mile **from** the crash site. **The** paramedics proceeded on foot -io the crash site with extreme difficulty due to the lack of direct access, adverse weather, and **terrain.** The Wake **County** Incident Command Plan was implemented with the rescue squad assuming on-scene command responsibility to locate survivors. **perform** triage. and treat and transport the victims to the medical treatment area on Old Maynard Road. Seven survivors were **found,** treated, and removed from the crash site with the aid of firefighters and 4-wheel drive vehicles. They were then taken to hospitals by ambulances, four to **Duke** Medical Center and three to Wake Medical Center. **Tws** of the three survivors taken to Wake Medical Center died shortly after arrival.

1.16 Tests and Research

1.16.1 Flight Tests at Jetstream Aircraft

The Safety Board requested that Jetstream Aircraft, Ltd., conduct certain flight tests to produce data to aid in the investigation. The tests examined the **1)** engine dynamic responses that would produce an ignition light; *2)* the power settings. configurations, and flight controls required to produce the accident flight profile; **3)** the single engine **go-around** capabilities using abnormal procedures; and 4) the effects of sideslip on **stail** warning speed.

Right tests were conducted at **the** Jetstream Aircraft, Ltd., facilities, Prestwick. Scotland, from March 21 through 24, 1995. **The** configuration **of** test aircraft. **S/N** 983. was consistent with the accident aircraft, except that no baggage **pod was** installed. Jetstream reported that the pod would not have significantly affected the *results* ***of*** the *tests.* Test instrumentation **was** installed to record airspeed, aititude, normal acceleration, engine torques, propeller RPMs, sideslip angie, stall warning system operations, and pitch, roll, and herding angles. **In** addition, a video camera, with audio and digital clock, was installed in the cockpit to monitor the instrument panel.

It was found that flight idle torque was needed on both engines of the test aircraft to match the accident flight profile up to the time that propeller RPMs were increased from 97 percent to 100 percent (about 1 minute before impact). According to the CVR, just after propeller speedup on the accident flight, the captain said "why's that ignition light on? we just had a flameout?" Advancing the speed levers simultaneously increases propeller RPM and reduces engine torque. If engine torques are abnormally low, then increasing propeller RPM can cause engine toque to momentarily fall below 0 percent, which causes the Negative Torque Sensing (NTS) to activate.

Negative torque is a condition in which air loads on the propeller drive the engine. To reduce windmilling propeller drag after an engine flameout, the NTS causes a rhythmic cycling of propeller blade angle toward feather. The engine ignition system has an auto-relight feature that activates the engine igniters following a negative torque condition If the engine was operating normally prior to a transient negative torque, tken its performance is basically unchanged by activating the ignition system. Ignition is usually maintained for roughly 20 seconds after negative torque was last sensed. Flagship pilots interviewed during the investigation stated that they had not seen the ignition lights illuminated in line operation. One pilot had observed the ignition light on a different model Jetstream prior io coming to Flagship.

Therefore, tc assess the conditions that could produce an ignition light, the fuel flows on the test airplane were adjusted to produce lower than normal flight idle toque values. This resulted in 6 percent and 7 percent on the left and right engines, respectively, at 100 percent RPM and 130 knots. The 1 percent torque split was within the 2 percent allowable limit. The flight test pilots stated that they occasionally observed the left ignition light come on during flight idle descents, following quick movement of the propeller speed levers from 97 percent to 100 percent. Examination of the recorded torque values revealed that the negative torque condition that triggered the light was transient. Further, in one case in which the ignition lights were observed. toque values had teen further lowered by setting cabin bleed air to the maximum setting (10), and engine anti-ice was on. The accident flight had engine anti-ice on, but the cabin bleed setting could not be determined from the wreckage.

The J-3201 demonstrated satisfactory single engine go-around performance during airplane certification using the approved configuration (engine-out propeller feathered, flaps 10°, gear up). However, the accident flight's performance indicates that the go-around attempt was not in accordance with approved procedures. The evidence suggests that the landing gear remained down and the flaps remained at 20° rather than being raised to 10°. The CVR sound spectrum analysis showed that the propellers on both engines maintained approximately 100 percent RPM from about 1 minute before impact until impact, which indicates that neither engine flamed out during the accident sequence. The airplane also experienced a sharp left heading change and did not climb, even though the captain had called for maximum power. Therefore, in the postaccident flight simulations, the go-around was attempted with maximum power on the right engine, flight idle on the left engine, flaps at 20°, and landing gear down. The go-arounds were performed by both J-3201-rated pilots on the investigation's Airplane Performance Group, as well as the Jetstream test pilot.

In the abnormal go-around configuration at the weight, altitude, and temperature conditions tested, the airplane could maintain 120 KIAS, barely hold altitude and maintain heading, but it was not possible to climb. When airspeed slowed to 110 KIAS, full right rudder was required to maintain constant heading. Further decrease in airspeed to stick shaker activation (approximately 101 KIAS) produced a left turn rate, but the airplane was still controllable. (It was also noted that pilot workload during a single engine go-around was not excessive, using correct procedures, but that the workload was substantially increased when the abnormal go-around procedure was used.)

The tests demonstrated that the minimum directional control speed for the assumed conditions of the accident airplane was approximately 110 KIAS, 17 knots higher than the V_{MCA} speed published in the airplane flight manual. V_{MCA} is the minimum speed at which the airplane can be controlled in the air under a specific set of conditions. The minimum control speed was higher in the test flight because the left engine was producing negative thrust at 6 percent torque while 12 percent torque is equivalent to "zero thrust" for the test conditions.

The normal 1 G stick shaker and stick pusher airspeeds, at an aircraft weight of 15,500 pounds, flaps 20°, are 101 KIAS and 92 KIAS, respectively. The airplane performance study indicated that the stall warning on the accident airplane activated approximately 8 KIAS higher than the certification values. However, the certification speeds are not directly comparable to the accident flight because of different deceleration rates, engine thrusts, a possible sideslip condition, and other factors. Several flight tests were conducted to investigate the effect of sideslip angle on the stall warning activation speed. Steady heading sideslips to the left and right were performed at airspeeds between 108 and 117 KIAS. The stall warning activated on one occasion when the speed dropped to 106 KIAS. The test pilot thought that this activation might have been due to atmospheric turbulence. There were no discrepancies noted in either the left or right airspeed indicators during these tests.

1.16.2 Wake Vortex Study

A study was conducted by the Safety Board to determine if the wake vortex from the preceding B-727 could have affected the performance of flight 3379. The study used three separate winds: two from weather data; and one derived. In addition, standard vortex descent characteristics and radar position data for the B-727 defined the movement of the B-727's wake vortices. The radar data were recovered from the Automated Radar Terminal System (ARTS) at RDU; two of the winds were based on rawinsonde data from the GSO NWS office. The 0000 Coordinated Universal time (UTC) sounding was, in part, as follows:

Altitude (AGL) (Feet)	Wind Direction and Speed (Knots)
755	048°/16
2,394	075°/17

A third wind, 068° at 25 knots, was also used. It was derived from the airplane performance study by reconciling the FDR-derived and the ARTS-derived ground tracks. In each case, the wind was assumed to be constant, and the wake vortex descent rate was assumed to be 300 feet per minute (fpm).[14]

The first wind (048°/16 knots) was almost a direct headwind, and the ground track of flight 3379 was not in the vicinity of the vortex at any point near the time of the upset. In the case of the second wind (075°/17 knots), the ground track of flight 3379 intersected the ground track of the vortex at 1834:13. However, the

[14]See "Vortex Wake Characteristics of B-757-200 and B-767-200 Aircraft Using the Tower Fly-By Technique," by Leo Garodz and Kirk Clawson, National Oceanographic and Atmospheric Administration Technical Memorandum ERL ARL-199, which also includes B-727 test results on vortex descent rate.

altitude of the flight was 643 feet above the vortex at the intersecting point. By the time the airplane had descended to the vortex altitude, the airplane and the vortex were separated horizontally by 1,300 feet. For the third wind (068° at 25 knots), the ground track of flight 3379 intersected the ground track of the vortex at 1834:14. However, the altitude of the airplane was 674 feet above the vortex at the intersection point. By 1834:21, the airplane had descended to the same altitude as the wake vortex (from 1,694 to 1,020 feet msl), and the flight and the vortex were separated horizontally by 1,200 feet.

1.17 Organizational and Management Information

1.17.1 AMR Eagle

AMR Eagle, a subsidiary of AMR Corporation, is headquartered at Dallas-Fort Worth International Airport (DFW). It operates four separate regional airlines, with each entity holding a separate FAA operating certificate. The four carriers include Wings West Airlines, Inc., headquartered in San Luis Obispo, California; Simmons Airlines, Inc., headquartered in Dallas, Texas; Executive Airlines, Inc., headquartered in San Juan, Puerto Rico; and Flagship Airlines, Inc., headquartered in Nashville, Tennessee. All four carriers operated similar aircraft and adhered to the same basic operating standards and procedures prescribed by AMR Eagle. AMR Eagle performed the following functions for all four carriers:

- Pilot recruitment and hiring
- Pilot training and checking
- Crew planning and aircraft acquisition
- Airline planning and marketing

In addition to these functions, AMR Eagle performed a coordinating function in route planning, developing operating procedures and related manuals, and allocating aircraft among the individual carriers. AMR Eagle provided a collocated dispatch center and training facilities, but the facilities were staffed with the employees of the individual airlines. Flight operations, in-flight services, and pilot recordkeeping were the responsibility of the individual carriers. AMR Eagle conducted periodic meetings of all four carriers involving senior operations staff and other invited parties (FAA, training center management, and vendors) to discuss safety, regulatory, and policy issues.

1.17.2 Flagship Airlines

Flagship Airlines was formed on June 1, 1991, by the merger of Nashville Eagle (created from AMR Eagle subsidiaries Air Midwest and Air Virginia in December 1987) and Command Airways. Flagship operated routes in the eastern half of the United States and the Bahamas from hubs in RDU, BNA, New York City (JFK), and Miami, Florida. The RDU base, with approximarely 294 pilots, was closed on December 28, 1994, in accordance with plans that were announced before the accident. At the time of the accident, Flagship was operating 135 aircraft, including 48 J-3201s, 53 Saab 340s, 20 Shorts SD3-60s, and 14 ATR-42s. The company had 3,900 employees, including 1,130 pilots and 400 flight attendants. Following the RDU base closure, the company reduced the aircraft fleet to 122, and the pilot force to 1,083.

The senior management of Flagship's flight operations includes a President, who reports to the President of AMR Eagle, a Vice President of Operations, a Director of Flight Operations, a Director of night Administration, a Manager of Flight Standards and Training, and Base Managers at each of the hubs. The Vice President of Operations and the Director of Flight Operations both consider Fiagship to be a separate airline operating under its own FAA-approved operations specifications.

Flagship maintains pilot records containing data on qualifications, currency, dares of previous flight and proficiency checks, training and medical certificates. mere is no requirement for captains to complete reports on probationary first officers, but evaluation forms are available. No evaluations were found for the captain but the fimt officer had received two outstanding evaluations from Miami-based captains. The Vice President of Operations remembered meeting the captain and discussing scheduling with him; he did not know the fimt officer. He reviewed the captain's records following the accident and did not notice anything si-'ficant. The Director of Flight Operations was not familiar with either . member. and did not review their records after the accident.

1.17.3 AMR Eagle Training Center

Prior to the formation of the training center, Flagship Airlines had its own training department. It leased simulator time from several facilities, including Flight Safety International (FSI), and AMR Eagle, while conducting its own "in-house" ground and flight training. After the transfer of training to the AMR

Eagle Training Center in September 1933, the Flagship training department was dismantled. A manager of flight standards ensured that training and training records provided by the center met the needs of Flagship.

The AMR Eagle Training Center; located at DFW, was dedicated in August 1991. It served as a flight simulator dry lease facility for She four American Eagle carriers until September 1993. At that time, instructors from individual carriers were transferred to the center, and it became a separate entity. The management structure consists of a program manager, and a manager of training and standards for each airplane type flown by AMR Eagle. Although the program manager reports to the center managing director, he is a Flagship employee. Similarly, each of the managers of training and standards, and all the check airmen and instructors are employees of one of the four AMR Eagle carriers.

The J-3201 manager of training and standards was a Wings West employee. His staff included three ground school and eleven flight instructors in the J-3201 program, all paid by their respective airlines. AMR Eagle had one simulator at the facility and used simulators at the Reflectone Training Center, Sterling, Virginia, and FSI, St. Louis, Missouri, as necessary.

Each carrier contracts with the training center for both ground and flight training, When students enter training they are given start and projected completion dates. Student progress is tracked by daily reports to the carrier, including failures, illness, and mechanical breakdowns. Unsatisfactory performance during checking is logged and kept on file at the training center for review by the FAA. This information can be used by the FAA to spot trends m training. The official training record is made from the daily reports, and is seat to the individual carrier at the end of training. The training center retains a copy of She records for 1 year, and then archives them on microfilm. Instructor comments on individual students are destroyed upon satisfactory completion of training. Any issues between the training center and the carrier are resolved between the involved manager of training and standards and the respective director of operations.

1.17.4 FAA Surveillance

FAA surveillance of operations, airworthiness, and avionics at Flagship Airlines was the primary responsibility of principal inspectors assigned to the Flight Standards District Office (FSDO) at BNA. The principal operations inspector (POI) and the Assistant POI estimated that 90 percent of their duties were related to surveillance of Flagship. FAA Program Tracking and Reporting System (PTRS) records indicate that between January 1, 1993, and December 18, 1994, the FAA performed 703 inspections of Ragship (440 operations, 186 airworthiness, and 77 avionics). The FAA had not conducted a National Aviation Safety Inspection Program (NASIP) of Flagship; however, a NASIP was performed on Nashville Eagle (one of the Flagship predecessors) from August 1 through 12, 1988. No Class I findings (those involving required regulation enforcement) were made- Additionally, a December 1994 NASIP of Simmons Airlines included inspection of the AMR Eagle Training Center. Although there were no findings at the center, the J-3201 program was not included in the inspection because Simmons did not operate the J-3201.

