

FB85-910410



# NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

## AIRCRAFT ACCIDENT/INCIDENT SUMMARY REPORTS

CONCORD, CALIFORNIA -- JULY 14, 1984

ATLANTA, GEORGIA -- SEPTEMBER 24, 1984

JASPER, ALABAMA -- DECEMBER 16, 1984

AVALON, CALIFORNIA -- JANUARY 30, 1984

CHARLOTTESVILLE, VIRGINIA -- FEBRUARY 17, 1984

KANSAS CITY, KANSAS -- JANUARY 9, 1985

NTSB/AAR-85/02/SUM

UNITED STATES GOVERNMENT

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16. Abstract This publication is a compilation of the reports of six separate aircraft accidents investigated by the National Transportation Safety Board. The accident locations and their dates are as follows: Concord, California, July 14, 1984; Atlanta, Georgia, September 24, 1984; Jasper, Alabama, December 16, 1984; Avalon, California, January 30, 1984; Charlottesville, Virginia, February 17, 1984; and Kansas City, Kansas, January 9, 1985. A Brief of Accident containing the probable cause is included for each case.					
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# AIRCRAFT ACCIDENT/INCIDENT SUMMARY

File No.: 5003  
Aircraft Operator: Klaus Schroter  
Aircraft Type & Registration: Piper PA-31T, DIKKS  
Location: Concord, California  
Date & Time: July 14, 1984, 1211 P.d.t.  
Persons on Board: 6  
Injuries: 6 fatal  
Aircraft Damage: Destroyed  
Other Damage or Injury: \$80,000  
Type of Occurrence: Loss of control in flight  
Phase of Operation: Approach

On July 14, 1984, about 1212 Pacific daylight time (P.d.t.), a privately owned Piper PA-31T of German registry, DIKKS, crashed about 1/2 mile southeast of Buchanan Airport, Concord, California. The pilot, copilot, and the four passengers received fatal impact injuries, and the aircraft was destroyed by the impact and postcrash fire. Several automobiles were destroyed, and a ground structure was damaged substantially.

The airplane had departed Santa Monica, California, at 1035 P.d.t. for a pleasure flight to Concord. Visual meteorological conditions existed. No flight plan was filed, nor was one required. According to witnesses, when the airplane departed Santa Monica the 54-year-old owner, a citizen of the Federal Republic of Germany (FRG), was in the left front seat, and the right seat was occupied by a 21-year-old United States (U.S.) citizen. Two of the four passengers were FRG citizens and two were U.S. citizens.

At 1205:58, the pilot contacted Buchanan Airport Air Traffic Control (ATC) Tower and advised that the flight (DIKKS) was at approximately 5,000 feet just coming up over the airport and requested landing instructions. DIKKS was instructed to descend to the northeast and to fly a right traffic pattern to runway 32R and to report turning downwind. The acknowledgement from the flight was "that was one nine right?" ATC replied in the negative and repeated the landing instructions, "right traffic three two right"; DIKKS acknowledged.

At 1210:19, the flight reported downwind for 32R and was instructed to follow a Decathlon (Bellanca N2986L) on final approach. DIKKS made a tight base leg turn, and, when the tower controller saw DIKKS "cutting out a Decathlon already on final for runway 32R," he changed the landing runway for the Decathlon

to 32L at 1211:33, and at 1211:52 advised DIKKS that the Decathlon would be landing on the left runway. DIKKS overshot the centerline of 32R on final from the right traffic pattern approach. Witnesses saw the airplane enter into a slow, noseup sharp right turn. The right wing and nose dropped, and the aircraft entered a spin to the right and crashed in a nosedown attitude. Fire erupted within 20 seconds.

A chronology of communications between ATC and the two airplanes that were in the landing pattern follows; all communications were broadcast over the same frequency.

1208:21-ATC           And Cheyenne kilo kilo sierra, did you copy your landing instructions right traffic three two right?

1208:26-DIKKS        That-s affirmative.

1208:27-ATC         Thanks.

1209:05-ATC         Cheyenne kilo kilo sierra traffic-s a twin Cessna on upwind off runway three two right, he'll be a right down wind departure.

1209:11-DIKKS       We'll look.

1210:10-N2986L      Buchanan tower Decathlon two niner eight six lima is two miles out with a light.

1210:14-ATC         Decathlon eight six lima cleared to land.

1210:16-N2986L      Eight *six* lima.

1210:19-DIKKS       Kilo kilo sierra downwind two three right [pause] three two right at Buchanan.

1210:26-ATC         Cheyenne kilo kilo sierra number two follow a Decathlon one and a half mile final with a light.

1210:31-DIKKS       kilo kilo sierra.

1211:24-DIKKS       Kilo kilo sierra I'm coming to the base.

1211:29-ATC         Cheyenne kilo kilo sierra do you have the Decathlon?

[DIKKS did not acknowledge this transmission.]

1211:33-ATC Decathlon eight six lima change to runway three two left, cleared to land.

1211:38-N2986L I've got traffic on short final runway three two left.

1211:41-ATC Decathlon eight six lima he'll be going around change to runway three two left cleared to land.

1211:45-N2986L Eight *six* lima thank you.

1211:52-ATCT Cheyenne kilo kilo sierra the Decathlon will be landing the left runway.

{DIKKS did not respond.}

At 1211:58, an emergency locator transmitter signal was heard on the local control frequency.

There were no language difficulties between the accident aircraft and the air traffic control facilities. Although the ATC tapes disclosed that the U.S. pilot made most of the radio transmissions and the majority of evidence indicates that the owner was in the left front seat, the investigation did not conclusively determine who was flying the airplane when the **accident** occurred. It should *be* noted that *there was same* factual disagreement about which seat each person occupied. Shortly after the accident, based on physical descriptions of the airplane's occupants provided to the Contra Costa County Coroner's office, the Coroner's representative, said the "heavy set man (FRG owner/operator), was sitting front left and a thinner man (U.S. pilot), was sitting front right." **Also**, two witnesses who saw the airplane before takeoff in Santa Monica reported that the owner was in the left front seat. The official Contra Costa County Coroner's report indicates that the owner/operator was in the right seat. When the coroner's office was called about the apparent discrepancy, a coroner's deputy said the report would be amended. However, an amended report was not received, and when contacted in early 1985, the coroner's office reported that no change would be made in the report with respect to seating positions. Based on all the evidence, the Board concluded that the owner/operator was in the left seat.

Toxicological tests on the two pilots were negative for drugs and alcohol.

All requests to obtain logbooks or records from Germany concerning the 54-year-old owner's flight time and experience, and the aircraft and maintenance records have been denied by representatives of the owner; the German Vice Consul in San Francisco provided information from West German aviation records. He reported that the owner of **DIKKS** held a Federal Republic of

Germany commercial: certificate with airplane instrument, single and multiengine land ratings, dated June 12, 1980. The commercial certificate was valid until May 1, 1984. The West German second class medical certificate was issued on May 2, 1983, with a limitation that the pilot must wear corrective glasses. It is not known if the medical certificate was still valid. The owner had approximately 1,400 total hours, but his training, experience, and proficiency in the Piper PA-31T is not known.

The second pilot held a United States private pilot certificate with an airplane single engine land rating issued February 6, 1982. He also held a third class medical certificate issued on August 22, 1983, with an endorsement that he must wear glasses. He had approximately 200 total flight hours, 40 hours logged in DIKKS, and had copiloted the airplane from Germany to the United States 2 weeks before the accident.

The German Vice Consul reported that the airplane was manufactured in 1981, that the current owner had purchased it in November 1983 in Dusseldorf, West Germany, and that it had approximately 1,050 total flight hours at the time of purchase. It is not known how much the airplane was flown by the current owner, or what maintenance had been performed on the airplane, either before or after the purchase. According to Piper Aircraft, the airplane should have been on a progressive maintenance inspection schedule.

Witnesses did not report abnormal engine sounds before the crash, and disassembly of the engines revealed no evidence of power failure before impact. The rudder, elevator, and aileron trim positions were neutral, and the integrity of the flight control system for the elevators and the right aileron was established.

Two weight and balance computations were made following the accident using information supplied by the families of the occupants and by the coroner. One computation assumed baggage weight in the rear of the airplane and one, based on the wreckage site information, assumed the baggage forward of the rear seats. Both computations were within the gross weight limitations and the center of gravity (c.g.) envelope, but the c.g. figures of 136.95 and 136.45 were near the aft c.g. limit of 138 inches.

Tests and research completed in 1977 by Calspan at the request of the Safety Board concluded that the handling characteristics of the PA-31T airplane are poor at slow speeds at the aft certified c.g.:

At 138.00 ins.

All the pilots commented adversely about the longitudinal flying qualities of the aircraft with this c.g. location. They complained of a tendency to

overcontrol (related to very low stick force per g value) and a tendency of the aircraft to wander off in attitude and airspeed (related to the effects of the static instability when the pilot holds the stick) when the pilot was not paying close attention. The dynamically unstable stick-free airspeed response modulated the forces with stick speed changes and no doubt contributed to the tendency to overcontrol. Workload was high; much attention was required. While the aircraft was not unsafe, its performance was considered undesirable<sup>4</sup> because of the deficiencies. However, one pilot commented that an inexperienced pilot could get into problems in an actual instrument situation.

