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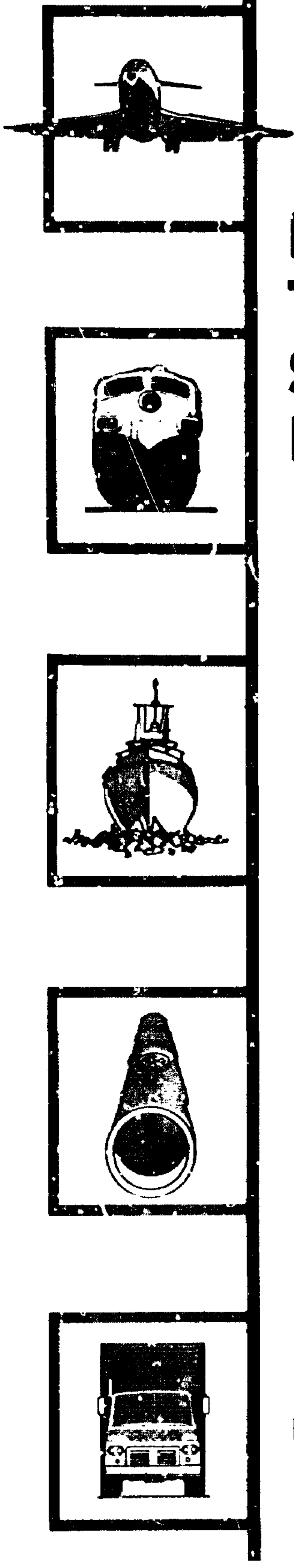

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

**EAGLE COMMUTER AIRLINES, INC.,
PIPER PA-31-350, NAVAJO CHIEFTAIN, N59932
WILLIAM P. HOBBY AIRPORT
HOUSTON, TEXAS
MARCH 21, 1980**

NTSB-AAR-81-4

UNITED STATES GOVERNMENT

TECHNICAL REPORT DOCUMENTATION PAGE

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16. Abstract

On March 21, 1980, at 1949, Eagle Commuter Airlines, Inc., Flight 108, a Piper PA-31-350, with a pilot, a pilot-in-command trainee, and eight passengers on board, crashed on takeoff from runway 22 at William P. Hobby Airport, Houston, Texas. The pilot, the pilot-in-command trainee, and five passengers were killed, and three passengers were injured seriously. The aircraft was destroyed by the crash and the postcrash fire.

The aircraft, which made a normal takeoff, was about 278 lbs over its maximum allowable gross takeoff weight and had a center of gravity about 3 in beyond the rear limit. Passengers reported surging and popping noises from an engine when the aircraft was about 50 ft above the runway. They also reported that the aircraft veered to the right. The crew reported to the tower controller they had lost the right engine. The aircraft began a turn to the right, entered a shallow dive, and crashed on an airport parking ramp. During the crash sequence, the aircraft struck two other aircraft and four cars before hitting a hangar.

The National Transportation Safety Board determines that the probable cause of the accident was a power loss in the right engine for undetermined reasons at a critical point in takeoff, the aircraft's marginal single-engine performance capability, and the captain's incorrect emergency response to the engine power loss when he failed either to land immediately on the remaining runway or to configure the aircraft properly for the engine-out condition.

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Adopted: March 3, 1981

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PIPER PA-31-350 NAVAJO CHIEFTAIN, N59932
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HOUSTON, TEXAS
MARCH 21, 1980

SYNOPSIS

On March 21, 1980, at 1949, Eagle Commuter Airlines, Inc., Flight 108, a Piper PA-31-350, with a pilot, a pilot-in-command trainee, and eight passengers on board, crashed on takeoff from runway 22 at William P. Hobby Airport, Houston, Texas. The pilot, the pilot-in-command trainee, and five passengers were killed, and three passengers were injured seriously. The aircraft was destroyed by the crash and the postcrash fire.

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1. FACTUAL INFORMATION

1.1 History of the Flight

On March 21, 1980, Eagle Commuter Airlines, Inc., Flight 108 was a commuter air carrier flight from William P. Hobby Airport, Houston, Texas, to Brownwood, Texas, and was scheduled to depart Hobby Airport at 1915. 1/ Two intermediate stops were scheduled. It was operating behind schedule because

1/ All times herein are central standard time based on the 24-hour clock.

of delays in the first three flights of the day which were flown by the same captain who was readying Flight 108. The aircraft had been on the ground for 31 minutes between the time it landed and the time it taxied for takeoff. Two crewmembers and eight passengers were on board Flight 108.

At 1941, the ground controller cleared Flight 108 to taxi to runway 22. At 1943:40, the captain reported that Flight 108 was "ready to go on 22," and at 1945:10 transmitted "Eagle Air 108 is No. 1 for 22." At 1945:55, Flight 108 was cleared to taxi into position and to hold on runway 22. A pilot of an aircraft in the runup area adjacent to runway 22 stated that Flight 108 did not use the runup area, nor did he see the crew conduct an engine runup while awaiting takeoff clearance.

At 1947:50, Flight 108 was cleared for takeoff, and at 1948:35, the tower air traffic controller inquired if Flight 108 would be making a right turn away from the airport. Flight 108 responded, "Eagle 108 just lost the right engine." The controller stated that when this transmission was made the aircraft was about 4,300 ft from the start of its takeoff roll and about 100 ft above the runway. A pilot witness on the ground stated that the aircraft was between 100 and 200 ft above the runway when the crew reported the loss of the right engine. An Eagle Airlines employee identified the person who made the transmission as a company employee--a pilot-in-command trainee who was in the copilot seat.

The aircraft maintained runway heading for about 10 sec more before it began a right turn and a shallow descent. The rate of turn, the angle of bank to the right, and the rate of descent continued to increase as the aircraft turned 90° away from the runway heading. The angle of bank also increased as the aircraft descended, but the crew managed to level the wings just before impact.

A passenger who was seated two seats behind the captain stated that when the aircraft was about 50 ft in the air he heard an engine "sputter" which continued until impact. The aircraft "dropped, veered left, then right, and down." He recalled that a crewmember said, "What's next or what do we do now." A passenger on the right side, four seats back, heard a "popping or thudding" noise after the aircraft left the runway and veered to the right. He recalled that someone said, "What do I do?" The third survivor was seated in the left rear seat. He heard an engine go "pop-pop like a backfire." He saw the captain pull back the "left red controls and the right pilot reach and turn things." None of the survivors could tell who was flying the aircraft.

The aircraft crashed on a concrete airport parking ramp in a nearly level pitch attitude, with the right wing slightly lowered, about 1,000 ft from the runway. It then slid 200 ft on the ramp and hit two aircraft, four cars, and finally a hangar. A fire broke out when the aircraft hit the cars and the hangar. The coordinates of the crash site were 29° 38' 7" N latitude and 95° 16' 7" W longitude. The accident occurred during hours of darkness.

1.2 Injuries to Persons

Injuries	Crew	Passengers	Others	Total
Fatal	2	5	0	7
Serious	0	3	0	3
Minor/None	0	0	0	0
Total	2	8	0	10

1.3 Damage to Aircraft

The aircraft was destroyed by impact forces and the postcrash fire.

1.4 Other Damage

The aircraft struck two parked aircraft, four cars, and a hangar. The two aircraft and the hangar were damaged heavily; the four cars were destroyed.

1.5 Personnel Information

The captain was qualified and certificated for the flight and had received the training required by current Federal Aviation Regulations. (See appendix B.) He had completed initial ground school on December 14, 1979, initial flight training on December 13 and 14, 1979, and a 2.5-hour 14 CFR 135 flight check on December 14, 1979. He had been off duty for 15 hours 15 minutes before reporting for duty at 1500 on the day of the accident. On March 20, 1980, the captain had flown 4.6 hours.

The company employee in the copilot seat was a pilot-in-command trainee. He held an Airline Transport Pilot certificate and a current first-class medical certificate. On Flight 108, he was to observe company procedures, learn the routes, and assist the captain with baggage. He had not completed the Eagle Commuter Airlines pilot training program and was assigned no pilot or copilot duties on Flight 108.

1.6 Aircraft Information

The aircraft was certificated and equipped in accordance with current regulations. It was equipped with two Lycoming turbocharged engines, each rated at 350 hp at takeoff (sea level, standard day). The aircraft, manufactured in 1975, was certificated under 14 CFR 23.