At the time of the accident, FAA oversight of the other three AMR Eagle carriers was accomplished by principal inspectors assigned to FSDOs at the respective main operating bases: Simmons at DFW, Wings West at San Jose, and Executive at San Juan. Organizational structure of the FAA surveillance reflected the efforts of AMR Eagle to standardize operations of all four carriers. Changes to the operations, procedures, and handbooks were coordinated through a central point in the DFW Certificate Management Office (CMO), known as the Focal Point Coordinator (FPC). The FPC had EO authority over the various principal inspectors, individual carriers, or AMR Eagle. He served as the liaison between the four POIs and between the POIs and AMR Eagle; Any changes proposed by a carrier or AMR Eagle were sent to the FPC, who would-forward the proposal to the other POIs for approval. Once all four POIs approved, the FPC would send the responses io AMR Eagle for distribution to the individual carriers. If the POIs did not agree, the reasons far the disagreement would be Sent to the other POIs by the FPC, and the process would repeat until there was agreement, or the revision was dropped. Regardless of the involvement of the FPC in facilitating ?he process of standardization among the carriers, the responsibility for oversight of any implemented changes remained with the assigned POIs.

Oversight of the AMR Eagle Training Center was accomplished by a program manager at the CMO. He was assisted by four partial program managers, one for each airplane type in the XMR Eagle fleet. He was responsible for oversight of pilot training, testing and checking; training recordkeeping; training devices; and mining curriculum. Any questions about training from the individual carrier's POI were answered directly by the appropriate FAA specialist at the training center.

1.17.5 Recordkeeping Anomalies

During the course of the investigation, the Safety Board encountered several discrepancies in the records/information provided by AMR Eagle/Flagship Airlines. An entry in the Flagship Airlines "Aircraft Out of Service" report indicated that N918AE was removed from service at Nashville on the day of the accident. The entry indicated that the left engine would not start. Subsequent review revealed that N919AE had the problem, and the records were corrected approximately 40 minutes after company personnel made the initial error. The mixup in aircraft identification was further confirmed by review of the respective aircraft maintenance logs. Similarly, the two writeups in the maintenance log of N918AE regarding the right propeller fluctuation on December 9 indicated that the discrepancies were recorded at Miami (MIA); however, the corrective action was accomplished at BNA. The mechanic involved in this entry stated that both the discrepancies and the corrective actions occurred at BNA. He had incorrectly entered MIA from habit because he had recently transferred from MIA to BNA. A check of his company records confirmed the transfer.

At the time of the accident, the Safety Board requested all company records, both AMR Eagle and Flagship Airlines, for the accident crew. During discussions at the Technical Review Meeting,[15] on April 26, 1995, AMR Eagle personnel reported that there was a "recruitment file" and a medical file on each crew member. The airline coordinator for the accident investigation stated that he was not previously aware of the existence of these files, but he did make available excerpts from the "recruitment file" at the meeting. To ensure that all records were made available, as previously requested, the Safety Board subpoenaed both files for each flightcrew member. In response to the subpoena. AMR Eagle provided what appeared to be complete recruitment files on both crewmembers. They also provided the captain's medical records, but they were not able to locate all of the first officer's medical records.

Finally, the left engine, S/N P66134, was removed from N918AE on November 18, 1994, to return this engine, on the proper airframe, to the lessor. A zero-time since overhaul engine, S/N P66241, was installed on N918AE on November 22, 1994. This change of engines occurred during the HMBV, and was noted in the engine service records of both engines. It was also recorded in Flagship

[15] A formal meeting of all parties to the investigation to conclude the fact-finding phase of the investigation and to establish the completeness of the record.

maintenance records on nonroutine work card number 471801. However, there was no entry in the aircraft maintenance log documenting the change. and the Flagship engine removal summary report, dated December 16, 1994, did not document the exchange. Flagship advised that this documentation was in process when the aircraft maintenance records were impounded at the time of the accident.

1.17.6 Maintenance Anomalies

During a review of the Flagship Maintenance Manual for the JS-3200, an error was found in the angle listed in the procedure for adjusting the propeller flight idle blade angle setting. Page 204 of the manual indicated that the proper angle is 15°, plus or minus 0.1°. This error was repeated in the work cards for propeller removal and installation, which were derived from the maintenance manual. The work card that was executed in the installation of the right propeller of N918AE on December 8, 1994, contained the improper Made angle reference. The last revision of the installation cards was dated March 8, 1993. According to Jetstream Aircraft Customer Support. the discrepancy in the manual was discovered in late 1994, and a revision was issued on January 18, 1995. The correct value, 15° 45' plus or minus 6' (0.1°), was found on page 202A of the revised manual. This discrepancy probably resulted in the entire Flagship fleet of J-3201's having the propeller blade angles misset. Jetstream advised that the 45' error would not have affected the conditions under which the negative torque system (NTS) would have activated the automatic ignition light, since the engines would still be in the propeller governing mode. and the blades would no! have decreased &+itch-to the incorrectly set flight idle setting. The propellers would not flatten to the flight idle setting until the aircraft speed slowed during the flare and touchdown sequence. Flagship corrected these discrepancies in the documents on March 15, 1995.

During the field phase of the investigation, a pair of safety wire pliers was found in the wreckage. The nature of the pliers usage suggested that the tool was left by a mechanic who had been working on the aircraft. Initials inscribed on the pliers did not match any Flagship mechanics. but they were traced to a mechanic at Eagle Aviation Services, Inc.. (EASI) the Little Rock. Arkansas, subsidiary of AMR Eagle that performed the HMBV on N918AE. He had been looking for his pliers and identified them by the initials. A review of the work cards from the HMBV indicated that this mechanic worked on the inside of the aircraft on seats 2A, 4B, 5A and C, and 6B. Outside the aircraft he worked on the right fuselage ice shield. the flap actuator jack, and the main hydraulic filter housing. The latest repair. accomplished on November 17. 1994, was the only one that required safety wire. The filter housing is located under Panel 21. situated near the forward right side of the baggage pod, near cables for the right engine power lever, speed lever, and stop and feather lever. Standard maintenance practice includes a tool check of the area by both the mechanic and his supervisor before an aircraft panel can be dosed at the completion of work. EASI did not have a published tool control program at the time of the HMBV; however, toolbox inspections began on February 18, 1995. An EASI maintenance manager advised that they were in the process of finalizing a tool control program. By contrast, Flagship had a computer tracking system that identified the location of all company-owned tools. Tools issued at various facilities were tracked by a hand receipt, and all tools that were not retuned at the end of each work shift required that a supervisor determine the disposition and location.

1.18 Additional Information

1.18.1 Company Procedures

The AMR Eagle Jetstream 3201 Operating Manual contains the following emergency/abnormal procedures:

ENGINE FAILURE OR INFLIGHT SHUTDOWN

WARNING

Confirm failed engine via engine indications prior to retarding power lever.

POWER LEVER	FLIGHT IDLE
FEATHER LEVER	TURN/PULL
LP COCKS indicators (affected side)	SHUT
• If LP Cocks do not indicate shut	
LP COCKS SWITCH	SHUT

SINGLE ENGINE MISSED APPROACH

CAUTION

Do not attempt a single engine go-aiound below 200' AGL

MAX POWER	SET
FLAPS	10°
GEAR	UP
FLAPS (at 500' AFL minimum and V_{YSE})	UP
FLOW selector	AS REQ
OIL COOLER FLAPS	AS REQ
ENG/ELEV & PROP HEAT	AS REQ
PRESSURIZATION	SET/CHECKED

The JS-3201 Operating Manual also contains text which amplifies the checklists. The section describing Liftoff and Initial Climb following an engine failure contains guidance to confirm which engine failed and specifically assigns the responsibility for the nonflying pilot to, "...verify the failed engine by scanning the engine instruments, and if confirmed, will state (L/R) ENGINE HAS FAILED, POSITIVE NTS or if NTS did not occur, will state (L/R) ENGINE HAS FAILED, NEGATIVE NTS." This is followed by the following:

WARNING

> To prevent loss of control in the event of an engine failure with a negative NTS, the PF [pilot flying] must immediately call for the affected engine's shutdown and feathering by stating:
> (L/R) POWER LEVER FLIGHT IDLE, and
>
> (L/R) FEATHER LEVER TURN AND PULL
>
> The PF will then call for the ENGINE FAILURE CHECKLIST

This section also contains guidance on single engine ILS approach procedures, including standard calls, stabilized approach criteria, prohibition against use of flaps 35°, and a statement that the minimum airspeed is 130 knots until the aircraft is in the final landing configuration.

The missed approach discussion specifies that if it is not initiated by 200 feet AFL, the aircraft is normally committed to land. The profile detail for a balked landing from a single-engine approach states the following:

> Upon reaching the decision to execute a missed approach or balked landing, the Pilot Flying will:

- Advance the power levers to within 15 percent of the max power torque setting, and rotate to approximately 8° to 10° nose-up pitch attitude.

- Call SET MAX POWER, FLAPS 10°.

- The Pilot Not Flying will trim power as necessary and retract flaps to 10°.

- When a positive rate of climb is attained, the Pilot Flying will immediately call POSITIVE RATE, GEAR UP.

The landing configuration stall recovery procedure specifies:

1. Start recovery at earliest indication
2. Advance power levers and call for max power, flaps 10°
3. If stall entry was accomplished in a turn, smoothly roll wings level
4. Recover with minimum loss of altitude
5. Climb back to original altitude, at a minimum of V_2
6. When a positive rate of climb is achieved, retract the gear
7. Accelerate to climb speed
8. At 130 KIAS select flaps up
9. Level off at original altitude and accelerate to 170 KIAS

The AMR Eagle Jetstream 3201 Operating Manual contains the following normal approach procedures:

> Recommended airspeed prior to glideslope intercept is 150 KIAS unless ATC requirements dictate otherwise....
>
> Flaps 10° should be selected prior to glide slope intercept....
>
> The gear should be extended and flaps selected to 20° at approximately 1 dot below glide slope intercept. At glide slope intercept, flaps are selected to 35°, and the Before Landing Checklist accomplished.
>
> The minimum speed during the approach is V_{REF} + 10 Kts

V_{REF} + 10 at 20° flaps was 130 KIAS; at 35° flaps it was 126 KIAS.

1.18.2 Stall Protection

Stall protection in the J-3201 includes two stall warning systems and an automatic stall recovery (stick pusher) system. The stall warning is triggered by a vane in the leading edge of each wing. When the wing reaches the stall warning angle, the vane makes contact to send an electrical signal to a Signal Summing Unit (SSU). The SSU operates the stick shaker and a stall warning horn. If the wing angle of attack (AOA) increases to the stall identification angle, a red caption light on the glareshield also illuminates. The stick pusher is activated when both wings are above the stall identification AOA. The stick pusher is hydraulically operated to move the elevator to the 8° trailing-edge-down (nose-down) position, and deactivated by spring tension when the wing AOA falls below the stall identification angle. It is also canceled if either red caption light is pressed by the pilot, or the control input results in less than 0.5 G. A pull force of 80 pounds on the control column will override the nose-down pressure of the stick pusher.

1.18.3 Powerplant Operation

Engine power is managed by use of the power levers and the propeller speed levers. Power is controlled in two modes, propeller governing mode (flight idle to full power) and beta mode (below flight idle to full reverse). Operation in the propeller governing mode is for use in flight, while the beta mode is used for ground operation only, and is prohibited in flight. The position of the power lever determines whether the engine RPM is controlled by the propeller governor changing the propeller blade pitch, or by the underspeed governor metering fuel flow through the fuel control unit. The propeller speed levers vary the engine RPM between 97 percent and 100 percent, in the propeller governing mode, and between 72 percent and 97 percent in the beta mode.

1.18.4 Negative Torque System (NTS)

Negative torque is a condition in which the propeller drives the engine. The NTS reduces windmilling propeller drag, following an engine flameout, by increasing the propeller blade angle toward feather. As negative torque values exceed preloaded values in the torque load arm assemblies, the NTS valve closes, and oil pressure opens the feathering valve which dumps pressure in the propeller dome, and the blades move toward feather. This increase in propeller blade angle provides a momentary reduction in negative torque by decreasing engine RPM. The RPM drop is sensed by the propeller governor which ports metered oil pressure to the propeller dome and allows the propeller to move back toward low pitch. The lower blade angle results in a momentary increase in engine RPM and a return to the negative torque. This reactivates the NTS, and the cycle repeats in a fluctuating engine RPM condition. The minimum allowable RPM for a windmilling propeller on NTS is 30 percent RPM, when the pilot must manually feather the propeller. Activation of the NTS creates a distinctive aural and physical sensation which is readily detectable by the pilot. It automatically triggers the engine igniters to correct a possible flameout condition.

1.18.5 Ignition System

The engine ignition system is a high-energy capacitance-discharge type system with an auto-relight feature. The auto-relight feature, incorporated in the aircraft ignition control system, activates the engine ignition system following a negative torque signal from the NTS. Activation of the zuto-relight system is indicated by illumination of an "IGN cockpit annunciator light on the engine instrument panel, under the engine instruments. Each engine has its own light Once the auto-relight system activates the igniters, the system remains on for 20 to 30 seconds after positive torque output is restored. Consequently, the ignition light is illuminated and the igniters are energized for approximately 20 io 30 seconds, after the auto-relight feature is activated, regardless of the engine power condition.

1.18.6 *Jetstream* Notice to Operators J31-72-03

On January 9, 1995, Jetstream Aircraft, Ltd., requested that Jetstream Ai , Inc., issue Notice to Operators J31-72-03 regarding the recognition of engine failure/flameout in flight It was sent to all operators of J-3100 and J-3200 aircraft in Notch and South America. The text was as follows:

> The following information is provided to assist 'aircrews in distinguishing in flight between an engine that is running at low power and one that has suffered flameout or failure.
>
> Low torque and low EGT are not in themselves an indication of flameout or failure.

(iii) Deactivation for planned abnormal and emergency conditions....

The Collins FPA-80 Operating Instructions, issued February 15, 1979, describe the system, in part, as follows:

> The ??PA-80 Flight Profile Advisory system is a solid-state aural advisory and warning system. The FPA-80 is completely automatic and requires no controls or visual displays. All advisory and warning information is conveyed to the pilot with a natural sounding voice over the cockpit audio system....
>
> One of the main functions of the FPA-80 is to announce radio altitude and decision height. The FPA-80 informs the pilot when the aircraft enters the operating range of the radio altimeter system. At 1,000 fee! and continuing to 100 feet, radio altitude is announced in 100-foot intervals. Decision height is announced.... A second function of the FPA-80 is to announce messages of a warning or advisory nature. Such messages are repeated three times. Messages are included for glideslope and localizer deviations, trim failure, altitude and barometric altitude deviations and landing gear.