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<sup>4</sup> In context with pilot evaluations of the aircraft handling qualities, undesirable essentially means that the pilot can do the task but there are deficiencies in the aircraft that he would like fixed.

The stability augmentation system (SAS) on DIKKS was examined to determine its integrity. The SAS servo actuator arm was found in the up position, which is the most tensioned spring condition, in line with the upper scribe mark on the servo case; this normally corresponds to a low-speed, high angle of attack condition. The servo gearing was intact and was not stripped, neither the servo case nor the actuator arm was distorted, and the motor was attached. The actuating cable was still attached to the arm of the servo actuator. The SAS override cylinder was in the extended (not actuated) position, and all components of the lock mechanism were intact. Therefore, evidence indicates that the SAS was operating normally at the time of impact.

The stability augmentation system in the Piper PA-31T is required in order to satisfy certification requirements regarding static longitudinal stability. The SAS consists four major components--a stall margin indicator, a computer, an angle of attack sensing vane, and a servo actuator--plus a test switch. Incorporated in the system is a power warning light, a ram warning light and 2 stall warning light and horn.

The SAS automatically improves the static longitudinal stability of the airplane by providing variable elevator force. This variable force stems from a servo actuated downspring which increases the stick forces at slow speeds (below about 120 kts calibrated airspeed (KCAS)). An angle-of-attack sensing vane on the right side of the fuselage nose section signals the SAS computer which powers the elevator downspring servo. The SAS computer also activates the stall-warning horn and provides the signal for the visual stall margin indicator on the upper left side of the instrument panel



The SAS test panel, located on the pilot's instrument panel, provides a test switch for preflight checking of the SAS and fault lights to indicate SAS malfunctions. Should the SAS malfunction, the lights will illuminate continuously until the malfunction is corrected.

The SAS is equipped with a pneumatically operated stability augmentor override system. Should the SAS fail to function satisfactorily during flight, the pilot can override the system.

The Pilot's Operating Handbook/FAA Approved Flight Manual requires the primary SAS system to be on during flight; initiation of flight is not permitted with malfunction of either the primary or the override SAS system, and the SAS down spring must be replaced after every 2,000 hours of aircraft operation. The handbook further states that approaches cannot be based on the stall margin indicator.

In summary, the Safety Board's investigation revealed no mechanical condition or malfunction that would have caused the airplane to enter a steep bank or the pilot to lose control of the airplane. Toxicology tests on the two pilots were negative for drugs and alcohol. The airplane was within the prescribed limits for weight and balance; however, the near aft c.g. might have resulted in a longitudinal stability characterized by a relatively low stick force per g which, although not unsafe, would have required closer pilot attention in order to prevent overcontrol than would a forward c.g.

The attached Brief of Accident contains the Safety Board's conclusions, findings of probable cause, and related factors.

**BY THE NATIONAL TRANSPORTATION SAFETY BOARD**

/s/ JIM BURNETT  
Chairman

/s/ PATRICIA A. GOLDMAN  
Vice Chairman

/s/ G. H. PATRICK BURSLEY  
Member

October 21, 1985

Brief of Accident/Incident

File No. - 6003 7/14/84 CONCORD, CA A/C Reg. No. D1KKS Time (LCL) - 1212 PDT

Basic Information

Type Operating Certificate-NONE (GENERAL AVIATION)  
 Type of Operation - PERSONAL  
 Flight Conducted Under - 14 CFR 91  
 Acc/Inc Occurred During - APPROACH  
 Injuries Fatal 4 Serious 0 Minor 0 None 0  
 Aircraft Damage DESTROYED Crew 2  
 Fire ON GROUND  
 ON GROUND  
 Pass  
 Injuries Fatal 4 Serious 0 Minor 0 None 0  
 Aircraft Damage DESTROYED Crew 2  
 Fire ON GROUND  
 ON GROUND  
 Pass

Aircraft Information

Make/Model - PIPER PA-31T  
 Landing Gear - TRICYCLE-RETRACTABLE  
 Max Gross Wt - 9000  
 No. of Seats - 7  
 Make/Model - P & W P16A-28  
 Engine Type - TURBOPROP  
 Rated Power - 620 HP  
 ELT Installed/Activated - YES/YES  
 Stall Warning System - YES

Environment/Operations Information

Weather Data  
 Max Briefing - FSS  
 Method - TELETYPE  
 Completeness - FULL  
 Basic Weather - VMC  
 Wind Dir/Speed - 310/008 KTS  
 Visibility - 20.0 SM  
 Lowest Sky/Clouds - 15000 FT SCATTERED  
 A/C/Airspace  
 Type of Flight Plan - NONE  
 Type of Clearance - NONE  
 Type of Traffic Pattern - FULL STOP  
 Runway Ident - 32  
 Runway Lth/Wid - 4600/ 150  
 Runway Surface - ASPHALT  
 Runway Status - DRY  
 Airport Data  
 Airport Name BUCHANAN  
 Airport Proximity OFF AIRPORT/STRIP

Personnel Information

Pilot-In-Command  
 Certificate(s)/Rating(s)  
 FOREIGN  
 SE LAND/WE LAND  
 Age - 49  
 Medical Certificate - VALID MEDICAL-MAIVERS/LIMIT  
 Flight Time (Hours)  
 Total - 1400  
 Last 24 Hrs - UNK/NR  
 Last 30 Days - UNK/NR  
 Last 90 Days - UNK/NR  
 Rotorcraft - UNK/NR  
 Instrument- UNK/NR  
 Make/Model- UNK/NR  
 Months Since - 1  
 Aircraft Type - PA-42  
 Current - YES  
 Biennial Flight Review  
 Instrument Rating(s) - AIRPLANE

THE PIPER PA-31T WAS A FOREIGN REGISTERED ACFT (FEDERAL REPUBLIC OF GERMANY). THE OWNER/PILOT IN THE LEFT FRONT SEAT HELD A GERMAN COMMERCIAL CERTIFICATE WITH AIRPLANE INSTRUMENT, SINGLE ENG LAND & MULTI-ENG LAND RATINGS. THE PILOT IN THE RIGHT FRONT SEAT HELD AN AMERICAN PRIVATE CERTIFICATE WITH AN AIRPLANE SINGLE ENG LAND RATING. DURING ARRIVAL, THE ACFT WAS CLEARED TO ENTER A RIGHT TRAFFIC PATTERN FOR RWY 32R & WAS TO FOLLOW A DECAHLON THAT WAS LANDING ON THE SAME RWY. WHEN THE PA-31 AIRCREW CALLED TURNING ONTO A BASE LEG, THE TOWER ASKED IF THEY HAD THE DECAHLON IN SIGHT, BUT THEY DID NOT REPLY. THE DECAHLON PILOT WAS THEN INSTRUCTED TO CHANGE HIS APCH TO 32L & WAS CLEARED TO LAND. THE PA-31 WAS OBSERVED TO OVERTHROO THE TURN TO THE FINAL APCH COURSE TO RWY 32R. WITNESSES REPORTED THE ACFT MADE AN ERKATIC, SLOW SPEED, NOSE HI TURN AT LOW ALT, THEN IT ENTERED A RIGHT TURN, NOSE DOWN SPIN, CRASHED & BURNED. IMPACT OCCURRED ON A GROUND STRUCTURE. AN INVESTIGATION REVEALED NO PREIMPACT/PART FAILURE OR MALFUNCTION. FIRE DNG TO 5 AUTOS.

Brief of Accident/Incident (Continued)

File No. - 6003

7/14/84

CONCORD, CA

A/C Reg. No. DKKK

Time (Lcl) - 1212 PDT

Occurrence #1            LOSS OF CONTROL - IN FLIGHT  
Phase of Operation      APPROACH - VFR PATTERN - BASE TO FINAL

Findings(s)

1. YLONNEP APPROACH - IMPROPER - PILOT IN COMMAND
2. IMPROPER USE OF EQUIPMENT/AIRCRAFT, DIVERTED ATTENTION - PILOT IN COMMAND
3. AIRSPEED - NOT MAINTAINED - PILOT IN COMMAND
4. STALL/SPIN - INADVERTENT - PILOT IN COMMAND

Occurrence #2            IN FLIGHT COLLISION WITH OBJECT  
Phase of Operation      DESCENT - UNCONTROLLED

Findings(s)

5. OBJECT - BUILDING (NONRESIDENTIAL)

-----Probable Cause-----

The National Transportation Safety Board determines that the Probable Cause(s) of this accident/incident is/are finding(s) 3,4

Factor(s) relating to this incident is/are finding(s) 1,2



## AIRCRAFT ACCIDENT/INCIDENT SUMMARY

File No.:	2177
Aircraft Operator:	Pee Dee Air Express, Inc.
Aircraft Type & Registration:	Piper PA-31T3, N9193Y
Location:	Atlanta, Georgia
Date & Time:	September 24, 1984, 1609 e.d.t.
Persons on Board:	2 crew, 9 passengers
Injuries:	6 serious, 5 minor
Aircraft Damage:	Substantial
Other Damage or Injury:	None
Type of Occurrence:	Collision with the Ground
Phase of Operation:	Landing

On September 24, 1984, at 1609 eastern daylight time (e.d.t.), a Piper PA-31T3, N9193Y, crash-landed about 1,500 feet short of the threshold of runway 8 at William B. Hartsfield International Airport, Atlanta, Georgia, while executing an Instrument Landing System (ILS) approach. During the approach the crew had advised air traffic control (ATC) twice that the airplane was low on fuel. The airplane was registered to HRS Textiles, Inc., and was operated in Part 135 scheduled commuter operations as Pee Dee Flight 561 by Pee Dee Air Express, Inc., doing business as (d/b/a) Trans Southern Airways. The copilot and five of the nine passengers aboard were seriously injured, and the pilot and four passengers received minor injuries. The airplane was damaged substantially by impact forces, but there was no fire and no injury or damage to other persons or property. The accident occurred during daylight hours in visual meteorological conditions.