The captain prepared the weight and balance computation of Flight 108. Eagle Commuter Airlines station agents stated that the captain weighed the luggage of the eight passengers and that a station agent had weighed four cardboard boxes which had a combined weight of 155 lbs. The captain used the Federal Aviation Administration (FAA)-approved standard average passenger weight of 165 lbs for each passenger and the standard 170-lb average weight for each crewmember. The total passenger weight for eight passengers at 165 lbs per passenger was 1,320 lbs, whereas their actual weight was about 1,549 lbs. Four of the passengers weighed 205 lbs or more, and the captain and the pilot-in-command trainee weighed 210 lbs and 179 lbs, respectively. The passenger and freight manifest for Flight 108, initialed by the captain, listed the aircraft gross weight as 7,000 lbs with a center of gravity of 135.4 in. The maximum certificated gross takeoff weight was 7,000 lbs and the center of gravity limits were 126 in forward and 135 in aft. The postaccident weight and balance computation revealed that the actual takeoff weight was at least 7,278 lbs and the aft center of gravity limit was exceeded by at least 3 in.

Although not having actually observed the captain, a station agent stated that the captain loaded the aircraft himself. The passenger and freight manifest that was prepared by the captain of Flight 108 listed the following information:

Basic empty weight of aircraft plus crew (2 x 170) 5,063 lbs

	Number	x	Weight (lb) =	Total	
Passenger	8		165	1,320	
Carry-on Luggage	8		7.1	57	
Luggage	Actual		Actual	200	
Freight	-		-	-	
Fuel	60		6	360	
		Total		1,937	1,937 lbs
		Gross Weight			7,000 lbs
		Maximum Allowable Gross Weight			7,000 lbs
		Center of Gravity			135.4 in

Because the aircraft was burned severely, it was not possible to weigh the passenger baggage or to determine the exact location of the baggage in the aircraft. However, no remains of baggage were found in the forward baggage compartment. The Safety Board used the baggage weight of 200 lbs listed on the passenger and freight manifest to calculate the actual gross weight. The figure included the four boxes which weighed 155 lbs. For weight and balance purposes, the four boxes were figured in the rear baggage area, since one passenger stated that he saw some boxes in the back of the aircraft. In addition, an FAA inspector at the crash site saw some boxes in the back of the aircraft. The remaining 45 lbs were divided equally among the nacelle baggage compartments since burned luggage was found in these areas. The seven fatalities were weighed by the coroner and the survivors were asked their weights. A weight of 7.1 lbs was added to each passenger weight to reflect the eight pieces of carry-on luggage the captain noted on the manifest. Passenger seat locations were documented by the survivors and the coroner.

The following is the Safety Board's weight and balance calculation using actual passenger weights and the manifest information provided by the captain:

Item	Weight (lbs)	Arm[2/] (in)	Moment
Basic airplane	4,723	124.1	586,124.30
Captain	210	95.0	19,950.00
Copilot seat	179	95.0	17,005.00
Seat 3 and carry-on luggage	191.1 (184+7.1)	132.0	25,225.20
Seat 4 and carry-on luggage	237.1 (230+7.1)	132.0	31,297.20
Seat 5 and carry-on luggage	252.1 (245+7.1)	163.5	41,218.35
Seat 6 and carry-on luggage	169.1 (162+7.1)	163.5	27,647.85
Seat 7 and carry-on luggage	167.1 (160+7.1)	195.0	32,584.50
Seat 8 and carry-on luggage	162.1 (155+7.1)	195.0	31,609.50
Seat 9 and carry-on luggage	215.1 (208+7.1)	229.0	49,257.90
Seat 10 and carry-on luggage	212.1 (205+7.1)	242.0	51,328.20
Rear baggage area	155	255.0	39,525.00
Right nacelle - forward	11.25	145.0	1,631.25
Right nacelle - rear	11.25	192.0	2,160.00
Left nacelle - forward	11.25	145.0	1,631.25
Left nacelle - rear	11.25	192.0	2,160.00
Fuel - inboard tanks	360	126.8	45,648.00
	7,277.8		1,006,003.05
		Arm (in)	138.23

1.7 Meteorological Information

The surface weather observation at the airport, taken by the National Weather Service at 1950 was:

Clear, visibility--15 mi; temperature--56°F;
dewpoint--45°F; wind -- 180° at 7 kns;
altimeter setting--30.11 inHg.

1.8 Aids to Navigation

Not applicable.

1.9 Communications

There was no evidence of communications difficulties.

1.10 Aerodrome Information

William P. Hobby Airport, elevation 47 ft m.s.l., has three hard-surface runways. (See figure 1.) Runway 4/22, constructed of asphalt and concrete, is 7,600 ft long by 150 ft wide. The clear zone beyond runway 22 was flat and unobstructed except for the approach light system. A road bisects the clear zone about 1,300 ft from the departure end of runway 22.

2/ For balance purposes, the horizontal distance in inches from the reference datum to the center of gravity of an item.

1.11 Flight Recorders

The aircraft was not equipped, nor was it required to be equipped, with flight recorders.

1.12 Wreckage and Impact Information

The aircraft struck the concrete parking ramp in a nearly level pitch attitude and the right wing slightly lowered. The initial impact was about 1,000 ft to the right of runway 22 and the impact heading was 310°. The aircraft slid 200 ft on a 310° heading. It struck two aircraft, four cars, and an aircraft hangar. The fire, fed by fuel from the cars and aircraft, erupted when the aircraft struck the four cars parked near the hangar.

The aircraft remained intact during the impact sequence, and all control surfaces were located within the immediate area of the crash site. Damage to the vertical stabilizer was minor, the elevators were not damaged, and the rudder had only minor impact damage. Rudder and elevator trim tabs were not damaged. The flight control system to the empennage was destroyed by fire. The nose structure was crushed and displaced rearward about 3 ft when it struck the cars and hangar. The fuselage forward of the passenger door, and the entire right wing were completely destroyed by the fire. The bottom of the fuselage was crushed upward on the average of 6 in for the length of the fuselage. The landing gear was up and locked, and the wing flaps were extended 15°.

The left engine was intact and the nacelle and engine assembly remained attached to the wing. The entire assembly was damaged extensively by the postimpact ground fire. The exterior of the engine was coated with oil. All cylinders were intact and fastened to the crankcase. The upper cooling fins of the Nos. 2 and 4 cylinders had heavy compression-type damage. The bottom portion of the oil sump was crushed upward. Both crankcase halves were intact; however, only the left half received impact damage. The accessory case was intact, but was burned severely. The fuel servo injector components were intact and showed signs only of heat damage. The operating components of the dual magneto were intact and, with the exception of one distributor block tower, free from impact damage. A bright blue spark was produced at each magneto terminal when the magneto driveshaft was rotated.

The right engine and nacelle remained attached to the wing. The exterior of the engine was damaged extensively by the postaccident fire. Both crankcase halves shattered at a point above and behind the oil sump. The oil sump was broken into two sections and a portion had separated from the crankcase halves. The accessory case was generally intact and was burned severely. Except for the alternator, the engine accessories were in their installed positions. Each of the accessories was burned or heat damaged. The dual magneto distributor block was burned and cracked by heat at many locations. Except for the charred magneto breaker contact points, all internal components above the distributor were missing. Spark plugs, installed in each cylinder, displayed no excessive carbon buildup, oil deposits, or erosion. About 50 percent of the fuel servo injector was recovered, including the fuel regulator assembly. The fuel servo injector regulator had been burned but was intact and attached to the engine by fuel lines.

