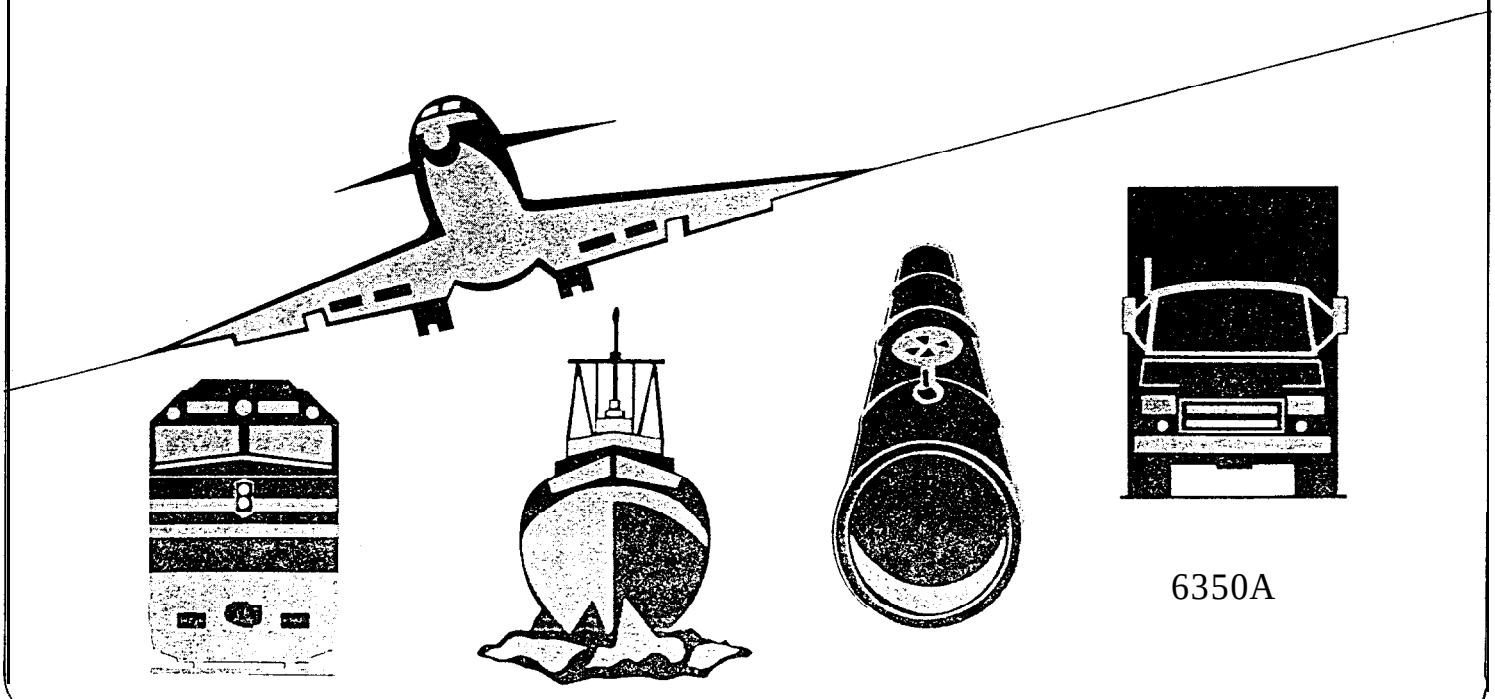
PB94-910410
NTSB/AAR-94/08

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

IMPACT WITH BLAST FENCE UPON LANDING ROLLOUT
ACTION AIR CHARTERS FLIGHT 990
PIPER PA-31-350, N990RA
STRATFORD, CONNECTICUT
APRIL 27, 1994



6350A

The National Transportation Safety Board is an independent Federal agency dedicated to promoting aviation, railroad, highway, marine, pipeline, and hazardous materials safety. Established in 1967, the agency is mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The Safety Board makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

Information about available publications may be obtained by contacting:

National Transportation Safety Board
Public Inquiries Section, RE-51
490 L'Enfant Plaza, S.W.
Washington, D.C. 20594
(202)382-6735

Safety Board publications may be purchased, by individual copy or by subscription, from:

National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161
(703)487-4600

NTSB/AAR-94/08 PB94-910410

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

IMPACT WITH BLAST FENCE UPON LANDING ROLLOUT
ACTION AIR CHARTERS FLIGHT 990
PIPER PA-31-350, N990RA
STRATFORD, CONNECTICUT
APRIL 27, 1994

Adopted: December 13, 1994
Notation 6350A

Abstract: This report explains the accident involving Action Air Charters flight 990, a PA-31-350 airplane, which crashed into a blast fence at the end of runway 6 after the airplane landed at Sikorsky Memorial Airport, Stratford, Connecticut, on April 27, 1994. Safety issues in the report focused on the instrument landing system, runway safety areas, runway lighting systems, and aircraft maintenance. Safety recommendations concerning these issues were made to the Federal Aviation Administration, the Connecticut Department of Transportation, the City of Bridgeport, and the Town of Stratford, Connecticut.

CONTENTS

EXECUTIVE SUMMARY

On April 27, 1994, about 2256 eastern daylight time, Action Air Charters flight 990, a Piper PA-31-350 Navajo Chieftain, N990RA, crashed into a blast fence at the departure end of runway 6 after landing at Sikorsky Memorial Airport, Stratford, Connecticut. The flight originated in Atlantic City, New Jersey, and operated on a visual flight rules flight plan. The airplane was operating under Title 14 Code of Federal Regulations Part 135 as a single pilot, on-demand air carrier flight. Following landing touchdown and during rollout, the airplane collided with a blast deflector fence at the departure end of runway 6. The airplane was destroyed by impact forces and a postcrash fire. Eight of the nine occupants sustained fatal injuries. One passenger was seriously injured.

The National Transportation Safety Board determines that the probable causes of this accident were the failure of the captain to use the available ILS glideslope, his failure to execute a go-around when the conditions were not suitable for landing, and his failure to land the airplane on the runway at a point sufficient to allow for a safe stopping distance; the fatalities were caused by the presence of the nonfrangible blast fence and the absence of a safety area at the end of the runway.

Safety issues in this report focused on the instrument landing system, runway safety areas, and runway lighting systems. Safety recommendations concerning these issues were made to the Federal Aviation Administration, the Connecticut Department of Transportation, the City of Bridgeport, and the Town of Stratford, Connecticut. Also, as a result of the investigation of this accident, on May 11, 1994, the Safety Board issued Urgent Action Safety Recommendations A-94-111 and A-94-112 to the Federal Aviation Administration concerning aircraft maintenance performed by Harrington Industries, Inc.

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

IMPACT WITH BLAST FENCE UPON LANDING ROLLOUT

ACTION AIR CHARTERS FLIGHT 990
PIPER PA-31-350, N990RA
STRATFORD, CONNECTICUT
APRIL 27, 1994

1. FACTUAL INFORMATION

1.1 History of the Flight

On April 27, 1994, about 2256 eastern daylight time (EDT),[1] Action Air Charters flight 990, a Piper PA-3 l-350 Navajo Chieftain, N990RA, crashed into a blast fence at the departure end of runway 6 after landing at Sikorsky Memorial Airport (BDR), Stratford, Connecticut. The flight originated in Atlantic City, New Jersey, and operated on a visual flight rules (VFR) flight plan. The airplane was operating under Title 14 Code of Federal Regulations (CFR) Part 135 as a single pilot, on-demand passenger air carrier flight. Following landing touchdown and during rollout, the airplane collided with a blast deflector fence at the departure end of runway 6. The airplane was destroyed by impact forces and a postcrash fire. Eight of the nine occupants sustained fatal injuries. One passenger was seriously injured.

The chartered series of flights began on the morning of April 27, 1994. The flights were contracted by an independent representative of Resorts International, Inc., a gambling casino operator located in Atlantic City, New Jersey. The flights operated as Action Air flight 990 from Hartford/Brainard Airport (HFD), Hartford, Connecticut, to Pomona Airport (ACY), Atlantic City, New Jersey, with an intermediate stop at Sikorsky Memorial Airport. A return flight was scheduled in the evening to return the passengers to their points of origin.

---

[1] All times in this report are in eastern daylight time, using the 24-hour clock, unless otherwise noted.

The captain reported for duty at 0800. The airplane was fueled with 116 gallons of fuel, as recorded on the airplane weight, balance, and load manifest. The flight was scheduled to depart HFD at 0830 with two passengers and one company employee; however, the flight was delayed because the BDR weather was below landing minimums. According to company records, Action Air 990 was released at 0845 and was airborne at 0855. The flight landed routinely at BDR and picked up five additional passengers. No arrival times at BDR were reported by the captain to the company. After departure, the flight reported a takeoff time of 0931 and proceeded to ACY. The captain reported arriving at ACY with a landing time of 1020.

After arrival, the captain joined several other pilots from Action Airlines and proceeded to a local diner for a meal. Afterwards, several crewmembers rode in a company-provided automobile to a hotel to commence a rest period until the flight departures that evening. The captain shared a room with another pilot from Action Airlines. According to the roommate, the captain remained in the hotel during the afternoon hours. His activities consisted of telephoning his wife, watching television, and sleeping for a period of about 4 hours. According to hotel records, the captain checked out of the hotel about 2000. He departed with fellow pilots in the company car and arrived at the airport about 2020.

The scheduled departure for the accident flight was 2200, with the same eight passengers who had been brought in on the morning flight. The departure times were not reported since company policy did not require the pilot to do so unless a delay of 30 minutes or more was incurred. The captain had filed an instrument flight rules (IFR) flight plan; however, it was never activated. The airplane departed about 2200 and operated under visual flight rules (VFR). The route of flight was ACY direct to BDR, and the cruise portion was flown at an altitude of 5,500 feet above mean sea level (msl). Radio contact was made with the New York Terminal Radar Approach Control (TRACON) to request flight following through the New York area Class B airspace.

About 2225, Learjet N400EP called BDR tower and was advised by the tower controller that the tower visibility was ½ mile and that the controller did not think N400EP would be able to land at the an-port in VFR conditions. At 2230, BDR tower closed for the evening. About 2237, the pilot of N303A, a Sabre 65,

conducted a missed approach from the very high frequency omnidirectional radio range (VOR) approach to runway 29 and diverted to White Plains, New York. According to the pilot, the weather on downwind was 2 miles visibility with fog. About 2242, N11 1SK, a Turbo Commander, planned to land on runway 24 at BDR. However, about 5 miles from the runway, the pilot lost sight of the runway lights. He then overflew the runway and could see the runway and other lights at the airport from overhead. He then diverted to New Haven, Connecticut. He later stated that there were no defined tops to the fog at the airfield.

Also, at 2242, Action Air 990 advised the TRACON that the flight was initiating a VFR descent out of 5,500 feet and was proceeding direct towards BDR. At 2251, Action Air 990 switched to the Common Traffic Advisory Frequency (CTAF) for BDR[2] because the tower had closed.

The captain of Learjet N400EP reported that at about 2252, after landing at BDR, he received a radio transmission (believed to be from the accident captain) inquiring, "How was the weather down there?" A second transmission was received asking, "how was the ground fog?" The reply from the copilot of Lear-jet N400EP was, "not bad until you get on the ground." The captain of the Learjet later stated that a Piper Navajo reported 8 miles out for landing at BDR. This was the last known transmission by the pilot of Action Air 990. The captain of Action Air 990 flew the approach to runway 6 at BDR. Examination of the cockpit wreckage revealed that the ILS frequency for runway 6 was selected on the navigation receiver. The airplane crashed into a jet blast fence located at the departure end of runway 6 at about 2256. Other than the surviving passenger, there were no witnesses to the accident, although several individuals noted weather conditions at the time. The accident occurred during the hours of darkness at 41 degrees, 9.8 minutes north latitude, and 73 degrees, 7.6 minutes west longitude.

---

[2]The CTAF is a frequency designated for the purpose of carrying out airport advisory practices while operating to or from an airport without an operating control tower. The CTAF for BDR is tower frequency 120.9 MHz.

1.1.1 The Survivor's Account

According to the surviving passenger,[3] the captain performed the preflight with the aid of a flashlight at ACY. The captain then told the survivor to sit in the right seat while the passengers boarded the airplane. He then heard the captain give a seat belt and emergency exit briefing. He stated that he listened to the briefing, since he was not familiar with the Piper Navajo. The captain then told the survivor that he always filed an IFR flight plan, even though he might fly VFR.

The passengers seemed to be in good spirits. They were not inebriated or unruly. When asked if the passengers had their seat belts on to land, the survivor stated that he thought most of them did. He believed that if they did not, they would have been thrown into the cockpit like the one male passenger who did come to rest there. He did not think that person had his seat belt on.

The flight departed ACY behind another company flight bound for Albany, New York. During the flight, the survivor monitored the company radio frequency while the captain talked to ACY and New York TRACON air traffic controllers. He stated that as the flight approached BDR, he could see Long Island and he noticed that fog was developing along the coast. He said that he saw the rotating beacon at BDR and observed fog developing there also. When the BDR radio frequency was tuned, he said that he and the captain heard a Learjet making an approach to BDR. The Learjet crew indicated that there was thin fog. There were no tower communications, and the survivor did not recall if New York TRACON issued any weather information. Everything sounded routine to the survivor. The captain did not appear to be rushed or anxious. He accomplished the checklist by touching each appropriate object rather than reading it out loud. The survivor stated that the captain made no comments about any personal or physiological problems during the flight and that he seemed well rested. The survivor stated that he believed nothing was wrong with the airplane and that the captain would have said so if there was. The survivor also stated that the captain was "very religious" about checklists.

---

[3] The survivor was an instrument-rated private pilot employed by Action Airlines as a dispatcher and general assistant, He stated that he had accumulated about 320 flying hours. He occupied the right cockpit seat on the accident flight.

During the approach, the survivor could see the runway, and to him "everything seemed normal." He said that he assumed that since he could see the runway, the captain could too. He thought that they were a little bit high during the approach to the runway. He did not know whether the localizer frequency had been tuned in. As they flew down the approach path, the captain said to him, "See this button up here?" [referring to the landing light switch] "Turn that on when I tell you to." He also stated that during the approach he had no sense of a tailwind.

The survivor stated that although he never lost sight of the runway during the approach or landing, he could not see the beginning and the end of the runway at the same time. He did not recall the runway lighting, but he did remember the threshold bars painted on the runway, a runway number painted on the runway (he could not recall the number), and the white lines (side markings) of the runway. He did not see the area of skid marks in the touchdown zone. He saw the pavement, and he thought that he might have seen a strobe light at the approach end of the runway.

During the approach, he saw the captain making throttle adjustments, and he watched him lower the flaps. He did not know the flap setting used. He said that it was foggy when they "rounded out" and were going down the runway. The captain said, "turn it on," referring to the landing light. Then, almost immediately, he said, "turn it off." He did not add any power and was "fishing for the runway." The survivor said that he observed a considerable adjustment of the yoke. He did not know the length of the runway, but he thought that their approach was high and long. He did not know if it was a normal touchdown because of his unfamiliarity with the type of airplane. He did not hear the stall warning just before touchdown, and he stated that he was familiar with that sound.

After touchdown, the braking was initially hard. The survivor stated that his head was down at the time and that when he looked up, he saw the blast fence at the end of the runway. He thought that he and the captain saw it at the same time. The last thing the captain said at that time was "oh no" or "uh oh." He stated that the impact with the "wall" felt like "we hit it at 100 miles an hour."

Following impact, the passengers were calm, and they seemed to be catching their breaths. After the impact, both he and the captain were conscious.

The captain turned toward the passengers and said, "don't panic," and "it's all right." The survivor stated that at that time, the captain may have taken off his seat belt to turn and talk to the passengers. Concerning his own seat belt, he stated that he could "feel the belt" during the impact, and believes that he may have unbuckled his seat belt at the same time as the captain.

The survivor said he then looked down toward the fuel shutoff valve handle. After what he estimated to be 3 to 5 seconds, the airplane "exploded." Then the passengers began to scream. When he looked up, he saw that a passenger had been thrown into the windshield during impact. This individual was on fire. He believed it to be the passenger seated behind the captain. He did not think that the passenger had his seat belt on at the time of impact. He pushed the passenger and himself out the window onto the ground. He stated that they were out of the airplane in seconds. He held the passenger, and together they rolled away from the fire until the survivor thought the fire was out. He then ran back toward what he thought was the rear of the airplane. He ran into a person that he thought was a woman passenger and rolled her out on to the ground. He remembered getting to a cool place and that the person that he had initially pushed out of the airplane was on the ground talking.

The survivor offered his opinion that the captain was a conscientious pilot and very good with checklists. He believed that the fog and visibility were major factors in the accident sequence of events. He did not know why they landed so far down the runway.