Flight 561 originated in Florence, South Carolina, at 1446 on September 26 and was conducted under an instrument flight rules flight plan. Pee Dee Air Express operated two Piper PA-31T3 airplanes between its main operations base in Florence and the destinations of Atlanta and Charlotte, North Carolina. N9193Y was equipped with nine passenger seats, and the other airplane was equipped with eight passenger seats; otherwise the airplanes were identical. Normally, N9193Y was used on the Charlotte route, but the airplanes were switched occasionally when nine passengers were booked for Atlanta, as occurred on September 24. The airplane had been fueled in Charlotte earlier the same day and operated by another crew as Pee Dee Flight 460 to Florence.

According to the captain of Flight 460, the fuel gauges indicated 1,000 pounds total fuel at shutdown in Florence. Before departure from Florence for Atlanta, both the captain and

copilot of Flight 561 said that the fuel gauges indicated a total of 950 pounds. This amount was confirmed by the pilot and copilot after takeoff because, the copilot explained, "the gauges have been known to fluctuate." The captain did not request additional fuel because he said the typical flight duration of 1 hour 10 to 15 minutes required only about 750 pounds of fuel. After the accident, computations using the Pilots Operating Handbook performance charts for conditions that existed on September 24 determined that expected fuel consumption would have been 763 pounds. The company president stated that the "normal" fuel load for this flight was 1,500 pounds.

The flight encountered no delays and was uneventful with fuel consumption indications normal until in the vicinity of Athens, Georgia. The captain stated that the fuel "seemed to dissipate faster beyond there." At 1545:35, when Pee Dee Flight 561 was cleared "direct +Atlanta" by Atlanta Approach Control, 400 pounds of fuel remained, 200 pounds per side; however, about 10 minutes later, the gauges indicated a total of only 150 pounds of fuel, 100 pounds on the right gauge and 50 pounds on the left gauge. At that time, the flight was about 8.5 nautical miles northeast of the Atlanta Airport, according to radar data. Approach Control assigned Flight 561 a heading for the downwind leg to runway 8. The crew was concerned about the sudden change in fuel indications, and the copilot said he requested that they declare an emergency; the captain asked ATC at 1556:40 how far out the downwind leg would take them. When told "20 miles," he advised Approach Control, "...we'd like to get it down as soon as we can, ah, we're a little low on fuel." Approach Control responded, "Okay, 'bout only thing I can give you is five thousand, you can descend to five thousand right now." Following the accident, the controller stated that Pee Dee 561 "...advised me that he would like a lower altitude because he was getting low on fuel."

At 1601:56, after communicating with the flight seven times regarding assigned heading and altitude deviations, Approach Control said "...you seem to be ...drifting all over the sky...you having any problem," to which Flight 561 replied that they were low on fuel and asked, "...can you, ah, expedite us to get down?" Approach Control responded, "If you wanta declare emergency I can clear out about four or five airplanes on the final else we'll fly the ILS at one hundred seventy." Flight 561 did not declare an emergency. At 1602:40, the flight was cleared for the approach and again requested to verify assigned altitude, at 1604:35 was instructed to contact Atlanta tower, and at 1607:31 was cleared to land. At 1608:39, the flight radioed Atlanta tower, "Five sixty one declaring emergency." When the tower controller asked, "What's your problem," the response was, "Out of fuel, out of fuel," and "We're goin in the dirt."



National  
Transportation  
Safety Board

Washington, D.C. ,20594

# AIRCRAFT ACCIDENT/INCIDENT SUMMARY

File No.	311
Aircraft Operator:	TPI International Airways, Inc.
Aircraft Type & Registration:	L-188 Electra, N357Q
Location:	Kansas City, Kansas
Date and Time:	January 9, 1985; 0701 c.s.t.
Occupants on Board:	Crew = 3, Passengers = 0
Injuria:	Crew = 3 Fatal
Aircraft Damage:	Destroyed
Other Damage:	Water Tank Catwalk & Power Lines
Type of Occurrence:	Loss of Control/Stall
Phase of Operation:	Maneuvering

On January 9, 1985, about 0701 c.s.t. 1/ a Lockheed L-188 Electra, N357Q, being operated as a cargo flight under 14 CFR Part 125, crashed into a water sediment tank at the Kansas City Board of Public Utilities water treatment plant, in Kansas City, Kansas. The airplane was destroyed, and the three crewmembers were killed. There was no fire. The airplane was owned and operated by TPI International Airways, Inc., (TPI) of Miami, Florida. The cargo-configured Electra was carrying about 23,000 pounds of automobile parts from Detroit Metropolitan Airport (DTW) to assembly plants in Kansas City, Kansas. The flight's destination was Kansas City Downtown Airport (MCK) located in Kansas City, Missouri.

The flight had departed Kansas City Downtown Airport the previous evening about 2200 and had flown to Memphis, Tennessee, and Detroit, Michigan, and was returning to Kansas City, Missouri, on a regularly scheduled night cargo flight. The captain had filed an instrument flight rules (IFR) flight plan with the Detroit Flight Service Station (FSS) before departing Detroit for Kansas City. All phases of the flight were normal until the flight arrived in the Kansas City area.

The MCK 0650 weather observation was, in part, ceiling — measured 2,800 feet overcast; visibility — 5 miles, fog; temperature — 25 degrees F. The 0705 weather observation was, in part, ceiling — measured 1,000 feet overcast, visibility — 5 miles, and fog. Based on these observations, the cloud bases and visibility at the time of the accident were about 2,300 feet MSL 2/ and 5 miles, respectively. Other weather information indicated that cloud bases probably were lower to the west and northwest of the Downtown Airport and that flight visibility was reduced to about 3 miles in the area. Although the area forecast called for moderate turbulence, moderate icing, and IFR conditions, a helicopter pilot flying at 1,300 feet MSL in the area of the accident stated that there was no precipitation, icing, windshear, or turbulence. No evidence was found to indicate that the flightcrew of N357Q had received a weather briefing before departing Detroit on the morning of the accident.

1/ All Times are central standard time unless otherwise noted.

2/ All altitudes herein are mean sea level unless otherwise specified.

reading on the gauge is not 1,200 pounds, he is to adjust the set screws on the gauge to obtain the correct reading. This procedure did not and will not reveal that the wrong fuel sensors have been installed in one or more tanks.

Another method to test the calibration of the quantity-indicating system, which also is described in the Piper Maintenance Manual, requires a capacitance type of calibration test set. The capacitance test set would have given indications that the wrong sensors were installed; however, use of this method is not mandatory.

In summary, the pilot's decision to continue the approach with normal ATC handling after fuel indications became unstable extended the flight time, with the result that total fuel exhaustion occurred about 1,500 feet short of the runway. However, the Safety Board's investigation revealed that the installation of the wrong fuel sensors in the inboard and outboard fuel tanks caused the fuel gauge initially to indicate 90 pounds more fuel per side than was present and the fuel indications to fluctuate when the fuel quantity became low. Had the fuel gauge indicated only 763 pounds before takeoff, it is unlikely the pilot would have begun the flight without adding fuel. Because there is no evidence of subsequent removal for maintenance or replacement, the Safety Board concludes that the wrong sensors were installed when the airplane was manufactured.

Since the accident, Pee Dee Air Express has adopted additional operational procedures to establish a minimum fuel load for departure and a minimum fuel level at landing and has initiated the use of the fuel totalizer on each flight.

As a result of this investigation, the National Transportation Safety Board made the following recommendations to the Federal Aviation Administration:

Issue an airworthiness Directive to require owners and operators of Piper PA-31T and PA-42 model series airplanes to inspect and verify that the fuel quantity sensor installation conforms to the manufacturer's specifications and to require that a fuel quantity calibration check be performed using a capacitance type of calibration test set. (Class II, Priority Action) (A-85-88)

Require the Piper Aircraft Corporation to modify the main inboard and main outboard fuel quantity sensors in PA-31T and PA-42 model series airplanes to eliminate the possibility of installing the wrong sensors. (Class II, Priority Action) (A-85-89)

Require the Piper Aircraft Corporation to amend the maintenance manuals for the PA-31F and PA-42 model series airplanes to require *use* of the capacitance type of recalibration test set when checking the fuel quantity indication systems for accuracy and to delete any other test procedure. (Class ITI, Longer-Term Action) (A-85-90)

The attached Brief of Accident contains the Safety Board's conclusions, findings of probable cause, and related factors.