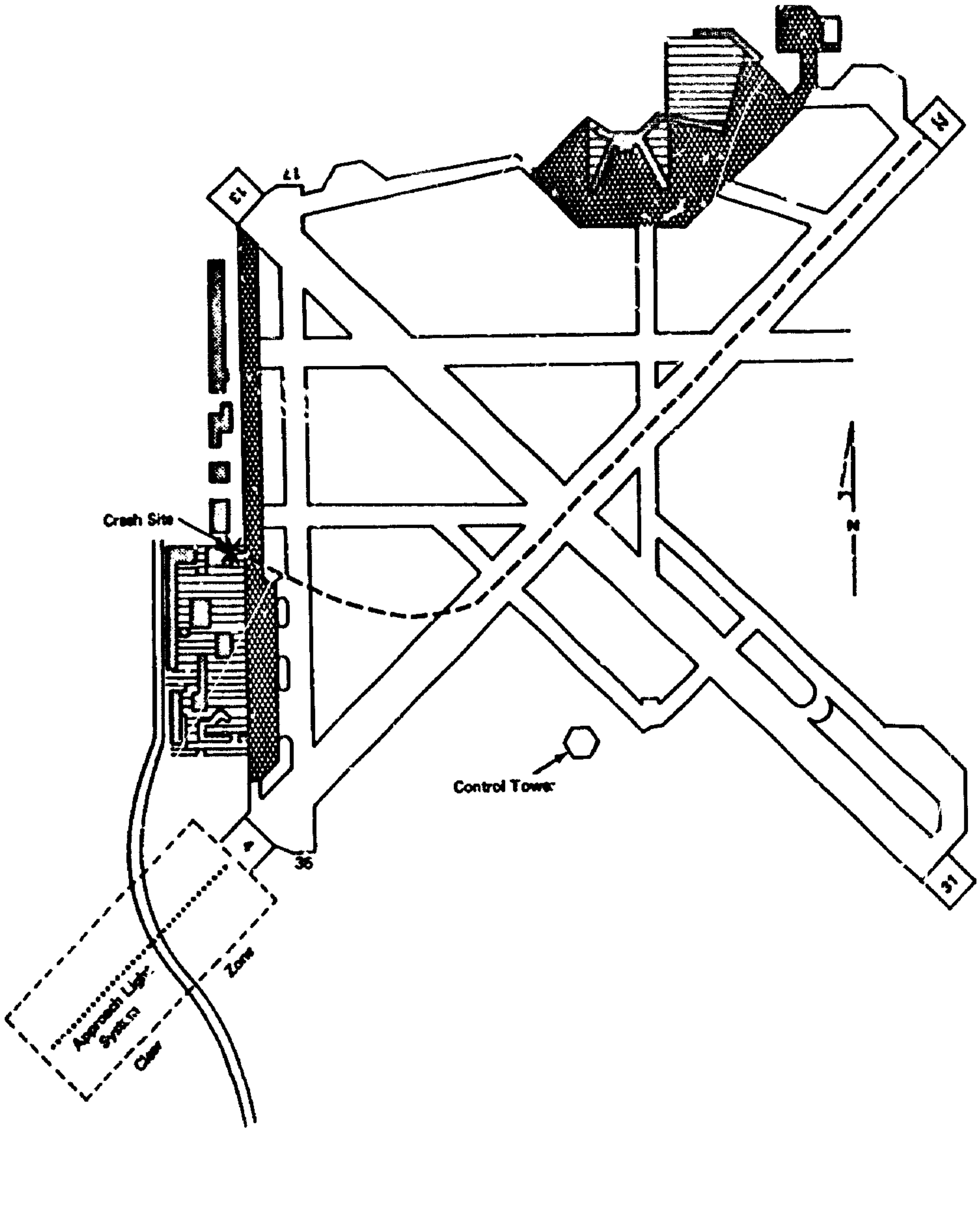

Figure 1--Diagram of William P. Hobby Airport
and probable flight track of Flight 108.

The turbocharger was burned, but received no impact damage. Although none of the cylinder assemblies were damaged by impact, all of the cylinder intake pipes were crushed and scraped.

The right propeller spinner and most of the spinner bulkhead were destroyed by ground fire. All the propeller blades were melted partially. Blade R-1, fractured 10 in from the blade tip, was bent rearward about 45° toward the face side. The blade, indicated by the position of the counterweight, was beyond the normal feathered position. Blade R-2, bent rearward about 90° and curled opposite the direction of rotation, was fractured about 3 in from the tip of the blade. The blade was near the low pitch position. About 20 in of the tip of blade R-3 was missing, but the remaining stub did not appear to have any abnormal twisting or bending. The blade was near the feathered position.

The left propeller spinner was crushed around the dome in the area of blade L-2. The dome and hub assembly was intact, but damaged by the postimpact fire. The six propeller mounting studs and blade counterweights were not damaged by impact.

Blade L-1 was bent forward 90° toward the camber side at the outboard end of the deicer boot. The blade tip was additionally bent and curled in a high pitch direction. The leading edge chordwise had been gouged severely. The blade was beyond the feathered position. Blade L-2 was normal except for the last 5 in of the tip which was bent forward about 85°. The leading and trailing edges were not damaged. The blade was near the feathered position. Blade L-3 was bent rearward 10° to 15° at the midblade position. The last 5 in of the tip was bent rearward about 360° in a smooth spiral. The leading edge had several dents. The blade was near the feathered position.

1.13 Medical and Pathological Information

Postmortem and toxicological examinations of the pilot and the pilot-in-command trainee disclosed no evidence of factors which would have detracted from their physical ability to operate the aircraft. Postmortem examinations did not indicate which crewmember was manipulating the controls at impact.

Examination of the captain, the pilot-in-command trainee, and four of the deceased passengers disclosed that they died of impact trauma. Most of the occupants received bilateral rib fractures and fractured sternums. There was no indication of extensive facial or head injuries.

The fifth passenger, rendered unconscious by a fractured skull, died in the postcrash fire. He sustained impact injuries which were different from those of other passengers, even though his seat and the cabin area surrounding it received essentially the same impact damages as the other seats and the rest of the cabin.

1.14 Fire

The aircraft was burned severely during the postcrash fire. The right main fuel cell ruptured during the crash. Initially, the major fire damage was confined to the area of the right wing. One of the cars was leaning against the right engine while two other cars were in contact with the right engine and wing. The fire from the right fuel tank destroyed the cars and caused the fuel from some of them to burn.

The fire progressed into the cockpit and cabin areas. The interior of the aircraft, the cabin wall, and the roof were gutted from the lower window edge on the right side to the top of the window line on the left side. The cabin roof was destroyed from a point 2 ft forward of the entry door. Although the cabin roof aft of the entry door to the empennage was not burned, the interior of that section was destroyed by fire.

1.15 Survival Aspects

The accident was not survivable for the captain and the pilot-in-command trainee because of damage to the cockpit area and the high vertical decelerative g forces. The accident was partially survivable for the passengers because the cabin area remained relatively intact and its shape was maintained.

The structural damage to the aircraft seats indicated high downward vertical forces, which inflicted download damage to the seat pans and leg structures of the two cockpit seats. In addition, they were displaced slightly to the right. The seat pans for seats 3 and 4 were separated from the leg structures, which were damaged severely. (See figure 2.) The inboard floor track was torn loose. The areas of attachment for both seat tracks had been displaced downward. Seats 5 and 7 remained attached to the floor, but had collapsed down and to the right. Seat 8 was attached to the rear outboard leg; the front legs had collapsed downward. Seat 10 was torn loose from the attachment plate. The inboard rear leg attach pin separated from the leg and remained in the floor plate while the other pins remained with the seat. The cabin floor was crushed downward about 3 in at the front leg position. Seats 6 and 9 were not found.

Fire consumed most of the seatbelt fabric of the restraint systems. Two buckles were found, both with the belt inserts in the buckle assemblies. The captain's seatbelt was latched, but the shoulder harness was not used. The buckle of the pilot-in-command trainee was unlatched and the shoulder harness was destroyed.

The right overwing exit window was found away from the main wreckage; it was not usable because it was blocked by a car. The main cabin door was open and was used by survivors to escape from the aircraft.

The occupants of seats 5, 7, 8, 9, and 10 survived the impact. The occupants of seats 5, 8, and 9 were able to escape by themselves, while the occupant of seat 10 was removed from the aircraft by persons at the accident site. He later died in the hospital. The occupant of seat 7 did not escape from the aircraft. However, the postmortem examination indicated that he received a nonfatal fractured skull injury and died in the postcrash fire.