1.2 Injuries to Persons

	Pilot	Passengers	Other	Total
Fatal	1	7	0	8
Serious	0	1	0	1
Minor	0	0	0	0
None	0	0	0	0
Total	1	8	0	9

1.3 Damage to Airplane

The airplane was destroyed during impact with the blast fence and subsequent fire. See figures la and lb.

1.4 Other Damage

Approximately 50 feet of nonfrangible blast fence was destroyed during the impact sequence and subsequent fire.

1.5 Personnel Information

The captain was certificated in accordance with existing Federal Aviation Regulations (FARs) and possessed an FAA First Class Medical Certificate issued on March 23, 1994. A limitation on the certificate stated that the captain must wear correcting lenses for near and distant vision. His last FAA Report of Medical Examination stated that his distant vision in his right eye was 20/40 corrected to 20/20, while his distant vision in his left eye was 20/15. His near vision in his right eye was 20/40 corrected to 20/20, while his near vision in his left eye was 20/20. When asked if the captain was wearing glasses during the accident flight, the surviving passenger stated that he did not recall. The captain's wife stated that he did not wear contact lenses.

Identifying Data:

Age at time of accident:	33
Date of birth:	09-07-60
Date of Hire Action Airlines:	08-28-93

FAA Airman Certification Information:

Private Pilot	12/22/78
Instrument - Airplane	01/22/89
Commercial Pilot Certificate No.	40680050
Single-engine - Land	06/11/89
Multiengine - Land	10/28/89

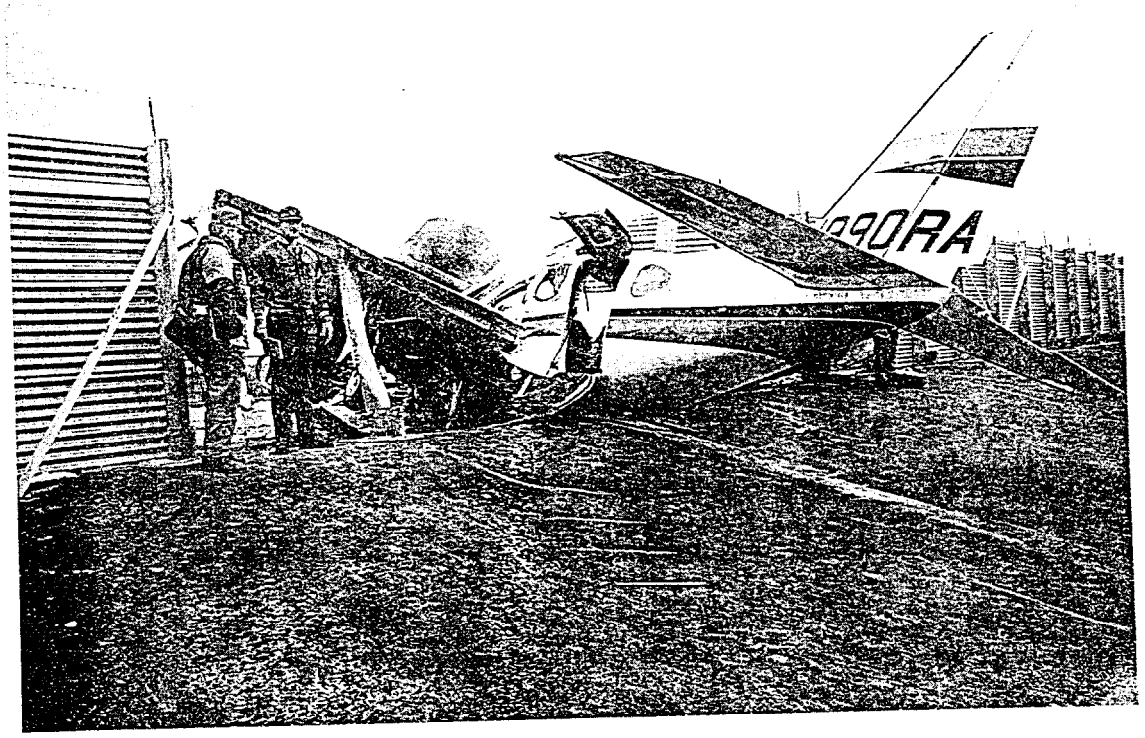


Figure 1 a.-Rear view of wreckage.

Figure lb.-Front view of wreckage.

Aeronautical Experience:

Experience	Time and Source of Information
Total Flight Time:	3,500 Hrs. (per 3/23/94 Medical Application)
Multiengine PIC:	1,000 Hrs. (per 8/93 training record)
Multiengine SIC:	1,000 Hrs. (per 8/93 training record)
Instrument Total:	250 Hrs. (per 8/93 training record)
Night Total:	1,025 Hrs. (per 8/93 training record)
PIC PA-3 1:	127 Hrs. Action Airlines (9/93 - 4/94)
50 Hrs. Corporate Air (5/91 - 4/94)[4]	
SIC PA-3 1:	350 His. Action Airlines (4/90 - 4/91)[5]
Total PA-3 1:	527 Hrs.

Recent Flight Activity:

Last: 24 hours - 2.2 hours (including the accident flight)
30 days - 43.5 hours
60 days - 55.9 hours
90 days - 70.6 hours

Training and Check Ride History:

Training/Check Ride	Date	Source
Completed Action Air PA-3 1 training	09/11/93	Company
Part 135 Proficiency Check, PA-3 1	09/11/93	Company
Part 135 Line Check, PA-3 1	09/11/93	Company
Completed Action Air PA-34 training	12/07/93	Company
Part 135 Proficiency Check, PA-34	12/07/93	Company
Part 135 Instrument Check, PA-23	09/02/93	FAA
Part 13 5 Proficiency Check, PA-23	04/04/94	FAA
ATP Oral Exam	04/04/94	FAA
ATP Flight Exam (Failure), PA-23	04/04/94	FAA[6]

[4] Times were estimated, based upon interview with the president of Corporate Air, Inc.

[5] Times were estimated, based upon prior employment with Action Airlines, and obtained from an interview with the president of Action Airlines, Inc.

The captain of N990RA had no FAA accident, incident, or enforcement record. According to company records, he was assigned by Action Airlines as a captain flying single engine Cessna 172 and Piper PA-32 Cherokee Six airplanes on May 1, 1990. He also flew as a PA-3 1 Navajo copilot. On April 1, 1991, he went to work with Corporate Air, Inc., and flew as a captain on Piper PA-31 Navajo, Piper PA-23 Aztec, and Beech 58 Baron airplanes. On May 4, 1992, he was employed by Precision Airlines, Inc., as a copilot on the Domier Do-228. He was furloughed from Precision Airlines on January 10, 1993, and was recalled to flying on March 29, 1993. During this period, until the time of the accident, he continued to fly part-time for Corporate Air, Inc. When he was scheduled for furlough from Precision Airlines, to be effective September 1, 1993, he returned to Action Airlines and was rehired on August 28, 1993. He received training and qualification as captain on the Piper PA-31 Navajo and the Piper PA-34 Seneca. According to the company president, the captain had flown the PA-34 only in training. After he was rehired, all of his flights for Action Airlines were in the PA-3 1 Navaj o .

1.6 Airplane Information

1.6.1 Airframe Information

N990RA was purchased from Coastal Air Service on September 21, 1990. The U.S. aircraft registration number was changed from N104AQ to N990RA after the acquisition. Other information follows:

Serial Number	31-7405417
Basic operating weight	**4,772** pounds
Basic operating weight CG	122.6 inches
Maximum gross weight for takeoff	**7,250** pounds
Maximum gross weight CG	127 - 135 inches
Maximum fuel capacity	192 gallons
Maximum gross weight for landing	**7,000** pounds

[6]The failure resulted because the captain attempted to complete an airline transport pilot (ATP) check ride on the same flight as his Part 135 proficiency check ride, when equipment needed to complete the ATP check ride (the automatic direction finder (ADF) receiver and the autopilot) were inoperative. An ATP rating is not required to fly Action Air routes *or* airplanes,

Usable fuel	182 gallons
Total seats	10 (9 passengers + 1 pilot)

The airplane had a maximum gross weight of 7,000 pounds for takeoff. However, the airplane was modified by Supplemental Type Certificate SA5796NM that incorporated the installation of vortex generators on the wing and vertical stabilizer. Also, two strakes were installed on each engine nacelle. These components were manufactured by Boundary Layer Research and were installed by Aviation Maintenance Services, Inc. This allowed an increase of the maximum takeoff gross weight to 7,250 pounds.

According to the Airplane Flight Manual, the airplane was certificated for day/night, VFR/IFR operations, and light-to-moderate icing conditions. The minimum number of crewmembers for operating the an-plane in night IFR operations is one pilot, provided that the autopilot was operative. Maintenance records and interviews with Action Airlines personnel indicated that the autopilot on N990RA was operative.

1.6.2 Weight and Balance

Weight and balance. calculations for the accident flight were reconstructed from information obtained from the weight, balance, and load manifest forms from the two flights before the accident. The forms for the accident flight were not recovered. Based on available data, the airplane's gross weight was calculated at 7,120 pounds at takeoff, with a center of gravity (CG) of 13 1.1 inches. A review of the weight, balance, and load manifest for the first two flights indicated that the basic operating weight did not include the company passenger occupying the number two (copilot) seat in the airplane. Also, the company employee weight was not reflected in the passenger count for the first two flights. Based on the fuel consumption from ACY to BDR, the landing weight was calculated at around 6,860 pounds. The airplane was within prescribed weight and balance limitations for takeoff and landing.

1.6.3 Engine and Propeller Information

The airplane was powered by two Textron Lycoming engines, models TIO-540-J2BD and LTIO-540-J2BD. The TIO-540 and LTIO-540 are turbocharged, fuel-injected, six cylinder, horizontally opposed, piston engines with a displacement of 540 cubic inches. The LTIO-540 engine designation denotes left-hand or counterclockwise rotation. The engine is rated at 350 shaft horsepower at 2,575 revolutions per minute (rpm). The Hartzell propellers, models HC-E3YR-2AT and HC-E3YR-2ALTF, are variable pitch, single-acting, full-feathering, nonreversing propellers. The HC-E3YR-2ALTF propeller designation denotes left-hand or counterclockwise rotation. The propellers have three forged aluminum alloy blades with deice boots. The total times on the left and right engines at the last 50-hour inspection were 3,729.9 and 5,479.0 hours, respectively. The total times on the left and right propellers as of the last 50-hour inspection were 3,088.3 and 1,113.7 hours, respectively.

1.6.4 Maintenance Records

The maintenance records of N990RA were examined for the period from May 22, 1986, through April 26, 1994. Records indicated that the airplane had been inspected and maintained in accordance with the inspection program required by FAR sections 91.409 (a) and (b) (annual/100 hours inspection program) and the additional maintenance requirement set forth in FAR section 135.42 1 as approved by operation specification. The review of the maintenance records revealed no discrepancies that were relevant to the circumstances of the accident. The records indicated that all required inspections and maintenance actions had been accomplished within the time specified.

Scheduled Inspections and Airframe Times:

Event	Date	Place
Last unscheduled repair[7]	April 26, 1994	East Haddam, CT
Last 50-hour inspection	April 19, 1994	East Haddam, CT

[7] A new slaved gyro was installed at this time.

Last annual inspection	January 17, 1994	East Haddam, CT

Airframe total time (at 50-hour inspection)	7,980.8 hours
Airframe total time at annual inspection	7,930.8 hours

The aircraft was stripped and repainted with Jet-Glo polyurethane enamel on January 6, 1994. According to the records, all flight control surfaces were checked for balance limits and installed in accordance with the Piper Service Manual. At this time, the interior was refurbished with new seat covers, carpet, and panels. See section 1.15.4 of this report for details. A new weight and balance data sheet for the airplane was dated March 2, 1994.

1.7 Meteorological Information

1.7.1 Surface Weather Observations

Weather observations at BDR are usually taken by the National Weather Service (NWS). The NWS office is located on the second floor of the terminal building. The NWS hours of operation are between 0600 and 2200.

After the NWS office closes at 2200, no official observations are normally available for BDR unless they are taken by certified weather observers employed by USAir Express for use by that company's airplanes. No weather observations were taken by USAir Express employees on April 27.

The pertinent surface weather observation for BDR was as follows:

Time--21 50; Type-Record Special; partial obscuration, 2,700 feet scattered, measured ceiling 9,500 feet broken, 25,000 feet overcast; visibility 2 miles variable, fog; temperature 59 degrees F; dew point 59 degrees F; winds out of 250 degrees[8] at 6 knots; altimeter setting

[8] All wind directions in surface weather observations are with reference to true north.

29.90 inches of Hg; Remarks--O.2 of sky obscured in fog, visibility 1 mile variable 3 miles, last observation.

The pertinent surface weather observations for New Haven, Connecticut, located about 10 miles north of BDR, were as follows:

Time--2145; Type-Record; 10,000 feet scattered; visibility 8 miles; temperature 64 degrees F; dew point missing; winds calm; altimeter setting 29.91 inches of Hg.

Time--2245; Type-Record; partial obscuration; visibility ¾ mile, fog; temperature 61 degrees F; dew point missing; winds calm; altimeter setting 29.88 inches of Hg; Remarks--O.5 of sky obscured in fog.

Time--2320; Type-Special; partial obscuration; visibility 1/8 mile, fog; winds calm; altimeter setting 29.88 inches of Hg; Remarks--O.8 of sky obscured in fog.

1.7.2 Other Meteorological Information

According to the BDR Surface Weather Observation forms, 0.07 inch of rain fell on April 27. The forms indicated that the rain ended at 2000. Fog was reported to have formed at 1825 and continued until the office closed at 2200.

A wind gust recorder chart for the FAA center-field anemometer is located in the NWS office. According to the recorder, wind speeds were measured 4 knots or less between 2250 and 2300. Wind directions were not recorded. The thermograph recording indicated that the temperature at BDR just prior to 2300 was about 57 degrees F. No pilot reports (PIREPs) relevant to the BDR area were available from the NWS archive.

1.7.3 NWS Aviation **Advisories**

AIRMETs (airman's meteorological information)[9] Sierra and Zulu, issued at 2145, forecast no instrument flight rules (IFR) conditions and no significant icing for Connecticut. AIRMET Tango, issued at the same time, forecast light occasional moderate turbulence below 8,000 feet in an area of moderate westerly to northwesterly winds. The turbulence condition was forecast to end by April 28 at 0200. AIRMET Tango also forecast low level windshear potential over New England and the eastern portions of New York and Pennsylvania through April 28 at 0400. There were no nonconvective SIGMETs, convective SIGMETs, or Center Weather Advisories valid for the BDR area at the time of the accident.

1.7.4 **Witness Accounts Concerning the Weather**

The duty weather observer at the Bridgeport Weather Service Office (WSO) lives in South Stratford, which is about 4 miles north of the airport. He stated that when he left that night, the fog was thicker at the airport than at his home. He departed the WSO within a couple of minutes of 2200, and he noticed that the weather had changed considerably since his final recorded observation. He said that, at that time, it was probably below airport minimums.[10]

An employee of USAir Express, who is also a trained weather observer, stated that, in her opinion, the visibility was zero at the terminal when the accident occurred. She also said that the fog cleared up about 20 minutes after the accident. A Bridgeport Flight Service Station (FSS) specialist, also a trained (but not current) weather observer, stated that he departed the FSS very near 2200. He said that horizontal visibility was zero in the parking lot and that it remained near zero until he was in the vicinity of the Ramada Inn and I-95 (about 1 ¼ miles from the airport) where it improved to around ½ mile. A Bridgeport tower controller, certified to take tower visibility reports, stated that at the time the tower closed at 2230, he perceived that the fog was thicker near the ground. He estimated the top

---

[9] AIRMETs are in-flight advisories prepared by the National Severe Storms Forecast Center (NSSFC) at Kansas City, Missouri.

[10] Decision height for the ILS approach to runway 6 is 321 feet. The minimum visibility required to execute the approach is 1 1/4 miles.

of the fog to be around 150 feet, with a distinct top to the fog, and VFR conditions above the top of the fog.

Two witnesses, who were near Sniffens Lane just east of the airport at the time of the accident, stated that visibility was variable but estimated that it was less than 200 feet. They estimated the height of the fog at 20 to 30 feet. Two other witnesses said that they were driving north on state highway 113 from south of the airport at a speed of less than 5 miles per hour because "you couldn't see your hand in front of your face."

1.8 Aids to Navigation

Shortly after the accident, a flight check of the ILS array was conducted by FAA navigational aid technicians. They found that the middle marker (MM)[11] portion of the ILS was not operating during the flight check.