**BY THE NATIONAL TRANSPORTATION SAFETY BOARD**

/s/ JIM BURNETT  
Chairman

/s/ PATRICIA A. GOLDMAN  
Vice Chairman

/s/ G. H. PATRICK BURSLEY  
Member

October 21, 1985



National Transportation Safety Board  
Washington, D.C. 20594

Brief of Accident

File No. - 2177      9/24/84      ATLANTA, GA      A/C Reg. No. N9193Y      Time (Lcl) - 1609 EDT

-----Basic Information-----

Type Operations Certificate	COMMUTER	Aircraft Damage	Injuries			
Name of Carrier	-PEE DEE AIR EXPRESS, INC	SUBSTANTIAL	Fatal	Serious	Minor	None
Type of Operation	-SCHEDULED, DOMESTIC, PASSENGER	Fire	Crew 0	1	1	0
Flight Conducted Under	-14 CFR 135	NONE	Pass 0	5	4	0
Accident Occurred During	-LANDING					

-----Aircraft Information-----

Make/Model	- PIPER PA-31T3	Eng Make/Model	- P1W PT6A-11	ELI Installed/Activated	- YES/YES
Landing Gear	- TRICYCLE-RETRACTABLE	Number Engines	- 2	Stall Warning System	- YES
Max Gross Wt	- 9050	Engine Type	- TURBOPROP		
No. of Seats	- 11	Rated Power	- 500 HP		

-----Environment/Operations Information-----

Weather Data	Itinerary	Airport Proximity
Wx Briefing - FSS	Last Departure Point	ON AIRPORT
Method - TELEPHONE	FLORENCE, SC	
Completeness - WEATHER NOT PERTINENT	Destination	Airport Data
Basic Weather - VMC	SAME AS ACC/INC	HARTSFIELD AIRPORT
Wind Dir/Speed - 150/006 KTS	ATC/Airspace	Runway Ident - 08
Visibility - 7.0 SM	Type of Flight Plan - IFR	Runway Lth/Wid - 10000/ 150
Lowest Sky/Clouds - 25000 FT THIN BKN	Type of Clearance - IFR	Runway Surface - CONCRETE
Lowest Ceiling - NONE	Type Arch/Lnds - ILS-COMPLETE	Runway Status - DRY
Obstructions to Vision - NONE		
Precipitation - NONE		
Condition of Light - DAYLIGHT		

-----Personnel Information-----

Pilot-In-Command	AS. - 34	Medical Certificate	VALID MEDICAL-NO WAIVERS/LIMIT	
Certificate(s)/Rating(s)	Biennial Flight Review	Flight Time (Hours)		
ATP, CFI	Current - YES	Total - 3309	Last 24 Hrs -	1
SE LAND, ME LAND	Months Since - 4	Make/Model - 439	Last 30 Days -	E?
	Aircraft Type - PA-3113	Instrument - 99	Last 90 Days -	245
		Multi-Eng - 850		

Instrument Rating(s) - AIRPLANE

-----Narrative-----

THE NORMAL FUEL LOAD FOR THE FLT WAS 1500 LBS, BUT WITH A FORECAST TAIL WIND & AN ESTIMATED FLT TIME OF ONLY 1410, THE CREW ACCEPTED THE LOWER INDCTD (950 LB) FUEL LOAD. THE FLT WAS UNEVENTFUL UNTIL AN INDCTN OF 250 LBS PER SIDE, THEN THE FUEL "SEEMED TO DISSIPATE FASTER," WITH AN INDCTN OF 150 LBS ON DWNWD, THE COPLT RCHDD DECLARING AN EMERGENCY. THE CAPT'S RESPONSE WAS TO ASK ATC FOR THE ANTICIPATED LENGTH OF THE DWNWD LEG. HE WAS TOLD 20 MI. PRIORITY HNDLG WAS REQUESTED, BUT WAS ONLY AVAILABLE FOR A DECLARED EMERGENCY. THE APCH WAS CONTD WITH NORMAL HNDLG FOR APRX 10 MIN. AT 1608:39, THE CREW DECLARED AN EMERGENCY, THEN APRTD THE ACFT WAS OUT OF FUEL. IT CRASH LANDED ON ROUGH TERRAIN, SHORT OF RWY 8. AN EXAM REVEALED FUEL SENSORS HAD BEEN IMPROPERLY INSTALLED (INTERCHANGED BTN THE INBRD & OUTBRD TANKS), THUS THE GAGES INDCTD ABOUT 180 LBS MORE THAN THE APRX 763 LBS THAT WAS ACTUALLY ABOARD AT TKOF, A SPCL 500 HR INSPN OF THE ENTIRE FUEL SYS WAS MADE ON 7/8/84 USING THE 'WET' METHOD, BUT ONLY THE CAPACITANCE METHOD CHECKS EACH INDIVIDUAL SENSOR

Brief of Accident (Continued)

File No. - 2177

9/24/84

ATLANTA, GA

A/C Reg. No. N9193Y

Time (Lcl) - 1609 EDT

Occurrence #1      LOSS OF POWER (TOTAL) - NON-MECHANICAL  
Phase of Operation      APPROACH - FAF/OUTER MARKER TO THRESHOLD (IFR)

Findings(s)

1. FUEL SYSTEM - INCORRECT
2. MAINTENANCE, INSTALLATION - IMPROPER -
3. ENGINE INSTRUMENTS, FUEL QUANTITY GAGE - FALSE INDICATION
4. MAINTENANCE, INSPECTION OF AIRCRAFT - INADEQUATE -
5. PROCEDURE INADEQUATE - MANUFACTURER
6. FLUID, FUEL - LOW LEVEL
7. IN-FLIGHT PLANNING/DECISION - IMPROPER - PILOT IN COMMAND
8. REMEDIAL ACTION - DELAYED - PILOT IN COMMAND
9. FLUID, FUEL - EXHAUSTION
10. FUEL SUPPLY - INADEQUATE -

Occurrence #2      FORCED LANDING  
Phase of Operation      APPROACH - FAF/OUTER MARKER TO THRESHOLD (IFR)

Occurrence #3      IN FLIGHT COLLISION WITH TERRAIN  
Phase of Operation      LANDING - FLARE/TOUCHDOWN

Findings(s)

11. TERRAIN CONDITION - ROUGH/UNEVEN

-----Probable Cause-----

The National Transportation Safety Board determines that the Probable Cause(s) of this accident is/are finding(s) 7,8,9

Factor(s) relating to this accident is/are finding(s) 1,2,3,5,6,11



## AIRCRAFT ACCIDENT/INCIDENT SUMMARY

File No: 2961  
Aircraft Operator: Air Resorts Airlines  
(ARZ) Flight 953  
Aircraft Type and: General Dynamics  
Registration: Convair, CV 440, N44828  
Location: Jasper, Alabama  
Date: December 16, 1984  
Time: 1230 central standard time  
Occupants: Total 39, including 2 pilots, 1 mechanic,  
2 flight attendants, and 34 passengers  
Injuries: 2 serious, 11 minor injuries  
Aircraft Damage: Destroyed  
Other Damage or Injuries: None  
First Occurrence: Engine failure--inflight  
Phase of Operation: Cruise  
Second Occurrence: On ground collision with object--taxiway  
Phase of Operation: Landing roll

About 1240 <sup>1/</sup> on December 16, 1984, Air Resorts Airline Flight 953, operating as a 14 CFR Part 121 charter flight, made an emergency landing at Walker County Airport, Jasper, Alabama, after experiencing a rapid loss of power in the No. 2 engine. The flight was transporting the East Tennessee State University basketball team to Oxford, Mississippi. Flight 953 had departed Birmingham (BHM), Alabama, at 1201 and was cleared by Birmingham departure control to cruise at 6,000 feet mean sea level (m.s.l.). The captain stated that the takeoff and climb to 6,000 feet were normal. Both the pilots stated that about 1214:35, which was shortly after level off, the No. 2 engine Brake Mean Effective Pressure (BMEP) <sup>2/</sup> gauge indicated a rapid power loss, and the rpm on the right engine "increased out of control" to approximately 3,100 rpm. The right throttle was retarded and the rpm was reduced to 2,100 by using the propeller pitch increase/decrease toggle switch.

After advising Birmingham departure control of the problem, Flight 953 was provided with radar vectors to Birmingham and was cleared to descend to 3,500 feet. The crew then attempted to feather the right propeller, but it would not go into the feather position. The crew stated that although the left engine was set at climb power they could not maintain altitude because of the drag caused by the windmilling right propeller.

At 1220:37, Flight 953 advised Birmingham Center that they could not feather the right propeller and requested radar vectors to the nearest airport. At 1220:44, Birmingham Center stated that Walker County Airport was 8 miles from their position and to turn right to a heading of 310 degrees. Flight 953 then declared an emergency and prepared for an emergency landing at Walker County Airport.

<sup>1/</sup> All times contained herein are central standard time (c.s.t.), based on the 24-hour clock.

<sup>2/</sup> That part of the indicated mean effective pressure that produces the brake horsepower delivered at the propeller shaft of an aircraft engine.

Shortly thereafter, while turning to the downwind leg for runway 09, the right engine fire indicator activated and the first officer confirmed that the right engine was on fire. The captain advised the first officer to use the emergency fire procedures, and the first officer discharged both fire bottles into the right engine. According to the first officer, the fire was extinguished, and he then attempted again to feather the right propeller: this time, he reported that the propeller did feather. According to the captain, full power then was applied to the left engine, including the use of water injection. The captain said that he was not able to land on runway 09 because the airplane was too close to the airport so he made the decision to land on runway 27.

When the airplane was on the downwind leg of runway 27 and passing abeam the approach end of the runway, the water-injection was depleted and the left engine started to "backfire very hard." The first officer reduced the power of the left engine. The captain then told the first officer to ask Birmingham Air Traffic Control Center to "call the airport and tell them to have any equipment available for us."