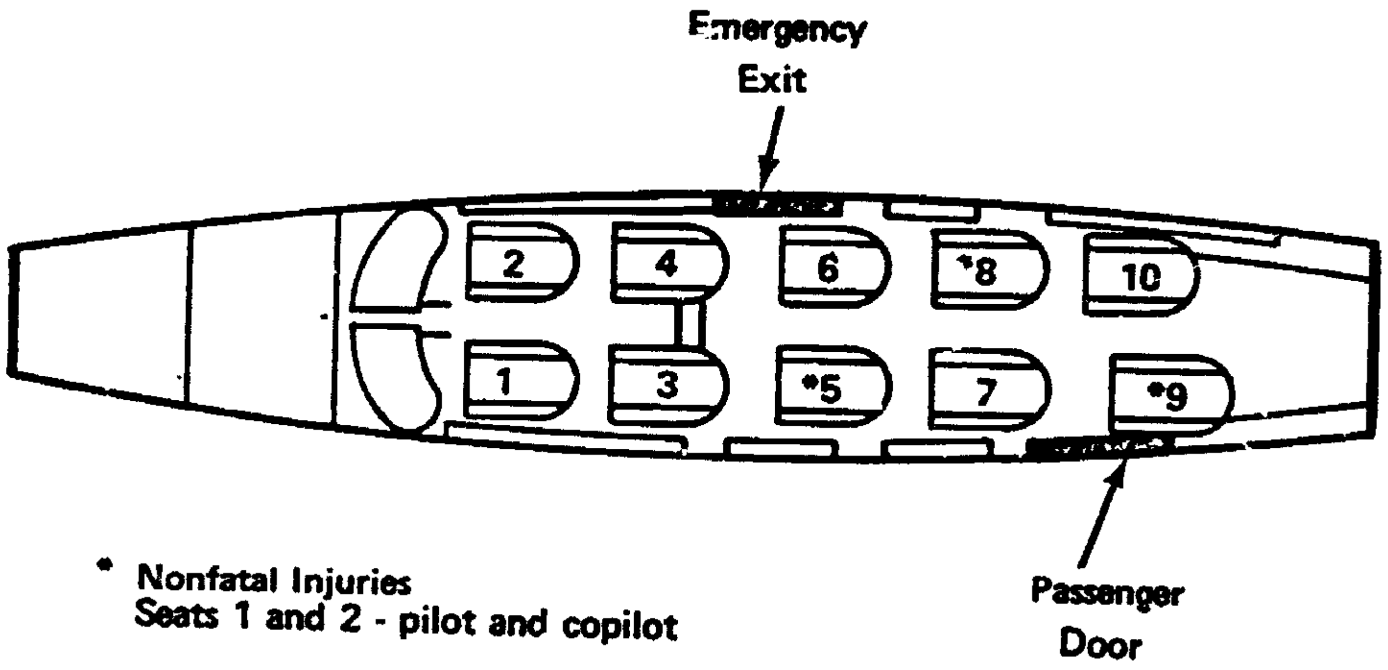

Figure 2--Seat diagram.

Control tower personnel alerted the Houston fire department station at the airport at 1950 and the first unit was on scene at 1951. The fire was completely extinguished at 2100. Eight fire department vehicles and five ambulances responded to the scene.

1.16 Tests and Research

1.16.1 Powerplants

The Safety Board's powerplants group disassembled the engines and examined the accessories. The left and right engine fuel servo injectors were examined at the Bendix Energy Control Division, Bendix Corporation. The left and right engine turbochargers, the associated wastegate assemblies and density controllers, and differential pressure controllers were examined at Garrett AiResearch Manufacturing Company facilities. The dual magnetos of both engines were tested and disassembled at Bendix Electrical Components Division facilities.

No mechanical defects or abnormalities were found during the disassembly, examination, or functional testing of the engines or accessories. All damage to the engines and accessories was caused by impact or fire.

The examination of the right engine fuel servo injector regulator assembly indicated that the regulator valve stem had fractured in the thread area near the stem of the shaft. The fractured stem was examined under the supervision of a Safety Board metallurgist. The regulator stem suffered an instantaneous-type fracture from a side overload; no preexisting damage was found. The regulator assembly diaphragm retaining nut was installed and secured properly. The regulator valve seat examination indicated that the regulator valve was open at the time of the accident.

The Safety Board examined the left and right propellers and corresponding governors at Hartzell Propeller facilities. The propellers were disassembled and the internal operating components were inspected. No mechanical defects were found in either propeller.

During the disassembly of the left propeller, marks were found on the three preload plates opposite the cut-out portion. When matched with the pitch change fork, the marks indicated that the pitch change fork was at a high blade angle position when the marks were made. A high blade angle indicates a feathered propeller. Marks were noted on two of the right propeller blade preload plates. The imprints matched the contour of the pitch change fork tines. The location of the imprints corresponded to a low blade angle position of the pitch change fork.

Both propeller governors were disassembled and examined; each was reassembled, and the damaged propeller governor bases were replaced. A functional test, performed on a test stand, conformed to the manufacturer's test specifications including the feathering function. No mechanical defects or abnormalities were found during the examination of either propeller or propeller governor, and no mechanical reason was found which would have caused the left propeller to feather itself or to be feathered because of an engine problem.

1.17 Additional Information

1.17.1 Company Procedures

The following procedures were extracted from the aircraft flight manual:

TAKEOFF AND CLIMB

Before takeoff the following should be checked:

1. All seat belts/shoulder harnesses fastened
2. Crossfeed off
3. Fuel on inboard tanks
4. Mixtures rich
5. Propellers set
6. Emergency fuel pumps-on
7. Engine instruments normal
8. Flaps sets - 15 degrees
9. Trim tabs set
10. Controls free
11. Pitot heat as required
12. Alternator inoperative light-check
13. Doors locked

Takeoff is accomplished using full throttle, full rich mixture, and full increase RPM. Rotate the aircraft at 90 MPH.

After the takeoff has proceeded to a point where a landing can no longer be made wheels-down in the event of power failure; the wheels and flaps should be retracted. Once a single-engine climb speed of 125 MPH and a 400-foot altitude have been reached, the power should be reduced to best climb settings.

ENGINE FAILURE DURING TAKEOFF

a. If there is adequate runway remaining for deceleration - CUT POWER IMMEDIATELY AND STOP STRAIGHT AHEAD.
b. If there is inadequate runway remaining and sufficient margin of airspeed above Vmc [3/] is not yet attained, the following procedure is recommended:
   (1) Throttles-close
   (2) Master switch-off
   (3) Main fuel valves-off
   (4) Firewall shut-off valves-off
   (5) Continue straight ahead turning to avoid obstacles, if necessary

3/ Minimum control airspeed with the critical engine inoperative. Based on takeoff flaps, retracted landing gear, maximum available horsepower on the operating engine, propeller windmilling on the inoperative engine, and a 5° bank into the operating engine.

c. If engine failure occurs when sufficient airspeed above Vmc is obtained, the pilot must decide whether to abort the take-off or attempt a single engine take-off. His decision should be based on his judgement considering the runway remaining, density altitude, loading, obstruction, weather and his own capability.

DETECTING A DEAD ENGINE

a. Loss of thrust
b. Aircraft will yaw in the direction of the inoperative engine

FEATHERING PROCEDURE

a. Maintain direction and adequate airspeed
b. Mixtures--forward
c. Props--forward
d. Throttles--forward
e. Gear--retract
f. Flaps--retract
g. Emergency fuel pumps--on
h. Air conditioning--off (if installed)
i. Identify inoperative engine
j. Throttle on inoperative engine--retard to verify
k. Prop on inoperative engine--feather
l. Mixture on inoperative engine--idle cut off
m. Emergency fuel pump on inoperative engine--off
n. Magnetos on inoperative engine--off
o. Cowl flaps--close on inoperative engine, as required on good engine
p. Alternator circuit breaker switch for inoperative engine--off
q. Electrical load--reduce, to prevent battery depletion
r. Trim--as required--retrim for landing
s. Fuel management--fuel off on inoperative engine, consider crossfeed
t. Land at first opportunity
u. Circuit breaker for inoperative engine fuel boost pump—off

ENGINE FAILURE DURING CLIMB

a. Follow feathering procedure.
b. Hold single engine best rate-of-climb speed of 125 mph (109 Kts); climb at 130 mph (113 Kts) for high ambient temperature.
c. Watch cylinder head temperature--adjust cowl flaps to maintain temperature at or below maximum allowable.

Maximum Take-Off and Landing Weight 7,000 LBS

IT IS THE RESPONSIBILITY OF THE AIRPLANE OWNER AND PILOT TO ASSURE THAT THE AIRPLANE IS PROPERLY LOADED. MAXIMUM ALLOWABLE GROSS WEIGHT IS 7000 POUNDS. SEE "WEIGHT AND BALANCE SECTION" FOR LOADING INSTRUCTIONS.