Correspondence between Collins and the Wichita, Kansas, FAA Engineering and Manufacturing District Office (EMDO) between November 1979 and May 1980 established that the FPA-80 could be used in lieu of a GPWS if the following conditions were met:

1. The FPA-80 must have an "on-off" switch in the cockpit.

2. An "FPA warn" annunciator other than the warning flags in the radio altimeter and HSI [Horizontal Situation Indicator] must be provided to indicate system malfunction/failure and be located so as to be easily discernible during the normal instrument scan of the pilot(s).

3. The audio signal of the FPA-80 must be set at some level that is satisfactory for the specific installation and cannot be reduced by the pilot(s).

4. The FPA-80 system will not be installed with audible altitude callouts "strapped" out. If "strapping" out of specific altitude callouts is requested by the customer, approval/disapproval will be obtained from the FAA district office charged with the overall inspection of the certificate holder.

5. In accordance with FAR [Federal Aviation Regulations] 135.153(c), the Airplane Flight Manual for each installation must include information which is specifically tailored for that installation.

6. An STC [Supplemental Type Certificate] is necessary for installation in each aircraft type. Once STC is accomplished, the system is acceptable for FAR 135 use.

In July 1980, Collins submitted an FPA-80 Interconnect Diagram to the Wichita EMDO depicting the incorporation of features 1-4 above, and the FPA-80, as described in the Interconnect Diagram, was approved for substitution as a GPWS by return letter on July 16, 1980.

There was no documentation found during the investigation that the FPA-80s installed in the Flagship fleet conformed to the provisions of the 1980 coordination between Collins and the FAA Wichita, Kansas, EMDO, allowing substitution of the FPA-80 for a GPWS. There was no record of any exemption or waiver granted to Flagship to allow substitution of the FPA-80, as installed, for a GPWS. The equipment was installed by Jetstream, during production, in accordance with Flagship's order. On September 1, 1993, Flagship sent a letter to the FAA principal avionics inspector (PAI), stating, in part, as follows:

> In accordance with FAR 135.153 (b) (1), this letter is to request FAA acceptance of the [FPA-80] as an alternate to a TSO'd [GPWS]. The Collins FPA System meets the requirements of FAR 135.153 (b) (2) & (3), therefore, Flagship requires approval from your office to continue to operate these aircraft without GPWS thru April 20, 1996. About 9 months ago I contacted Mr. Phil Akers, (FAA Washington), and Mr. Akers confirmed that the Collins FPA System was and (sic) acceptable alternate to GPWS. Mr. Akers stated that since Flagship had the FPA system installed

> we wouldn't be required to install the GPWS until the April 96 deadline.

The FAA PAI responded in a letter dated November 15, 1993, in part, as follows:

> Based on information I received from Washington, guidance will be issued accepting those systems similar to the Collins FPA as meeting the requirements of 135.153 (b) (2) and (3).

On the basis of this approval, Flagship continued to operate the J-3201 fleet with the Collins FPA-80 system until the accident. However, no guidance has been issued. The FPA-80 installed in its fleet failed to meet the requirements of the May 27, 1980 FAA letter as follows:

- There was no "on-off" switch in the cockpit.
- It was determined that pilots could reduce the volume of the aural warnings by manipulating the radio control boxes in the cockpit.
- The pilots had the capability to delete the radio altitude warning, and 100-foot interval callouts, and had deselected them on this flight.
- The Airplane Flight Manual did not include appropriate information on system operation.

Finally, although there was a warning light indicating system failure, there was no visual means to convey warnings of excessive closure rate with terrain or deviations below glideslope.

Flagship has now replaced the FPA-80 in all J-3201 aircraft with GPWS equipment.

2 ANALYSIS

2.1 General

The flightcrew was properly certified in accordance with applicable Federal Aviation Regulations and company requirements

There was no indication of any preexisting discrepancy or preimpact mechanical failure of the structure, systems, or flight controls of the airplane that contributed to the accident. The airplane was certificated in accordance with appropriate FAA regulations, except for the improper substitution of the FPA-80 for a GPWS (to be discussed further in Section 2.10). Although the airplane was maintained in accordance with the FAA-approved maintenance program, the discrepancy in the maintenance manual, and the work cards for propeller removal and installation, resulted in both propellers having incorrect flight idle blade angle settings (also to be discussed).

The air traffic services provided to flight 3379 by the RDU approach control and tower were routine and performed in accordance with requirements.

All components of the runway 5L ILS were operating properly, based on the successful landing of the preceding B-727 at 1834 and the flight inspection of all components the following morning. Similarly, the runway and approach lighting systems were operating properly.

Although the weather at RDU included variable low ceilings and reduced visibility in light rain and fog, it was well above minimums for the runway 5L ILS approach. There were several reports of icing by pilots operating in the RDU area at the time of the accident, but none were at approach pattern altitude. In addition, the crew discussed the possibility of ice, and had checked for the presence of any during the descent into the RDU area. The Safety Board concludes that there were no problems with airframe or engine ice during the approach.

The wake vortex study revealed that flight 3379 never encountered the wake vortices from either of the two aircraft immediately preceding it.

There was a discussion between the pilots regarding an anomaly in the left engine, and the captain stated that it had failed. However, the sound spectral analysis showed that the left engine continued operating. Additionally, examination of the internal components of the engines revealed damage that was indicative of similar rotational velocities of the left and right engines. Finally, damage to the propellers, witness marks, and blade bending were consistent with rotation at high power. During the go-around, airplane performance was consistent with the left engine operating at flight idle, gear down. and flaps at 20". Data show that the airplane could not climb in that configuration. Therefore, the Safety Board's analysis of the accident concentrated on the crew actions, company training and oversight, and the performance capability of the aircraft as it was operated.

2.2 Crew Actions and Decisions

The captain was the flying pilot on the GSO-RDU leg, and initially used proper crew resource ma-merit techniques in calling for the descent and approach checklists. discussing icing conditions, using positive skills for transfer of control of the aircraft, and briefing the approach procedures. He also advised the fis officer that he was going to remain at 3,000 feet rather than descend to 2,100 feer. which he was authorized to do (there was no obvious reason fo: this decision, so it was particularly appropriate that he informed the first officer of his intention: further, he actually did not remain at 3,000 feet for long).

The flight tests demonstrated that flight idle power was necessary to match the profile as the airplane descended further. After staring "speeds high" and then requesting the first officer to configure the aircraft with 20° flaps and gear down. the captain detected an IGN light. Apparently, the IGN light was the result of a transient negative torque condition caused by the combination of low torque at flight idle and rapid movement of the propeller speed levers to 100 percent. At that point he asked, "Why's that ignition light on? We just had a flameout?" The first officer responded in about 5 seconds. "I'm not sure what's goin' on with it." After an additional 5 seconds the captain announced, "We had a flameout." Following the IO seconds of relatively silent evaluation, the captain apparently decided that there was a flameout in the left engine. There was no discussion about the specific parameters that led him to 'he conclusion, so that the fis officer could concur. Significantly, having reached the decision tha: an engine had faiied, there was no attempt to feather the propeller and secure the engine. The first officer did not call this fact to the captain's attention.

During the next 20 seconds, there was almost continuous dialogue as the first officer queried the aptain about his conclusions, and the captain confirmed his conclusion. Finally, at 1833:55.9, the first officer asked. "Watta you want me to do you gonna continue?" The captain responded, "OK, yeah. I'm gonna continue. Just back me up." This demonstrated that even when the first officer asked what the captain wanted him to do, the captain did not follow the company procedures for an engine failure.

In this circumstance, it is not clear if the first officer was really thinking of the engine-out procedures they should have been following. or merely seeking assurance that the captain had a specific plan of action. If he was concerned about the failure to follow engine-out procedures, he should have prompted the captain to implement them If he was skeptical of the captain's conclusion, he should have either challenged him by identifying specific engine indications that the engine was still operating, or suggested additional tests to confirm that the engine had failed. Additionally, the first officer did not report the decreasing airspeed.

The captain reversed his initial decision to continue the approach approximately 4 seconds later, and announced, "Lets go missed approach." This represents another decision that is puzzling. The aircraft was positioned for the approach, and all that was required was minimal differential power to continue the approach. However, the aircraft, which had leveled at approximately 1,800 feet when the engine anomaly was detected, continued to drift to the left. The rate of turn increased after the call for, "Set max power," and the airspeed continued to decrease as he continued to maintain a relatively constant altitude of 1,800 feet. The crew did nor properly configure .the aircraft for a single engine go-around, leaving the left propeller at flight idle, the landing gear down, and the flaps at 20°. During this same time interval. there were two stall warnings, which prompted the first officer to say, "Lower the nose, lower the nose, lower the nose."

At this point, the captain had responded inappropriately to indications of an apparent engine anomaly, failed to follow company procedures for engine failure, go-around, and stall recovery. and was about to lose control of the aircraft. The first officer asked the captain, "You got it?" At this time, the aircraft was approximately 30° off course, and the captain had not responded to the stall warning or the first officer's comments to lower the nose. The captain failed to cope with what was actually a minor transient anomaly. Good crew resource management dictates that he, as the pilot-in-command, should have assured that control of the airplane was maintained while the problem was analyzed. He had the option of sharing either function with the first officer, or retaining both. He could have transferred control to the first officer, so that he would be free to analyze the problem, and decide on the proper course of action. Instead. he tried to do both and failed. He contincedto attempt to fly the aircraft, unilaterally decided that there was an engine faiiure, and neither ordered nor performed the immediate action items associated with the engine failure checklist. Subsequently, his decision to go around was nor followed by the correct flight procedures. The increasing left turn indicates that he failed to advance both power levers, did not command flaps 10° or gear up, and did not maintain adequate airspeed. If he had advanced both power levels, both engines would have responded, and the perceived emergency would have been resolved. Finally, the captain did not follow company procedures for stall avoidance or recovery. He not only failed to control the aircraft. he did not request help from the first officer. Therefore, the Safety Board concludes that the captain's improper conclusion that the left engine had failed, and his failure to follow established procedures, led directly to the accident

The exact motivation for some statements by *the* first officer are unknown, but, based on his reputation, it is assumed that he was applying some crew resource management skills to the situation, in an effort to assist the captain. For example, he asked, "K, you got it?," when the captain decided the engine had failed. He questioned *this* assessment twice in the *next* seconds, "We lose an engine?," "We lose that en' left one?," but he never did directly challenge the assessment. He also made two suggestions to facilitate their situation. He announced that he was *goin;* to turn OR both engine ignition switches. and then asked, "Watta you want me *to* do you gonna continue?" If he had suggested that they either advance the left power lever to test the engine response, or perform the engine failure checklist, there could have been a more positive result. The first officer may hare been about to suggest one of these actions, but he was interrupted in midsentence, "Alright I'm gonna...," by the captain's statement, "Let's go missed approach." At this point, the stall warnings occurred and he was focused on trying to get the captain to lower the nose.

It is impossible to determine what control inputs were being made by either crew member, but they had little or no lateral or directional control of the aircraft for the next 13 seconds. During that interval the first officer asked, "*You* got it?," and made the following prompts: "Lower the nose;" and "It's the wrong, wrong foot, wrong engine." The dual stall warning homs and positive G values recorded by the FDR indicate that the captain induced repeated stick pusher activations with excessive nose-up control column inputs. Finally, the first officer said. "Here." This could have signaled his decision to help with rudder input, because they were 110° off heading. It could have indicated that he was adding power on the left engine, or it could have signaled his decision to take control of the airplane himself. Whatever the meaning, it was too late to recover from the extreme descent rate that developed during the loss of control.

Although the first officer asked the captain twice if they had lost an engine. he did not challenge the captain's erroneous conclusion with specific information (RPM, EGT, oil pressure, etc.) that indicated it was still operating. More importantly, he should have suggested that the captain advance the left power lever to see if the engine was operative. Nonetheless, he did continue a supportive role by prompting the captain to lower the nose as they encountered the stall warnings during the early stages of the go-around. Finally, the evidence suggests that he resorted to direct control inputs and power lever movement when he said, "...wrong foot...." and "Here." Unfortunately, these actions occurred too late for recovery. The Safety Board believes that the first officer's actions did not directly lead to the accident, but his delayed assertiveness precluded an oppcrtunity to avoid it.

2.3 AMR Eagle Seiection and Hiring Practices

AMR Eagle's application process required prospective employees to complete employment history forms, and to sign civil releases giving AMR Eagle permission to contact previous or present employers. Such an employment practice is not uncommon in the industry, and is intended to check past job performance as a means to predict future performance. Contacting former employers has been shown to be one of she best methods for evaluating prospective employees. The accident captain had signed a release permitting his previous employer to respond to AMR Eagle's inquiries. but a request was apparently not sent by AMR.

By not following the intent of its own hiring procedures that were established to gather information on an applicant's background, AMR Eagle precluded the possibility that it could learn that the pilot possessed questionable aviation abilities. If Flagship had asked for, and Comair had provided. the captain's performance history while at their company, it is likely that the deficiencies in the captain's skills would have been specifically addressed prior to his being offered employment. This might have resulted in a decision not to hire him. But, even if AMR Eagle had decided to make an offer of employment, a complete employment history, in the possession of his immediate supervisor, should have made the subsequent complaints regarding his abilities far more meaningful.

Three times previously the Safety Board has recommended that air carriers be required to conduct substantive background checks of prospective airmen/employees before they are hired.[16] Each time the FAA has essentially rejected this recommendation, and the Safety Board has classified all three "Closed--Unacceptable Action."

The first recommendation was issued following a DC-9 takeoff accident at Denver, Colorado. The investigation revealed that the first officer had been dismissed by his previous employer because of his unsuccessful performance after 30 hours of simulator training. This information was not obtained in the background check performed for the airline by a contract security company. On November 3, 1988, the Safety Board issued the following recommendation to the FAA:

> A-88-141
> Require commercial operators to conduct substantive background checks of pilot applicants which include verification of personal flight records and examination of training, performance, and disciplinary records of previous employers and Federal Aviation Administration safety and enforcement records.