Birmingham Approach called Walker County Airport at 1228:14 and informed the airport manager that Flight 953 was making an emergency landing and that the pilot had requested emergency equipment to standby. Emergency equipment was not available at the airport, but the manager immediately called the Jasper Fire Department, which is located about 6 miles from the airport.

The airplane touched down on runway 27 slightly left of the centerline and about 1,200 feet from the approach threshold. As soon as the right main gear touched down, both tires blew out. Directional control could not be maintained as the aircraft rolled off the right side of the runway into the dirt. The aircraft continued to roll until it crossed the taxiway which was perpendicular to the runway. The right main landing gear separated from the airframe. The aircraft continued to slide, finally coming to rest on a heading of 060 degrees approximately 3,000 feet from the point of touchdown on runway 27. The flight attendant and ground witnesses testified that they saw fire on the right engine throughout the approach. Of the 35 occupants, 2 persons received serious injuries and 11 persons received minor injuries. A postcrash fire destroyed the airplane.

The accident occurred during daylight at 033°54.1" north latitude and 087°18.8" west longitude. Weather at time of the accident was clear with no restrictions to visibility.

The flightcrew was properly certificated in accordance with existing regulations. There was no evidence that any physiological or psychological factors affected their performance.

The airplane was properly certificated, equipped, and maintained in accordance with existing regulations and procedures approved by the company and the Federal Aviation Administration (FAA). The airplane weight and balance were within the specified limits at takeoff. Although the flight mechanic made minor repairs to stop oil leaks on the right engine while the airplane was on the ground at Birmingham, there was no evidence to establish a link between a loss of oil and the failure of the right engine.

According to the flightcrew, when Flight 953 departed Birmingham, there were no known maintenance discrepancies on the airplane. The last maintenance inspection was completed on the aircraft on October 20, 1984, when the airplane had 27,523.5 total hours of operation. At the time of the accident, the left engine had 1,556.4 hours of operation since overhaul, and the right engine had 858.7 hours since overhaul. The right engine was

installed on September 24, 1981, with 840.3 hours since major overhaul and having been extensively repaired just before it was returned to service on N44828. At the time, the right engine was installed, the airframe had 27,506 hours.

The right main landing gear was located about 120 feet east of the wreckage and out of the area of the postcrash fire. Both tires were blown out, and the casings showed evidence of having been exposed to heat. Examination revealed that both tire tracks on the runway, which corresponded to the right main landing gear were irregular at the first point of contact with the runway. The tracks continued to the right and off the paved surface.

Examination of the right engine indicated that either the link rod or the piston in the No. 6 cylinder had failed. The link rod subsequently pounded its way through the right side of the No. 6 cylinder, the crankcase web section, and the left side of the No. 8 cylinder which initiated a chain reaction within the engine that destroyed the front row of cylinders. Continued rotation of the engine after the failure further damaged the remaining link rods to the point where a total loss of engine power and subsequent engine seizure occurred. Due to the mutilated condition of the link rods, an analysis of the fractured surfaces could not be made. Consequently, the precise cause of the initial failure within the engine could not be determined.

Shortly after the start of the investigation, Air Resorts voluntarily suspended its flight operations pending a records and manuals review by the FAA.

During the course of the Board's investigation, sworn testimony from the flight crew, the chief pilot and the vice president of operations indicated that immediate corrective actions should be taken in certain areas of company operations. The areas that required attention related to the dispatch of flights away from the home station, mailing of flight dispatch papers back to the home station, passenger briefing and alerting procedures, and the computation of weight and balance data when the passenger load consists of athletic squads. In addition, the FAA reviewed flightcrew training records, airplane maintenance records, and company manuals and gave flight checks to the crewmembers involved in the accident. As a result of the company's initiative in taking corrective actions in the areas noted, and the immediate review of the company's operation undertaken by the FAA, the Safety Board did not propose any safety recommendations. Air Resorts Airlines resumed service on January 2, 1985. Nevertheless, the existence of these deficiencies prior to the accident could be indicative of inadequate FAA routine surveillance, which probably should have detected and corrected them. The issues regarding FAA surveillance will be addressed in a safety study presently being conducted by the Safety Board.

The Safety Board's investigation concluded that the failure of the No. 6 cylinder in the right engine resulted in a complete loss of power with a subsequent windmilling propeller and engine fire.

The attached brief of aviation accidents contained the Safety Board's finding of probable cause relating to the accident.

**BY THE NATIONAL TRANSPORTATION SAFETY BOARD**

/s/ JIM BURNETT  
Chairman

/s/ PATRICIA A. GOLDMAN  
Vice Chairman

/s/ G. H. PATRICK BURSLEY  
Member

October 25, 1985

National Transportation Safety Board  
Washington, D.C. 20594

Brief of Accident

File No. - 2961      12/16/84      JASPER, AL      A/C Reg. No. N44828      Time (Lcl) - 1230 C9

-----Basic Information-----

Type Operating Certificate - AIR CARRIER - SUPPLEMENTAL	Aircraft Damage	Fatal	Injuries		
Name of Carrier - FLIGHT TRAILS	DESTROYED		Serious	Minor	None
Type of Operation - NON SCHED, DOMESTIC, PASSENGER	Fire	Crew	1	0	4
Flight Conducted Under - 14 CFR 121	IN FLIGHT	Pass	1	0	33
Accident Occurred During - LANDING					

Aircraft Information-----

Make/Model - CONVAIR 440	Eng Make/Model - P & W R-2800-CR16	ELT Installed/Activated - YES-UNK/NR
Landing Gear - TRICYCLE-RETRACTABLE	Number Engines - 2	Stall Warning System - YES
Max Gross Wt - 48000	Engine Type - RECIPROCATING-CARBURETOR	
No. of Seats - 48	Rated Power - 2500 HP	

-----Environment/Operations Information-----

<b>Weather Data</b>	<b>Itinerary</b>	<b>Airport Proximity</b>
Wx Briefing - FSS	Last Departure Point - BIRMINGHAM, AL	ON AIRPORT
Method - TELEPHONE	Destination - OXFORD, MS	<b>Airport Data</b>
Completeness - FULL		WALKER COUNTY
Basic Weather - VMC		Runway Ident - 27
Wind Dir/Speed - UNK/NR	<b>ATC/Airspace</b>	Runway Lth/Wid - 4800/ 100
Visibility - 15.0 SM	Type of Flight Plan - IFR	Runway Surface - MACADAM
Lowest Sky/Clouds - 4500 FT THIN OVC	Type of Clearance - IFH	Runway Status - DRY
Lowest Ceiling - NONE	Type Arch/Lnds - TRAFFIC PATTERN	
Obstructions to Vision - HAZE		
Precipitation - NONE		
Condition of Light - DAYLIGHT		

-----Personnel Information-----

<b>Pilot-In-Command</b>	Age - 31	Medical Certificate - VALID MEDICAL-NO WAIVERS/LIMIT
Certificate(s)/Rating(s)	Biennial Flight Review	Flight Time (Hours)
ATP, CFI	Current - UNK/NR	Total - 3500
SE LAND, ME LAND	Months Since - UNK/NR	Make/Model - UNK/NR
	Aircraft Type - UNK/NR	Instrument - UNK/NR
		Multi-Eng - UNK/NR
		last 24 Hrs - 1
		Last 30 Days - 21
		Last 70 Days - 105
		Rotorcraft - UNK/NR

Instrument Rating(s) - AIRPLANE

-----Narrative-----

SHORTLY AFTER CLIMBING & LEVELING (IT 6000 FT, THE R ENG BMEP GAGE INDICATED A RAPID POWER LOSS X THE R END RPM INCREASED OUT OF CONTROL TO ABOUT 3100 RPM, THE AIRCREW RETARDED THE R THROTTLE & REDUCED THE R ENG TO 2100 RPM BY USING THE PROP INCREASE/DECREASE TOGGLE SW, THE AIRCREW WERE UNABLE TO FEATHER THE R PROP OR MAINTAIN ALT, SO THEY DIVERTED TO THE NEAREST ARPT (WALKER COUNTY), WHILE TURNING DOWNWIND FOR RWY 9, THE R ENG FIRE INDICATOR ACTIVATED & THE COPILOT CONFIRMED A FIRE, BOTH FIRE BOTTLES WERE DISCHARGED & THE R PROP STOPPED ROTATING, INJECTION WATER FOR THE L ENG WAS EXHAUSTED & THE L ENG BEGAN BACKFIRING, THE CAPTAIN THEN MANEUVERED & LANDED ON RWY 27, AFTER TOUCHDOWN, THE R MAIN TIRES FAILED, THE ACFT VEERED OFF THE R SIDE OF THE RWY & HIT A DITCH THE GEAR COLLAPSED, AN EXAM REVEALED THE #6 CYL LINK ROD &/OR PISTON IN THE R ENG HAD FAILED, RESULTING IN FURTHER DAMAGE TO THE ENG & #6 CYL, SUBSEQUENTLY, FIRE & HEAT CAUSED THE R END TO SEIZE & ALSO DAMAGED THE R MAIN TIRES WHICH FAILED AT TOUCHDOWN.