The following procedures were extracted from Eagle Commuter Airlines, Inc., Operations Manual:

Preflight Action and Inspection

It will be the responsibility of the pilot-in-command to determine that the following requirements are met:

(2) Determine that the aircraft is loaded in compliance with applicable weight-and-balance limitations per appropriate sample loading schedules, load computer, or applicable information and graphs contained in the aircraft flight manual.

Training

The training section of the Eagle Commuter Airlines Operations Manual provided descriptions of flight maneuvers, which included the objective of the maneuver, the manner in which the maneuver would be demonstrated by the instructor and performed by the student, and performance standards. The following maneuvers were covered, in part, in the training section:

1. Emergency Operations--partial or complete power malfunctions; rejected takeoff.
2. Maneuvering with one engine inoperative.
3. Engine-out minimum control speed demonstration.
4. Use of engine-out best rate-of-climb speed.
5. Engine failure at takeoff.

The training section of the operations manual provides the following directions for engine failure on takeoff:

1. There are two speeds which are of vital importance in any actual or simulated engine failure during takeoff: Vmc and Vyse. [4/] The trainee will state these two speeds aloud as he pulls onto the runway to begin takeoff. There are three situations through which each takeoff must pass before reaching a safe altitude for maneuvering: (Engine failure)

(A) On takeoff roll before becoming airborne when engine fails.

(B) Airborne at a speed below Vyse when engine fails.

4/ Vyse - Best single engine rate-of-climb speed. Based on gear retracted, flaps retracted, critical engine propeller feathered, and full throttle on operating engine.

(C) Airborne at a speed at or above Vyse when engine fails.

* * * *

3. Situation B usually requires an immediate landing because of altitude loss required to increase speed to Vyse. The variables such as remaining runway, aircraft weight, altitude, density altitude and single-engine performance must be considered in deciding whether it is safer to land immediately or to accelerate to Vyse and continue flight.

NOTE: The minimum speed for all normal takeoffs is Vmc + 5.

4. Situation C leaves but one major decision to the pilot, which is where to land. After reaching Vyse, and before reaching a safe maneuvering altitude, the pilot must decide whether to land on the remaining runway, or performance permitting, continue climbing on one engine to a safe maneuvering altitude. If the last option is selected, follow the procedures outlined below.

Maintain Vyse, retract the landing gear with a maximum bank angle of 5 degrees to maintain directional control. Identify and simulate propeller feather on failed engine. Adjust pitch to maintain Vyse.

Weight and Balance

Eagle Commuter Airlines operations specifications, approved on July 30, 1979, by the FAA, authorized the "use of average passenger weights to complete passenger loads over any route." From November 1 through April 30, each adult would be listed as 165 lbs. The average passenger weight included "minor items normally carried by a passenger, such as handbags and attache cases. The use of average passenger weight is not authorized in the case of flights carrying passengers whose average weight obviously does not conform with the normal standard weight."

The operations specifications also stated:

"IN ANY EVENT, REGARDLESS OF WHICH METHOD IS USED, THE AIRCRAFT MUST NOT EXCEED ALLOWABLE WEIGHT AND CENTER OF GRAVITY LIMITS."

On March 31, 1980, the company operations specifications were changed, in part, as follows:

1. Actual or computed passenger weights are authorized.

2. Actual weights require that the passenger and all major articles be weighed.

3. Computed weights will be determined by asking each passenger his/her weight. Between November 1 and April 30, 5 lbs will be added to the asked weight.

4. Actual or asked crew weights will be used.

The purpose of the change in the operations specifications was "to assure that passenger, crew and baggage weights for aircraft with 9 or less passengers seating configuration does not exceed weight and balance limitations."

1.17.2 Aircraft Performance

The aircraft performance of Flight 108 was computed based on the meteorological conditions at the time of the accident and a gross weight of 7,278 lbs. The performance chart in the aircraft flight manual provided standard-day data for aircraft weights up to 7,000 lbs. Since operations at weights above 7,000 lbs are not authorized, no performance data are available for that weight regime. The Safety Board based performance data for Flight 108 on an extrapolation of flight manual data for aircraft weights up to 7,000 lbs.

Performance element	Theoretical extrapolated values Flight 108	Flight manual data
Ground run — 0 mph - 90 mph with 4-kn headwind	1,322 ft	1,242 ft
Ground run acceleration time to 90 mph	20 sec	18 sec
Total distance to clear 50 ft obstacle	2,991 ft	2,875 ft
Time from liftoff to 50 ft	10.7 sec	10 sec
Flight manual indicated airspeed at 50 ft	116 mph	116 mph
Total distance and time to accelerate from start to takeoff roll to 90 ft above the runway	4,325 ft—38.2 sec	
Indicated airspeed at 90 ft	125 mph	125 mph
Landing distance required from a point 50 ft above the runway, 110 mph and 40° flaps		2,610 ft
Landing distance required from a point 90 ft above the runway, 110 mph and 40° flaps	About 4,000 ft	

The best single-engine rate-of-climb speed (Vyse) of 125 mph would have resulted in a rate of climb of 230 ft/min for a 7,000-lb PA-31-350. That rate, according to the aircraft flight manual, would be attained with landing gear and flaps up, right propeller feathered, and a 5° bank into the operating engine. Assuming a linear progression, Flight 108 should have been capable of a single-engine rate-of-climb of 190 ft/min if the aircraft was configured properly and Vyse was maintained.

The minimum control speed for the PA-31-350 is 90 mph indicated airspeed. Vmc, according to 14 CFR 23.149, is predicated on takeoff flaps, retracted landing gear, maximum available horsepower on the operating engine, propeller of the inoperative engine windmilling, and a bank angle of zero to 5° into the operating engine. The aircraft flight manual does not specify if Vmc is based on a wings-level attitude or a 5° bank. However, after the accident the manufacturer stated that a 5° bank into the operating engine was used when Vmc was determined.

The stall speeds specified in the manual apply to a power-off, 15° flap setting, 7,000-lb condition. Under these conditions, the stall speed is 88 mph with 0° bank, 89 mph with 10° bank, 92 mph with 20° bank, and 96 mph with 30° bank. Power-on stall speed data are not required to be published. Power-on, however, would reduce the stall speed.

1.17.3 Federal Aviation Administration Surveillance

The Fort Worth Flight Standards District Office (FSDO-61) holds Eagle Commuter Airline's Air Carrier Operating Certificate and was responsible for surveillance of the company. From September 26, 1979, until February 13, 1980, the following surveillance was conducted: 10 ramp inspections, 3 en route inspections, and on February 12, 1980, a base inspection which included a review of the operational procedures. There was no indication that ground or flight training was observed by FSDO inspectors.

FAA Notice 8000.183, issued October 23, 1979, provides interim guidance for the approval of weight and balance programs for Part 135 operators. The Notice required that authorizations for the use of average passenger weights for aircraft with nine or less passenger seats be deleted from operations specifications. Actual or weights ascertained by asking the passengers were to be used.

On January 11, 1980, FAA Order 8000.189 provided further guidance on weight and balance programs and authorized a weight range system which would provide for "detection of and for manageable accommodation of passengers outside that weight range." The operator's revised average passenger weight system had to be approved by FAA Headquarters, Washington, D.C.

FAA Order 8430.1B, issued on January 29, 1980, states that for aircraft with passenger seating configurations of nine or less seats, "The use of average passenger weights derived from AC-135-1C should no longer be authorized."

The Eagle Commuter Airlines operations specifications governing weight and balance were approved on July 30, 1979. No change in the weight and balance program was required by the FAA FSDO, nor was the program changed, until the authorization for the use of average weights was deleted on March 31, 1980.

1.18 Useful or Effective Investigative Techniques

None

2. ANALYSIS

2.1 Power Loss and Crew Response

The aircraft was certificated in accordance with regulations and approved procedures. All flight control systems functioned properly. The company records contained no indication of previous discrepancies on the right engine which could have resulted in a malfunction.

The flightcrew reported a power loss on the right engine shortly after liftoff and survivors corroborated that report. Examinations of both engines revealed no evidence of preimpact failures or malfunctions, and postaccident disassembly and examination of the right engine showed that all of the internal operating components were intact and undamaged. Additionally, examination revealed that at impact the right engine propeller was in the low-pitch position and the left engine propeller in the feathered position.

The operating accessories of the engine were burned severely, and only parts of the individual operating accessories were found. Although ground fire may have obliterated a preimpact discrepancy which might have caused a transient engine malfunction, no discrepancies were discovered in the remains of the dual magneto and turbocharger system.