The FAA indicated that although it agreed with the intent of the recommendation, "it does not believe that any benefits derived from such regulatory change would outweigh the costs of promulgating and enforcing the regulatory change."

The second recommendation was issued as a result of a commuter accident at Molokai, Hawaii. This investigation revealed that Aloha IslandAir did not contact the captain's previous employers, and the FAA enforcement and accident records were not checked. The two most recent employers reported that they had already given unfavorable references to other operators who did inquire about the accident captain. As a result of this accident and the FAA response to Safety Recommendation A-88-141, it was classified "Closed--Unacceptable

[16]Safety Recommendations A-88-141, issued as a result of the Continental Airlines, Inc., accident at Denver, Colorado, November 15, 1987, NTSB/AAR-88/09; A-90-141, issued as a result of the Aloha IslandAir, Inc., accident on Molokai, Hawaii, October 28, 1989, NTSB/AAR-90/05; A-93-14, issued as a result of the Tomy International, Inc., d/b/a Scenic Air Tours accident on Maui, Hawaii, April 22, 1992, NTSB/AAR-93/01.

Action/Superseded" on September 25, 1990, by Safety Recommendation A-90-141. Safety Recommendation A-90-141 was identical to A-88-141 except that it added the National Driver Register as a source of background information to be checked. The FAA indicated in its response, dated February 8, 1991, that regulatory action to require background checks would be no more effective than voluntary compliance. In this response, the FAA did note that it had issued Air Carrier Operations Bulletin 8-92-2, "Certificated Airman Preemployment Safety Verification," encouraging airlines to use FAA data bases to verify the validity of an applicant's certificate and safety history. Because the FAA again failed to take the recommended regulatory action, the Safety Board classified Safety Recommendation A-90-141 "Closed—Unacceptable Action" on October 20, 1992.

Interestingly, although the FAA rejected the recommendation, Aloha IslandAir did not. As a result of a newly implemented pre-employment screening procedure, Aloha IslandAir rejected a captain who misrepresented his employment record. That captain subsequently was hired by Scenic Air Tours, which did not check his background and he was involved in the accident that prompted a third recommendation.

The third recommendation was issued following the Scenic Airlines sightseeing on-demand air taxi accident on Mount Haleakala, Maui, Hawaii. This investigation revealed that the captain had falsified his employment application, and the company failed to conduct a substantive background check to verify his aeronautical experience. On February 19, 1993, the Safety Board issued Safety Recommendation A-93-14 to the FAA, as follows:

> <u>A-93-14</u>
> Require commercial operators to conduct substantive background checks of pilot applicants, which include verification of personal flight records and examination of training, performance, and disciplinary and other records of previous employers, the Federal Aviation Administration safety and enforcement records, and the National Driver Register.

Similarly, the FAA disagreed with the third recommendation, contending that it was the responsibility of the airlines to verify the validity of a pilot's certificate. Once again, failure of the FAA to take regulatory action resulted in the Safety Board classifying Safety Recommendation A-93-14 "Closed--Unacceptable Action" on February 22, 1994.

As part of its Safety Study, Commuter Airline Safety, NTSB/SS-94/02, the Safety Board reported

> The Safety Board obtained information on the types of preemployment background checks conducted by air carriers that participated in the commuter airline survey. Eleven of 20 airlines (55 percent) indicated thzt they routinely check the Department of Motor Vehicle records of pilot applicants, 14 of 20 airlines (70 percent) request a check of pilot applicants' accident/incident history from the FAX, and 9 of 19 airlines (47 percent) check for past alcohol-involved motor vehicle violations. Sixteen of 20 airlines (80 percent) request and verify the professional references provided by applicants; however, officials as many airlines reported that, with the exception of employment dates, past employers provide little or no information on applicants because of fears of legal action. Of the 21 commuter airlines that participated in the survey, 7 (33 percent) routinely include all of the above checks in their preemployment screening of pilot applicants.

Comair's stated policy–the nondisclosure of employee performance infomarion–illustram the common perception that the release of such information (especially unfavorable information) may lead to civil liability. The commuter study and information from the Air Transport Association confirm that Comair's position is typical within the industry.

The Safety Board notes that air carriers are required to conduct security checks of pilot applicants prior to employment because they have unescorted access to security areas. The checks must include references and employment history verification for the preceding years. They also conduct preemployment screens for alcohol and drug abuse. However, then is no requirement to verify an applicant's flight experience, safety/enforcement history, pilot mining and performance at kis previous employers, or any criminal and driver history.

The Safety Board acknowledges tile concerns within the industry about potential legal actions and other issues regarding the retention and use (especially the prevision to a third party) of records containing pilot performance evaluations. However, it should be recognized that a major portion of airline pilot mining records involve checkrides given by designated pilot examiners. The designated examiners represent the FAA during such checkrides, so the records of their work are technically FAA records. The Safety Board believes that many of the industry concerns about the provision of records to a third party can be alleviated by having the performance/training and checking records for airline pilots forwarded to the FAA, similar to the manner in which airman's records are currently retained by the FAA. This system would permit airlines to request pilot records directly from the FAA and would resolve the problems faced by airlines in providing previous employee records. Similarly, continuity of the recordkeeping process would be maintained when an airline goes out of business. The Safety Board believes that state-of-the-art electronic scanning, storage, retrieval, and transfer methods would limit the effort and costs associated with developing such a system. Consequently, the Safety Board believes that the FAA should develop and maintain a storage and retrieval system that contains pertinent standardized information on the quality of pilot performance in activities that assess pilot skills, abilities, knowledge, and judgment during training, check flights, initial operating experience, and line checks.

The Safety Board continues to believe that airlines and the traveling public would benefit from more availability of pertinent information on the quality of the previous performance of applicants for pilot positions. Therefore, the Safety Board concludes that the FAA should require all airlines operating under 14 CFR Parts 121 and 135 and independent facilities providing training to the airlines to provide to the FAA, for incorporation into a storage and retrieval system, pertinent standardized information on the quality of pilot performance in activities that assess pilot skills, abilities, knowledge, and judgment during training, check flights, initial operating experience, and line checks.

In addition, the Safety Board believes that the FAA should require all airlines operating under 14 CFR Parts 121 and 135 to obtain records from the FAA's storage and retrieval system that contain pertinent standardized information on the quality of pilot training and performance, for the purpose of evaluating applicants for pilot positions during the pilot selection and hiring process. Of course, such a requirement should include the appropriate privacy protections, should require the permission of the applicant before dissemination, and should provide for sufficient access to the records by an applicant to ensure accuracy of the records.

2.4 AMR Eagle Training

2.4.1 Training Records

However, before the system discussed above can be effective, appropriate records on the training and performance of pilots must be developed and maintained. For example, the computer-based records generated by the AMR Eagle training center, provided to Flagship Airlines, contained an annotation of the dates when specific required activities were accomplished, but there were no amplifying comments regarding performance or strengths/weaknesses for reference by subsequent instructors, check airmen, or managers. Information concerning specific problems experienced, if any, were either not recorded, or were destroyed once training was completed. There was not even a record to indicate when extra training sessions were required. This not only eliminated the ability to evaluate the individual's performance, it also prevented management from evaluating the effectiveness of its syllabus. Further opportunity to evaluate both the training and the individual pilot was lost because AMR Eagle/Flagship did not require written comments during a pilot's IOE or probationary year.

By contrast, the Flagship training records compiled during the captain's training by Flagship personnel, prior to transfer of all training to AMR Eagle in September 1993, reflected cause for possible concern. The records not only documented the captain's unsatisfactory progress, they reflected the maneuvers involved (single engine nonprecision approaches March 24, 1992, and crosswind takeoffs and landings, engine failures, and single engine missed approaches on April 29, 1992). Although these records were not available at the RDU base, they could have been reviewed by BNA management for the RDU Base Manager, or sent to RDU via company mail for his own examination.

The captain had demonstrated adequate skills in routine operations that may have masked his deficiencies in some checking and oversight situations. However, his line flying performance caused several line pilots to speak to the Base Manager about the accident captain. In fact, the captain had even approached the Base Manager to discuss this situation on his own initiative. Although the Base Manager addressed the issues raised with the individuals making the comments, and offered the captain additional training/simulator time, there was no evidence that he attempted to review the captain's records. If the Base Manager had reviewed the AMR Eagle computerized training records of the captain, he would not have found the annotation of the failed SD3-60 training periods (March 24, 1992 and April 29, 1992). Also he would not have found any record of the failed J-3201 upgrade type rating of October 6, 1992. However, these failures were documented in records available in the Flagship training records at Nashville and might have prompted additional discussion/action by management. Rather than relying on a report from a first officer, the events calling the deficient performance of the accident captain to the attention of his Base Manager should have prompted some form of records review, discussions with other company personnel, and possibly a line check or check airman assessment.

The deficiencies in the company's recordkeeping, and the company's failure to use the records it had for safety enhancement, are best exemplified by the fact that following the accident, the Director of Operations stated that he had not reviewed the crew records. Moreover. although the Vice President of Operations had reviewed the records, he was still unaware that the captain had failed a check ride in the J-3201. In short, the lack of accessibility of and sufficient detail in the pilot records apparently prevented Flagship management from reviewing the captain's performance history, even when complains from others and self-initiated comments from him were received. Moreover, the deficiency in the AMR Eagle/Flagship training records prevented Flagship management from ensuring that pilor. problems were king addressed in training and from adequately monitoring substandard pilot performance trends.

The Safety Board previously investigated an accident[17] in which it found that the recordkeeping of a major airline was inadequate to use for trend analysis or evaluation of an individual's performance during training. As a result, the Safety Board issued the following safety recommendation to the FAA:

> A-94-24
> Review the pilot recordkeeping systems of airlines operated under FAR Parts 121 and 135 to determine the quality of information contained therein, and require the airlines to maintain appropriate information on the quality of pilot performance in training and checking programs.

In a response to the recommendation, the FAA Administrator issued Flight Standards Information Bulletin (FSIB) 94-16A, January 22, 1995, directing

[17]Safety Recommendation A-94-24 was issued as a result of the American Airlines, Inc., DC-10-30 accident at Dallas/Fort Worth International Airport, Texas, April 14, 1993, NTSB/AAR-94/01.

POIs to review their assigned operator's airman training recordkeeping procedures "...to ensure that quality control measures are adequate to maintain appropriate information on the quality of pilot performance in training and checking programs." The accident involving flight 3379 demonstrates a continuing need for positive FAA action to enhance the quality of information that airlines retain on each pilot. The Safety Board believes that the FAA's response to A-94-24 is ineffective because it does not require operators to keep and retain data that is identifiable with individual performance. The action taken, which is voluntary for the operator, may provide some measure of overall training program quality control, but it would not be useful in identifying individual weak pilots. At a minimum, the airlines should include specific information about the quality of the individual pilot's performance, preferably with instructor comments/evaluations, quantitative data, such as test scores, the number of training sessions, and the number of unsatisfactory checks (including maneuvers involved). Therefore, the Safety Board classifies Safety Recommendation A-94-24 "Closed--Unacceptable Action/Superseded." The Safety Board believes that the FAA should require all airlines operating under 14 CFR Parts 121 and 135 and independent facilities that train pilots for the airlines to maintain pertinent standardized information on the quality of pilot performance in activities that assess pilot skills, abilities, knowledge, and judgment during training, check flights, initial operating experience, and line checks and to use this information in quality assurance of individual performance and of the training program.

2.4.2 Engine-out Training

Flagship line pilots currently receive all ground and flight training at the AMR Eagle flight training center in DFW. Examination of the syllabus indicated that both ground school and simulator training addressed the auto-relight system and the IGN light, the engine torque/NTS system, engine failure recognition, go-around procedures, and stall recognition/recovery. Various ground and flight instructors interviewed responded properly to questions about these subjects.

However, several line pilots, by contrast, gave varying responses regarding engine failure recognition. The confusion represented in the line pilots' answers reflected unfavorably on the training effectiveness, and at least, in part, prompted Jetstream customer support to issue the Notice to Operators that emphasized RPM as the single unequivocal indication of engine failure. It stated that low torque and low EGT are not necessarily indications of flameout or failure. If RPM is above 90 percent, then the engine is running. The availability of power should be assessed by advancing the power lever and checking whether the torque responds normally.

The captain apparently did not advance the power lever to test the operating condition of the left engine, and this was possibly reinforced by inappropriate simulator training on the combined NTS/engine failure. This simulator demonstration allowed the RPM to remain at about 60 percent on the failed engine. Th fine pitch condition of the unfeathered propeller created high drag that required significant pilot control inputs until the propeller was feathered manually. This exercise alerted the pilot that the NTS had failed. It also established the misconception that any NTS condition, and the associated IGN light, were connected with an engine failure. The actions of the captain and the answers of the line pilots interviewed indicated that they associated the illumination of the IGN light with an NTS/flameout condition. The Safety Board considers this a "negative training" situation because the training taught a concept that was incorrect and that could adversely affect pilot performance in a real emergency. Although the training scenario concludes with feathering the propeller, the captain did not follow this procedure in the accident flight.

Another indication of "negative training" is that during single engine missed approaches in the simulator, most pilots stated that they advance only one power lever. This may be a direct reflection of previous training in airplanes in which a zero-thrust condition (for safety reasons) had been established on one engine in the emergency scenario, and consequently only one power lever was used by the pilot receiving the training. Apparently this practice was perpetuated in the simulator training because the instructors did not enforce the company procedure, described in the Aircraft Operating Manual, to advance both power levers to maximum power.

The CRM training provided by AMR Eagle was thorough and consistent with current industry standards and practices. Both crew members had received this training. However, the captain failed to apply it to this perceived emergency situation. The first officer, by contrast, appears to have been at least attempting to assert himself in the various questions and suggestions he made, if not in actions he took or initiated. However, when corrective action was not commanded in memory items for engine failure and go-around procedures, he did not verbally advise the captain of the appropriate company procedures.

2.5 Company Maintenance

The investigation disclosed several administrative errors involving maintenance records. Items included incorrect aircraft registration numbers and a location where work was performed, which are considered isolated incidents, and the improper blade angle value entered on work reference material which was corrected.