Brief of Accident (Continued)

File No. - 2961

12/16/84

JASPER,AL

A/C Reg. No. N4482B

Time (Lcl) - 1230 CS

Occurrence #1            LOSS OF POWER  
Phase of Operation      CRUISE

Findings(s)

1. ENGINE ASSEMBLY,CONNECTING ROD - FAILURE,TOTAL
2. ENGINE ASSEMBLY,PISTON - FAILURE,TOTAL
3. ENGINE ASSEMBLY - FAILURE,TOTAL
4. PROPELLER FEATHERING - NOT POSSIBLE -

Occurrence #2            FIRE  
Phase of Operation      CRUISE

Findings(s)

5. ENGINE ASSEMBLY - FIRE
6. FIRE EXTINGUISHING EQUIPMENT - SELECTED -
7. LANDING GEAR,TIRE - OVERTEMPERATURE

Occurrence #3            FORCED LANDING  
Phase of Operation      LANDING

Findings(s)

8. FLUID,ADI FLUID - EXHAUSTION

Occurrence #4            LOSS OF CONTROL - ON GROUND  
Phase of Operation      LANDING - ROLL

Findings(s)

9. LANDING GEAR,TIRE - FAILURE,TOTAL
10. DIRECTIONAL CONTROL - NOT POSSIBLE -
11. GROUND LOOP/SWERVE - UNCONTROLLED -

Occurrence #5            ON GROUND COLLISION WITH TERRAIN  
Phase of Operation      LANDING - ROLL

Findings(s)

12. TERRAIN CONDITION - DITCH
13. LANDING GEAR - OVERLOAD

---Probable Cause---

The National Transportation Safety Board determines that the Probable Cause(s) of this accident is/are finding(s) 3,5,9

Factor(s) relating to this accident is/are finding(s) 1,2,4,7,10,11,12



# AIRCRAFT ACCIDENT/INCIDENT SUMMARY

File No.:	2616
Aircraft Owner:	Gee Bee Aero, Inc.
Aircraft Type and Registration:	Gates Learjet, Model 24, N44GA
Location:	Catalina Airport Avalon, California
Date and Time:	January 30, 1984 2330 Pacific standard time
Occupants:	6
Injuries:	All Fatal
Aircraft Damage:	Vestroyed
Other Damage or Injury:	None
Type of Occurrence:	Overrun
Phase of Operation:	Landing Roll

About 1330 on January 30, 1984, a Gates Learjet, Model 24, N44GA, operated by Aviation Business Flights of San Jose California, overran the end of runway 22 during an attempted landing at the Catalina Airport, Santa Catalina Island, Avalon, California. The airplane departed the end of the runway onto a nonpaved surface and traveled off a 90-foot-high bluff before impacting upright on downsloping terrain. The airplane was destroyed by severe impact forces and a postcrash fire. The four passengers and the two flightcrew members on board were fatally injured.

The flight originated in Santa Rosa, California, at 1226 for a sales demonstration of the airplane to potential buyers. The original en route stop was Monterey, California, but during the course of the flight, the stop was changed to the Catalina Airport because one of the buyers requested to stop at Catalina.

Visual meteorological conditions prevailed at the Catalina Airport, and the Unicom 1/ operator provided the flight with the following information when the crew requested landing advisories: wind--100 degrees at 4 knots, temperature--72 degrees, and altimeter--29.97 inHg.

The airplane's downwind and base legs of the approach appeared normal. The airplane was slightly high on final approach, but the pilot corrected the angle of descent and the airplane touched down 527 feet beyond the runway threshold. Witnesses said that they heard an increase in engine sound just before the first taxiway which they associated with the use of thrust reversers. One witness said that the thrust reversers deployed about 1,000 feet beyond the point of initial touchdown. The thrust reverser sound ceased or diminished for a few seconds in the area of the second taxiway turnoff, about 2,000 feet from the threshold. Thereafter, the sound increased as the airplane overran the end of the runway, producing a large cloud of dust and dirt. It traveled off the bluff in a slight nose high, wings level attitude before dropping 90 feet vertically and striking the ground.

1/ 4 nongovernment communication facility which may provide airport information at certain airports.



Catalina Airport is a private airport, open to public use, and is owned and operated by the Santa Catalina Island Conservancy. The airport has no scheduled airline service and, thus, is not subject to any State or Federal regulation regarding crash/fire/rescue (CFR) capability. The County of Los Angeles Fire Department on Santa Catalina island is responsible for the CFR response at the airport. The City of Avalon Fire Department, by mutual agreement, assists the county fire department whenever necessary. Both fire departments are co-located in the city of Avalon, 10 miles from the airport.

The Unicom operator called the fire department immediately after the crash. Four airport personnel arrived on scene within 3 minutes of the accident with a small truck equipped with an "Ansul" firefighting unit, two firefighter proximity suits, and 700 pounds of dry chemicals. However, because they were not trained in CFR procedures, they did not attempt to extinguish the fire for fear the airplane would explode. They stated that there was a period of time that the forward cabin was free of fire. Several units from the Avalon fire station arrived on scene about 20 minutes later and were told by airport personnel that there were no survivors. The fire was contained about 10 minutes later and completely extinguished about 20 minutes later.

The investigation disclosed that impact forces were survivable. Postmortem examination of all occupants showed that the cause of death was smoke inhalation and thermal burns.

The severe postcrash fire consumed most of the airplane from the cockpit to the tailcone. However, remaining components of the flight control system and surfaces showed no evidence of pre-impact failure or malfunction. The wing flaps were fully extended, and the wing spoilers were in the retracted and locked position at the time of the accident. The right main landing gear tires and the nose gear tire were consumed in the fire. The main landing gear wheel brake assemblies and the left main landing gear tires were in serviceable condition. There was no evidence of flat spots or scrub marks on either of the left tires.

There was no evidence of pre-impact failure or malfunction of the two General Electric CJ610-4 engines. The engine driven hydraulic pumps showed no evidence of irregularity. It was determined that the thrust reversers were deployed at the time of the accident.

The locking pins for both the upper and lower halves of the main cabin split door were found retracted. There was no evidence to indicate that passengers attempted to open the emergency window exit on the right side of the cabin.

The four main wheel brake assemblies were overhauled, and two new tires were installed on the right main landing gear at the last maintenance inspection on August 8, 1983. The emergency brake system air bottle was replaced at the same time. Reportedly, no unscheduled maintenance had been performed on the engine reverser system or on the airframe hydraulic system since the inspection. The total time on the airplane at the time of the accident was 3,306 hours.

The Catalina Airport is located on a bluff at an elevation of 1,602 feet above mean sea level. A winding road up the mountainside leads to the airport. Runway 04/22, the only runway, is 3,240 feet long and 100 feet wide with 120-foot displaced thresholds at either end. There is a two-box visual approach slope indicator (VASI) for runway 22. This landing aid provides a 3-degree angle of descent to the runway with a crossing height of 31 feet over the threshold. The touchdown area between the VASI boxes is from 200 to

700 feet from the displaced threshold. The runway is not level. The Airport/Facility Directory states that, "Rwy 22 first 2,000' slopes up; remainder level. Pilots cannot see aircraft on opposite ends of runway due to gradient."

Wheel brake marks were found on the last 150 feet of the runway. A sample of the displaced threshold paving for runway 4, which contained the tire mark left by the airplane when it rolled off the end, was examined. The sample appeared to be rich in asphalt and did not contain much coarse aggregate material. Federal Highway Administration researchers reported that the sample was indicative of a cold emulsion type of mixture. Although, a skid resistance test of the sample was inconclusive, researchers believed that the tire mark, as well as photographic evidence, indicated some wheel braking. There was no evidence of asphalt deformation to indicate that the tire marks were caused by the tire rolling over a warm asphalt surface. The researchers reported that the skid resistance of the displaced threshold area probably was much lower than that of the runway surface.

At 11,500 lbs., the airplane was within its weight limits and its center of gravity limits at the time of the accident. Based on the temperature and wind at the time of the accident, the airport elevation, and the runway gradient, the Learjet flight manual (AFM) of the accident flight required a landing distance <sup>2/</sup> of 3,100 feet at a landing weight of 11,500 lbs. This landing distance is predicated on the use of full wing flaps, wing spoilers, and anti-skid braking. The AFM landing performance does not include the landing distance reduction achieved when using thrust reversers, which would be 26 percent provided that maximum wheel braking is used, and would result in a landing distance of about 2,300 feet. The computed reference airspeed (Vref) was 118 KIAS. Eased on a takeoff weight of 11,500 lbs. and the prevailing environmental conditions on January 30, calculations show<sup>3/</sup> that a takeoff distance <sup>3/</sup> of 3,740 feet would have been required to meet the requirements of the AFM. (For the Learjet, this distance is based on the greater of the accelerate-stop distance or the accelerate-go distance.)

The flightcrew was certificated and qualified to make the flight in accordance with Federal regulations. Both the pilot and copilot held Airline Transport Pilot certificates and type ratings in the Learjet. The pilot had over 8,000 hours of total flight time and about 1,100 hours in the Learjet. The copilot had 4,410 hours of total flight time and about 1,300 hours in the Learjet. The pilot completed a Learjet recurrent training course with Flight Safety International on August 25, 1983, and the copilot completed a similar course at Flight Safety International on February 4, 1982.

The flightcrew held first class medical certificates with no limitations. There was no evidence of any pre-existing psychological or physiological conditions that might have affected their performance.