A transient engine malfunction in the fuel servo injector would likely occur if fuel flow was interrupted by a disengaged retaining nut in the diaphragm assembly. However, the regulator section of the fuel servo was recovered from the wreckage relatively undamaged and the nut was installed correctly and in its normal position.

Power loss would also result from fuel contamination or a break in the fuel line. However, since no fuel was added at Houston and since the aircraft had operated without problems on the previous flight, the Safety Board discounted fuel contamination as a possible cause of the power loss. Since the fuel system was destroyed in the ground fire, the continuity of the system could not be determined completely.

In spite of the foregoing, the Safety Board must conclude, based on the flightcrew and survivors' reports, that the right engine experienced a transient power loss shortly after the aircraft lifted off the runway. Since no defects were discovered in the testing and inspection of the right engine, the source of the interruption probably was within one of the burned engine operating accessories.

Although the Safety Board could not determine the reason for the power loss, it believes that the power loss should not have resulted in an accident. For this reason, the Board evaluated the aircraft's takeoff profile under the conditions that existed at the time of the accident. The evaluation was limited by the lack of actual performance data such as that which would have been provided by a flight data recorder. Also, limitations are inherent in assumptions about the profile of Flight 108 which were made as a result of witnesses' observations made at night from a distance of more than 1/2 mile.

The Safety Board believes that Flight 108 climbed to about 90 ft before it experienced a power loss in the right engine since (1) the captain probably would have aborted the takeoff before liftoff if the engine malfunction occurred earlier, (2) the ground roll and initial climb computations were compatible with the observed flight profile performance requirements, and (3) survivors reported that the aircraft was airborne when the engine problem started. Additionally, the tower controller and ground witnesses stated th. . the aircraft was about 100 ft above the ground when the crew reported the loss of the engine. Flight 108 would have required about 1,669 ft to climb to 50 ft after liftoff, a total of 2,991 ft from the start of the takeoff roll. (These computations are reasonable for a 2-engine climb of a 7,278 lb-aircraft, since the flight manual figure for a 7,000-lb aircraft is 2,875 ft.) Flight 108 would have reached 90 ft of altitude in another 1,334 ft, a total of 4,325 ft or 38.2 sec from the start of the takeoff roll. The difference between the cleared-for-takeoff time at 1947:50 and the report of the loss of the right engine at 1948:35 was 45 sec, which would have allowed the 38.2 sec to climb to 90 ft and 6 sec to initiate the transmission to the air traffic control tower and begin the takeoff roll. This sequence is confirmed by witnesses' observations, times on the air traffic control tapes, and the computed flight profile based on flight manual performance data.

Assuming that the aircraft lifted off the runway at an airspeed of 90 mph to 95 mph, its speed would have been about 116 mph at 50 ft above the runway and about 125 mph at 90 ft above the runway. These airspeeds are consistent with flight manual performance data and with the observed performance of Flight 108 from the start of the takeoff roll to a point 4,325 ft down and 90 ft above the runway.

Based on these calculations, the loss of power occurred in the right engine at a critical time in the takeoff. Although an indicated airspeed of 125 mph (Vyse) could have been achieved, the power loss would have resulted in an immediate decrease in airspeed because of a loss of thrust. Because of the drag induced by the unfeathered right propeller and by the 15° flap setting, the indicated airspeed would have continued to decrease until the captain had configured the aircraft for Vyse. Since the flaps remained in the 15° position and the right engine propeller was not feathered, the aircraft did not have the capability to climb once power was lost.

Had the captain immediately feathered the right propeller, raised the flaps, and banked into the operative engine, the aircraft still would have decelerated from 125 mph and may have lost altitude during this 3- to 8-sec period. Once configured properly, the aircraft probably had the capability, although slight, to maintain level flight. However, directional control would have been possible as long as the indicated airspeed remained above Vmc. The captain could have then put the aircraft in a shallow descent to regain Vyse. This would have been a difficult decision at night and from an altitude of less than 90 ft.

Since the captain did not configure the aircraft properly after the power loss, the most viable option available to him was to land straight ahead, a course of action which should have been apparent because of the aircraft's decreasing airspeed and improper configuration. This option should have been readily apparent to the captain since the Eagle Commuter Airlines training guidance specifically states that when an engine fails on takeoff and the aircraft is airborne and below Vyse, an immediate landing is usually required "because of altitude loss needed to increase to Vyse." Also, there was sufficient runway and unobstructed area available on which to land with minimum damage to the aircraft. Beyond the intersection of the two runways was about 3,200 ft of runway and 1,300 ft of unobstructed area. If the captain had reduced power on the left engine and lowered the gear and flaps, he could have landed and stopped the aircraft in about 4,000 ft. This distance could have been reduced further if short-field landing techniques had been used.

The captain apparently was unprepared for the suddenness of the engine power loss, described by witnesses as a veer to the right accompanied by sputtering and popping noises, because he failed to feather the right engine propeller and raise the flaps, and he either asked or failed to respond to questions of "what do we do now." He did maintain the runway heading for about 10 sec, but apparently was so distracted by the loss of engine power, the noises from the engine, and the lack of visual orientation because of darkness that he allowed the aircraft to enter a bank to the right as the airspeed decreased. If the airspeed decreased below Vmc, directional control would have been impossible and the right bank would have increased until power was reduced on the left engine. If he continued to attempt to maintain the runway heading by applying full rudder deflection rather than by establishing a 5° bank into the left engine, the captain's ability to maintain directional control would have decreased further. The full rudder deflection would have resulted in a high drag configuration which in turn would have raised Vmc above the 90 mph listed in the aircraft flight manual.

The examination of the powerplant revealed that the left engine propeller had been feathered by the flightcrew, a fact difficult to explain since the right engine reportedly had lost power and since the flight profile indicated that the left engine was a major influence on the aircraft for some time after the reported loss. The Safety Board believes that during the seconds after the reported power loss, the captain maintained the runway heading while a state of confusion existed in the cockpit. The confusion, which was confirmed by the surviving passengers, may have been a result of the noises from the right engine, the belief that the right engine would recover, the darkness, or a combination of these factors. However, as the indicated airspeed decreased to Vmc, a bank and turn to the right developed. At this point the captain feathered the left propeller, either by mistake or intentionally, in an effort to reduce power on the engine. By this time, the aircraft was probably well into the right turn so that when the left engine was feathered there was sufficient inertia to continue the right turn. In any event, he was able to nearly level the wings before impact. While intentional feathering is possible, the thrust reduction could have been achieved by closing the throttle on the left engine.

Based on the evidence, the Safety Board concludes that the captain, who was certificated properly and qualified by Federal regulations for the flight, responded inappropriately to the emergency. While the loss of an engine during takeoff is critical to safe flight, it was covered in detail in the company's training program which he had undergone 3 months before the accident, and the specific options and emergency procedures were clear. In addition, the criticality of a precise response to a loss of engine or takeoff emergency is stressed in multiengine aircraft training. Because the captain was an experienced PA-31-350 and multiengine pilot, and a multiengine aircraft flight instructor, he should have been able to identify the emergency situation and properly respond. Apparently the captain was not mentally prepared to analyze and respond to the engine failure.

The single-engine performance of the aircraft involved in this accident was predicated on several factors which were established under optimal operating conditions; these conditions rarely exist in emergency situations. As the Safety Board stressed in its special study, 5/ "The ability to fly the aircraft in precisely the proper attitude and configuration to achieve the maximum climb performance is difficult at best, and highly dependent on knowledge of, and proficiency in, the emergency situations." Since most light twin-engine aircraft with piston engines have a single-engine rate of climb of 200 fpm to 400 fpm at sea level, any shortcoming in pilot technique or aircraft loading will reduce already marginal single-engine performance. A light twin-engine aircraft which loses power on an engine shortly after takeoff will not have the capability to continue the takeoff unless the pilot analyzes the emergency correctly and responds immediately. The pilot must also be prepared to accept the possibility that continued single-engine flight is not possible and that a controlled landing straight ahead is the safest option. The Safety Board believes that pilots must be trained to expect marginal single-engine performance following engine failure on takeoff from many light twin-engine aircraft. Certain critical information relating to engine loss shortly after takeoff in light twin-engine aircraft is not stressed sufficiently in pilot training or is not taken into account when emergency procedures are developed.