1.9 Communications

Examination of the audio magnetic tapes of air-to-ground and ground-to-air transmissions between air traffic control facilities, other airplanes, and Action Air Charter flight 990 revealed no communications difficulties.

1.10 Aerodrome Information

Sikorsky Memorial Airport is owned and operated by the City of Bridgeport and is in the Lordship section of Stratford, Connecticut. The airport is an 800-acre facility, 10 feet above sea level, with two asphalt non-grooved runways. Runway 11/29 is 4,761 feet long and 150 feet wide. The safety area[12] for the approach end of runway 11 is 200 feet long as measured from the threshold. The safety area at the approach end of runway 29 is 0 feet. The width of the safety area surrounding runway 11/29 is 200 feet to each side of the runway centerline.

[11] A nondirectional radio marker beacon near the end of an ILS-equipped runway producing a substantially vertical signal that gives aural and visual signals in the cockpit. The middle marker is not a required component of the ILS.

[12] A safety area is a designated area abutting the edges of a runway or taxiway intended to reduce the risk of damage to an aircraft inadvertently leaving the runway or taxiway. (Title 14 CFR 13 9.3)

Runway 6/24 is 4,677 feet long and 150 feet wide. The safety area for the approach end of runway 6 is 100 feet measured from the threshold. The safety area at the approach end of runway 24 is 0 feet. The width of the safety area surrounding runway 6/24 is 250 feet, from each side the runway centerline. In addition, the first 1,500 feet of runway 6 pavement is noted to be "uneven," according to a note on the Jeppesen airport diagram dated October 15, 1993.

The runway lighting system was replaced in 1993 with high intensity runway lights (HIRL). The last 2,000 feet of runway 6's edge lights are amber. All four runway thresholds have runway end identifier lights (REIL). Runway 6 is equipped with a localizer, glideslope, and precision approach path indicator (PAPI) lights.[13] Runways 24 and 29 have visual approach slope indicators (VASI). Additionally, the airport has a very high frequency omnidirectional radio range (VOR) and an Automated Flight Service Station (AFSS) that is located on the airport. Sikorsky Memorial Airport is certificated in accordance with Title 14 CFR 139 at Aircraft Rescue and Fire Fighting (ARFF) index level A.[14]

Following an annual FAA inspection on February 6, 1991, the FAA suspended the airport's Operating Certificate for 14 CFR 139 violations because of ARFF training and airport inspection discrepancies. The discrepancies were corrected, and on June 14, 1991, the certificate was reissued.

1.10.1 Blast Fence

A nonfrangible metal blast fence is located 342.5 feet northeast of the east edge of the runway 24 displaced threshold. In 1993, a 200-foot-wide, 8-foot 9-inch-high central portion of the previous nonfrangible blast fence was replaced with this stronger fencing to protect state highway 113 from the jet/propeller blast of aircraft currently operating at the airport. This portion of state highway 113 is a

---

[13] Following the accident, it was discovered that the PAPI would not operate on the high intensity setting. During the day, the PAP1 should operate at its highest intensity. At night, the PAP1 was controlled by a photo-electric cell, and was part of the pilotcontrolled lighting system after the tower closed. Since the PAPI was not monitored, its malfunctioning status was unknown, and there was no NOTAMs issued regarding its status.

[14] Index A - FAA ARFF index for air carrier aircraft less than 90 feet long. 14 CFR 139 requires one vehicle carrying at least (1) 500 pounds of sodium-based dry chemical or halon 1211, or (2) 450 pounds of potassium-based dry chemical and water with a commensurate quantity of aqueous film-forming foam (AFFF) to total 100 gallons (for simultaneous dry chemical and APFF production).

two-lane paved road. The fence is parallel to highway 113, which is 10 feet from the blast fence. The blast fence was constructed with galvanized structural steel upright sections and double reverse galvanized corrugated sheet metal.

In 1977, the blast fence was approved by the FAA, funded, and installed. In 1993, the blast fence was rebuilt with FAA, state, and local funding and approval because the old fence no longer provided adequate public protection from blast and debris. A heavier metal frame- of steel "C" channel material was used to support the metal fence because of the proximity of the fence to turbine-powered airplanes during takeoff thrust.

1.10.2 FAA Runway Safety Area (RSA)

Title 14 CFR 139, Certification and Operations: Land Airports Serving Certain Air Carriers, paragraph 139.309 Safety Areas, states:

> (a) To the extent practicable, each certificate holder shall provide and maintain for each runway and taxiway which is available for air carrier use (1) If the runway or taxiway had a safety area on December 31, 1987, and if no reconstruction or significant expansion of the runway or taxiway was begun on or after January 1, 1988, a safety area of at least the dimensions that existed on December 31, 1987, or (2) If construction, reconstruction, or significant expansion of the runway or taxiway began on or after January 1, 1988, a safety area which conforms to the dimensions acceptable to the Administrator at the time construction, reconstruction, or expansion began.
>
> Title 14 CFR 139.309, (b)(4)states:
>
> No object may be located in any safety area, except for objects that need to be located in a safety area because of their function. These objects shall be constructed, to the extent practical, on frangibly mounted structures of the lowest practical height with the frangible point no higher than 3 inches above grade.

The June 5, 1991 edition of FAA Advisory Circular (AC) 150/5300-13, entitled "Airport Design," Table 3-2, recommends an RSA of 800 feet beyond each end of runways such as 6/24 at BDR.

BDR has not begun construction, reconstruction, or significant expansion of runway 6/24 since December 3 1, 1987. In April 1994, the FAA's New England Region stated that, "With the reconstruction of Runway 6/24 coming up within the next couple of years, Sikorsky-Memorial will need to address the safety area issue and how they might achieve compliance, or at least gain more safety area than they currently maintain."

During the course of the investigation the BDR Airport Director reported that previous conversations and meetings had taken place with BDR, the FAA, and Connecticut Department of Transportation representatives regarding moving state highway 113 and constructing an RSA for runway 24. The Airport Director reported that such changes could **and** should be accomplished; however, they remained concerned about community resistance because of environmental issues. Nevertheless, in January 1995, a new airport master plan, which includes relocating state highway 113, removing the blast fence, and constructing an RSA for runway 24, is scheduled to be submitted to the City of Bridgeport for approval.

1.10.3 Approach Lighting

Currently, BDR has no approach lighting systems extending beyond the ends of the runways. A review of FAA records regarding approach lights showed that the FAA approved the installation of a medium intensity approach lighting system with runway alignment indicator lights (MALSR) for runway 6 in conjunction with the ILS. Although the ILS was approved and installed, the FAA experienced a considerable amount of community resistance, with congressional support of that resistance, based upon land use and environmental issues. The FAA has attempted to receive local approvals to construct the MALSR, but, as yet, it has not succeeded. The current status of the project is reflected in a letter dated September 2, 1993, from the FAA's Northeast Regional Administrator to a private citizen, which states:

Sikorsky Memorial is an important airport to our regional airport system. The Federal Aviation Administration (FAA) takes a keen interest in the operation and safety of all airports, especially those airports with scheduled passenger service, like Sikorsky. Public safety is our first priority. The MALSR is an important safety enhancement which raises the safety level of the current Instrument Landing System.

The above notwithstanding, in consideration of the comments received on the Draft Environmental Assessment (EA) together with our own evaluation and in anticipation of an Airport Master Plan Update (AMPU), we have decided to take the following course of action: we will delay further environmental study of the MALSR proposal until the airport Master Planning process is complete. This process is expected to take about 18 months.

A review of the Safety Board's accident data base, which contains accidents at BDR during the last 10 years, showed that three accidents have occurred during approaches to runway 6, and that one other accident (in addition to Action Air 990) occurred upon landing rollout and impact with the original nonfrangible blast fence at the departure end of runway 6 during instrument meteorological conditions (IMC). Four fatalities occurred during the approach accidents, and no fatalities occurred during the landing rollout accident.[15]

1.11 Flight Recorders

N990RA was neither equipped with a cockpit voice recorder or a flight data recorder, nor was it required to be, under current Federal regulations.

[15] N613PW, Cessna 210, 10/23/90, NTSB file number 1651. N262C, Beech A36, 12/24/88, NTSB file number 2137. N2469M, Piper PA-34, 2/19/88, NTSB file number 2187. N100CT, Aero Commander 680V, 9/3/84. NTSB file number 3 101.

1.12 Wreckage and Impact Information

Ground impact marks indicated that the airplane's landing gear tires were in contact with the runway and that the airplane was in a relatively wings-level attitude as it hit the blast fence. The airplane came to rest upright at the blast fence and was involved in an intense postcrash fire that consumed most of the fuselage. The wreckage path revealed no evidence of an in-flight fire or separation of any airplane parts before the collision with the blast fence. All control surfaces and the engines were found at the main wreckage site.

1.12.1 Airframe Wreckage Distribution

The elevation of the accident site was 10 feet msl. The first mark on the runway associated with the accident flight was approximately 3,471 feet from the threshold of runway 6 and about 36 feet to the left of the runway centerline; it consisted of a black-brown rubber tire mark. A second mark associated with the flight was found on the runway, approximately 3,522 feet from the threshold of runway 6 and about 50 feet to the left of the runway centerline; it also consisted of a black-brown rubber tire mark. The tire marks were approximately 13.8 feet apart, running parallel to each other, consistent with the lateral distance between the left and right main landing gear of a PA-3 l-350 airplane.

Tire marks associated with the left and right main landing gear of the airplane next became visible at 4,204 feet and 4,270 feet from the runway threshold and 34 feet and 20 feet to the left of the runway centerline, respectively. Both these tire marks continued to the main wreckage. Approximately 25 feet before the blast fence, the left main landing gear tire mark became dark black for about 6 feet. Approximately 10 feet before the blast fence, evidence of left and right propeller strike marks and right wing tip scrape marks were observed. A total of seven "C" channel structures of the blast fence were involved in the impact sequence.

1.12.2 Structures and Systems Damage

1.12.2.1 Fuselage

The fuselage remained in one piece at the main wreckage. The nose section of the fuselage was found about 10 feet past the blast fence in the direction of the flight. There was no evidence of bird feathers or any foreign objects in or near the cockpit.

The fuselage section from the nose of the airplane to the wing rear spar and above the cabin floor line was consumed by fire. The belly of the fuselage remained intact but was heavily damaged by fire. The fuselage belly structure near the pilot's seat was bent aft and suffered heavy fire damage. A "C" channel of the blast fence had dislodged from its base and was near the left side of the forward fuselage structure. Another "C" channel of the blast fence was near the right wing rear spar root area. This "C" channel remained attached to its base and was bent in the direction of flight. The distance between the "C" channel sections of the blast fence before impact was 6 feet. The nose gear trunnion was separated from the fuselage and was broken in numerous sections. The tire remained attached to the rim and was found under the right wing aileron and had no fire damage.

The fuselage section from the wing rear spar to the passenger door had no impact damage. The left side windows were heat damaged. Heavy soot accumulation and fire damage was observed on the upper forward portion of the passenger door. The split-type passenger door was open, and fire damage to the interior of the door was evident. The fuselage section aft of the passenger door to the tail cone did not have fire or impact damage. There was no evidence of scrape marks on the aft tail cone belly section.

1.12.2.2 Wings

The right wing, which was heavily fire damaged, sheared from the fuselage at the root and remained with the main wreckage. The leading edge section between the fuselage and the right engine was consumed by fire. The mid and aft spars were bent aft at the wing root and had fire damage. There was no buckling or twisting observed in the web or the angles of the right wing spars. The fracture

surfaces exhibited evidence of overload failure. A "C" channel structure of the blast fence was found between the aft spar and the fuselage at the wing root area.

The wing tip light lens cover broke into small pieces that were found at the base of a "C" channel section of the blast fence. The lower surface of the wing tip exhibited heavy scraping on the skin from forward to aft in a chordwise direction. There was no evidence of bird feathers or other foreign objects on or near the wing leading edge. The flap remained attached to the wing and was slightly twisted and torn. The aileron and aileron trim tab remained attached to the wing and showed no fire or impact damage.

The left wing remained attached to the fuselage and had heavy fire and impact damage. Evidence of tire damage to the upper and lower skin surfaces of the leading edge was observed. A "C" channel section of the blast fence was aft of the crush and was embedded in the flap structure section.

The left wing sheared outboard of the left engine. The leading edge skin was crushed aft, and the front spar was bent in the aft direction. No evidence of bird feathers or foreign objects was found on or near the wing leading edge. The flap remained attached to the wing with slight fire damage and bending at various locations. The aileron remained attached to the broken section of the outboard wing and suffered impact damage but no fire damage.

1.12.2.3 Empennage

The empennage remained attached to the fuselage and had no fire or impact damage.

1.12.2.4 Powerplants

The left engine was found upright, angled nose down, with the forward end resting on the ground and the aft end elevated where it was attached to the wing. None of the nacelle panels revealed any evidence of preimpact separation,

penetrations, or fire. Most of the nacelle structure was disintegrated from 12 o'clock to 5 o'clock.[16]

Visual inspection of the exterior of the left engine did not reveal holes or cracks in any of the cylinders, cases, or accessories. The propeller governor was intact and in place and at a midrange rpm setting. The throttle was 3/16 inch from the idle stop and, the mixture was 13/32 inch from the idle cutoff stop. A compression test was performed on the left engine, and normal compression was performed on the cylinders. The left engine was rotated manually using the propeller, and no grinding, binding or n-regularities were felt or heard. The left propeller was in place on the engine propeller shaft with two of the three propeller blades complete and half of the third blade consumed by tie. The two complete blades were bent opposite the direction of rotation. Chordwise and spanwise scratches and scores and leading edge gouges were also on the camber side of the two complete blades.

The right engine was found upright, flat on the ground and was separated from the wing at the nacelle aft of the fire wall. None of the nacelle panels revealed any evidence of preimpact separation, penetrations, or tie. Portions of all the nacelle panels remained in place; however, much of the nacelle structure was disintegrated from the 10 o'clock to 7 o'clock positions.

Visual inspection of the exterior of the right engine did not reveal any holes or cracks in the cylinders, cases, or accessories. The propeller governor was intact and in place with the setting at minimum rpm; however, the governor linkage was separated at the fire wall and was free to move. The throttle was found against the idle stop, and the mixture was at full rich. A compression test was performed on the right engine, and the test indicated normal compression on the cylinders. The right engine was rotated manually using the propeller, and no grinding, binding, or irregularities were felt or heard.

The right propeller was found in place on the engine propeller shaft. All three propeller blades were complete, and two of the blades were bent opposite

[16] All references to the clock will be aft looking forward.

the direction of rotation and twisted toward low pitch. The third blade was bent approximately 15" aft with a 90" bend, 2 inches from the tip. There were also spanwise and chordwise scratches, and scores and scuffs with leading edge nicks on the camber side of all three blades.

1.12.2.5 Airplane Subsystems

The left main landing gear was found in the down and locked position and remained attached to the left wing. The tire remained inflated, and distinct tread grooves were present. However, a 9-inch portion of the tire circumference was flat-spotted and showed evidence of reverted rubber. The right main gear separated from the wing and was found under the right wing root. The tire was deflated and fire damaged. Distinct tread grooves were present; however, this tire also had a 9-inch flat spot. The nose gear strut separated just above the wheel and was found beneath the right aileron. The tire remained inflated and showed distinct tread grooves.

The brake pedals and master cylinders were functional, but the brake lines were discontinuous from the cockpit in the area of heavy fire damage. When the brake pedals were depressed, fluid was ejected from the brake lines. The brakes were then tested by using a hand pump to apply pressure directly to the calipers. The calipers operated normally and were able to apply adequate pressure to stop the wheels from rotating after being spun up by hand. The brake disks showed evidence of bluish discoloration similar to that seen on another Action Air PA-3 1-350. Measurements of brake lining thickness were made to determine the brake wear remaining. Four linings from each brake were measured and ranged from .200 to .206 inch. A new brake lining, furnished by the airline as a test case, was .219 inch thick, of which .112 inch was brake material and .107 inch was the backing plate.

1.12.2.5.1 Cockpit

The cockpit was heavily fire damaged. The right airspeed indicator showed 65 knots, the NAV 1 radio was set to the frequency of the runway 6 ILS (110.70 MHz), the inbound course for the ILS 6 approach was set on the pilot's

course indicator, the flap selector was in the middle (off) position, and a headset was found plugged into the jack for the right front seat.

1.12.2.5.2 Flight Controls

All flight control surfaces were accounted for at the accident site. The cockpit flap control lever has three positions; up (which retracts the flaps), middle or off (which holds the flaps at their present position), and down (which extends the flaps). The flap control lever was found in the middle (off) position. Due to damage to the wing, it was not possible to obtain an accurate measurement of the flap positions. However, both the left and right electric flap jackscrew actuators were extended to a length corresponding to a flap deflection of 24 degrees.