N44GA was type certificated under 14 CFR Part 25, "Airworthiness Standards: Transport Category Airplanes." Section 25.735(b) requires in effect that to be certificated it must be possible to bring the airplane to a stop in the event of a single

<sup>2/</sup> The horizontal distance necessary to land and come to a complete stop from a point 50 feet above the runway.

<sup>3/</sup> The greater of the horizontal distance along the takeoff path from the start of the takeoff to the point at which the airplane is 35 feet above the takeoff surface, considering an engine failure at  $V_1$ , or 115 percent of the horizontal distance along the takeoff path, with all engines operating, from the start of the takeoff to the point at which the airplane is 35 feet above the takeoff surface.

failure in the brake system and under the landing performance conditions specified in Part 25.125 with a mean deceleration during the landing roll of at least 50 percent of that obtained during normal landing performance. Accordingly, the Learjet AFM requires that the actual landing distance shown in the performance section be increased by 60 percent when it becomes necessary to use the emergency braking system; thus, N44GA would have required a landing distance of 4,960 feet if use of the emergency braking system had become necessary.

The accident flight was being operated under the provisions of 14 CFR Part 91 which does not require flightcrews to add runway distance (factored landing distance: to the computed runway length specified in the landing performance charts of the approved AFM for the Learjet.

During the investigation, it was learned that the pilot had landed at the Catalina Airport in a Beech Baron in 1981. Reportedly, he had demonstrated his ability to make a short field landing in the Learjet with a former copilot.

The investigation showed that the Learjet could have been stopped before it reached the end of the runway. However, because the Learjet's stance is relatively low to the ground, it would have been difficult for the flightcrew to have seen the end of the runway, particularly in view of the substantial difference in elevation between the ends of the runway. The varying engine sounds reported by the witnesses suggest that the pilot may have decided to initiate a go-around and then at the last minute decided to stop on the remaining available runway. However, the evidence of the pilot's indecisiveness is inconclusive since there was insufficient physical evidence to rule out the possibility of a mechanical failure or malfunction. Consequently, the Safety Board was not able to determine why the flightcrew could not stop the airplane on the runway.

Although Federal regulations under which the flight was operating did not specifically prohibit the flightcrew from landing at Catalina, the Safety Board believes that the flightcrew used poor judgment in attempting to land because the runway length did not provide any room for error and there was an Inadequate margin of Safety. Furthermore, while the airplane had the performance capability to make a takeoff from Catalina, the AFM requirements were more restrictive for the takeoff condition than for the landing condition so that 3,710 feet of runway was required. Therefore, the pilots should not have attempted a landing. In view of the fact that Catalina was not the flightcrew's intended en route stop, the desire to sell the airplane may have been a factor in their decision to land.

Flightcrews must insure that an adequate margin of safety is available in general aviation operations. Accordingly, operators and flightcrews of transport category airplanes in general aviation operations must be aware of the fact that the aircraft certification regulations, 14 CFR Part 25, provide a higher margin of safety than the general operating and flight rules, 14 CFR Part 91. Manufacturers meet the brake failure criteria established by the certification regulations by installing an emergency pneumatic braking system with which to meet the minimum deceleration criteria. Thus, if a single failure of the normal braking system occurs and the pilot has to resort to emergency braking, the runway length needed to stop the airplane would increase substantially and could exceed the 14 CFR Part 91 computed runway length and possibly the actual runway length. The Learjet AFM states that the landing distance required to stop will be increased 60 percent in the event of a single braking system failure or malfunction. N44GA, therefore, would have needed 4,960 feet of runway to **Stop** the airplane if such a failure had occurred.

Had N44GA been operating under the provisions of 14 CFR Part 121 or 135, a minimum landing runway length would have been required which would have permitted the airplane to land and stop within 60 percent of the effective runway length. Thus, a runway length of 5,167 feet would have been required. A safe landing could have been made on a 5,167-foot runway using the emergency brake system.

The Safety Board recognizes that many professional and prudent 14 CFR Part 91 operators previously have adopted a practice of using landing runway lengths consistent with the margins provided by Parts 121 and 135. However, informal discussions with several operators of airplanes who operate under Part 91 indicate that, in some instances, there is misunderstanding and uncertainty about the benefits to be derived from the use of factored versus actual landing distance data. Furthermore, we believe that some operators and flightcrews do not adhere to this practice or are unaware of, or fail to consider, the added stopping distance required in the event of a primary brake failure. The Safety Board believes the Federal Aviation Administration should encourage operators and flightcrews to adhere to landing runway length requirements consistent with either the emergency brake requirements of 14 CFR Part 25 or the factored landing runway length requirements contained in 14 CFR Parts 121 and 135.

The road leading to the airport from the city of Avalon is steep, narrow, and winding, and does not lend itself to high vehicle speeds. Consequently, the 20-minute travel time of the units to reach the accident scene from Avalon probably was the minimum that could have been expected. Based on aircraft accident survival data, a 20-minute response time is unacceptable because occupants who cannot escape or be removed from a burning airplane in 2 minutes or less time are not likely to survive.

As of February 1981, there had been a total of 56,566 aircraft operations at the Catalina Airport during the previous 12 months, including 3,768 nonscheduled and 52,798 general aviation operations involving a total of 57,881 passengers. In the last 16 years, the Catalina Airport has had 24 other accidents which fortunately did not result in any fatalities. However, given the number of aircraft operations each year and the number of passengers involved, the potential exists for an accident such as the one involving N44GA to occur again, possibly with the same tragic results, since the safety areas at both ends of the runway are very short and the terrain drops off precipitously at both ends. This airport has a very unforgiving environment in the event of an undershoot or overrun type of accident.

The Safety Board believes that there are several ways in which the CFR capability at the airport could be improved:

- (1) A fully trained Los Angeles County CFR unit or an Avalon City Fire Department unit could be stationed at the airport during its operating hours; 4/ or
- (2) Airport personnel could be trained in CFR techniques by the Los Angeles County and Avalon City Fire Departments under the guidelines provided by the Federal Aviation Administration's (FAA) Advisory Circular 139.49, "Programs for Training of Fire Fighting and Rescue Personnel":  
or

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4/ The operating hours of the airport are 0800-1900 from June to September and 0800-1700 from October to May.

- (3) One or more trained CFR personnel from the Los Angeles County and Avalon City Fire Departments could be stationed at the airport during operating hours to direct airport personnel who have some training in CFR procedures in *responding to an* accident.

As a result of its investigation of this accident, the National Transportation Safety Board recommended that:

--the Federal Aviation Administration:

Issue an operations bulletin directing general aviation inspectors and accident prevention specialists to urge operators of transport category airplanes in general aviation operations to use minimum landing runway lengths which provide the safety margin required by 14 CFR Part 135 or, at the least, a safety margin consistent with the performance of the emergency brake system of the airplane. The operations bulletin should highlight the use of the emergency brake system or alternate emergency procedures (i.e., aborted landings) not only for preplanned failed **brake** landings, **but** for use in the event the brakes fail after touchdown. **Copies** of the operations bulletin should be provided to the National Business Aircraft Association for dissemination to its members. (Class II, Priority Action) (A-85-115)

--the County of Los Angeles Fire Department, the Santa Catalina Island Conservancy, and the City of Avalon Fire Department:

Improve the current crash, fire/rescue (CFR) capability at the Catalina Airport **by:** (1) stationing a fully trained CFR unit at the airport during its operating hours; or (2) training airport personnel in CFR techniques under the guidelines provided by Federal Aviation Administration Advisory Circular 139-49; or (3) stationing one or more trained CFR personnel at the airport during operating hours to direct airport personnel who have some training in CFR procedures. (Class II, Priority Action) (A-85-116)

The attached aviation accident brief contains the Safety Board's findings of probable cause of the accident.

**BY THE NATIONAL TRANSPORTATION SAFETY BOARD**

/s/ JIM BURNETT  
Chairman

/s/ PATRICIA A. GOLDMAN  
Vice Chairman

/s/ G. H. PATRICK BURSLEY  
Member

October 30, 1985

National Transportation Safety Board  
Washington, D.C. 20594

Brief of Accident

File No. - 2616      1/30/84      AVALON:CA      A/C Reg. No. N446A      Time (Lcl) - 1330 FS

---Basic Information---

Type Operating Certificate - NONE (GENERAL AVIATION)

Type of Operation - BUSINESS  
Flight Conducted Under - 14 CFR 91  
Accident Occurred During - LANDING

Aircraft Damage  
DESTROYED

Fire -  
ON GROUND

	Injuries			
	Fatal	Serious	Minor	None
Crew	2	0	0	0
Pass	4	0	0	0

---Aircraft Information---

Make/Model - LEAR JET 24  
Landing Gear - TRICYCLE-RETRACTABLE  
Max Gross Wt - 13000  
No. of Seats - 7

Eng Make/Model -  
Number Engines - 2  
Engine Type - UNK/NR  
Rated Power - 2850 LBS THRUST

ETI Installed/Activated - NO - N/A  
Stall Warning System - UNK/NK

---Environment/Operations Information---

Weather Data

Wx Briefing - NO RECORD OF BRIEFING  
Method - N/A  
Completeness - N/A  
Basic Weather - VMC

Wind Dir/Speed - 110/004 KTS  
Visibility - 100.0 SM

Lowest Sky/Clouds - 20000 FT SCATTERED  
Lowest Ceiling - NONE  
Obstructions to Vision - NONE  
Precipitation - NONE  
Condition of Light - DAYLIGHT