The Safety Board recommends that emergency training stress that many light twin-engine aircraft, properly configured for single-engine climb, have a marginal capability to maintain level flight at speeds below Vyse and very limited capabili[illegible] to climb even at airspeeds of Vyse. As a result, when an aircraft loses power on takeoff, the pilot must raise the landing gear and flaps, identify and feather the inoperative propeller, and establish a bank into the operating engine before the airspeed falls below Vyse. At the same time, he must lower the nose of the aircraft to a level flight attitude or a slight nosedown attitude. Realistically 3 sec to 8 sec [illegible] be required to accomplish the proper emergency response, during which time the aircraft may decelerate at up to 3 kns per sec. The aircraft would have to be at some airspeed greater than Vyse in order to provide the pilot with the opportunity to configure the aircraft properly and still preserve Vyse. The FAA, in Advisory Circular 61-21A, "Flight Training Handbook," recognizes the need for airspeed above Vyse "... sufficiently... to permit attainment of that speed quickly and easily in the event power is suddenly lost on one engine." If the airspeed does fall below Vyse, the pilot probably must lower the nose of the

5/ Special Study: "Light Twin-Engine Aircraft Accidents Following Engine Failures, 1972-1976" (NTSB-AAS-79-2).

aircraft to accelerate back to Vyse, since he cannot rely upon the aircraft to accelerate to Vyse in level flight. The low altitudes at which a power loss on takeoff occurs causes the latter maneuver to be difficult, and may encourage a pilot to attempt to continue single-engine flight below Vyse.

2.2 Preflight Planning

The captain's preflight planning was inadequate since he computed and approved a weight and balance which allowed an overgross condition and which contained a center of gravity which was clearly beyond the aft limit.

The overgross weight/aft center of gravity condition probably had little effect on the accident sequence, since the aircraft would have climbed at 190 fpm on one engine if it had been reconfigured quickly and if Vyse had been achieved and maintained. However, the aft center of gravity would have made the yaw to the right more pronounced, and the flight controls would have required more displacement for controlled flight. The exact handling characteristics of the aircraft could not be determined because no flight test data for an overgross weight/aft center of gravity condition existed.

The captain was authorized to use the average passenger weight method for weight and balance computation provided the passengers conformed in size to the 165-lb average weight contained in the operations specifications. However, the captain was required to determine if the passengers were in the 165-lb range. Since five of the eight passengers did not conform with the average weight, and four of the passengers far exceeded the weight, the captain was required to use the actual passenger weight method which was approved in the operations specifications.

Using average passenger and crew weights, the captain determined that the aircraft would be at the maximum allowable gross takeoff weight. At that point he knew the gross weight of the aircraft exceeded the limit because he and the pilot-in-command trainee exceeded the average crew weight by a total of 49 lbs. Finally, the captain computed the center of gravity at 135.4 in, which was beyond the aft limit. In fact, the center of gravity computation alone was basis for the captain to recompute and verify the weight and balance for Flight 108.

The use of average passenger weights instead of actual weights, and the out-of-limit center of gravity condition clearly indicate that the captain did not follow the procedures specified in the operations specifications. The captain was either careless or was attempting to shorten the turnaround to make up time lost on the schedule.

In several recent commuter airline accidents, the Safety Board has underscored its concern with the operational management of weight and balance programs and with the manner in which the pilot-in-command has implemented the program. 6/ In this case, the Safety Board believes that Eagle Commuter Airlines may not have monitored adequately the manner in which individual pilots performed weight and balance planning. As illustrated by other accidents, this inadequate monitoring, coupled with other pressures on the pilot-in-command, can lead to weight and balance deficiencies which result in unsafe flight conditions.

The FAA did not insure that Eagle Commuter Airlines adhere to the procedural changes specified in the FAA notices and orders issued on weight and balance between October 1979 and January 1980, or require that the weight and balance program be revised in accordance with the notices and orders.

The Safety Board urges commuter and air taxi operators to exert strong management control of critical programs such as preflight and weight and balance planning, especially when the administration of the programs is solely within the purview of the pilot-in-command. Additionally, FAA inspectors must conduct surveillance in a manner which insures that companies implement the weight and balance procedures approved in the airline operations specifications.

2.3 Survival Aspects

The g forces that the aircraft and occupants experienced were calculated based on an indicated airspeed at impact of 100 mph, an altitude of 50 ft at a distance of 300 ft from the impact point, and an average descent angle of 8°. Based on these assumptions, the vertical speed of the aircraft at the initial impact was about 22 ft/sec and the horizontal speed was about 145 ft/sec. These speeds and the crushing damage exhibited by the bottom of the fuselage indicate that the average peak vertical decelerative load was about 29 g's. This vertical load was sufficient to cause the seat pans to separate and fail downward.

The fracture patterns exhibited by the crew and occupants support the conclusion of a crash sequence where high vertical g forces caused the occupants to move downward through the seat pan. When coupled with the horizontal deceleration load, the occupants' chests were forced downward into contact with the knees and the anterior portion of the thighs. The average peak horizontal decelerative load was about 21 g's. Although the aircraft continued to decelerate throughout the 200 ft slide after the initial impact, the g forces were greatest when the aircraft struck the cars and the hangar.

6/ Aircraft Accident Report: "Air East, Inc. B99A, Johnstown-Cambria County Airport, Johnstown, Pennsylvania, January 6, 1974" NTSB-AAR-75-3); Aircraft Accident Report: "Rocky Mountain Airways, Inc., DHC 6-300, Cheyenne, Wyoming, February 27, 1979" (NTSB-AAR-79-10); Aircraft Accident Report: "COMAIR, Inc., Piper PA-31, N6642L, Covington, Kentucky, October 8, 1979" (NTSB-AAR-80-8); Aircraft Accident Report: "Puerto Rico International Airlines, Inc., DH-114, Christiansted, St. Croix, U.S. Virgin Islands, July 24, 1979" (NTSB-AAR-80-3); and Aircraft Accident Report: "Universal Airways, Inc., Beech 70, Excalibur Conversion, Gulfport, Mississippi, March 1, 1979" (NTSB-AAR-79-16).

The near absence of head and facial fractures commonly observed in accidents with similar longitudinal decelerative loads was attributed to the position the occupants were forced into during the initial impact. When the occupants were forced downward into the seat pan, they were also thrown into a semivertical brace position. This position prevented the head and upper torsoes from flailing and from hitting the seat in front.

Initially, five of the six occupants who were seated aft of the wing spar survived the impact, while all four occupants forward of the spar died. With the exception of two of the survivors' seats that exhibited slightly more seat leg deformation than the other seats, the examination of the cabin interior revealed that the areas on both sides of the wing spar received virtually identical damage. The distribution of the survivors in relation to the wing spar was probably caused by the slight nosedown attitude of the aircraft at the initial impact. The occupants forward of the spar would have received greater vertical deceleration loads than the rear occupants, who would have been protected by the absorption of energy in the forward fuselage and the continuing collapse of the fuselage structure aft of the spar. It is also likely that the engines and the wing spar were still absorbing energy after the forward occupants had received the peak vertical decelerative load. Finally, the rearmost occupants benefited from the upward slope of the fuselage beneath seats 7, 8, 9, and 10 which probably allowed more time for the decelerative forces to be absorbed.

Instrumented Piper Navajos were tested by the National Aeronautics and Space Administration (NASA) at three different pitch angles--12° nosedown, 4° noseup, and 14° noseup--but at equal flightpath angles and velocities. The pitch-down test showed floor accelerations in front of the spar structure that were more than twice as high (70 g's) as those behind the spar (30 g's). 7/ Therefore, the Safety Board concludes that, given current industry design practices of airframes and interior furnishings, the impact conditions were not survivable for the occupants seated forward of the spar and were marginally survivable for those seated aft of the spar.

Also, the impact conditions would have been survivable for more of the occupants if known energy-absorbing principles had been incorporated into the design of the seating systems. On December 17, 1980, the Safety Board released a safety report in which the lack of such safety principles in general aviation aircraft was discussed in detail. 8/

7/ Vaugh, et. al., "Light Airplane Crash Tests at Three Pitch Angles," NASA Technical Paper 1481, November 1979.
8/ Safety Report: "The Status of General Aviation Aircraft Crashworthiness," National Transportation Safety Board, Washington, D.C. 20594 (NTSB-SR-80-2).