The elevator was in the full trailing edge down position, and the elevator trim tab was deflected 25 degrees trailing edge down. The rudder was fully deflected trailing edge right with the trim tab neutral. The right aileron was neutral with the trim tab deflected 6 degrees down. The left aileron was extensively damaged, and its position could not be measured.

The aileron and rudder control cables were continuous from the cockpit to the control surfaces. Both elevator cables had failed at a point just aft of the cockpit where turnbuckles are used to connect two cable sections. There was extensive fire damage in this area, and the failed turnbuckles showed evidence of material flow and melting. Continuity was established for all trim tab cables.

1.12.2.5.3 Fuel, Hydraulic, and Electrical Systems

The fire wall shutoff valves were in the open position, and the fuel selectors were set to the inboard tanks. Fire and rescue personnel reported that there was a large quantity of fuel on the ground as the airplane burned.

The circuit breaker panel, which is located to the left of the pilot, was extensively fire damaged, and many circuit breakers had melted. The electrical system control switches, which are located on the overhead panel, were destroyed by the fire.

1.13 Medical and Pathological Information

1.13.1 72-Hour History

According to the wife of the captain, on Sunday, April 24, 1994, he piloted a flight to ACY and "overnighted" there. He returned to his home on Monday evening, April 25, 1994, and retired for the night at 2330. On Tuesday, April 26, 1994, he awoke at 0745. It'was his day off. At 1000, he contacted his wife, via telephone, and advised her that he was going to run some errands and do some shopping. At 1730, she arrived home, and they had dinner and watched television. Afterwards, they went shopping, returned home, and retired for the night at 2330. On Wednesday, April 27, 1994, they awoke at 0600, and he prepared and departed for work. During the day, she received several telephone calls from him while he was on the layover at ACY. He mentioned that a company dispatcher had flown with him to ACY to learn the route and for familiarization. Between 2100 and 2130, he called from ACY, and advised her that he expected to arrive home between 0030 and 0130 on April 28, 1994.

The captain's wife stated that her husband had not voiced any complaints about his health in recent weeks and that he had no known medical problems. She advised that he did not have a private physician, but said that he visited his FAA AME [airman medical examiner] at regular 6-month intervals. His wife did not believe that he suffered from any chronic or acute illness. During the investigation, an Action Airlines employee stated that he thought that the captain once loosened or removed his seat belt during a flight to relieve gastrointestinal pain. When asked about this possibility, the captain's wife noted that he enjoyed eating spicy foods and that sometimes, shortly after a meal, he would experience gastrointestinal distress. Therefore, it was his practice to limit his food intake to bananas and granola bars prior to a flight, so that he did not experience stomach discomfort during flight. He did not use any over-the-counter or prescribed medications. In September 1991, his cholesterol level was tested at 182, and his blood pressure was normal. He had no record of surgery or serious injuries. She stated that he used a multivitamin occasionally, wore glasses only while flying, and never missed work because of illness. He did not wear contact lenses.

He did not smoke or use controlled dangerous substances. He did like beer on occasion, but did not drink to excess. His disposition was always good, and he had no unusual financial pressures. He had no complaints about Action Air operations or management. The captain's wife stated that her husband had worked for U.S. Check, Inc., and Lightning Express, Inc., in recent weeks as a ground courier, but that he had not done so during the 72 hours prior to the accident.

The captain's AME stated that he-had been performing the captain's flight physical examinations since he first applied for a medical certificate. The AME stated that the captain was required to wear corrective lenses while flying, that he was somewhat overweight, but that he was otherwise in excellent physical condition. A review of the applications for medical certification on file in the doctor's office confirmed this information. Toxicological testing completed on urine and blood samples obtained posthumously from the captain were negative for major drugs of abuse (including alcohol).

1.14 Fire

The fire damage to the airplane is described in sections 1.12, Wreckage and Impact Information, and 1.15, Survival Aspects, of this report. During the impact of the wings with the blast fence, the wing tanks were ripped open by the fence "C" channel uprights, and an unknown quantity of fuel was liberated. Numerous possible ignition sources, such as hot engine parts and electrical short circuits, existed. The wind was blowing from the rear of the airplane to the front, as evidenced by the rear to front soot pattern around the entry door and recorded wind readings at the airport.

1.15 Survival Aspects

1.15.1 General

The airplane was configured in the standard pilot, copilot configuration. However, a copilot was not required on this flight, and the surviving passenger occupied the seat at the time of the accident. To the rear of the pilot and copilot seats were four rows of forward facing single occupancy seat units labeled, for the purpose of this report, 1A through 4A on the left side of the fuselage, and 1B

through 4B on the right side, for a total of eight passenger seats. There was no flight attendant on this flight, and one was not required.

There were five male and three female passengers on this flight, ranging in age from 33 to 76 years. Of the eight passengers, seven sustained fatal injuries, and the 37-year-old male passenger, who occupied the copilot's seat, sustained a facial fracture and serious thermal injuries to 50 percent of his upper torso.

The local Medical Examiner determined that the pilot and seven passengers died as a result of smoke inhalation and thermal injury. The eighth passenger, who survived for several hours after the accident, died as a result of thermal injuries only, and, according to his attending physician, smoke inhalation was not a factor because his carbon monoxide (CO) level was within normal limits.

1.15.2 Seat and Restraint System Damage

The pilot's seat cushions sustained fire damage, and the seatback was folded forward over the bottom seat cushion. No deformation was noted to the seat frame or structure. The unbuckled seat belt was found in between the seatback cushion and the seatback. It was undamaged except where it was attached to the seat frame and was exposed to the fire.

The first officer's seat cushions sustained fire damage, and the seatback was folded forward over the seat cushion. When the seatback was put into its upright position, the lapbelt buckle that was attached to the left side of the seat frame was found lying on the seat undamaged. The insert end of the lapbelt was found on the floor under debris next to the seat unit, with the "D" ring attached to the seat. The webbing, although partially destroyed by fire, was in one piece. There was no damage to either the lapbelt buckle or the insert end fitting, or to the seat frame. The buckle functioned properly when it was connected to the insert and then released.

Seat unit 1A cushions sustained tie damage, and the seatback was folded for-ward over the seat cushion. When the seatback was put into its upright position, there was no lapbelt found attached to the seat frame. The lapbelt

assembly was subsequently found undamaged under the copilot's seat unit with both halves buckled together. The buckle functioned properly during examination. Examination of the inboard and outboard lapbelt attachment points indicated that undersized bolts were in place at improper lapbelt attachment points on the seat frame, and the "D" ring's bolt hole on the seat belt passed freely over the bolt that was on the seat frame. There was no damage to the seat frame.

Seat unit 1B cushions sustained fire damage, and the seatback was folded forward over the seat cushion. When the seatback was put into its upright position, the lapbelt buckle was found lying on the seat cushion undamaged. The insert half of the lapbelt was found on the floor under debris next to the seat unit, with the "D" ring attached to the seat unit. The webbing was damaged by fire; however, it was still in one piece. There was no damage seen to either the lapbelt buckle or the insert; the buckle functioned properly, and there was no damage noted to the seat frame. The right half of the lapbelt was about 30 inches long. A representative of the operator stated that lapbelts, when not in use, are typically stowed by passing the insert end of the lapbelt under the right front of the seat cushion and then over the seat cushion and connecting it to the buckle on top of the seat cushion. Examination of the inboard lapbelt attachment point to the seat frame found that a nonstandard bolt, not manufactured for use in airplanes, was installed at an improper lapbelt attachment point to the seat frame.

Seat unit 2A cushions sustained fire damage, and the seatback was found in the upright position. Both halves of the seat belt were found on the floor under debris on each side of the seat unit, both halves had sustained some fire damage, and they were in one piece. There was no damage seen to either the lapbelt buckle or the insert. The buckle functioned properly, and there was no damage noted to the seat frame. The insert end of the lapbelt was about 30 inches long.

Seat unit 2B cushions sustained fire damage, and the seatback was found in the upright position. Both seat belt halves were found on the floor under debris on each side of the seat unit. Both sides had sustained some fire damage but they were in one piece. There was no damage seen to the lapbelt buckle or the insert end fitting, and there was no damage seen to the seat frame. The buckle

functioned properly when connected with the insert and then released. The insert end fitting of the lapbelt was about 30 inches long.

Seat unit 3A cushions sustained fire damage, and the seatback was found in the upright position. The right half of the seat belt was found on the floor undamaged. The left half of the seat belt webbing was burned away at the seat frame, and the buckle was undamaged and functioned properly. There was no damage seen to the seat frame. The right half of the lapbelt was about 30 inches long.

Seat unit 3B cushions sustained minor fire damage, and the seatback was found in the upright position. Both halves of the seat belt were found loose on the floor under the seat unit. There was no damage seen to either the lapbelt buckle or the insert, it functioned properly, and there was no damage seen to the seat frame. The right half of the seat belt was about 30 inches long.

Seat unit 4A/B cushions on both seat units sustained minor fire damage and the seatbacks were found in their upright positions. Both seat belts were found buckled together in what the operator referred to as their stowed positions around the seat cushions, and they were undamaged. The buckles operated normally. It was not apparent which seat was occupied by a passenger, but one of these two seat units was occupied due to the number of people aboard the airplane.

1.15.3 Seats and Restraints on Other Airplanes

The Safety Board inspected seats installed in three other PA-31-350 airplanes and one PA-34 Seneca airplane owned by Action Airlines. The seats had been reupholstered, and the seat belts of the four airplanes had been installed by Harrington Industries, Inc., Aiken, South Carolina. The following are the results of those inspections:

> N400RA - Seat Units 1A & 1B: Seat belts were attached to the wrong attachment points on the seat frame, and no bushings on the attachment bolts were installed. Seat Units 2A, 2B, 3A and 3B: All bushings were missing. Seat Unit 4B had loose seat belt attachment nuts, and the bushings were missing.

N27537 - Seat Unit 1A: Seat belts were attached to wrong attachment points on the seat frame, and no bushings were installed. The seatback hinge locking pins were broken. Seat Unit 1B: Seat belts were attached to wrong attachment points on the seat frame, and no bushings were installed.

N12TM - Seat Units 1A, 1B, 2A, 2B, and 3A: Seat belts were attached to wrong attachment points on the seat frame, and no bushings were installed. Seat Units 4A and 4B: Seat belts were attached to wrong attachment points on the seat frame, and no: bushings were installed.

N660RA - Left cockpit seatback lock springs were broken. Seat Unit 1A: outboard seat belt was missing the bushing at the attachment point. Seat Unit 1B: the outboard seat belt was missing its bushing at attachment point. Seat Units 2A, 2B, 3A and 3B: All seat belts were missing bushings on all belt attachment points.

1.15.4 Visit to Harrington Industries, Inc.

As a result of the examination of the accident airplane, and the four other airplanes operated by Action Airlines, Safety Board investigators visited Harrington Industries, obtained signed statements from employees, and made the following observations:

Parts bins in various locations contained used nuts, bolts, and washers that were intermixed, unlabeled, and in large quantities. In addition, hardware was located that was similar to that used on the accident airplane and the four other airplanes operated by Action Airlines. Three drawers full of bushings of various diameters and lengths were found. The bushings appeared to be used, and no new bushings were seen.

New and used automotive hardware, such as tinner-man nuts, nut plates, and various automotive finishing screws in various quantities, were found in the upholstery shop. Some of the used hardware was heavily corroded, damaged, or otherwise unserviceable. An adhesive that was used on upholstery trim and

decorative panels was also found in the upholstery shop. The adhesive was labeled for use on automobile landau tops, and the label also identified the adhesive as being extremely flammable. The label indicated that the cement was fast drying, permanent, high heat resistant, and waterproof. In addition, nylon thread used to sew the upholstery that was purchased locally had no documentation that would indicate that it conformed to applicable FAA regulations (14 CFR 23.853) for fire-resistant materials. The president of the company stated that the materials used in all of the reupholstering conformed to 14 CFR 25.853, but he was unable to produce certification documentation. He stated that he had no documentation for any of the other materials used in the cabin, such as foams, leather, and vinyl.

Harrington Industries employs three airframe and power-plant (A&P) mechanics. During the 2 days that investigators were at the facility, they did not observe any supervision provided to the upholstery shop employees by any of the three A&P mechanics. The most experienced employee (not an A&P mechanic) in the upholstery shop, titled a Chief Installer, stated that he had worked for Harrington Industries for about 5 ½ years. He stated that he had not been provided any training for the disassembly and reassembly of aircraft seats or maintenance of safety belts, oxygen systems, pressurization systems, or electrical systems. In addition, he was unaware that there were parts manuals and maintenance manuals available to show him how to properly assemble an aircraft seat. He further stated that he was not the only person who disassembled, assembled, and installed the seats, but that he had the most experience. He also said that employees would come to him if they had questions or problems with anything they were doing in the upholstery shop.

The Chief Installer was asked how hardware was handled during the disassembly of the seats. He stated that seat belts were removed and sent to Belt Makers, Inc., for rework. The seats were then disassembled prior to reupholstering, and the hardware was placed in an unmarked bag and left with the disassembled seat, This hardware was then used during the reassembling of the seat unit. When he was asked about replacing missing hardware and parts, he stated that if they were not on the seat at the time of disassembly, the seats would be reassembled without these parts (i.e. seat belt bushings and washers). He stated that if critical parts, such as seat frame bolts and nuts, were missing during the reassembly of the seat, then the-person doing the work would go to the parts bin and find a used part that could be utilized. He also stated that, on occasion, management would pressure

employees to expedite the reassembly process to meet deadlines, and that they were told to get the job done in any manner they could. He said that this meant that they had to improvise during the reassembling of seats if the appropriate parts were not available. He stated that he believed he knew how to reassemble the seats, but when asked, he was unaware that seat belts had to be mounted at specific locations. He further stated that it was likely that there could be many seats that they had reassembled that had the seat belts attached at the wrong locations.

The Safety Board reviewed the maintenance records for N990RA maintained by Harrington Industries. During that review, it was found that the Chief Installer, who was not an A&P mechanic; had signed off on the final checklist as the inspector for the installation of the airplane's interior. This checklist was completed prior to the installation of the headliner, sidewall panels, carpeting, and seats, and included the inspection of such items as rudder pedals, overhead air vent hoses, light disconnects, and all electrical connections and oxygen lines. After the inspection was completed and the interior was installed by non-A&P employees, according to the A&P mechanics who were interviewed, the A&P's would then look at the completed interior without removing any access panels, and sign off on the maintenance records that released the airplane to service.

In the paint shop, employees were stripping paint from the flight control surfaces of airplanes using chemicals that were sprayed on and then rinsed off with a water hose. It was observed that the chemicals, paint, and water flowed down a floor dram. In addition, it was observed that. flight control surfaces and other parts of the airplane were also stripped with powered wire brushes. The chemical and wire brush stripping of paint took place with no direct supervision or guidance by any of the A&P mechanics. The elevator control cables of a Beech C-90, which had its elevators removed for painting, were hanging loosely, and they were not secured in accordance with the airplane's maintenance manual. Also, a cable tensiometer, which was used for rigging flight control cables, had not been calibrated since it was purchased about 10 years ago.

Examination of the company's maintenance manuals (stored on microfiche in a room that was accessible to all of the employees) revealed that the microfiche records were last revised in January 1982. Aircraft type certificate data sheets, in a folder in the president's office, were last revised on July 15, 1991.

Federal Aviation Regulations (FARs), also in the office, were last revised on the same date. The maintenance manuals for the Piper PA-31-350 airplane were last revised on November 6, 1981. The president stated that Harrington Industries had reupholstered and repainted many Cessna Citations and Gates Learjets; however, Safety Board investigators were unable to find maintenance manuals for either of these types of airplanes.

Safety Board investigators then asked one of the A&P mechanics to approve for return to service a newly painted elevator from a Beech airplane. The mechanic, without the use of a maintenance manual or other instructions, proceeded with the balancing of this control surface. He placed the elevator on a stand and used a tape measure to measure the distance between the roller line and the balance point; and he measured the weight at the balance point using an uncalibrated produce scale. He made two calculations on a note pad and declared that the elevator was balanced. When asked what the balance limits were for this elevator, he stated that he would have to check the maintenance manual on the microfiche. Based upon the mechanic's calculations, the elevator was within limits specified in the maintenance manual for the Beech airplane at Harrington Industries (last revised by Harrington on October 17, 1980). However, the manual stated that the balancing stand must be level, the elevator must be leveled along its chordline, the balancing points of the stand must have a knife edge, a calibrated gram scale was to be used, and that the fulcrum arms must be leveled, Examination of the balancing stand revealed that the stand was not level when measured, the elevator had not been leveled along its chordline, there was no knife edge at the balancing points, the fulcrum arms were not level, and the scale used was a produce scale that had not been calibrated since it was purchased about 20 years ago.