Additionally, the maintenance action to correct the engine torque split, described on the December 9, 1994, FCF, was inappropriate. The mechanic attempted to correct the 10 percent split, which was in excess of the 2 percent allowed, by moving the beta tube locking pin one hole (the smallest possible adjustment to the flight idle blade angle). He then made a ground run of the engines and reported that the torque and fuel flow values were symmetrical. Unfortunately, he did not record the values observed as the action he took could not have remedied the 10 percent torque split. Movement of the beta tube locking pin one hole changes the blade angle 0.17°, which would probably produce a torque change so small that it would not be discernible on the gauge (less than 1 percent).

The mechanic should have reviewed the maintenance history of the torque indicating system and checked the torque gauge and the torque signal conditioner to determine the validity of the indication first, especially since the captain did not report any directional control problem on the approach/landing. The service history of the engines indicates that a number of different torque signal conditioners have been used with this engine application because of conditioner signal drift. Accurate assessment of flight idle torque can only be accomplished during an in-flight test using specific conditions of altitude, airspeed, configuration, bleed switch position, propeller RPM, and power lever position. Some of these conditions were not met at the time of the torque split observation, and the indication is considered suspect. In fact, the pilot should have extended the FCF to perform the proper in-flight check of the torque, which would have resolved the perceived problem.

Further indication that the torque split was inaccurate is the absence of comments from pilots who flew the airplane on the subsequent 24 flights prior to the accident. There were no comments on either asymmetric torque indications or directional control difficulties on landing. Both the airplane and engine manufacturers agreed that if there was a 10 percent differential in torque, the pilots would have experienced significant thrust differential on landing.

Although the accident captain made comments about directional control problems experienced at GSO, en mute to RDU, there was no direct connection between those comments and the condition observed on the FCF. Accordingly, the Safety Board concludes that the torque sptit condition identifiid on the FCF was most likely an error in indication only.

2.6 AMR Eagle/Flagship Management Structure

The Safety Board examined the nature of the oversight of Flagship by AMR Eagle, and the management of Flagship itself, to determine what role, if any, the organizational structure may have had in the accident. The evidence indicates that most, if not all, of the critical decisions governing the conduct of Flagship operations were made at AMR Eagle headquarters by persons employed either directly or indirectly by AMR Eagle. These decisions addressed such areas as pilot selection, pilot training, route selection, flight scheduling, recordkeeping procedures, aircraft operating practices, payroll, profit and loss determinations and other key elements critical to managing the airline. Nevertheless, Flagship (like the other AMR Eagle carriers) operated under its own certificate in accordance with FAA requirements. For example, pilots reported to base managers who performed the duties of chief pilots. X Director of Operations supervised the base managers, and a Vice President of Operations oversaw the performance of the Director of Operations. in accordance with FAA requirements, these individuals were responsible for assuring that flight operations were conducted safely and m compliance with FAA regulations.

However. the evidence indicates that major decisions regarding Flagship operations originated at AMR Eagle's DFW headquarters. For example. in response to the temporary suspension of the airworthiness certificate of the ATR 42 and 72 aircraft of a sister airline. AMR Eagle shifted aircraft across the various carriers' structures and routes. Flagship's J-32Oi operating handbook was rewritten to standardize it with those of the other AMR Eagle operators, a decision made at DFW by AMR Eagle personnel. In addition. flagship's recordkeeping system was developed. coordinated. and implemented by AMR Eagle personnel based at DFW.

The fact that the major decisions affecting Flagship operations were made by AMR Eagle personnel at DFW who were not directly involved in Flagship operations did not adversely affect safety of line operations at Flagship. For example, the ineffectiveness of Flagship management in its oversight of the captain does not appear to have resulted from my action taken or decision made by AMR

Eagle. The evidence suggests that the decisions and actions of the RDU base manager with regard to this captain were independent of AMR Eagle management. Consequently, the Safety Board does not believe that the organizational structure of Flagship and its relationship to AMR Eagle was a factor in this accident

2.7 FAA Oversight

In response to the unique organizational structure of AMR Eagle and the related carriers, the FAA developed a unique method of oversight of the operation of the AMR Eagle carriers. Each principal inspector, when dealing with matters of compliance within the specific carrier, dealt directly with the appropriate personnel from that carrier. The principal inspectors dealt indirectly with AMR Eagle through the FAA focal point coordinator (FPC). This individual had no oversight responsibility, but was to facilitate interaction among the principal inspectors of the four carriers and the AMR Eagle management. His duties were administrative in nature, gathering and distributing information to all appropriate personnel.

The organization of the FAA's surveillance of Flagship and the AMR Eagle carriers, although seemingly cumbersome and awkward, may in some ways have enhanced the quality of the surveillance. The FPC, a full-time specialist, was dedicated to facilitating interaction between the individual inspectors and any single AMR Eagle entity, or the entire organization. At the same time, other inspectors were working full time overseeing training and checking on each of the aircraft types conducted at the training center. The unique structure also provided, in part, redundant oversight, since manual changes were reviewed independently by four separate inspectors instead of just one. The separation of responsibility for operation and training also allowed the inspector to concentrate exclusively on either training or operations.

However, there was one negative aspect of this organization. The individual principal inspectors did not interact with the critical decisionmakers at AMR Eagle, the people who were, in effect, directing the operations of the four carriers. Rather, the FPC, a purely administrative position, served as the individual interacting with AMR Eagle. Additionally, the nature of this interaction was primarily limited to the exchange of correspondence. As a result, the FPC insulated both entities from direct personal involvement. By contrast, in traditional oversight activity, FAA inspectors are in daily contact with those persons who are the key decisionmakers. Effective oversight depends on both a minimum frequency of individual surveillance, and an ongoing interpersonal relationship between the inspector and the critical decisionmakers of the operator. This relationship enables the inspector to gain an understanding of the corporate culture, as well as the reasons for corporate actions--an understanding that may not be developed otherwise. Such a personal relationship can facilitate a proactive relationship between the FAA and the operator, better than one in which all communication is accomplished by correspondence through an intermediary. Finally, an ongoing personal relationship between the principal inspector and the operator's decisionmakers enables the inspector to obtain a personal commitment to the highest standards of safety from the carrier. It is highly unlikely that an inspector could foster such a commitment from his assigned carrier through correspondence without the personal involvement. Therefore, the Safety Board believes that the FAA should review the organizational structure of its surveillance of AMR Eagle and its carriers with particular emphasis on the positions and responsibilities of the FPC and principal inspectors, as they relate to respective carriers.

2.8 Inappropriate Flightcrew Responses to Engine Anomalies

The Safety Board participated in the investigation of an accident involving an engine anomaly in a Saab 340B, Schiphol Airport, Amsterdam, the Netherlands, on April 4, 1994. That investigation is being conducted under the jurisdiction of the Netherlands Aviation Safety Board, and the final report has not yet been released; however, certain similarities between the two accidents do exist. The flightcrew of the Saab observed the right engine low oil pressure warning light without any confirming evidence of an actual malfunction. The captain elected to return and land at Schiphol, the main maintenance base. The flightcrew reduced the power to flight idle, in accordance with the appropriate checklist. They also discussed the single engine procedures. There was no further guidance, either in the manuals or training, regarding the use of flight idle during the approach.

Although the captain was experienced in the Saab, he was relatively inexperienced in total time. He was trained in the simulator and had not participated in engine out training in the airplane. Prior to the certification of the simulator, when engine out training was conducted in the airplane, the engine failure was simulated by reducing power on the "dead engine" to 15 percent thrust. This power was required to establish a zero thrust condition and offset the drag of the windmilling propeller. On April 26, 1994, the Netherlands Aviation Safety Board issued a warning, endorsed by the Rijks Luchtvaart Dienst (RLD, the certificating agency of the Netherlands), in part, as follows:

WARNING

Pilots should realize that the propeller of an engine in (flight) idle may produce considerably more drag than the propeller of an engine which has been shut down and feathered.

If for any reason it has been decided to fly the approach with one engine at idle power and the propeller not feathered:

1. The affected engine should be set at a power - or torque setting, at least sufficient to overcome any extra drag (ref. zero-drag setting for simulated single-engine training).

2. The decision to keep the engine at a setting around zero-drag implies that a one engine out approach should be made. This should be realized during the approach preparation. The preparation briefing should at least include the speeds and flap settings to be used according to the one engine inoperative approach, landing, and go-around procedures.

In May 1995, the FAA circulated draft Advisory Circular (AC) 39.XX, "Continued Airworthiness Assessments of Turbine Engines, Propellers, and APUs," for public comment. It is expected to be issued in the spring of 1996. Appendix 2 of the AC provides a listing of air carrier accidents and incidents that involved propulsion system safety hazards. This document defines a "propulsion system plus crew" event as one that initiated from a single propulsion system malfunction that should not have caused a problem, compounded by inappropriate crew response. The FAA reported that 32 of these events occurred between 1982 and 1991, with consequences ranging from severe (fatal accidents and hull losses) to serious (such as an inability to climb more than 1,000 feet above terrain elevation).

Of the 32 propulsion system plus crew events, 18 (56 percent) involved turboprop aircraft. The following examples, as cited in the FAA AC (appendix 2, p. 19), are illustrative of the turboprop-related events:

> Lost one engine and crew inadvertently feathered other engine -- forced landing.

On descent, crew shut down right-hand engine but inadvertently shut down left-hand engine also, aircraft struck electrical lines -- fatal.

Crew shut down left-hand engine for fuel leak. Aircraft stalled 1 km from runway and crashed, fatal.

None of the cited events exactly match the accident sequence of American Eagle flight 3379. However, in the more general sense, each flightcrew's aggravation of a benign engine condition demonstrated that the performance of flight 3379's flightcrew was not an isolated event. The Safety Board believes that the repetitive pattern in propulsion system plus crew events, of which this accident is a part, warrants further corrective action at an industry-wide level.

Circumstances of this accident included the flightcrew's confusion about engine operating status and their inadequate response to a perceived engine failure in a reduced power condition. The Safety Board believes that the FAA should publish advisory material that encourages air carriers to train flightcrews in the identification of and proper response to engine failures that occur in reduced power conditions, and in other situations that are similarly less clear than the traditional engine failure at takeoff decision speed.

2.9 Flight Profile Advisory System

The AMR Eagle training was inadequate with respect to the FPA-80 system. Information required by 14 CFR 135.153 was not available in the airplane flight manual, and only marginal system information was included in the ground school. Although a more thorough description was incorporated in the Jetstream 3200 Maintenance Manual, the line pilots do not have this manual available to them. More importantly, the system, as installed on the Flagship fleet, did not meet the requirements of 14 CFR 135.153. The FPA-80 did not have a visual means of warning the pilot of excessive closure rates with terrain or deviations from the glideslope. In addition, the provisions identified in the FPA-80 Interconnect Diagram that were required for approval were neither incorporated in the systems as installed on the Flagship fleet, nor were they mentioned in the 1993 correspondence seeking continuing approval of the FPA-80 as a substitute for a GPWS.

The Safety Board does not believe that the absence of a GPWS or the improper installation of the FPA-80 system contributed to the cause of this accident.

However, the installation of a GPWS, or an approved alternate system, is essential to safe operation in the air carrier industry today. This situation raises questions about management of Flagship Airlines, and the oversight of Flagship by the FAA. The Safety Board is concerned that other operators of the J-3201 and similar aircraft may be operating without the protection of a GPWS or equivalent.

2.10 Physiological Factors

Although the captain had taken sick leave for the 3 days prior to the accident, information from his roommates indicated that he was in good health the day before and the day of the accident. Similarly, those who saw him during his duties described him as appearing normal. Also, there were no statements or sounds on the CVR suggesting that the captain was sick. The presence of a small amount of chlorpheniramine in the toxicological analysis indicated that he had taken some antihistamine in the recent past. Although chlorpheniramine has the potential to reduce alertness, increase reaction time, and adversely affect perception, the variation in individual metabolic rates precluded the Safety Board from estimating either the time of ingestion or the effect, if any, it may have had on his performance.

The Safety Board remains concerned about the use and misuse of medications, both prescribed and over-the-counter, by pilots, air traffic controllers, dispatchers and others involved in aviation operations who may be unaware of the potential hazards many medications present. Moreover, many in the aviation community lack knowledge about these hazards and the fact that medications can remain hazardous following ingestion. With the number of medications that were available exclusively by prescription now being distributed over-the-counter, accompanied by extensive media marketing campaigns, the Safety Board believes that an already potentially hazardous situation may become worse.

The Safety Board previously investigated an accident[18] in which the presence of both prescribed and over-the-counter medication was found in crewmembers involved in the accident. The Safety Board found that:

> Various FAA programs have made pilots well aware of the consequences of the abuse of illicit drugs in aviation. However, the

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[18]Safety Recommendation A-91-119 was issued as a result of the USAir Flight 1493, Boeing 737, and Skywest Flight 5569, Fairchild Metroliner, Runway Collision, Los Angeles International Airport, February 1, 1991, NTSB/AAR-91/08.

circumstances revealed by this accident indicate that all pilots may not fully appreciate the potential dangers of many medications and, as a result, may use them inappropriately.

Therefore, the Safety Board believes that the circumstances involving the pilots in this accident demonstrate the need for the FAA to undertake a special educational program about the use of these types of drugs to reach all active pilots. Literature about the issue provided ta pilots by their FAA Aviation Medical Examiners may also be helpful. Such a program must describe, illustrate, and alert pilots to the potential consequences of the misuse of legitimately prescribed medications and over-the-counter preparations. It must also stress that pilots must seek and heed the advice of their physicians and FAA Aviation Medical Examiners concerning the use of all medications they take and the effect that each may have on the safety of their flight operations.

As a result of that accident, the Safety Board issued the following recommendation to the FAA:

A-91-119
Establish a comprehensive educational program to alert pilots to the potential adverse effects on flightcrew performance that may arise from the-misuse of prescribed and over-the-counter medication.

Based on the development and issuance of an educational brochure to be distributed to pilots, and the FAA commitment to an ongoing program of seminars, newsletters, and educational and advisory material for Aviation Medical Examiners dealing with the hazards of medications, the Safety Board classified this recommendation "Closed--Acceptable Action" on February 16,1994.