3. CONCLUSIONS

3.1 Findings

1. The aircraft was certificated and maintained according to regulations.

2. The propellers, propeller controls, and the flight control systems operated properly.

3. The right engine experienced a power loss when the aircraft was about 90 ft above the runway.

4. The reason for the power loss could not be determined; evidence to establish the cause of the power loss was probably destroyed in the postcrash ground fire.

5. The aircraft was at or slightly below Vyse when power was lost.

6. The airspeed began to decrease as soon as power was lost.

7. Since the captain never feathered the right propeller or raised the flaps, the airspeed continued to decrease until directional control could not be maintained.

8. As the airspeed decreased to Vmc, the angle of bank to the right developed.

9. The captain probably feathered the left propeller by mistake as the right turn increased and the indicated airspeed was Vmc or less.

10. With the left propeller feathered, the captain was able to level the wings after the aircraft started to descend.

11. The captain did not configure the aircraft for single-engine flight, and as a result, the aircraft did not have a climb capability after the power loss.

12. The captain should have been able to analyze the emergency and determine which options were available and which emergency procedures were necessary.

13. A straight-ahead emergency landing was a viable option available to the captain after the power loss.

14. Sufficient runway and overrun existed to land and stop the aircraft with minimum damage.

15. The captain was certificated and trained properly according to regulations.

16. The preflight preparations by the captain were inadequate because the aircraft was over gross weight and beyond the aft center of gravity limit.

17. The captain should have realized that the passenger weight was substantially more than the total derived from the use of the average weight formula.

18. The captain was required to use actual passenger weights in accordance with the operations specifications.

19. The overgross weight/aft center of gravity condition made the aircraft more difficult to fly, but did not contribute to the loss of power or the options available to the captain after the power loss.

20. The FAA office responsible for the surveillance of the airline failed insure that the weight and balance program was modified to meet the most recent FAA notices and orders.

21. The aircraft sustained greater vertical impact forces than horizontal forces.

22. Most of the fractures received by the occupants resulted from vertical impact forces.

3.2 Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was a power loss in the right engine for undetermined reasons at a critical point in takeoff, the aircraft's marginal single-engine performance capability, and the captain's incorrect emergency response to the engine power loss when he failed either to land immediately on the remaining runway or to configure the aircraft properly for the engine-out condition.

4. RECOMMENDATIONS

On August 8, 1980, the National Transportation Safety Board issued safety recommendation A-80-68, which stated:

> Require that only actual passenger weights be used in weight and balance computations for reciprocative engine aircraft used in Part 135 flights which are certificated for nine or less passengers. (Class II, Priority Action) (A-80-68).

The FAA responded, on November 6, 1980, that "this was accomplished on an interim basis by internal notices culminating April 1, 1980. Final implementation of this recommendation is by Advisory Circular, AC 120-27A, Weight and Balance Control, issued May 14, 1980, and by internal instructions to FAA airworthiness inspectors, which are under development. The thrust of FAA's efforts in this area is to cause the certificate holders to develop suitable weight and balance control systems that can be easily managed by pilots or other personnel responsible for loading, in accordance with methods and procedures provided by the respective certificate holder. The FAA considers action on Safety Recommendation A-80-68 completed."

The Safety Board's evaluation of this response was contained in a letter to the Acting Administrator on March 20, 1981, which stated in part:

> In Safety Recommendation A-80-68 we recommended that the FAA require that only actual passenger weights be used in weight and balance computations for reciprocating engine aircraft used in Part 135 flights which are certificated for nine or less passengers. Notwithstanding the FAA's internal notices on the subject of aircraft weight and balance Advisory Circular, AC 120-27A, on Weight and Balance Control dated May 14, 1980, commuter airline accidents attributed to aircraft being overloaded and out of balance are continuing. The Board appreciates the actions taken; however, pending FAA's further action to require the use of actual passenger weights, this recommendation will be maintained in an "Open--Acceptable Action" status.

As a result of its investigation of the Eagle Commuter Airline accident in Houston, Texas, on March 21, 1980, and a similar accident in Tusayan, Arizona, on July 21, 1980, the Safety Board issued as an interim measure the following recommendations to the Federal Aviation Administration:

> Require that pilot training programs for 14 CFR 135 certificate holders which operate light twin-engine aircraft include specific ground and flight training in: (1) the factors related to achieving and maintaining Vyse; (2) the capability of company aircraft to maintain level flight at airspeeds below Vyse while in a single-engine configuration; (3) the capability of company aircraft to accelerate to Vyse while in a single-engine configuration; and (4) rapid appraisal of those situations in which a controlled, straight-ahead landing is the safest or only option available. (Class II, Priority Action) (A-81-24)

> Require that aircraft flight manuals for light twin-engine aircraft used in 14 CFR 135 operations contain data related to those conditions in which the aircraft, in a single-engine configuration and at airspeeds between Vmc and Vyse, has the capability to maintain level flight. (Class II, Priority Action) (A-81-25)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JAMES B. KING
Chairman

/s/ ELWOOD T. DRIVER
Vice Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ PATRICIA A. GOLDMAN
Member

/s/ G. H. PATRICK BURSLEY
Member

March 3, 1981

APPENDIXES

APPENDIX A

INVESTIGATION AND HEARING

1. Investigation

The National Transportation Safety Board was notified of the accident about 2130 c.s.t., on March 21, 1980. An Investigator-in-Charge was dispatched from the Safety Board's Fort Worth, Texas, field office, and investigators from the team were sent from Washington, D.C. Investigative groups were formed for operations/witnesses, human factors, powerplants/systems/structures, and maintenance records.

Parties to the investigation were the Federal Aviation Administration, Eagle Commuter Airlines, Inc., and the Piper Aircraft Corporation.

2. Public Hearing

No public hearing or depositions were held.

APPENDIX B

PERSONNEL INFORMATION

Captain Walter J. Mathison

Captain Walter J. Mathison, 33, was employed by Eagle Commuter Airlines, Inc., on December 10, 1979. He held Airline Transport Pilot Certificate No. 1941219, issued August 6, 1979, with an airplane multiengine land rating and commercial privileges in aircraft single-engine land. He also was a certified flight instructor for multiengine aircraft and for instruments. His first-class medical certificate was issued on November 10, 1979, and contained no limitations. He had been off duty for 15 hours 15 minutes before reporting for duty at 1500 on March 21, 1980.

Captain Mathison had a total of 4,313 flight hours, 813 hours of which were in the PA-31-350. He had a total of 1,313 hours of multiengine flight time. He had flown 313 hours and 85 hours in the previous 90 days and 30 days, respectively. Captain Mathison completed initial ground and flight training on December 14, 1979.

Trainee Jud Roach

Mr. Jud Roach, 32, the pilot-in-command trainee, had been hired by Eagle Commuter Airlines, Inc., in January 1980 but had not started the initial ground or flight training program. He held Airline Transport Pilot Certificate No. 2169033, issued on December 27, 1979, with an airplane multiengine land rating and commercial privileges in single-engine land aircraft. He had a type rating in the Cessna Citation. His first-class medical certificate, issued on December 5, 1979, included the limitation of wearing corrective lenses while exercising the privileges of his certificate.

Mr. Roach had a total of 3,250 flying hours, 3,040 of which were listed as multiengine jet flight time. He had no light twin-engine flight time listed in his records. He had separated from the U.S. Air Force in July 1979. He had served as an instructor pilot and flight examiner in the C-141 aircraft.

APPENDIX C

AIRCRAFT INFORMATION

N59932 was a Piper PA-31-350, serial No. 75-52046, manufactured on February 2, 1975, and issued a standard airworthiness certificate. At the time of the accident it had accumulated a total of 5,545.4 hours. The aircraft had flown 88 hours since the last 100-hr inspection and 852 hours since the last annual inspection.

Engine and Propeller Data

Engine Data: AVCO Lycoming TIO-540J2BD

Position	Serial No.	Total time (hr)	Time since overhaul	Date of installation
Left	L-2633-61A	3095.8	1456.8	08-08-79
Right	RL-208-68A	1840.0	None	05-04-79

Propeller Data: Hartzell HC-E3YR-2AFT/JC - Left
Hartzell HC-E3YR -2ALTF/FJC - Right

Position	Serial No.	Total time (hr)	Time since overhaul	Date of installation
Left	DJ-5351	Unknown	722.3	11-07-79
Right	DJ-1306	Unknown	217.0	01-19-80

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