When asked about the accuracy of the produce-type scale, the company president said that calibrated weights were used to check its accuracy. He said that the calibrated weights were kept stored in a desk drawer and that they had not been calibrated since they were purchased new 10 years ago. The calibrated weights were found loose and unprotected in a drawer, and they could move freely within the drawer. Each weight was damaged to varying degrees and exhibited areas of corrosion. Investigators randomly selected a l-pound weight and placed it on the scale three times. The first time the scale indicated 1 pound and .25 ounces, the second time the scale indicated 1 pound, and the third time the scale indicated

under 1 pound. It was not possible to see the last indication because that portion of the face of the scale was obscured by paint.

1.16 Tests and Research

1.16.1 Representative Flight

A flight was performed by the investigators in N400RA, a sister ship to N990RA. The flight included a normal takeoff and approach, and a touch-and-go landing on runway 11 at BDR. An ILS approach to runway 6 was conducted to observe the offset localizer. According to the Jeppesen approach chart, the final approach course crosses the runway centerline extended 2,690 feet from the threshold. The localizer course is offset two degrees in heading. A missed approach was executed at 275 feet. A downwind landing was performed on runway 29 to simulate the conditions of the accident flight (tailwind) and to observe airplane performance. The wind reported by the tower while landing on runway 29 was 090 degrees at 15 knots. Moderate braking was used on touchdown. The stall warning horn sounded once, intermittently, at approximately the touchdown point. The touchdown speed was between 68 and 70 knots. The rollout from touchdown to a full stop was less than 1,000 feet.

1.16.2 Fire Tests of Cabin Materials

Burn tests were conducted at the FAA's Technical Center, Atlantic City, New Jersey, on interior furnishings from the accident airplane. These tests were conducted to determine the conformance of the materials with 14 Code of Federal Regulations (CFR) 25.853. Although the material used in this airplane needed only to comply with 14 CFR 23.853, it was found during reviews of the aircraft's maintenance records that Hanington Industries had installed new cabin furnishings that were manufactured from materials that conformed to the more stringent requirements of 14 CFR 25.853. Since the materials available for the burn test were in limited supply, the Safety Board elected to test them to the requirements of 14 CFR 25.853.

The materials tested included: seat covers, which were composed of fabric and vinyl sewn together; carpeting; vinyl sidewall covering; ½ inch foam

padding, which was installed between the vinyl sidewall covering and the cabin wall and between the seat covers and the seat cushions; and a thin cloth material used as backing for the foam that was located between the seat cover and the seat cushion. The tests found that the materials complied with the requirements described in 14 CFR 25.853.

1.16.3 The Flight-path and Landing Rollout

Examination of the recorded radar data indicate that the accident airplane was cruising at approximately 5,400 feet msl, began to descend, and then approached BDR runway 6 from the southwest on a magnetic heading of approximately 025 degrees. The airplane approached BDR in a shallow flightpath angle varying between 0.5 and 2.2 degrees. The groundspeed of the flight started out at approximately 190 knots near the top of the descent and gradually decreased during the descent.

The airplane entered the BDR runway 6 glideslope from below and crossed the glideslope centerline at approximately 2253:31 EDT, at which time its airspeed and groundspeed began decreasing further. The airplane's position at the time it crossed the glideslope centerline was approximately 1,400 feet msl and 4.23 nautical miles (nmi) from the runway threshold (0.77 nmi inside the STANE initial/final approach fix for the ILS 6 approach), and its speeds were approximately 152 KIAS [knots indicated airspeed] and 167 knots groundspeed. The airplane flew through the one dot high boundary of the glideslope at 2253:45 EDT (its position then was about 1,340 feet msl and 3.62 nmi out) and crossed the localizer centerline at 2253:50 EDT at a position about 1330 feet msl and 3.38 nmi out. The airplane then proceeded through the full fly-right boundary of the localizer, started a right turn with a maximum roll angle of approximately 11 degrees, and significantly increased its descent rate and downward flightpath angle. As the airplane descended through 1,000 feet msl, its descent rate and flightpath angle peaked at approximately 1,200 feet per minute (fpm) and -4.3 degrees, respectively, and its speeds decreased to 140 KIAS and 159 knots groundspeed.

The airplane decreased its deviations as it continued its approach, but remained more than one dot high and two dots left of course relative to the glideslope and localizer, respectively, at the point where the radar data end. The

last 6 radar data points show the airplane decreasing its descent rate and decreasing its downward flightpath angle. The last radar data point shows the airplane descending through 400 feet msl at a point 0.52 nmi from the BDR runway 6 threshold. The speeds estimated from the last two radar data points are approximately 126 KIAS and 138 knots groundspeed. Extrapolation indicated that maintaining the final flightpath angle would place the airplane at approximately 150 feet msl at the runway threshold (runway threshold elevation is 7 feet) and on the runway surface approximately 3,000 feet down the runway, assuming no flare prior to touchdown.

The touchdown marks found on runway 6 indicate that the an-plane touched down approximately 3,471 feet down the runway and 43 feet left of runway centerline. It then began leaving tire skid marks consistent with braking approximately 4,200 feet down the runway. The tire skid marks were intermittent and asymmetric (no left tire skid but heavy right tire skid, vice-versa, or asymmetric darkness) after initiation, as though brake pressure was being modulated or tire/runway surface friction or contact/down force was varying. The tire skid marks became heavy and continuous approximately 50 feet prior to impact with the steel blast fence at the end of BDR runway 6 (approximately 4,697 feet down the runway). The tire skid marks start at a magnetic heading of approximately 62 degrees and end at a magnetic heading of approximately 71 degrees, with an increasing rate of right turn toward the end.

Propeller strikes found in the upward-sloping asphalt berm leading up to the blast fence indicate propeller speeds between 1,200 and 1,600 rpm at the time of impact with the blast fence. The airplane traveled approximately 20 feet after the nose first contacted the blast fence; therefore, the average longitudinal deceleration from initial impact with the blast fence at 69 knots to the final resting place was approximately 10.5 G and occurred over a period of approximately 0.34 seconds.

Assurning longitudinal deceleration values of 0.2 to 0.3 G from the impact point back 497 feet to where the tire skid marks start, and at 0.1 to 0.2 G from the tire skid marks back 729 feet to the touchdown point, the results are touchdown speeds between 93 and 107 knots, and tire skid mark initiation speeds of between 83 and 90 knots. Different longitudinal deceleration estimates would result

in different speed values, but the deceleration ranges chosen are representative of typical small airplanes on wet runways.

1.17 Organizational and Management Information

1.17.1 Action Airlines and Action Air Charters

In 1976, JIB, Incorporated, was purchased primarily to buy and sell airplanes. In 1979, the company began operating a flight school at the Groton/New London Airport (GON), Groton, Connecticut. Also, in the same year, the company began operations as a certificated Part 135 single pilot, "on demand" air taxi service. The company was certificated to do business as Action Airlines and Action Air Charters. The first airplane operated by the company was a Cherokee 180. Later that year, the company expanded the Part 135 operation, using multiple pilots and multiengine airplanes.

In 1981, the first Piper PA-34 Seneca was purchased. The first Piper PA-31 Navajo was acquired in 1984. The same year, the company obtained commuter operations specifications and primarily flew routes for Pilgrim Airlines. These operations continued for approximately 2 years. After Action Airlines stopped flying for Pilgrim Airlines, the company placed more emphasis on the "on-demand" charter operation, primarily serving ACY.

The company operated about 90 percent of the flights on demand? while the remaining 10 percent of the flying was scheduled operations that occurred during the summer months. The scheduled operations included five flights from GON to Fisher's Island, Connecticut. Most of the on-demand business was contracted with the casinos as charters, providing "gambler's junkets" to ACY. At the time of the investigation, the company operated seven airplanes; three PA-31 Navajos, two PA-34 Senecas, one PA-32 Cherokee Six, and one Cessna 172.

The company officers included an owner who was President/Director of Operations; a Vice President of Sales; a Director of Maintenance; and a Chief Pilot. The company had three members that served as the Board of Directors. Annual meetings were held and minutes were kept of the meetings.

The company employed 12 pilots, including 4 that flew in a part-time capacity. All the pilots, except one, were qualified to fly as captains in one or more of the airplanes. Flight positions were based on experience. While one pilot was still a full-time copilot, two of the lesser experienced pilots were captains on the single-engine airplanes and served as copilots on the larger multieng-ine airplanes. The normal progression in the company, according to the chief pilot, was from captain Cessna 172, captain Cherokee Six, copilot Navajo, captain Seneca, and then to captain Navajo. Occasionally, **a** pilot was hired to be a copilot on the multiengine airplanes; however, that hiring decision was based on ability and the flight experience of the job applicant. Pilot turnover was very low during the last 3 years; and only one termination occurred during this period.

Flight following was accomplished by the use of **a** company radio located at the main base of operation. Both the president **and** chief pilot had backup radios to monitor the flights in progress in the event they were away from the main base of operation. According to the company operations manual, pilots were required to report off and on times and to monitor the company frequency. Delays in excess of 30 minutes were to be reported to the Director of Operations or the Chief Pilot.

1.18 Additional Information

1.18.1 Safety Recommendations Issued Following the Accident

As a result of the circumstances noted at Harrington Industries, Inc., the Safety Board made the following two Class I, Urgent Action Safety Recommendations to the FAA on May 11, 1994:

A-94- 111

Take immediate action to evaluate the quality of maintenance performed by Harrington Industries, including the qualifications of the FAA-certified airframe and power-plant mechanics employed there, to ensure that the work performed is in compliance with approved practices.

A-94-l 12

Take immediate action to identify airplanes that have been repaired, refurbished, or repainted by Hanington Industries, inspect their safety belts and seat assemblies for proper installation and use of approved hardware, inspect their flight control surfaces to ensure that balance is within tolerance limitations, and inspect them for any other airworthiness conditions if the need is indicated during the evaluation described in recommendation A-94-l 11.

Following an inspection of Harrington Industries on May 4, 1994, and in a formal response to Safety Recommendation A-94-l 11, the FAA stated:

The West Columbia Flight Standards District Office (FSDO) conducted an investigation and an inspection of Harrington Industries. During the investigation the certificated mechanics employed by Harrington Industries successfully demonstrated the procedures that they used to check the balance of aircraft flight controls. The procedures used were not unlike the procedures used by the majority of aircraft manufacturers. The scales used in the balance procedure were checked for calibration and found to be within tolerance. Regarding the possible use of unapproved hardware, the only hardware found in the Harrington Industries facility that may have been purchased at an automotive store was a box of Tinner-man nuts used for attachment of decorative interiors. During the investigation it was noted that the control surfaces of a Mitsubishi MU-2-36 aircraft had been balanced using a manufacturer's maintenance manual that was not current. It was also noted that the Federal Aviation Administration (FAA) type certificate data sheets referenced when performing annual inspections were not current. The FAA has taken appropriate corrective action.

The Safety Board has classified this recommendation as "Closed--Acceptable Response." In a formal response to Safety Recommendation A-94-l 12, the FAA stated:

> The West Columbia FSDO reviewed work sheets from Harrington Industries and identified 10 aircraft that had been painted by Harrington Industries within the last year. The FAA sent letters to the owners of the 10 aircraft requesting that they bring their aircraft to Harrington Industries to have their flight control balance checked. All but three owners responded.
>
> The flight controls were removed and checked for balance on the seven aircraft that were evaluated. The evaluation revealed that the balance of two surfaces was out of limits on one aircraft and that one surface was determined to be out of limits on two aircraft. All defects were immediately corrected. All other control surfaces were within balance limits.
>
> On September 28, 1994, the Federal Aviation Administration (FAA) notified all owners and operators of aircraft that that have had maintenance performed by Harrington Industries that their aircraft may have been maintained using unapproved data and/or techniques. Additionally, the FAA published this same information as a special notice in the November issue of Advisory Circular (AC) 43-16, General Aviation Airworthiness Alerts, to alert the aviation community.

The Safety Board has classified this recommendation as "Closed--Acceptable Response."

2. ANALYSIS

2.1 General

The evidence indicates that there were no preexisting structural defects in the airframe and no m-flight failure of airplane structures. All damage to the airplane occurred during the impact with the blast fence and subsequent fire. There was no evidence of an in-flight fire.

According to the surviving passenger, all airplane systems appeared to be operating normally. An examination of the wreckage revealed no anomalies in any systems that would affect the flight characteristics or stopping ability of the airplane. Performance of the landing gear, brakes, and tires was analyzed to determine if any system malfunction might have resulted in a loss of braking effectiveness. Measurements of the brake linings revealed that 85 percent of the brake wear remained, indicative of relatively new brake linings with ample wear remaining. Marks associated with both main gear tires were found at the touchdown point, indicating that both main gear were down and locked. Dark black skid marks were seen on the runway, and both tires had flat spots, indicative of heavy braking. The brake master cylinders and calipers were functional in postaccident testing. The main gear tires had distinct tread grooves indicating that they were not excessively worn. Further, the aircraft impacted the blast fence along the extended runway centerline, consistent with no loss of directional control.

There was no evidence of malfunction' of the fuel, hydraulic, 'or electrical systems or any other system that might have contributed to the accident. Propeller strike mark measurements and examination of the engines indicated that both were operating at low or idle rpm during the accident sequence of events. The airplane was configured with gear down and flaps deflected to 24" when it came to rest. The intense postcrash fire and the statements of rescue personnel are consistent with the presence of a quantity of fuel. All cockpit instruments appeared to have been operational at impact. Maintenance records and interviews with Action Airlines personnel indicated that the factory-installed autopilot on N990RA was operative in accordance with FAR 135.105(c)(l), thus allowing single-pilot, night IFR operations.

The Safety Board determined, from available data, that the airplane was properly loaded and was within proper weight and balance operating limits for takeoff and landing.

The investigation disclosed that the pilot of the airplane was qualified to fly this flight in night VFR or IFR conditions in accordance with the FARs and company requirements. Although qualified, he was in his grace month (the month after the due month) for receiving his 6-month IFR instrument proficiency check ride. The check ride was to be taken 2 days after the accident flight, and was to be administered by a designated pilot examiner who was also the president of Action Airlines.

Interviews with the captain's widow and several of his acquaintances revealed no psychological or physical ailments that would have affected his flying ability. Although the captain occasionally suffered from stomach distress, his wife stated that he adjusted his diet accordingly prior to flight, and the surviving passenger reported no evidence that the captain experienced such distress during the accident flight. Interviews with the surviving passenger and flying associates, as well as a review of his sleeping schedule, revealed no reason to believe that he was unduly fatigued during the flight.

The captains loss of visual contact with the runway during the approach and touchdown phases of the landing prompted an analytical review of his actions. During the investigation, shortcomings were discovered concerning a runway safety area and approach lighting at BDR. Also, numerous seat belt installation errors were attributed to the company that refurbished the accident airplane and other airplanes examined during the investigation.

Analysis of available weather data indicated that at the time of the accident, the surface conditions at the airport most likely consisted of a totally obscured sky, prevailing visibility of less than 1/4 mile in fog, and surface winds about 250 degrees at 4 knots. The tailwind component on final approach was about 21 knots at 3,000 feet, around 20 knots at 2,000 feet, and diminishing to around 4 knots at the runway.

The emergency response was timely and efficient.

2.2 The Appropriateness of the Approach

The Safety Board believes that the captain, from a decisionmaking standpoint, certainly wanted to land at Bridgeport and deplane the BDR-bound passengers who lived in that vicinity. A failure to land at Bridgeport would obviously inconvenience the passengers and Action Airlines because it would

require deplaning the passengers at an alternate airport late at night and then providing ground transportation for their return to Bridgeport. Weather information for Bridgeport that the pilot had received before departure was favorable, and the weather along the route was clear. Therefore, there was no reason to delay takeoff from Atlantic City or to plan to fly directly to an alternate airport.

The captain would have observed the presence of fog as he approached the airport, but, from altitude, he should have been able to see through it to the ground and to observe major features of the airport and runways. He was unaware of the actions of previous pilots who chose not to land. Because he tuned to the New York approach frequency responsible for Bridgeport at 2246, he would have heard no communications with the pilots of the Sabreliner or Turbo Commander airplanes that diverted earlier. However, he would have been able to hear communications with the Learjet. At 2248, the controller asked the Learjet whether he had the Bridgeport airport in sight, and the Learjet reported "we've got the runway in sight now."