This accident, involving AMR Eagle flight 3379, suggests that the FAA's program to educate and inform those holding airmen medical certificates about the potential hazards of medications may not be fully effective. Additional effort may be needed to educate those in the aviation community on the need to avoid all but a handful of approved medications for several days before flying, controlling air traffic, or being involved in other critical aspects of the air transport system. The Safety Board will conrinue to monitor the effectiveness of the current program.

2.11 Wake Turbulence

Although a wake turbulence encounter does not explain the low airspeeds and repeated aerodynamic stall warnings in this accident, the Safety Board investigated whether the accident airplane could have encountered wake turbulence from the B-727 that was immediately ahead of it on the ILS approach. The worst case wind investigated, 75 degrees at 17 knots, revealed that the accident flight ground track crossed the track of the B-727 wake vortices at 1834:13. However. the first stall warning on the accident flight occurred 8 seconds before this point, at 1834:05. Assuming that the vortex had not dissipated in the atmosphere, it would be 1 minute and 40 seconds old at 1834:13, which can be considered an old vortex. Further, in the vertical plane, the accident airplane was at a substantially higher altitude than the wake vortices at this point.

Based on flight test data for the E-727, a descent rate of 300 fpm was assumed for the wake vortices, which gives a vertical separation at this point of 643 feet (1,743 feet vs. 1,100 feet). Further, because of the accident airplane's sharp left turn, it was about 1,300 fee! horizontally from the wake vortices when it reached 1,100 fees.

The Allied Pilots Association proposed that the temperature inversion in the atmosphere might allow the vortices to maintain constant height and have "extended persistencies." They also pointed out that if the B-727 flightcrew hzd not selected landing flaps, the vortex descent rate would be reduced to 228 fpm. The Safety Board acknowledges that the mount of vertical separation could be less than that calculated in the wake vortex study. However, given the relative flightpaths of the two airplanes and the wind conditions that existed at the time, the vortices that crossed the accident ground track were generated by the 8-727 at approximately 1,500 to 1,600 feet mean sea level, which was below the altitude of the accident airplane until it had deviated far to the west. Therefore, to encounter the accident airplane, the wake vortices would have had to climb approximately 150 to 200 feet instead of descending. This is inconsistent with the normal motion characteristics of wake vortices. Therefore, the evidence indicates that the accident airplane could not have encountered wake turbulence.

3. CONCLUSIONS

3.1 Findings

1. The flightcrew was properly certificated in accordance with Federal Aviation Regulations and company procedures.

2. The airplane was certificated and maintained in accordance with existing regulations, except for the improper installation of the FPA-80 as a substitute for a GPWS.

3. Air traffic control services were properly performed.

4. Weather was not a factor in the accident.

5. The captain associated the illumination of the left engine IGN light with an engine failure.

6. The left engine IGN light illuminated as a result of a momentary negative torque condition when the propeller speed levers were advanced to 100 percent and the power levers were at flight idle.

7. There was no evidence of an engine failure. The CVR sound spectrum analysis revealed that both propellers operated at approximately 100 percent RPM until impact, and examination of both engines revealed that they were operating under power at impact.

8. The captain failed to follow established procedures for engine failure identification, single engine approach, single engine go-around, and stall recovery.

9. The flightcrew failed to manage resources adequately; specifically, the captain did not designate a pilot to ensure aircraft control, did not invite discussion of the situation, and did not brief his intended actions; and the first officer did not assert himself in a timely and effective manner and did not correct the captain's erroneous statement about engine failure.

10. Although the first officer did perform a supportive role to the captain, his delayed assertiveness precluded an opportunity to avoid the accident.

11. Flight 3379 did not encounter any wake turbulence during the approach to runway 5L, or during the departure from controlled flight.

12. AMR Eagle training did not adequately address the recognition of engine failure at low power, the aerodynamic effects of asymmetric thrust from a "windmilling" propeller, and high thrust on the other engine.

13. AMR Eagle provided "negative simulator training" to pilots by associating the IGN light with engine failure and by not instructing pilots to advance both power levers during single engine go-arounds as required by the operation manual.

14. AMR Eagle and Flagship Airlines crew training records do not provide sufficient detail for management to track performance.

15. Flagship Airlines management was deficient in its knowledge of the types of crew records available, and in the content and use of such records.

16. Flagship Airlines did not obtain any training records on the accident captain from Comair. Further, Comair's standard response for employment history would not, had it been obtained, have included meaningful information on training and flight proficiency, despite the availability of such data.

FAA did not provide adequate guidance for, or ensure installation of, the FPA-80 as a substitute for a GPWS on Flagship's fleet.

18. The structure of the FAA's oversight of AMR Eagle did not provide for adequate interaction between POIs and AMR Eagle management personnel who initiated changes in flight operations by the individual Eagle carriers.

3 2 Probable Cause

The National Transportation Safety Board determines that the probable causes of this accident were: 1) the captain's improper assumption that an engine had failed. and 2) the captain's subsequent failure to follow approved procedures for engine failure, single-engine approach and go-around, and stall recovery. Contributing to the cause of the accident was the failure of AMR Eagle/Flagship management to identify, document, monitor, and remedy deficiencies in pilot performance and training.

4. RECOMMENDATIONS

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

--to the Federal Aviation Administration:

Publish advisory material that encourages air carriers to train flightcrews in the identification of and proper response to engine failures that occur in reduced power conditions, and in other situations that are similarly less clear than the traditional engine failure at takeoff decision speed. (Class II, Priority Action) (A-95-98)

Review the organizational structure of the FAA surveillance of AMR Eagle and its carriers with particular emphasis on the positions and responsibilities of the Focal Point Coordinator and principal inspectors, as they relate to the respective carriers. (Class II, Priority Action) (A-95-99)

Ensure that all airplanes (other than the AMR Eagle J-3201 fleet) that currently use a Collins FPA-80 in lieu of a GPWS, under the provisions of 14 CFR 135.153, have installations that comply with Federal regulations. (Class II, Priority Action) (A-95-100)

Require all airlines operating under 14 CFR Parts 121 and 135 and independent facilities that train pilots for the airlines to maintain pertinent standardized information on the quality of pilot performance in activities that assess skills, abilities, knowledge, and judgment during training, check flights, initial operating experience, and line checks and to use this information in quality assurance of individual performance and of the training program. (Class II, Priority Action) (A-95-116)

Require all airlines operating under 14 CFR Parts 121 and 135 and independent facilities that train pilots for the airlines to provide the FAA, for incorporation into a storage and retrieval system, pertinent standardized information on the quality of pilot performance in activities that assess skills, abilities, knowledge, and judgment during training, check flights, initial operating experience, and fine checks. (Class II, Priority Action) (A-95-117)

Maintain a storage and retrieval system that contains pertinent standardized information on the quality of 14 CFR Parts 121 and 135 airline pilot performance during training in activities that assess skills, abilities, knowledge, and judgment during training, check flights, initial operating experience, and line checks. (Class II, Priority Action) (A-95-118)

Require all airlines operating under 14 CFR Parts 121 and 135 to obtain information, from the FAA's storage and retrieval system that contains pertinent standardized pilor mining and performance information. for the purpose of evaluating applicants for pilot positions during the pilot selection and hiring process. The system should have appropriate privacy protections, should require tire permission of the applicant before release of the information, and should provide for sufficient access to the records by an applicant to ensure accuracy of the records. (Class II, Priority Action) (A-95-119)

BY "HE NATIONAL TRANSPORTATION SAFETY BOARD

James E. Hall
Chairman

Robert T. Francis II
Vice Chairman

John Hammerschmidt
Member

John J. Goglia
Member

October 24, 1995

5. APPENDIXES

APPENDIX A

INVESTIGATION AND HEARING

1. Investigation

The National Transportation Safety Board was notified of the accident at 1900 on December 13, 1994. The full Go-Team was dispatched, and the following investigative groups were formed: Operations/Human Performance, Air Traffic Control, Weather, Survival Factors, Structures, Powerplants, Systems, Flight Data Recorder, Maintenance Records, Cockpit Voice Recorder, and Airplane Performance. A separate group was formed later to conduct a Sound Spectrum Study of the acoustic information from the engines and propellers recorded on the CVR. Member John Lauber accompanied the team to RDU but was replaced, for personal reasons, by Chairman James Hall.

In accordance with the provisions of the International Civil Aviation Organization's International Standards and Practices, Aircraft Accident and Incident Investigation, Annex 13, the Air Accidents Investigation Branch, Department of Transport, United Kingdom (the state of manufacture of the aircraft) was notified of the accident, and an Accredited Representative, with a team of advisers, participated in the investigation

Parties to the investigation included the Federal Aviation Administration, Flagship Airlines, Inc., Allied Pilots Association, Jetstream Aircraft, Ltd., Allied Signal Aerospace Company, McCauley Propellers, and the National Air Traffic Controllers Association.

2. Public Hearing

A public hearing was not held in conjunction with this investigation.

APPENDIX B

COCKPIT VOICE RECORDER TRANSCRIPT

LEGEND

HOT	Crewmember hot microphone voice or sound source
RDO	Radio transmission from accident aircraft
CAM	Cockpit area microphone voice or sound source
TWRG	Radio transmission from Greensboro tower
FPAB	Sound heard from aircraft mechanical voice system
GSOD	Radio transmission from Greensboro departure
GSOOP	Radio transmission from American Eagle's Greensboro operations
RDATIS	Radio transmission from Raleigh-Durham Air Terminal Information Service
RDUOP	Radio transmission from American Eagle's Raleigh-Durham operations.
APR-1	Radio transmission from 1st Raleigh-Durham approach controller
APR-2	Radio transmission from 2nd Raleigh-Durham approach controller
AA1402	Radio transmission from American Airlines flight 1402
PA	Transmission made over aircraft public address system
TWR	Radio transmission from Raleigh-Durham tower
4	Sounds heard only through both pilot's hot microphone systems
-1	Voice identified as Pilot-in-Command (PIC)
-2	Voice identified as Co-Pilot
-?	Voice unidentified
	Unintelligible word
@	Non pertinent word
#	Expletive

%	Break in continuity
( )	Questionable insertion
[ ]	Editorial insertion
....	Pause

Note 1: Times are expressed in eastern standard time (EST).

Note 2 Non-pertinent conversation where noted refers to conversation that does not directly concern the operation control or condition of the aircraft, the effect of which will be considered along with other facts during the analysis of flight crew performance.

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTEMT
START of RECORDING			
START of TRANSCRIPT			
		1803:45 RDO-2	three seventy nine's ready.
		1803:49 TWRC	Eagle three seventy nine Greensboro tower, runway five, taxi into position and hold.
		1803:54 RDO-2	position and hold, runway five. Eagle three seventy nine.
		1804:27 TWRG	Eagle flight three seventy nine. fly runway heading. cleared for takeoff.
		1804:30 RDO-2	runway heading, cleared to go, three seventy nine.
1804:31 HOT-1	OK, you can continue.		
1804:33 HOT-2	flows are off. speeds are high. CAP panel is normal. lights are on. before takeoff is complete.		
1804:37 CAM	[sound of increasing frequency then clicks and then sound similar to power being applied for takeoff]		
1804:44 HOT-1	that lever really lags bad.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	**CONTENT**	**TIME & SOURCE**	**CONTENT**
1804:50 HOT-1	OK, set power.		
1804:55 HOT-2	seventy knots, power sat hero. your aircraft.		
1804:56 HOT-1	X. *my* aircraft.		
1805:02 HOT-1	this one's squirrely on takeoff.		
1805:04 HOT-2	V one rotate.		
1805:08 HOT-1	OK, positive rate. gear up.		
[illegible]5:10 [illegible]-2	intransit.		
		1805:30 TWRG	three seventy nine. maintain two thousand five hundrad and lurn right heeding zero nine zoro.
		180535 RDO-2	two thousand five hundred, zero nine zero, three seventy nino.
1805:38 HOT-1	OK, flaps and flows.		
1805:40 FPAB	check baro altitude.		
1805:41 HOT-2	flaps up, flows are on		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	**CONTENT**	**TIME & SOURCE**	**CONTENT**
		1806:03 TWRG	* flight three, seventy nine contact departure now and have a good one.
		1806:07 RDO-2	goin' to departure. good night sir.
		1806:10 RDO-2	Greensboro departure, Eagle three seventy nine's, two point two for two thousand five hundred. zero nine zero on the heading.
		1806:18 GSOD	Eagle three seventy nine departure, radar contact. climb and maintain five thousand.
		1806:23 RDO-2	up to five thousand, three seventy nine
1806:26 HOT-1	'K, climb power climb check.		
1806:28 HOT-2	landing gear's up, flaps up flows on, APR off. climb power, watta you want		
1806:32 HOT-1	ah, you you need speeds high to get there?		
1806:35 HOT-2	well, we're already late you know I don't, it's uh, I don't care. uuh, I got three hours I should have plenty of time.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TINE & SOURCE	CONTENT
1806:42 HOT-1	OK, you can go ninety seven percent. Tomorrow we'll do that on your leg home. I ** make sure, make your, make you make your flight, but.... I don't think it matters too much on a little short leg like this.		
1806:59 HOT-2	climb power's set, boost pumps are off, props sync on, oil cooler flaps shut, pressurization set and check. climb's complete.		
1807:05 HOT-1	thanks.		
1807:06 HOT-2	your power levers. watta you want me to give her, fifty three?		
1807:10 HOT-1	yeah fifty three, and uh late bags, er uh, had too much bags.		
1807:14 HOT-2	OK.		
1807:17 HOT-2	I'm off.		
1807:18 HOT-1	OK.		
		1807:21 RDO-2	Greensboro, three seventy nine.
		1807:40 RDO-2	Greensboro ops, Eagle three seventy nine.
1807:43 FPAB	check baro altitude.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1807:46 HOT-2	one to go.		
1807:47 HOT-1	royer.		
		1807:59 RW-2	and Greensboro ops, Eagle thirty three sevenly nine.
1808:19 HOT-2	I'm back. I can't get ahold of them.		
1808:20 HOT-1	OK.		
1808:23 HOT-1	probably call you in a second.		
1808:39 HOT-2	what radial are we takin' outta here?		
1808:41 HOT-1	did, he didn't assign us one did he?		
1808:42 HOT-2	no but i's just...		
1808:43 HOT-1	ah, zero eight five normally.		
1808:45 HOT-2	OK, it's zero eight five.		
1808:46 HOT-1	I thought he just gave us this heading		
1808:47 HOT-2	yeah, it's uh, zero nine zero heading.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	**CONTENT**	**TIME & SOURCE**	**CONTENT**
1808:49 HOT-1	how's the temperature in the cockpit to you?		
1808:52 HOT-2	little bit uh, on the cool side. how about you?		
1808:54 HOT-1	yeah, a little bit on the cool		
1808:55 HOT-2	alright. I'll turn it up.		
		1809:02 GSOD	Eagle three seventy nine. climb and maintain niner thousand.
		1809:06 RQO-2	leavin' *five* thousand for nine thousand. Eagle three seventy nine.
		1809:13 ADO-2	and Greensboro ops, three seventy nine
		1809:30 RDATIS	.....Raleigh/Durham international information Sierra. two two five one Zulu weather. measured ceiling five hundred variable overcast. visibility two with light rain and fog. temperature three seven. dew point three five. wind zero two zero at six. altimeter three zero three one. remarks, ceiling variable three hundred feet to six hundred feet. parallel ILS approaches runway five left runway five right in use. read back all runway hold short instructions. advise on initial contact, you have information Sierra.......
		1810:32 GSOD	Eagle three seventy nine. turn ten degrees right.