At 2251, Action Air 990 changed radio frequencies to the Bridgeport common frequency. This frequency was not recorded, and the Safety Board has no direct record of what the pilot said or heard. However, the Learjet pilots indicated that they received a radio transmission from the accident pilot inquiring "how's the weather down there?" When he received no answer, the pilot inquired "how was the ground fog?" and was advised by the Learjet crew, "Not bad until you get on the ground." The surviving passenger corroborated this by stating that the Action Air captain received weather information from the Learjet crew indicating only a thin fog.

The Safety Board believes that it was appropriate that the pilot radioed ahead for weather information from the Learjet. Although he had a weather forecast and could make his own observations, the most credible and timely observations of the severity of the fog would be those made by a flightcrew that had just landed. Based on the fact that the Learjet had landed successfully, and based on the favorable conditions reported by the Learjet pilots, the Action Airline pilot was justified in continuing his approach. As a result, the Safety Board believes that the pilot's decision to make an approach to the airport was appropriate.

One question that the Safety Board was unable to resolve was why the weather conditions reported by the Learjet pilots were more favorable than those indicated by other witnesses. Based on the available evidence, including statements

by eyewitnesses on the ground and from flights overflying BDR earlier, visibility conditions might not have been sufficient for a safe landing at the time the Learjet executed its approach. However, because the fog at that time was patchy (as stated by the Learjet copilot), it is conceivable that visibility was sufficient for the Learjet landing but not good enough for the Action Air flight to land several minutes later. Nonetheless, the pilot of the accident flight was ultimately responsible for the safety of his own approach. The Safety Board believes, however, that in making his decisions, he was probably influenced by information provided by the preceding flight.

Runway 6 at Bridgeport had an ILS and VOR published approach. The Safety Board found that the ILS frequency was selected by the pilot on the navigation receiver, and the inbound course was selected for the localizer. The Board believes that the captain selected the frequency believing it would provide additional runway alignment information, as well as supplemental glidepath information for the visual approach. Radar data indicate that the captain did not fly the ILS approach as published.

The ILS runway 6 instrument approach provided a middle marker (MM) that was depicted on the approach chart. Also, a lighted precision approach path indicator (PAPI) was located to the right of runway 6 and provided visual approach path information to the pilot. The flightpath angle of the PAPI was 3 degrees, the same as the ILS runway 6 glideslope angle.

The PAP1 and the MM were not required to be monitored by any of the air traffic control facilities, and, prior to the accident, there had been no reports by pilots of the MM or the PAPI being out of service. However, after the accident, a flight check of the ES was conducted. The FAA navigational aid technicians found that the MM was not operating (although it was not a required component of the ILS) and that the PAP1 would not operate on the high intensity setting when that setting was attempted via the pilot-controlled lighting system. It did operate at the low setting. During the day, the PAP1 was always operated at high intensity. At night, the PAP1 was supposed to be on the lowest setting and controlled by a photo-electric cell. Its intensity was supposed to be changed by keying the radio microphone in the cockpit after tower closure. Since both the MM and the PAP1 were not monitored, there were no NOTAMs issued regarding the malfunction of those pieces of equipment.

Additionally, none of the runways at Sikorsky Memorial Airport had approach lighting systems. Runway 6 had runway end identifier lights (REILs). Given the fact that only REILs and runway lights existed for runway 6, the conditions for pilot confusion concerning the correct glidepath existed, especially if the captain failed to use the ILS as a backup for the visual approach, or was unable to see the PAP1 clearly, if at all, on the lower setting due to the fog.

It is the opinion of the Safety Board that the airplane's excess speed and altitude for its rate of descent, as it crossed the runway threshold, established a runway touchdown point well beyond the touchdown zone for runway 6. Additionally, the threshold crossing height of the airplane placed it off the scale of the localizer and glideslope cockpit display. Therefore, the captain could not have been determining the position of the airplane relative to the published approach using his cockpit instruments.

Although there were limited visual cues available to the captain, the Safety Board notes that this approach does not resemble the classic "black hole" visual approach situation. Scientific literature indicates that, in a "black hole" situation, landing pilots have a strong tendency to land short of their intended touchdown point.[17] It is possible that the captain realized that there was a natural tendency to land short because of the lack of visual guidance at BDR, and that he overcompensated somewhat. In addition, the first 1,500 feet of runway 6 pavement is noted to be "uneven," according to a note on the Jeppesen airport diagram, and the captain might have been intentionally extending his planned touchdown point in the interest of passenger comfort. These factors, coupled with the total lack of visual cues once he entered the ground fog layer, as well as a higher than normal groundspeed, could help explain his actions, even though it would have been inappropriate to continue the landing if visual cues were lost at any time during the VFR approach.

2.3 Air Traffic Control

The New York TRACON LOVE sector controller was aware of the official tower visibility (1/2 mile) prior to communicating with the flightcrew of Action Air 990. The controller advised the flightcrew of N303A of the tower visibility, and the pilot elected to divert to another airport. However, as the pilot

---

"Human Factors in Aviation. Wiener, E. I. and Nagel, D. C. (Editors). San Diego, California: Academic Press, 1988.

was flying over the airport, he indicated that he had the runways in sight. The following aircraft, Learjet N400EP, was advised of the visibility and was told to expect the ILS approach to runway 6. The pilot advised that he had Bridgeport Airport in sight and stated that he would proceed visually. He did so and landed on runway 29. By then, the official tower visibility report was approximately 20 minutes old, and the tower was closed. As soon as the tower closed, the airspace around the airport changed from Class D to Class E.[18] Class E indicates that, although the New York TRACON maintains control of the airspace, it is the pilot's responsibility to maintain visual separation from terrain and other airplanes. When the flightcrew of the Lear-jet N400EP, the second aircraft to make an approach to the airport after 2230, reported the airport and runway in sight, the controller might have believed that the weather had improved since the 2230 report. In any event, he discontinued the visibility report to inbound aircraft. The pilot of Action Air 990 was operating on a VFR flight plan and reported the field in sight, as required. The controller then terminated radar service and issued a frequency change. In conclusion, the Safety Board believes that Action Air 990 was handled by air traffic control according to accepted ATC practices.

2.4 The Landing

Weather data suggests that the winds in the BDR area were from about 284 degrees magnetic at around 33 knots at 3,000 feet, and diminished to about 4 knots at the surface of the runway. The wind direction provided a tailwind throughout the descent, approach, and landing. Evidence of postcrash fire smoke patterns on the rear cabin door indicated that smoke escaped from the seal around the upper left corner of the main cabin door. Soot deposits were toward the nose of the airplane, and there was no smoke residue on the door. This pattern is consistent with a tailwind down the runway.

The survivor indicated that he felt the airplane was high on the approach. Further, the absence of any approach lights or other visual aids for the runway of intended landing could tend to keep a prudent pilot higher rather than on

[18] Class D is defined as that airspace from the surface to 2,500 feet above the airport elevation surrounding those airports that have an operational control tower. Two-way radio communication must be established with the ATC services prior to entry, and those communications must be maintained thereafter while in the class D airspace. There are no separation services provided to VFR airplanes. Class E is controlled airspace that has no defined vertical limit but rather it extends upward from either the surface or a designated altitude to the overlying or adjacent controlled airspace.

glidepath during a visual descent to landing. The fog might have obscured the PAP1 due to the reported failure of the high intensity light position. In that case, any visual flightpath information might not have been observed by the captain and might have contributed to a higher than normal approach path.

The survivor stated that the captain pointed out the landing light switch on the overhead panel and told him, "when I tell you to, turn it on." At some point in the approach, the captain instructed the survivor to "turn it on." When the light was turned on, according to the survivor, "it was like a strobe light." The captain then quickly said, "turn it off." Estimates of the thickness of the fog layer varied. The survivor estimated the fog to be about 10 feet thick; the Learjet copilot estimated it to be between 15 and 20 feet; and airport personnel stated that it was 20 to 30 feet or more. The Safety Board believes that the landing light might have been turned on during a critical phase of the landing as the airplane entered the reduced visibility area. The "whiteout effect" might have caused the captain to temporarily lose sight of the runway due to the light. The Safety Board also believes that the lack of visual cues for landing could have caused the captain to lower his rate of descent while trying to visually reacquire the runway, when he should have been initiating a go-around maneuver.

The survivor stated that the captain was moving the control column as though he was "fishing" for the runway. After landing, the braking was hard before impact, according to the survivor. The survivor stated that he could see the runway markings. The Safety Board believes that as a nonflying passenger in the copilot seat, he was most likely looking down and out the side window, and was therefore able to see markings on the runway. The captain, on the other hand, probably would be looking forward and out the front windscreen for landing, and therefore would have had a greater slant range viewing distance to the runway with increased obscuration from fog. If the captain was, in fact, "fishing" for the runway, this suggests that he was satisfied with the airplane's alignment with the runway, and that he believed he was only slightly above the paved surface. Initial touchdown was not on runway centerline, but was on the paved surface with immediate correction toward centerline during rollout. This would substantiate the captains basic awareness of lateral positioning. However, the obscuration probably precluded the captain from accurately ascertaining his height above the runway and his distance from the runway end. Further, the existence of a tailwind increased both the groundspeed and landing distance of the airplane and exacerbated the effects of existing visibility limitations.

The flap position lever was found in the off position, so jackscrew measurements were used to determine the probable position of the flaps at impact with the fence. The Safety Board considered the fact that the flaps were found in the 24-degree position upon impact with the blast fence, rather than in the expected full down landing position. Landing with less than full flaps could have caused floating during the flare and a longer landing rollout. However, since there is no company or manufacturer-recommended procedure to land with less than full flaps, and indeed no logical reason to do so, the Safety Board concludes that the captain might have been in the process of raising the flaps to increase weight on the wheels (and braking capability) 'during the emergency stopping attempt.

In conclusion, the Safety Board believes that the captain, when confronted with weather conditions that seriously reduced his chances of successfully completing a visual landing, should have immediately executed a go-around. Actual landing conditions could then have been better assessed. If necessary, an IFR clearance could have been obtained and an instrument approach could have been flown to minimums. If the weather was below minimums, then a diversion to another suitable airport would have been appropriate.

2.5 The Blast Fence and the Lack of a Runway Safety Area

The Safety Board concludes that the destruction of N990RA, and the resulting deaths and injury, were a direct result of N990RA's collision with the blast fence. The impact forces with the fence were survivable, but the location and design of the fence precipitated the liberation of a large quantity of fuel that quickly ignited into a fatal fire. The Board acknowledges the necessity of protecting vehicle traffic on state highway 113 from jet blast developed by airplanes taking off on runway 24. Nevertheless, the Safety Board also believes that the lack of a safety area beyond the runway and the current location of the nonfrangible blast fence are clearly hazardous to crewmembers and passengers at BDR.

Runway 6/24 is currently not required to meet the minimum advisory criteria found in FAA Advisory Circular 150/5300-13, which establishes a runway safety area (RSA) of 800 feet. Ironically, due to FAA "grandfathering" policies during rulemaking, runway 6/24 is in compliance with 14 CFR Part 139 since there are no requirements to establish a safety area because there has been no major reconstruction or expansion of the runway since January 1, 1988. However, such "grandfathering" of the RSA requirement does not alter the fact that the absence of

safety areas and the location of the blast fence create a condition that is demonstrably unsafe.

The Safety Board also noted that the new section of the blast fence was considerably stronger than the previous one, which resulted in much more damage to the airplane than would have occurred had the old fence section been in place. Alternatives regarding a frangible fence were researched during the investigation. FAA Airport Standards staff informed the Board that no frangible blast fences were known to exist, and that the feasibility of making a blast fence truly frangible was questionable. The Board then reviewed the possibility of installing a less frangible, but more collapsible fence, which would satisfactorily withstand jet blast for airplanes currently using BDR. However, this approach, while probably feasible, could be considered impractical because the only required application for such a blast fence would be in or near RSAs. The Safety Board continues to believe that RSAs should meet AC 150/5300-13 standards and that RSAs should be kept clear of obstructions. Therefore, research and development of "quasi-frangible" blast fences could, in a sense, be considered counterproductive to aviation safety.

Interesting alternatives, such as sensor-activated or remotely activated railroad gate arms and/or traffic lights on state highway 113, would allow removal of the blast fence and might be worthy of consideration as interim solutions. However, the problems of control responsibility, maintenance, reliability, and legal liability might make the implementation of such devices difficult. Also, none of these devices would provide for an adequate RSA since state highway 113 is in itself an obstruction.

Therefore, the Safety Board believes that the State of Connecticut should immediately take steps to relocate state highway 113 away from the approach end of runway 24 so that an RSA can be established in accordance with the AC. Immediately following the relocation of highway 113, Sikorsky Memorial Airport should remove the blast fence and establish an RSA in accordance with AC 150/5300-3.

Similar blast fences and other nonfrangible obstructions exist close to runways and RSAs at other 14 CFR Part 139 certificated airports, and inadequate RSAs still exist because their dimensions were developed prior to the January 1, 1988, cutoff date. For example, obstructions were found to have contributed to airplane damage and/or injuries in a number of previous air carrier accidents, including those involving a Scandinavian Airlines System McDonnell Douglas DC-

10 at JFK International Airport in 1984 (NTSB/AAR-84-15); a Piedmont Airlines Boeing 737 at Charlotte/Douglas Airport in 1986 (NTSB/AAR-87-08); and a USAir Fokker F-28 at LaGuardia Airport in 1992 (NTSB/AAR-93-02).

During the Safety Board's investigation of a Trans World Airlines Lockheed L-1011 accident at JFK International Airport on July 30, 1992, (NTSB/AAR-93-04) it was found that the pilot steered the airplane off runway 13R to avoid colliding with a blast fence at the end of the runway. The Safety Board issued Safety Recommendation A-93-69 to the Port Authority of New York and New Jersey to: "Remove the blast fence located near the approach end of runway 31L at John F. Kennedy International Airport and implement alternative methods to protect airplane operations from jet blast on runway 4R/22L." The most recent correspondence from the Port Authority, dated December 1, 1993, stated that it had requested an evaluation by the FAA to analyze the safety and operational effects of removing the blast fence. The Safety Recommendation is currently classified as "Open--Acceptable Response."

The Safety Board is aware that the FAA has long advocated safety area improvements at BDR, and the FAA has been criticized by local communities and citizens for doing so. Some citizens erroneously viewed the FAA's proposed safety improvements as "airport expansion." Therefore, the Safety Board believes that the FAA should continue to interact and communicate aggressively with the affected communities. This would do much to clarify and illustrate the necessity to improve the safety areas. The Safety Board believes that the FAA should also communicate the same way with the community concerning the proposed approach lighting system for runway 6.

2.6 Runway 6 Approach Lighting

The Safety Board was unable to determine definitively whether this accident could have been prevented if runway 6 had been equipped with a MALSR. The approach lighting would most likely have been seen by the pilot on final approach, and he might have been more able to properly adjust the airplane's position relative to the runway threshold or, alternatively, to more readily have foreseen the need to initiate a missed approach.

A review of the three previous accidents, which occurred in the past 10 years involving approaches to runway 6 during IMC, led the Safety Board to conclude that two of the accidents (the Piper PA-34, on February 19, 1988; and the

Cessna 210 on February 23, 1990) might have been avoided if the MALSR had been installed and had been operating on runway 6 because it would have provided a visible cue that the pilots did not have in both cases.

Therefore, the Safety Board believes that there is ample evidence for the FAA to expedite the completion of environmental studies and to remedy a dangerous situation by encouraging the earliest installation of an approach lighting system on runway 6.

2.7 Survival Factors Analysis

2.7.1 Cabin Occupant Seat Belt Usage

Analysis revealed that the impact forces approximated 10.5 G for an estimated 1/3 second and that the impact occurred at a low estimated speed of 69 knots. The Safety Board believes that it is important to realize that the fuselage of the airplane passed between the rigid steel upright support beams of the blast fence. A direct impact with the blast fence support beams by the fuselage would have been much more detrimental to passenger survival. The Safety Board notes that unfortunately the fuel-laden wings of the airplane, rather than the nonfrangible blast fence, attenuated the impact, and that the airplane quickly burst into flames. According to the local coroner, all the fatalities resulted from smoke inhalation or burns. The impact alone, without the fire, would have been survivable for all occupants, regardless of the seat belt usage by anyone onboard.

Evidence exists that at least some of the cabin passengers were not wearing their seat belts at the time of the accident. It is known that at least two of the eight passengers were not belted in because one of the nine passenger seats (1A) had no seat belt installed and two of the remaining eight passenger seats had belts in their buckled and stowed positions. Details of the conditions of the seats and seat belts are in section 1.15 of this report.

The Safety Board believes that in a single pilot operation, such as Action Air flight 990, in spite of the seat belt instructions given by the captain to the passengers (according to the survivor), it is possible that all the passengers outside the direct view of the captain could have ignored his instructions or could have unfastened their belts at any time prior to landing. Indeed, it is possible that the passengers never fastened their seat belts in the first place.

It is the opinion of the survivor, who was in the cockpit right seat, that any passengers seated behind him not wearing seat belts would have been thrown forward into the cockpit during the impact sequence. According to the survivor, the only occupant who was actually thrown forward was the passenger directly behind the captain. The survivor subsequently pulled this person out of the airplane. Three burned, deceased passengers were located outside the airplane in front of the right engine. This could mean that these passengers were exposed to the fire for some time, then escaped forward, and were not immediately ejected upon impact. This scenario would support the survivor's opinion that the fire broke out 3 to 5 seconds after the airplane came to a stop. The positions of the passengers outside the fuselage could also mean that they were immediately ejected forward and were burned almost immediately thereafter, after they were doused with fuel and fire ignition.

The scenario of nonuse of seat belts is very unusual. However, the Safety Board recognizes that because of the lack of seat, seat buckle, and seat belt damage, and the length of the belts, it is likely that some of the passengers in the cabin were not wearing their seat belts at impact. They might have been stunned by the impact and died in a confused and delayed attempt to escape the airplane. It is conceivable that if the passengers in the rear of the airplane had been wearing their seat belts, they would not have been stunned, **and** they could have escaped through the boarding door. However, the passengers in the front of the airplane, belted or not, were afforded virtually no opportunity to escape because of the rapid outbreak of intense fire in that area. The Board also believes that because of the rapid development of intense fire in the seconds after impact, and the destruction that resulted, the exact circumstances of the escape effort will never be known.

2.7.2 Cockpit Occupant Seat Belt Usage

The Safety Board also found it difficult to reconcile the evidence found in the wreckage with the statements made by the survivor concerning his and the captain's use of seat belts.

Although the survivor said that he was wearing his seat belt, the physical evidence suggests otherwise. The seat belt was adjusted to a length that is inconsistent with passenger usage, but was consistent with the seat belts being stowed and buckled by the operator when not in use; that is, when tightened neatly across the bottom seat cushion. Also, there was no overstress damage to the survivor's seat belt buckle, overstress damage to his seat belt webbing, or visible

damage to the seat structure. Damage in these areas normally indicates the heavy loading on the belt that results from a high deceleration rate at impact with a person buckled into his seat.

He told investigators that he could "feel the belt" when the impact occurred, and that he must have removed his seat belt immediately after the blast fence impact but before the fire broke out. If, in the confusion of the evacuation, he did not let go of the buckle after unfastening it in haste, he might have lengthened that side of the belt as he exited the airplane.

Although the captain was found slumped forward in or just forward of his seat, with the buckle end of his seat belt wedged **behind him** between the seatback and seat cushion, the lack of multiple bone fractures or internal injuries to the captain, and the fact that the seat belt was adjusted to accommodate an average-sized individual, indicates that he was probably using his seat belt. If he had not been wearing his seat belt, impact with the instrument panel and glare shield probably would have caused at least debilitating facial **and** upper torso injuries. Also, in the confusion of the evacuation, it is possible that the captain would have tossed the buckle behind him as he attempted to evacuate forward. A passenger could have pushed his seat back down over the buckle before the area was exposed to fire. In addition, the survivor stated that the captain must have removed his seat belt after fence impact and before the fire broke out.

2.7.3 The Condition of the Passenger Seats and-Seat Belts

During the investigation, the Safety Board examined the seats and safety belts and found that the seats had been improperly assembled using unapproved parts, and that the seat belts had been installed incorrectly. This condition also was found on other airplanes belonging to Action Airlines. The Safety Board found that the airplane's interior had been recently refurbished and that the seats had been reupholstered by Harrington Industries, Aiken, South Carolina. The company was neither an FAA-approved repair station, nor was it required to be. Based upon the Safety Board's findings in the installation of the interior, "Urgent Action" Safety Recommendations A-94-l 11 and A-94-l 12 were issued to the FAA on May 11, 1994. See appendix B for these recommendations.

3. CONCLUSIONS

3.1 Findings

1. The landing gear, brakes, and tires were in good condition and were functional at touchdown.

2. The airplane was **maintained** according to Federal Aviation Regulations, with the exception of anomalous seat belt attachment methodology and hardware, and there was no evidence of any systems or power-plant malfunction that might have contributed to the accident.

3. The captain was properly certificated and operationally qualified for the flight in accordance with company procedures and Federal Aviation Regulations.

4. Air traffic control handling of the flight was appropriate.

5. The captain had ILS glideslope data available during the approach but did not fly the ILS glideslope. If he had used the ILS, he would have been better able to assess the touchdown point.

6. The tailwind during the descent, approach, and landing required a higher descent rate and resulted in a higher groundspeed at touchdown than that required if there had been a headwind or no wind. An alternate runway selection to provide a headwind component for landing would have been preferred.

7. The partial obscuration of the airport environment, due to ground fog, contributed to the captain's failure to recognize that the airplane was high on both his approach to the airport and subsequent landing attempt.

8. The captain continued his attempt to land in the partial obscuration conditions, although reduced forward visibility

restricted his ability to determine the length of runway remaining.

9. The PAPI for runway 6 would not operate at its highest setting.

10. After the tower closed at 2230, the pilot became responsible for determining the existing visibility and wind conditions at the airport.

11. Both engines were operating at low or idle power at impact with the blast fence.

12. The destruction of N990RA and the resulting occupant injuries were a direct result of the collision with the blast fence.

13. Crash forces resulting from N990RA's impact with the blast fence were survivable; however, the immediate postcrash fire created nonsurvivable conditions for occupants who remained in the front of the cabin.

14. FAA interaction and communication with local communities, although persistent, were unsuccessful in gaining support for runway safety area improvements and for the installation of approach lighting for runway 6.

15. Two of the four prior accidents at Sikorsky Memorial Airport in the past 10 years might have been avoided if approach lighting had been installed and had been operating on runway 6.

16. The passengers and captain died as a result of smoke inhalation and/or thermal injuries.

17. The passenger seats had been improperly assembled by Harrington Industries using unapproved parts, and seat belts had been installed incorrectly.

18. The emergency response was timely and efficient.

19. The captain was probably wearing his seat belt at impact, but at least two of the passengers were probably not wearing their seat belts.

3.2 Probable Cause

The National Transportation Safety Board determines that the probable causes of this accident were the failure of the captain to use the available ILS glideslope, his failure to execute a go-around when the conditions were not suitable for landing, and his failure to land the airplane on the runway at a point sufficient to allow for a safe stopping distance; the fatalities,, were caused by the presence of the nonfrangible blast fence and the absence of a safety area at the end of the runway.

4. RECOMMENDATIONS

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

--to the Federal Aviation Administration:

Inspect all Title 14 Code of Federal Regulations Part 139 certificated airports for adequate runway safety areas and nonfrangible objects, such as blast fences, and require that substandard runway safety areas be upgraded to Advisory Circular 150/5300-13 minimum standards wherever it is feasible. (Class II, Priority Action) (A-94-21 1)

Within 90 days, and in coordination with the City of Bridgeport and the Town of Stratford, implement a plan to resolve environmental considerations, and proceed with the installation of an approach lighting system on runway 6 as soon as possible. (Class II, Priority Action) (A-94-212)

--to the Connecticut Department of Transportation:

In coordination with the City of Bridgeport, the Town of Stratford and Sikorsky Memorial Airport, relocate state highway 113 away from the runway 24 threshold to provide adequate distance between airplanes and highway 113 to protect vehicles and persons from jet blast. (Class II, Priority Action) (A-94-213)

--to the City of Bridgeport, Connecticut

In coordination with the State of Connecticut and the Town of Stratford, following the relocation of state highway 113, Sikorsky Memorial Airport should immediately establish a runway safety area at the approach end of runway 24 in accordance with Federal Aviation Administration Advisory Circular 150\5300-13 and remove the nonfrangible blast fence. (Class II, Priority Action) (A-94-214)

Within 90 days, and in coordination with the Federal Aviation Administration and the Town of Stratford, implement a plan to resolve environmental considerations, and proceed with the installation of an approach lighting system on runway 6 as soon as possible. (Class II, Priority Action) (A-94-215)

--to the Town of Stratford, Connecticut:

In coordination with the State of Connecticut and the City of Bridgeport, following the relocation of state highway 113, Sikorsky Memorial Airport should immediately establish a runway safety area at the approach end of runway 24 in accordance with Federal Aviation Administration Advisory Circular 150\5300-13 and remove the nonfrangible blast fence. (Class II, Priority Action) (A-94-216)

Within 90 days, and in coordination with the Federal Aviation Administration and the City of Bridgeport, implement a plan to resolve environmental considerations, and proceed with the installation of an approach lighting system on runway 6 as soon as possible. (Class II, Priority Action) (A-94-217)

5. APPENDIXES

APPENDIX A

INVESTIGATION AND HEARING

1. Investigation

The National Transportation Safety Board was notified of the accident about 0100 on April 28, 1994. An investigation team was dispatched from Washington, D.C., about 0600 and arrived at Bridgeport Airport about 2 hours later. Investigative specialists for operations/human performance, airplane performance, structures, systems, power-plants, weather, airports, and survival factors gathered evidence on scene for about 1 week. Safety Board Chairman Jim Hall accompanied the investigative team to Stratford.

Parties to the investigation included Action Airlines, Inc., Aviation Maintenance, Inc., Textron Lycorning, Inc., Sikorsky Memorial Airport, and the Federal Aviation Administration.

2. Public Hearing

There was no Safety Board public hearing associated with this investigation.

APPENDIX B

SAFETY RECOMMENDATIONS

National Transportation Safety Board

Washington, D.C. 20594
Safety Recommendation

Date: May 11, 1994

In reply refer to: A-94-111 and A-94-112

Honorable David R. Hinson
Administrator
Federal Aviation Administration
Washington, D.C. 2059 1

On April 27, 1994, at 2257,' a Piper PA-31-350, N990RA, struck a blast fence during landing rollout on runway 06 at Sikorsky Memorial Airport, Stratford, Connecticut. The flight was operated by John I. Baily (JIB) Incorporated, doing business as Action Airlines. The flight was operating as a nonscheduled air taxi under the provisions of Title 14 Code of Federal Regulations (CFR) Part 135. The airplane was destroyed by an immediate ground fire, and the pilot and seven of eight passengers perished. The eighth passenger sustained serious thermal injuries. The flight had departed Atlantic City, New Jersey, about 1 hour before the accident. The pilot filed, but did not activate, an instrument flight rules flight plan. The weather at the time of the accident has not been definitely determined. Although the investigation is continuing, certain serious deficiencies related to the accident airplane have been noted that could affect the airworthiness or postcrash survivability of occupants of other airplanes. The Safety Board believes that the FAA should take immediate action to address these deficiencies.

During the initial examination of the airplane wreckage, the evidence indicated that no occupant of the airplane was using a safety belt at the time of the accident. It also became apparent that the safety belts had been improperly installed

[1] Eastern daylight time, in accordance with the 24-hour clock.

on several of the passenger seats. Incorrectly sized attachment bolts had been used on the seat frames during reassembly, and some attachment bolts had been found with no associated bushings to allow the belts to swivel on the bolts.

An examination of seats in other Piper PA-31 airplanes operated by Action Airlines revealed numerous safety belt and seat frame attachment anomalies on almost every seat. Safety belts were attached to unapproved locations, which resulted in the belts being at an incorrect angle when fastened. Some belts were installed so that their webbing originated beneath the seat pans. Both conditions were not in accordance with Piper-approved engineering drawings. Other anomalies. included nonstandard parts and missing, but required, parts associated with the safety belts and seat frames.

The interiors of the accident airplane and others operated by Action Airlines had been recently refurbished by Hanington Industries of Aiken, South Carolina. This company is not a Federal Aviation Administration (FAA)-approved repair station. However, FAA-certified airframe and power-plant (A & P) mechanics who work for the company routinely sign off repair documents and are surveilled by FAA inspectors. The president and two mechanics hold A & P certificates. In addition to refurbishing airplane interiors, the company also paints airplanes.

Following the investigative activity in Connecticut, the investigative team traveled to South Carolina to interview Harrington Industries personnel and to examine their repair facility. Employees acknowledged using the above-mentioned parts and techniques during the refurbishment of airplane interiors. Nonstandard parts were found in their parts bins. The person who is responsible for the complete disassembly and reassembly of newly upholstered seats, including the installation of safety belts, is not an A & P mechanic, but rather was previously employed as an automobile mechanic. This individual acknowledged that he had received no training on the disassembly and reassembly of airplane seats. Further, he was unaware of maintenance manual instructions and the need to use aviation quality hardware. The A & P mechanics who signed off the work orders acknowledged that they had not examined the work performed on the safety belt attachments, the reassembly of seats, and their installation in the airplane. Piper Service Bulletins and maintenance manuals for other airplanes that had been refurbished or repainted were found to be out of date by as much as 23 years. Lastly, company personnel acknowledged that they had not properly rebalanced control surfaces, as required, after they were repainted.

Harrington Industries has been in the aircraft refurbishment and airplane painting business for about 20 years. Interviews and records dating back 5 years revealed that the company has refurbished or repainted 12 to 15 airplanes per month. The records showed that the airplanes had been certificated under 14 CFR, Parts 23 and 25, and that they had been operated under 14 CFR, Parts 91 and 135.

As a result of its investigation of this accident, the National Transportation Safety Board recommends that the Federal Aviation Administration:

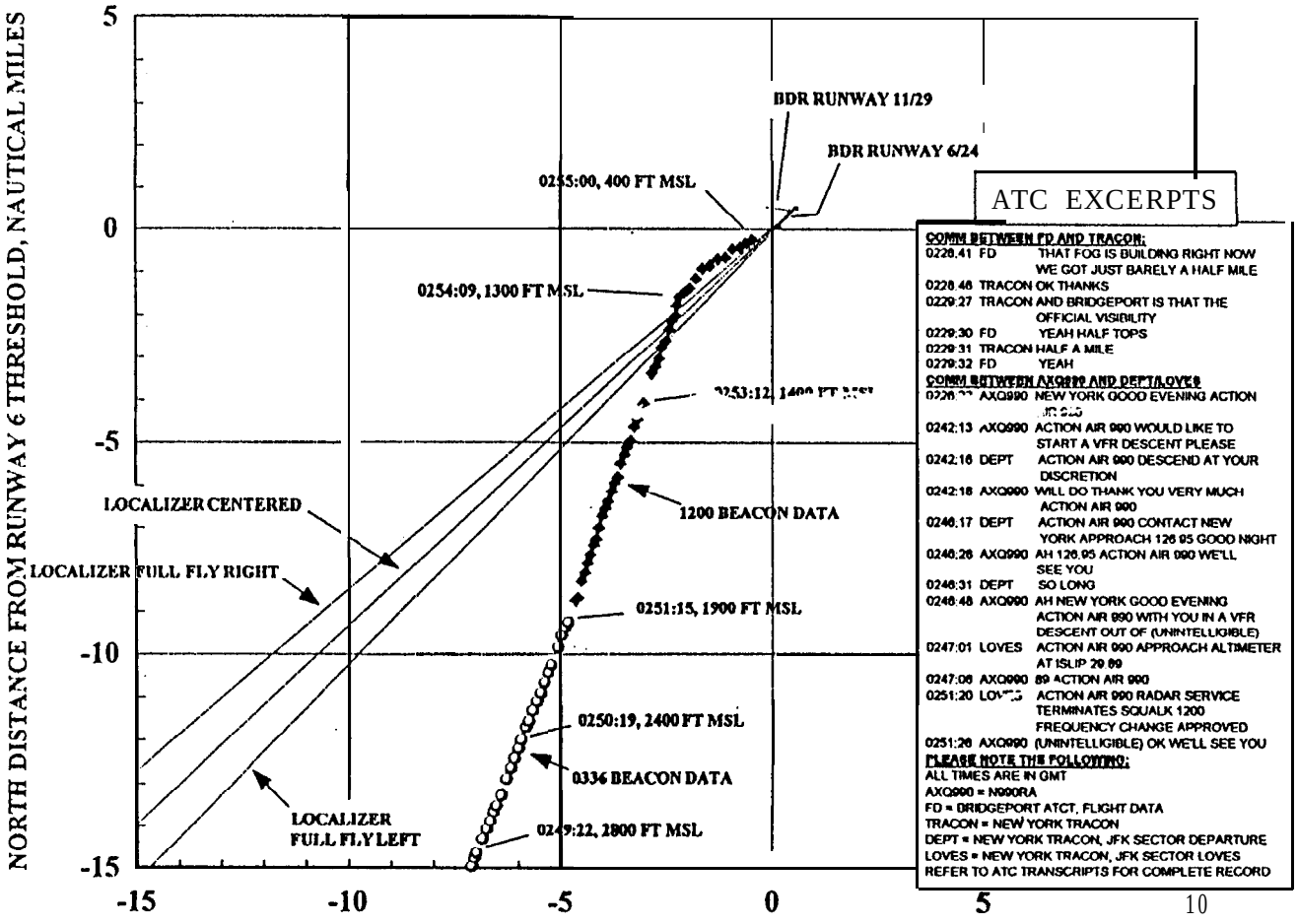
> Take immediate action to evaluate the quality of maintenance performed by Harrington Industries, including the qualifications of the FAA-certified airframe and powerplant mechanics employed there, to ensure that the work performed is in compliance with approved practices. (Class I, Urgent Action) (A-94-111)