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME b SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1810:34 ROO-2	ten righl. three seventy nine.
		181048 ADO-2	and Groensboro ops, Eagle three seventy nine.
1811:06 HOT-2	thin)' thirty one on the meters in Raleigh.		
1811:08 HOT-1	OK. thanks.		
1811:11 HOT-6	what ore they callin' *it?* I missed it.		
1811:13 HOT-2.	measured five hundred variable overcast, two miles lighl rain fog. thirty seven degrees. wind zero two zero at *six.* end uh, remarks. coiling's three hundred variable *six* hundred.		
1811:25 HOT-I	cool. OK.		
		1811:32 RDO-2	Greensboro operations, Eoglo thirty lhree sevenly nine.
1811:56 HOT-1	ever gel ahold of them?		
1811:57 HOT-2	naw. I'll just report it when I call into Raleigh.		
1812:00 HOT-1	yaah.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1812.02 HOT-1	let me ask you have you seen that MCI commercial with this guy's is lalking lo some woman who's workin' the computer and she's doin' this thing about some Egyptian princess or some-thing and he says you two look you two guys look the same, and then she looks at him kinda dirty?		
1812:14 FPAR	check baro altitude, check barn altitude		
1812:17 HOT-2	one to *go.*		
1812:19 HOT-1	you haven't seen lhat? I was gonna ask you whnt you thought they were trying to get at with that. you can go ahead and do a cruise check.		
1812:30 HOT-2	OK, less lhan a thousand uh, altimeters thirty thirty one set cross checked.		
1812:37 HOT-1	and thirty thirty one set on the left		
1812:38 HOT-2	boost pumps ere off, uh, cruise power set, pressurization set and checked. cruise complete.		
1812:45 HOT-1	lhank you		
		1812:46 GSOD	Eagle three seventy nine, contact Raleigh one two eight point three. good ovening.
		1812:50 RDO-2	twenty eight three. pleasure doin' business with you.

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	**CONTENT**	**TIME & SOURCE**	**CONTENT**
1812:54 HOT-2	I don't know why I said that. [sound of laughter]		
1812:56 HOT-1	I don't either.		
1812:57 HOT-2	just rolled off my tongue. sounded good.		
		1813:02 ROO-2	good evening Raleigh. Eagle three sevenly nine's. ni, eighl poinl six for nine wilh Sierra.
1813:20 HOT-1	boy. the tilt's way dl on lhat sucker.		
		1814:10 ROO-2	and good evening Raleigh approach. Eagle three sev-enly nine level at nine thousand Siena.
		1814:14 APA-1	Eagle three seventy nine, Raleigh approact,. good eve-ning. expect runway live left.
		1814:17 ROO-2	live left.
1814:25 HOT-I	, wonder if ho knows lhat we're still on a hundred heading?		
1814:30 HOT-2	'm sure he does. want me lo lell him?		
1814:33 HOT-1	yeah. if you wouldn't mind 'cause normally they have you on that redial.		

INTRA-COCKPIT COMMUNICATION TIME & SOURCE	CONTENT	AIR-GROUND COMMUNICATION TIME & SOURCE	CONTENT
		1814:39 RDO-2	and approach, three seventy nine. you want us to intercept the radial or just maintain a one hundred heading.
		1814:50 APR-1	three seventy nine uh, just uh, you can inlercept the radial off thal handing.
		1814:53 RC0.2	thank you.
1814:54 FPAB	[check baro altitude]		
1814:55 HOT-1	OK, if you'll do descent check please.		
1814:57 HOT-2	altimeters thirty thirty one set cross checked.		
1814:59 HOT-1	ah, thirty thirty one, set cross checked.		
1815:00 HOT-2	pressurization sot and chocked. ice protection's are on, fuel balance is chocked, seat bell sign is on, landing data's gonna be uh. fifteen and twenty one.		
1815:10 HOT-1	OK, reviewed.		
1815:11 HOT-2	uh, reviewed, external lights era on. they'll come on in descent.		
1815:17 HOT-1	OK.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME 6 SOURCE	CONTENT
1815:20 MOT-2	you want me lo stop there? descent complcte		
1815:21 HOT-1	thanks, if you'll take the controls, I'll go ahead and do approach briefing.		
1815:22 MOT-2	alright, I've got the controls, flight controls.		
1815:40 MOT-1	OK, frequency, it's a Raleigh/Durham ILS fie left. frequency, one oh nine point one. I'll put three eighty two up for the other side. 'K. frequency is one oh nine point one for the left side. and th. altitude is lhreo thousand or twenty one hundred, down to five, eighty five, two hundred foot approach, lhreo quarters of a mile W four thousand RVR, we have it. course inbound is fifty two. time is not required. missed approach is climb to a thousand, then climbing left turn to twenty one hundred, via three ten heading outbound to the. throe fifty one radial dll of seventeen two. uum, any questions?		
1816:29 HOT4	nope.		
1816:30 HOT-1	OK, I have the flight controls.		
1816:31 HOT-2	your controls.		
1816:33 HOT-1	thanks.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	**CONTENT**	**TIME & SOURCE**	**CONTENT**
1816:58 HOT-1	yeah. I don't know what MCI was gettin' at with that commercial whether 'cause the guy said, you two guys look alike referring to that, Egyptian princess or whatever, and she was like taking it as sexual harassment, 'cause she just kinda puts her head down and looks like you know this big pout on her face like how, how frustrating it is to be a woman or som', I don't know. the commercial really turned me off. I just wondered if you'd seen it, you know.		
1817:22 HOT-2	yeah. I saw that uh. Joe Montana playin' quarterback for the, he has a. he's dreaming.		
1817:29 HOT-1	oh yeah		
1817:30 HOT-2	or he gets hit, he he's quarterback and he's gonna pass the ball and he looks up in the stand and he sees this big fat Sumo wrestler starts goin' uhuh and his fat starts jiggling.		
1817:38 HOT-1	yeah.		
		1817:39 GSOOP	thirty three seventy nine, this is Greensboro, do you copy?
		1817:42 RDO-2	loud and clear there. how do you hear us?
		1817:46 GSOOP	guys, sorry it took (me) so long to get back to you. you got some times for me?
1817:49 HOT-2	yeah watta you want? ** the times again?		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1817:52 HOT-1	ah, fifty three, and whatever we're off.		
		1817:55 RDO-2	aaaah, it's goin' to have lo be fifty three, and oh three.
		1818:00 GSOOP	fifty three and oh three, OK thanks. you guys have a good night.
		1818:04 RDO-2	see if you can give that lo uh uh, you know fha bags or something like that. saa if you can work that out.
		1818:11 GSOOP	OK. thanks guys.
		1818:12 RDO-2	bye.
1818:30 HOT-2	anyway. so *he* he sees !his fat guy jiggling so he kinda goes ooooh you know he *k i n* distracts him and somebody comes from behind and Klondikes him and just knocks him out. and he's and he's in a dream and the next thing ye know he's in a Jet's uniform.		
1818:44 HOT-1	oh yeah.		
1818:44 HOT-2	[sound of laughter]		
1818:45 HOT-1	yeah, I hadn't seen that one.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	**CONTENT**	**TIME & SOURCE**	**CONTENT**
1818:46 HOT-2	it's funny as hell.		
1818:48 HOT-1	gettin' a little bit o' ice out there, aren't you? just like trace.		
1818:52 HOT-2	just a trace, yeah.		
1818:53 HOT-1	cool.		
1818:58 HOT-1	you're not a werewolf are you? I see the moon up there.		
1819:00 HOT-2	yeah, actually is it a full moon **? ** not even a# hair on that. Maybe just a ** but not a **.		
1819:21 HOT-1	yeah, we're uh, three uh, you wouldn't mind writing the flight number there, would you?		
1819:24 HOT-2	what's that?		
1819:25 HOT-1	you wouldn't mind puttin' the flight number there would you?		
		1819:33 APR-1	American fourteen zero two, fly heading zero two zero, descend and maintain eight thousand.
		1819:37 AA1402	zero two zero, eight thousand, American fourteen oh two.
1819:44 HOT-1	thank you.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTEHT	TIME & SOURCE	CONTENT
		1819:46 RDO-2	Raleigh ops, Eagle thirty three seventy nine, is about twelve out.
		1819:53 RDUOP	copy thirty three seventy nine. you'll park in Juliet. I'm showin' you goin' back out to Greenville. same phne, nine one eight.
		1820:00 RDO-2	OK. Juliet.
1820:18 HOT-2	what's the inbound radial to uh..		
1820:22 HOT-1	the ILS?		
1820:23 HOT-2	no, to uh, zero eight zero live, is it also the two seventy, two seventy nine isn't it into uh. Raleigh?		
1820:31 HOT-1	no, I don't think they match or anything like that.		
1820:34 HOT-2	uuh.		
		1820:35 APR-1	Eagle three seventy nine, are you in the turn direct Raleigh?
1820.36 HOT-2	yeah, s' that's what I'm saying		
		1820:38 RDO-2	that's affirmative.

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1820:40 HOT-1	OK, was that us?		
		1820:41 APR-1	Eagle three seventy nine. turn right heading one eight zero.
		182042 RDO-2	one eight zoro.
1820.43 HOT-2	that's what I mean. it's not direct. we're on the, we were cleared for Victor three ten.		
1820:48 HOT-1	yeah, but he just gave us the eighty five degree radial. I don't... I don't, huh.. ***.		
1820:51 HCT-2	** course.		
1820:52 HOT-1	huh?		
1820:53 HOT-2	isn't that part of the f, as filed?		
		182055 APA-1	fourteen zero two reduce speed now to one eight zero
1820:58 HOT-1	um, I don't think so, and you can go ahead and do approach check. we'll check about it on the ground, but uh,		
		1821:00 AA1402	one eighty, American fourteen oh two.

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1821:02 HOT-2	alright. flight instruments and radios set and checked on the right		
		1821:02 AA1402	fourteen oh two, are we gonna do downwind tonight or we gonna be able to Intercept.
1821:05 HOT-1	set and checked on the left.		
		1821:08 APR-1	fourteen oh two it's probably gonna be a base for ya. I need to get your speed back though to follow traffic.
1821:10 HOT-2	** eppmach briefing? approach briefing?		
1821:13 HOT-1	uh, it's complete		
1821:15 HOT-2	boost pumps and crossfeeds are on. pax briefing to go, I'll be uh, eppmach complete.		
1821:19 HOT-1	OK. oh. I see what you're talking about..		
		1821:21 APR-1	Eagle three seventy nine, turn right heading uh, two zero zero.
		1821:24 ROO-2	three seventy nine. two zero zero.
1821:28 HOT-2	yeah 'cause, it's the three ten and it dog legs.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1821:31 HOT-1	we got confused between you end I. I was talking about the zero eighl live degree radial.		
1821:36 HOT-2	yeah. we we were never at..		
1821:38 HOT-1	alright. Victor ton whal it, three ten whal is..		
1821:40 HOT-2	three ten's the one oh eighl so we weren't even on it, yeah.		
1821:42 HOT-1	OK.		
1821:43 HOT-2	OK, yeah you're, I didn't know what was goin' on there. I thought the zero eight five was the Victor three ten.		
1821:45 HOT-1	yeah. no.		
1821:46 HOT-2	OK.		
1821.48 'HOT-1	end uh,		
1821:49 HOT-2	that'll be elright.		
1821:50 HOT-1	you know, I don't I don't know why he's telling us to join on that if we're on zero eight live we just fly zero eighl five until lhey tell us to turn.		

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INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1821:55 HOT-2	righl. tight.		
1821:58 NOT-1	but I'm glad you brought ha up and everything.		
1821:59 HOT-2	I think ha said well then he came back and asked if we were gonna go direct. I lhink. Ithink what it was is he thought we were on the uh, airway too.		
1822:06 HOT-1	yaah. yeah he should paint you know.		
1822:08 HOT-2	yoah. yeah, ils a combination.		
		1822:09 APR-1	American fourteen zero two, turn right heading one two zero.
1822:11 HOT-1	'K. frequency is set and everything OK, thanks.		
		1822:13 AA1402	one two zoro. Americen fourteen oh two.
1822:17 HOT-2	OK uh. I'm gonna bo in back.		
1822:20 HOT-1	OK		
		1822:23 APR-1	American fourteen zoro two, contact approach one three livo point one live. advise them of your heading.

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	**CONTENT**	**TIME & SOURCE**	**CONTENT**
1822:24 PA-2	[sound similar lo cabin chime] well lolks. at this lime. we're about ten point eighl miles Irorn the Raleigh/Durham Interne-tional airport. 'bout live minutes out. and we're just about to begin our approach. at this time I'd like you lo double check your seat belts end make sure they're securely fastened, ell carry-on iuggage stowed, tray tables in the up and locked posi-tion. weather tonight's not very good in Raleigh. it's uh. live hundred foot overcast, two miles visibility because of rain and fog, end Iha winds are out of the north at six miles per hour.		
		1822:27 AA1402	thirty live fifteen. we'll do thal. take care.
		1822:29 APR-1	Eagle Ihrae seventy nine. I know earlier you asked me if I wanted you to join the radial or the slay on the heading. which did I tell you?
		1822:36 RDO-2	OK, it was our understanding you wanted us on the zero eight five degree radial.
		1822:39 APR-1	OK, I'm sorry I was thinking you meant p in the radial from the uh, inbound uh, to Raleigh.
		1822:45 RDO-2	uh, I'm bony about that, yeah. uh, wo meant Ihe zero eight live degree radial 'cause we ware just about on it.
		1822:50 APR-1	roger.
		1822:54 APR-1	Eagle llight three seventy nine. reduce speed lo uh, one eighl zero then dexend and maintain six thousand.