> Take immediate action to identify airplanes that have been repaired, refurbished, or repainted by Harrington Industries, inspect their safety belts and seat assemblies for proper installation and use of approved hardware, inspect their flight control surfaces to ensure that balance is within tolerance limitations, and inspect them for any other airworthiness conditions if the need is indicated during the evaluation described in recommendation A-94-1 11. (Class I, Urgent Action) (A-94-112)

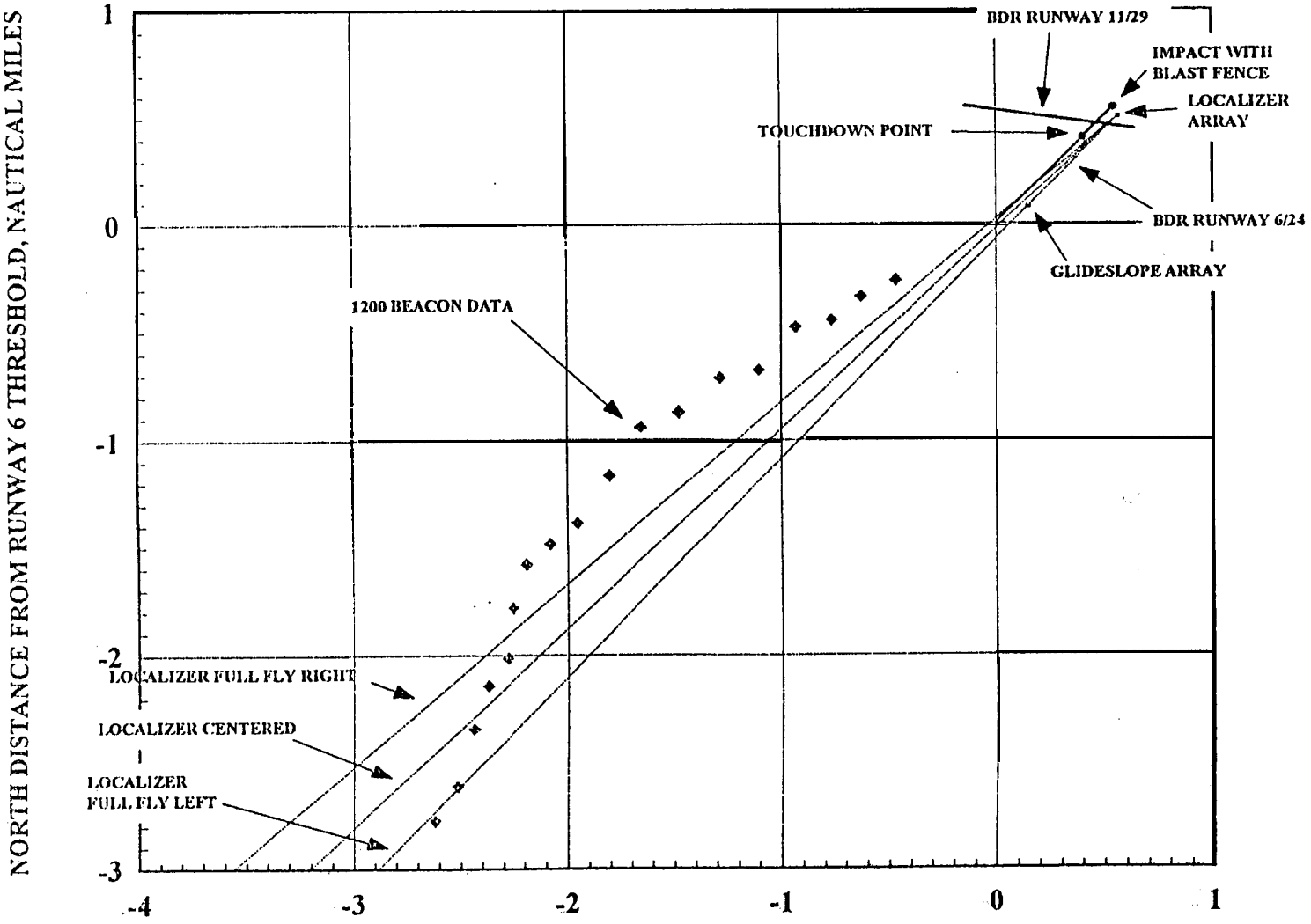
Chairman VOGT, Vice Chairman HALL, and Members LAUBER, and HAMMERSCHMIDT concurred in these recommendations.

By: Carl W. Vogt
Chairman

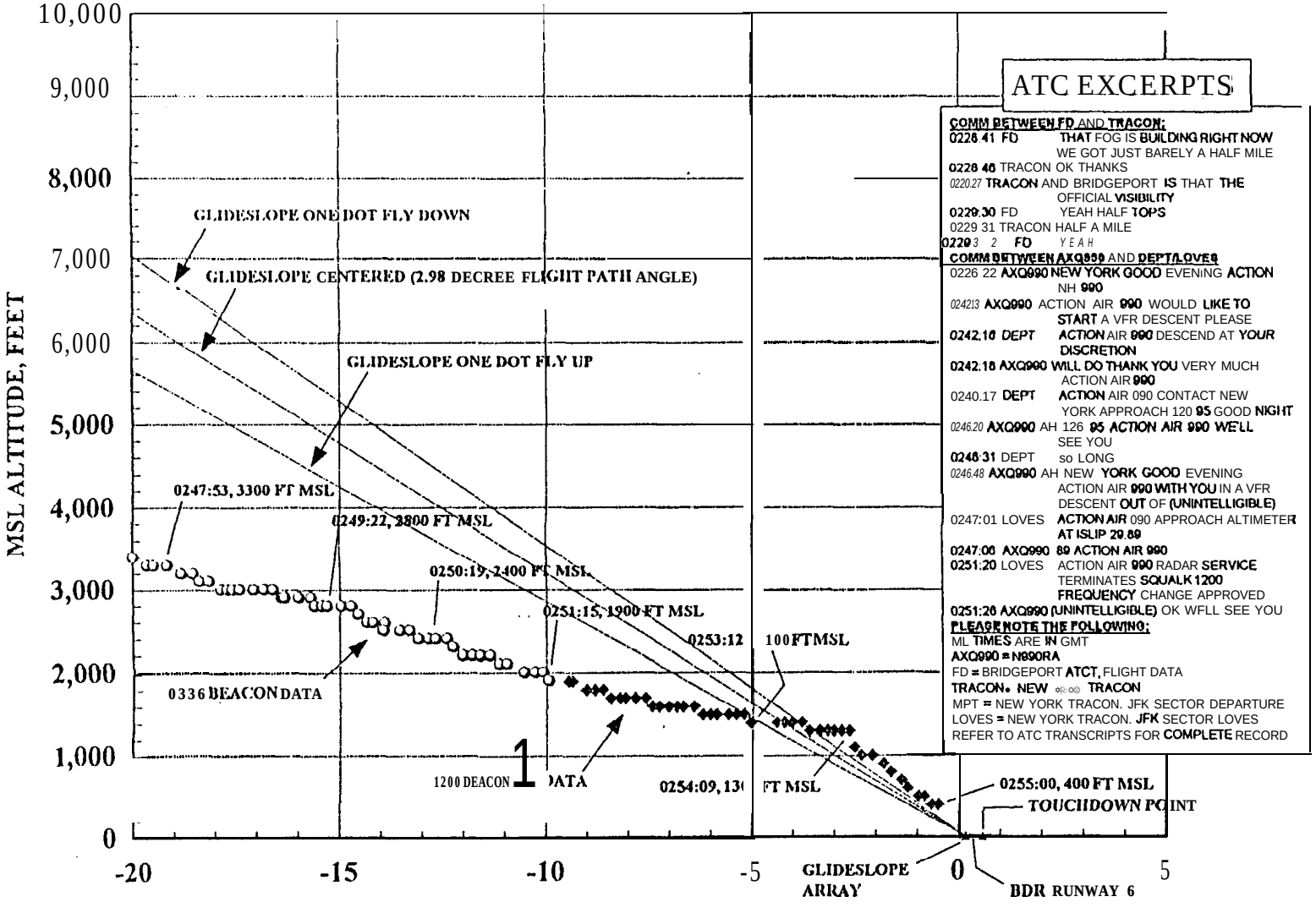
NORTH vs. EAST DISTANCE FROM RUNWAY 6 THRESHOLD, NAUTICAL MILES
DCA94MA051, PIPER PA-31-350 CHIEFTAIN, **N990RA**
APRIL **27, 1994,** ACTION AIRLINES @ STRATFORD, CONNECTICUT



NORTH vs. EAST DISTANCE FROM RUNWAY 6 THRESHOLD, NAUTICAL MILES
DCA94MA051, PIPER PA-31-350 CHIEFTAIN, N990RA
APRIL 27, 1994, ACTION AIRLINES @ STRATFORD, CONNECTICUT



MSL ALTITUDE (feet) vs. DISTANCE ALONG EXT. RWY. C/L (nm)
DCA94MA051, PIPER PA-31-350 CHIEFTAIN, **N990RA**
APRIL **27, 1994,** ACTION AIRLINES **@** STRATFORD, CONNECTICUT



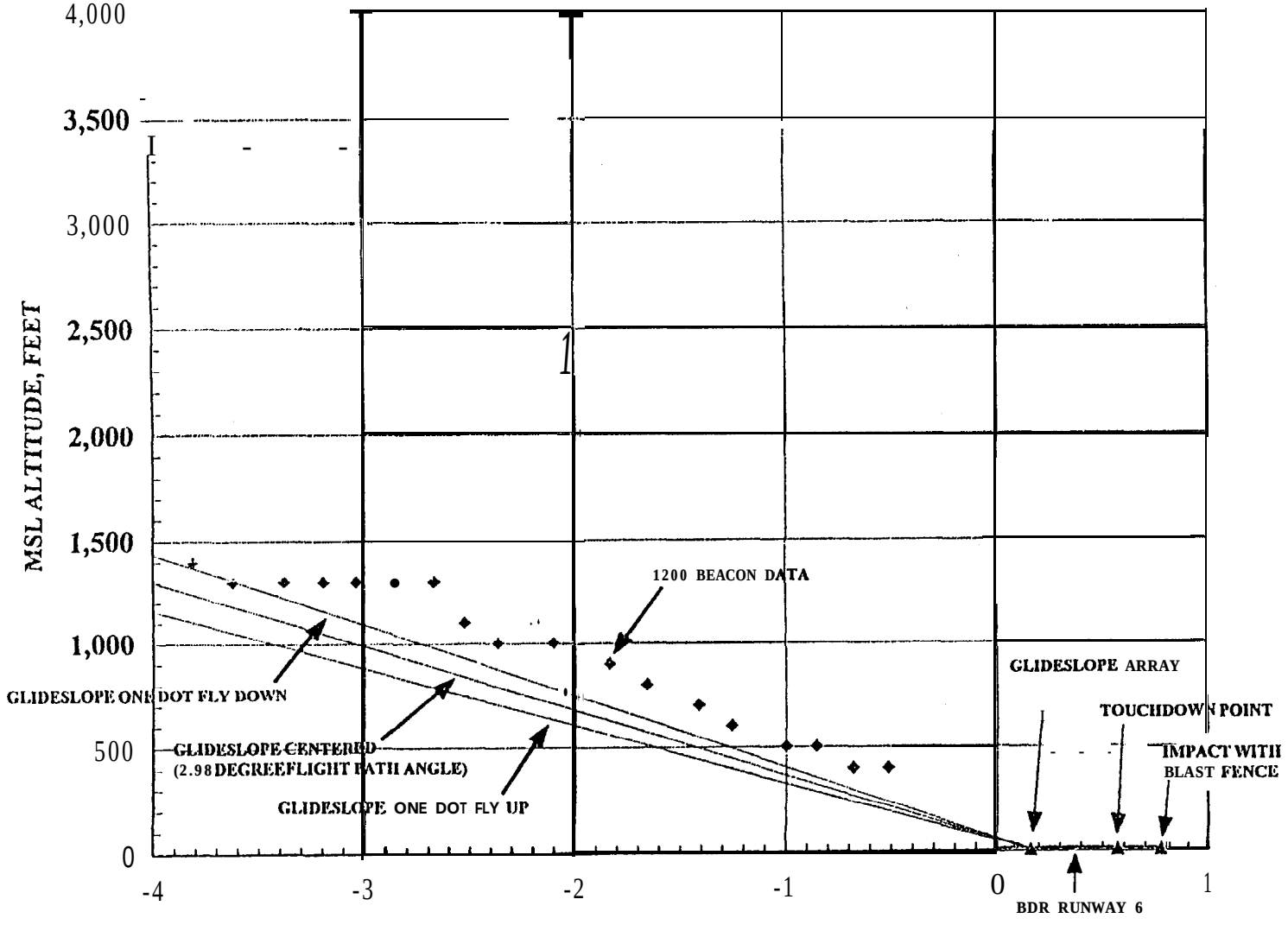
ATC EXCERPTS

COMM BETWEEN FD AND TRACON:
0226.41 FD THAT FOG IS BUILDING RIGHT NOW WE GOT JUST BARELY A HALF MILE
0226 46 TRACON OK THANKS
0220.27 TRACON AND BRIDGEPORT IS THAT THE OFFICIAL VISIBILITY
0229:30 FD YEAH HALF TOPS
0229 31 TRACON HALF A MILE
0229 3 2 FD YEAH
COMM BETWEEN AXQ990 AND DEPT/LOVES
0226 22 AXQ990 NEW YORK GOOD EVENING ACTION NH 990
024213 AXQ990 ACTION AIR 990 WOULD LIKE TO START A VFR DESCENT PLEASE
0242.16 DEPT ACTION AIR 990 DESCEND AT YOUR DISCRETION
0242.18 AXQ990 WILL DO THANK YOU VERY MUCH ACTION AIR 990
0240.17 DEPT ACTION AIR 090 CONTACT NEW YORK APPROACH 120 95 GOOD NIGHT
0246.20 AXQ990 AH 126 95 ACTION AIR 990 WE'LL SEE YOU
0246:31 DEPT so LONG
0246.48 AXQ990 AH NEW YORK GOOD EVENING ACTION AIR 990 WITH YOU IN A VFR DESCENT OUT OF (UNINTELLIGIBLE)
0247:01 LOVES ACTION AIR 090 APPROACH ALTIMETER AT ISLIP 29.89
0247:06 AXQ990 89 ACTION AIR 990
0251:20 LOVES ACTION AIR 990 RADAR SERVICE TERMINATES SQUALK 1200 FREQUENCY CHANGE APPROVED
0251:26 AXQ990 (UNINTELLIGIBLE) OK WFLL SEE YOU
PLEASE NOTE THE FOLLOWING:
ML TIMES ARE IN GMT
AXQ990 = N990RA
FD = BRIDGEPORT ATCT, FLIGHT DATA
TRACON. NEW TRACON
MPT = NEW YORK TRACON. JFK SECTOR DEPARTURE
LOVES = NEW YORK TRACON. JFK SECTOR LOVES
REFER TO ATC TRANSCRIPTS FOR COMPLETE RECORD

DISTANCE ALONG RUNWAY 6 EXTENDED CENTERLINE, RELATIVE TO RUNWAY 6 THRESHOLD, NAUTICAL MILES

Note: X and Y axes on this graph are not to same scale (feet vs. nm), which results in the flight path angle appearing to be steeper than it actually is.

MSL ALTITUDE (feet) vs. DISTANCE ALONG EXT. RWY. C/L (nm)
DCA94MA051, PIPER PA-31-350 CHIEFTAIN, **N990RA**
APRIL **27, 1994,** ACTION AIRLINES @ STRATFORD, CONNECTICUT



DISTANCE ALONG RUNWAY 6 EXTENDED CENTERLINE, RELATIVE TO RUNWAY 6 THRESHOLD, NAUTICAL MILES

Note: X and Y axes on this graph are not to same scale (feet vs. nm), which results in the flight path angle appearing to be steeper than it actually is.