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1822:57 HOT-2	I'm back		
		1822:59 RDO-1	OK, a hundred and dighty knots and then down to six thousand six thousand Eagle three seventy nine.
1823:11 HOT-1	and you heard that as six too, didn't you?		
1823.13 HOT-2	dearly. one eighty to six thousand, yeah.		
1823:15 HOT-1	yeah.		
1823:16 HOT-2	what he said. one eighty ond then down to six7		
1823:18 HOT-1	yeah. but I mean, you you clearly heard him said six 'cause you kinda came on light when he said it.		
1823:22 HOT-2	yeah.		
1823:23 HOT-1	OK. yeah. A was kinda, you were kinda sayin' I'm back and Iwas Wnda. it was kinda muffled a little bit..... and we, we've done the approach check, correct?		
1823:56 HOT-2	yep.		
1823:57 HOT-1	yeah. I remember you sayin' that.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	**CONTENT**	**TIME & SOURCE**	**CONTENT**
1823:58 HOT-2	complete		
1823:58 HOT-1	OK.		
1823:59 HOT-2	I'll leave the strobes o'f. is that alright !or you or do you want.		
1824:01 HOT-1	sura yeah. that's line. hey. at least this way we won't forget.		
1824:06 HOT-2	righl. the only problem if it's consistent it doesn'i bother mo. but if it's doin' the boom. boom, boom. horn like this, that's tho stuff that gets yo because it flashes.		
1824:16 HOT-1	yoah. I've tried to incorporate that into *my* flow now.		
		1824:19 APR-1	Eagle three sevenly nino. lurn righl heading two three zoro.
		1824:21 RDO-2	righl lo two lhreo zero, three sovonly nina
1824:23 HOT-1	..that you know when I go flight director slandby. lights on, you know, just trying lo add that up lo my scan. or to you know pattern. it's just that's lho first limo I've realty had e uh, ah, a first officer ltying ono kw a1 night uh you know whoro ye even considered turning tho lights out, and that's you know kinda just caught me as a first timer.		
		1824:45 APR-1	Eagle three sovonly nina. contact approach ono three five point ono live. good night

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1824:48 RDO-2	thirty five fifteen, see ya.
		1824:52 APR-2	American fourteen oh two, descend and maintain four thousand.
		1024:55 AA1402	four thousand, fourteen oh two.
		1824:58 RDO-2	Raleigh approach, Eagle three seventy nine, one eighty, seven point five for six.
		1825:02 APR-2	Eagle flight three seventy nine, Raleigh approach roger. fly heading two four zero.
		1825:05 RDO-2	two forty.
1825:25 FPAB	check baro altitude.		
1825:25 HOT-1	this one is so hard to get trimmed.		
		1825:26 APR-2	American fourteen oh two, turn left heading zero seven zero, join the localizer course, track it inbound.
1825:28 HOT-2	one to go.		
		1825:31 AA1402	zero seven zero to join. American fourteen oh two.

INTRA-COCKPIT COMMUNICATION		AIR-GHOUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1825:34 HOT-1	**?		
		1825:38 APR-2	Eagle flight Ihree sovonly nino. reduce lo one seven zero then descend and maintain three thousand.
		1825:42 ROO-2	one seventy then Ihroo thousand. three seventy nine.
		1825:49 APR-1	fourteen oh two, if you wanna do one eight zero, that's approved.
		AA1402	thank you very much. Ihal was our last assigned
		1825:55 APR-2	American fourteen oh two, you're ten miles lrom SCHOO. cross SCHOO at or above Ihreo thousand. cleared ILS five left. a hundred and eighty knots 'til BARRT please.
		1826:02 AA1402	be glad to do that. cleared approach, American fourteen oh two.
1826:07 HOT-1	yeah boy, I tell you, this one is really out of rig. it's squirrely as heck on takeoff so beware of that in Raleigh. seems to wanna go hard to the left.		
1826:18 HOT-2	yeah, that's what I seen when we were taxiing. it wanted to go left that's why I needed to, every time I'd feel a jerk, it was the right brake just trying to get the nose to turn.		
1826:26 HOT-1	yeah.		

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INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1826:26 HOT-2	**		
1826:27 HOT-1	you did a grant job		
		1826:28 APR-2	American fourteen oh lwo. caution wake turbulence seven fifty sovon. one o'clock six milos tumin' base to final lor runway five right.
		1826:33 AA1402	OK, wo appreciate it.
1826:34 HOT.2	that's why I was wondering if there's something you know, you said it pulls to the left, so I don't, there must be something wrong with tho uh. nosewheel or something. everything looks line * it?		
1826:45 HOT-1	well the torque's have a big, big split so if you're gonna kinda like dead slick it, your gonna have good split on the torque. I don't remember how much it was, but uh, I don't know, it might be the toque gauges may be off or somelhing.		
1827:28 HOT-1	how's the temperature now, do you feel it's gettin' a little warm or is it just me?		
1827:31 HOT.2	uh, it's toasty, I mean it's comfortable. you want me lo turn it down7		
1827:34 HOT-I	a tiny bit would be fine.		

INTRA-COCKPIT COMMUNICATION		AIR-QAOUNO COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1827:39 HOT-B	[sound of change in airflow]		
1827:40 FPAR	check baro altitude.		
1827:40 HOT-1	and when you get a chance. look out the window and see if you see any of that kc I might do ...		
1827:43 HOT-2	yeah, I was lookin' out there. it doesn't, I, I don't see anything right now.		
1827:46 HOT-I	OK, we can go ahead and do flaps thirty five landing. if there was a little bit out there I'd probably do flaps twenty.		
1827:54 HOT-2	do you have much king experience? loss than a lhousand to go.		
1827:58 HOT-I	uh, hi and miss here you know, you know you don't get too much here I mean I don't anyways. how 'bout you?		
1828:04 HOT-2	more than I want. I used to fly my dads ono eighty two around I'd get two or lhree Inches on the wing. ho'd go walk up to it and grab it like that and go crkkkkk, pull it off and throw it. takes a lot of icing to pull one of these ### out of tho sky, guarantee you that;		
		1828:20 APR-2	Eagle flight three sovonly nine, caution wnko turbulence your spacing on a, seven twenty sevon. turn left heading one niner zoro.

INTRA-COCKPIT COMMUNICATION TIME & SOURCE	CONTENT	AIR-GROUND COMMUNICATION TIME & SOURCE	CONTENT
		1828:27 RDO-2	left one niner zero, three seventy nine.
1828:31 HOT-1	caution wake turbulence, like what are we gonna do about it.		
1828:34 HOT-2	exactly.		
1828:45 HOT-1	I got some uh, shaving cream looking ice one time when I was goin' into Chattanooga, first officer and I had never seen anything that looked like that .... ever see anything that looks like that just kinda shaving cream, foamy lookin'?		
1829:08 HOT-2	uh huh,		
		1829:14 APR-2	Eagle three seventy nine, turn left heading one four zero.
		1829:19 RDO-2	left one four zero. three seventy nine
1829:26 HOT-2	[sound of Morse code identification 'IGKK]		
1829:31 FPAB	check baro altitude		
1829:34 HOT-1	I was trying to identify those but uh,		
1829:37 HOT-2	they're identified.		
1829:38 HOT-1	thanks.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1830:05 APRd	American fourteen oh two, contact Raleigh tower one two seven four live.
		1830:09 AA1402	twenty seven forty five. see you on tho way out
		1830:1'I APR-2	see ya.
		1830:29 APR-2	Eagle flight three seventy nino. cighl lrom BARRT. turn left heading zero seven zero. join the localizer course at or above Iwo thousand one hundred. cleared ILS live lelt.
		1830:38 RDO-2	zero sever, zero at twenty one hundred or above. cleared for the ILS live lelt. three. three seventy nine.
1830:40 FPA-B	check baro altitude.		
1830:44 HOT-I	see if we can maintain three lhousand 'til established.		
1830:47 HOT-2	what's that?		
1830:48 HOT-1	he said at or above, right?		
1830:49 HOT-2	right.		
1830:51 HOT4	OK, and could you hit approact ..		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
183057 HOT-2	it's armed.		
1830:59 HOT-1	OK, ** take it down a little bit.		
1831:02 HOT-2	what's that?		
1831:03 HOT-1	at or above. I'm going to go ahead and keep it here.		
1831:09 HOT-1	OK, everything's armed. right?		
1831:11 HOT-2	yep, glide slope's alive.		
1831:13 HOT-1	'K, at or *above* y w agree that I can stay at three thousand, right?		
1831:16 HOT-2	that's true		
1831:19 HOT-1	'cause I don't want him to *send* anybody over top of me thinking I'm down at twenty one hundred.		
1831:22 HOT-2	no, that's correct.		
1831:54 HOT-1	BARRT's seven DME?		
1832:00 HOT-2	ah. six point nine		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1832:07 APR-2	Eagle flight three seventy nine, contact Raleigh tower one two seven four five.
		1832:10 RDO-2	twenty seven forty five. good night.
		1832:13 APR-2	good night.
1832:15 CAM	[sound of beep similar to pilot changing VHF radio frequency]		
		1832:16 RDO-2	Raleigh tower. Eagle three seventy nine's with you for the left side.
		1832:18.0 TWR	Eagle flight three seventy nine Raleigh tower, runway five left, cleared to land wind zero one zero at eight. traffic three and a half mile final seven twenty seven.
		1832:24.8 RDO-2	cleared to land five left, three seventy nine.
1832:40.5 HOT-1	I'm gonna configure at the marker.		
1832:55.9 HOT-1	your glide slope bouncing around a little bit like maybe somebody's in the uh,, blocking it or somethin'?		
1833:00.9 HOT-2	uh, little bit o' jiggling back and forth. it's probably that seven twenty seven down there.		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
183305.1 HOT-1	yeah, I can see that how it's bouncing.		
1833:06.3 HOT-2	or it's actually probably that guy down over the threshold.		
183308.7 HOT-1	OK.		
1833:10.2 HOT-1	go ahead. flaps ten.		
1833:13.1 HOT-2	selected, indicatin' ten degrees.		
1833:23.2 HOT-I	lot's go ahead and go speeds high. this sucker is slooow.		
183328.7 CAM	[sound of increased frequency similar to increase in propeller RPM]		
1833:29.7 HOT-I	and gear down. flaps twenty.		
1833:33.3 HOT-1	why's that ignition light on? we just had a flame out?		
1833:36.4 HOT-2	I'm not sure what's goin' on with it.		
1833:39.8 HOT-1	we had a flame out.		
1833:40.7 CAM	[low frequency boat sound similar to propellors rotating out of synchronization starts and continues for approximately eight seconds]		

INTRA-COCKPIT COMMUNICATION		AIR-QROUNO COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
183341.4 HOT-2	'K, you got it?		
1833:42.5 HOT-1	yeah.		
1833:42.8 MOT-2	we lose an engine?		
1833:43.6 NOT-1	OK. yeah.		
1833:45.2 HOT-1	OK, uh ...		
1833:46.0 HOT-2	I'm gonna turn that. ..		
1833:46.5 HOT-1	see ifthat. turn on the auto ...		
183348.2 HOT-2	I'm goin' to turn on, both uh ... ignitions, OK?		
1833:51.5 HOT-I	OK.		
1833:54.2 HOT-2	we lose that en' lelt one?		
1833:55.9 NOT-I	yeah.		
1833:58.9 HOT-2	watta you want me la do you gonna continuo?		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1834:00.1 HOT-I	OK, yeah. I'm gonna continue. just back me up.		
1834:03 1 HOT-2	alright I'm gonna ...		
1834:03.7 CAM	[low frequency beat sound similar lo propellers rotating out of synchronization starts end continues lor approximately three seconds]		
1834:03.9 HOT-1	* let's go missed approach.		
1834:05.0 HOT-2	alright. **.		
1834:05.3 CAM	[sound similar lo single stall weming horn starts end continues for 0.7 seconds]		
1834:05.7 HOT-1	set max power.		
1834:06.1 CAM	[sound similar to single stall warning horn starts end continues for 0.3 seconds]		
1834:06.5 HOT-2	lower the nose. lower the nose. lower the nose		
1834:09.4 CAM	[sound similar lo single stall warning horn starts]		
1834:09.6 CAM	[sound similar lo dual stall wsrniny horns start]		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1834:09.8 HOT-2	you got it?		
1834:10.8 HOT-1	yeah.		
1834:12.2 HOT-2	lower the nose.		
1834:13.0 CAM	[unidentified rattling sound]		
1834:13.2 HOT-2	it's the wrong, wrong foot, wrong engine *.		
1834:14.7 CAM	[sound similar to dual stall warning horns stop]		
1834:14.8 CAM	[low frequency beat sound similar to propellers rotating out of synchronization starts and continues for approximately four seconds]		
1834:14.9 CAM	[sound similar to single stall warning horn stops]		
1834:16.1 CAM	[sound similar to dual stall warning horns start]		
1834:16.3 HOT-B	[sound of heavy breathing]		
1834:17.6 CAM	[sound similar to dual stall warning horns stop and single horn continues]		
1834:18.2 CAM	[sound similar to dual stall warning horns start]		

INTRA-COCKPIT COMMUNICATION		AIR-GROUND COMMUNICATION	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1834:18.9 HOT-2	here		
1834:19.6 CAM	[sound similar to dual stall warning horns stop]		
		1834:20.2 TWR	wind zero two zero at seven
1834:22.3 CAM	[sound similar to dual stall warning horns start and continues to impact]		
1834:24.4 CAM	[sound of impact]		
1834:24.6 END of RECORDING			
END of TRANSCRIPT			