Itinerary

Last Departure Point - SANTA ROSA:CA  
Destination - SAME AS ACC/INC

ATC/Airspace

Type of Flight Plan - IFR  
Type of Clearance - NONE  
Type Arch/Lndg - FULL STOP

Airport Proximity  
ON AIRPORT

Airport Data

CATALINA  
Runway Ident - 22  
Runway Lth/Wid - 3240/ 100  
Runway Surface - ASPHALT  
Runway Status - DRY

---Personnel Information---

Pilot-In-Command

Certificate(s)/Rating(s)  
COMMERCIAL, ATP, CFI  
SE LAND, ME LAND, SE SEA

Age - 37  
Biennial Flight Review  
Current - YES  
Months Since - 5  
Aircraft Type - LEAR 24

Medical Certificate - VALID MEDICAL-NO WAIVERS/LIMIT  
Flight Time (Hours)

Total	8000	Last 24 Hrs	1
Make/Model	1100	Last 30 Days	29
Instrument	UNK/NR	Last 90 Days	95
Multi-Eng	5300	Rotorcraft	UNK/NK

Instrument Rating(s) - AIRPLANE

---Narrative---

THE ACFT DEPARTED ON A SALES DEMO FLT TO MONTEREY, CA WITH POTENTIAL BUYERS ABOARD. EN ROUTE, THE DESTINATION WAS CHANGED TO AVALON, CA. UNICOM ADVISED THE CREW OF THE WIND DIRECTION & SPEED ON DOWNWIND. WITNESSES REPORTED THE ACFT WAS SLIGHTLY HI ON FINAL, BUT SAID THE PLT CORRECTED THE ANGLE OF DESCENT. THE ACFT TOUCHED DOWN APRX 500' DOWN THE RWY, WHICH WAS CROWNED (SLOPED UPWARD FOR APRX THE 1ST 2000', THEN LEVELED OFF). THE CREW COULD NOT SEE THE END OF THE RWY AT TOUCHDOWN. THE THRUST REVERSERS WERE DEPLOYED APRX 1000' AFTER TOUCHDOWN. WITNESSES HEARD THE ENG SOUND INCREASE, THEN DECREASE, THEN INCREASE AGAIN AS THE ACFT WENT OFF THE RWY & OVER A 90' BLUFF. FIRE ERUPTED IMMEDIATELY. WITHIN 3 MIN, ARPT PSNL ARRIVED WITH FIREFIGHTING EQUIP, BUT THEY WERE NOT TRAINED AS FIREFIGHTERS & DID NOT TRY TO STOP THE FIRE FOR FEAR OF AN EXPLOSION. NO EVIDENCE OF A MECHANICAL FAILURE/MALFUNCTION WAS FOUND. FOUND L FLAP EXTENDED, L SPOILER RETRACTED & LOCKED, TIRE MARKS ON RWY. ESTIMATED GROSS WT: 11,500 LBS. COMPUTED LANDING DIST OVER A 50' OBSTCL: 3100'.

Brief of Accident (Continued)

File No. - 2616

1/30/84

AVALON, CA

A/C Reg. No. N446A

Time (Lcl) - 1330 PS

Occurrence #1      OVERRUN  
Phase of Operation      LANDING - ROLL

Findings(s)

1. UNDETERMINED
2. FLIGHT TO ALTERNATE DESTINATION - IMPROPER - PILOT IN COMMAND
3. IMPROPER DECISION, SELF-INDUCED PRESSURE - PILOT IN COMMAND
4. IMPROPER DECISION, PRESSURE INDUCED BY OTHERS - OTHER PERSONNEL
5. AIRPORT FACILITIES, RUNWAY/LANDING AREA CONDITION - UPHILL
6. AIRPORT FACILITIES, RUNWAY/LANDING AREA CONDITION - ROUGH/UNEVEN

Occurrence #2      ON GROUND COLLISION WITH TERRAIN  
Phase of Operation      LANDING

Findings(s)

7. TERRAIN CONDITION - MOUNTAINOUS/HILLY
8. TERRAIN CONDITION - DOWNHILL
9. AIRPORT FIRE/RESCUE SERVICE - INADEQUATE

-----Probable Cause-----

The National Transportation Safety Board determines that the Probable Cause(s) of this accident is/are finding(s) 1

Factor(s) relating to this accident is/are finding(s) 2,3,4,5,6,7,8,9



# AIRCRAFT ACCIDENT/INCIDENT SUMMARY

File No. 1392

Aircraft Operator Bernard A. Lafferty

Aircraft Type & Registration: Beech V35B, N9353Q

Location: Charlottesville, Virginia

Date & Time: February 17, 1984, 1021 e.s.t.

Persons on Board: 1

Injuries: 4 Fatal

Aircraft Damage: Destroyed

Other Damage or Injury: None

Type of Occurrence: In-flight Breakup

Phase of Operation: Approach

On February 17, 1984, about 1021 eastern standard time (e.s.t.),<sup>1/</sup> a Beech V35, N9353Q, broke apart in flight and crashed during an Instrument Landing System (ILS) approach in instrument meteorological conditions to runway 3 at Charlottesville, Virginia. The pilot and the three passengers were fatally injured, and the airplane was destroyed. The 1036 surface weather observation for Charlottesville was estimated 500 feet overcast, visibility 5 miles in fog, and wind 170 degrees at 7 knots with no reports of thunderstorms or turbulence.

The flight originated at Rainard Field in Hartford, Connecticut, on February 17. The pilot, his wife, and two children were on a pleasure trip to Florida, with a planned stop at Charlottesville on business. The time of departure was not established, but at 0805, after departure under Visual Flight Rule; (VFR), the pilot radioed the Teterboro, New Jersey, Flight Service Station (FSS) for weather information, and at 0814:10 filed an Instrument Flight Rules (IFR) flight plan to Charlottesville, to be activated near Sparta, New Jersey. He

<sup>1/</sup> All times herein are eastern standard time, based on the 24-hour clock.



reported 3 hours 15 minutes fuel on board, an estimated time en route of 2 hours, 150 knots cruise speed, and requested 4,000 feet as a cruising altitude. Later, during communications with the New York Air Route Traffic Control Center (ARTCC) about the flight plan, he was requested to climb and maintain 8,000 feet and responded, "...we got a passenger with an ear problem;" the flight was then cleared to maintain 6,000 feet.

During the remainder of the flight the pilot was in contact with Harrisburg Approach Control, Baltimore and Dulles Air Traffic Control (ATC) Towers, Washington Air Route Traffic Control Center (ARTCC), and the Charlottesville ATC tower. No problems were reported. At 0931:32, the pilot requested "lower" to 4,000 feet and was advised that descent to 4,000 feet was not possible because of the minimum vectoring altitude and that 5,000 feet probably would put him in the clouds. About 5 minutes later, the pilot radioed "...may we go down to five now, looks like the clouds are down quite a bit." Descent to 5,000 feet was approved. At 1013:12, descent to 4,000 feet was approved, and between 1013:18 and 1017:23 the flight was vectored to intercept the localizer, cleared for a straight-in ILS approach to runway 3, and instructed to contact Charlottesville Tower. Most of the en route flight was conducted in visual meteorological conditions on top of the overcast, estimated to be 4,500 to 5,000 m.s.l.

The pilot contacted the Charlottesville Tower, was given current weather, and was requested to "report Azalea Park [Azalea Park nondirectional beacon (NDB), the initial approach fix (IAF)] and the outer marker." At 1019:45, the pilot reported inbound at the IAF. This was the last radio communication from the pilot. About 1 minute later, at 1020:43, radar contact was lost.

Based on analysis of the recorded radar data of the flight, airspeed on the entire approach was erratic, fluctuating between a high of 165 knots indicated airspeed (KIAS) within 3 nautical miles of the NDB to a low of 54 KIAS at the last radar "hit." Because radar plots were taken at 12-second intervals, no positive statements can be made concerning the airplane's performance between the plots. According to the data, the aircraft turned northeast to parallel the localizer course, and between 1016:33 and 1019:31, the calculated ground speed averaged 163 knots. During this time, the airplane descended from 3,800 feet mean sea level (m.s.l.) to 3,000 feet m.s.l. near the IAF, and in the next 1 minute 12 seconds, from 1019:31 to 1020:43, the encoding altimeter readout reflected a descent from 3,000 feet to 2,300 feet m.s.l.

The radar data showed that the flight initially intercepted and crossed the inbound course at about 1017:20 and proceeded left of the course. A large change in heading, from about 353 degrees to 065 degrees, was made to return to course, and the aircraft again passed through the localizer and remained right of the course until 1019:31 when nearly abeam the NDB.

Beginning at 1019:31, and up to 1020:43 when radar contact was lost, several large heading changes were made. From the position right of the localizer course, the radar indicated a change from about 017 degrees to about 325 degrees, back to the localizer course. With a heading intercept of this magnitude, the aircraft would rapidly pass through the localizer from right to left, and the abrupt full scale deflection of the localizer course indicator may not have been noticed. Juxtaposition of the radar plot with the pilot's last radio transmission at 1019:45 when he reported inbound at the IAF reveals no indication that the pilot was not in control of the aircraft at that time; he expressed no concern about the approach. The aircraft passed through the localizer, and data from the last two radar hits suggest that the pilot was turning right to correct back to the inbound course. The last radar return at 1020:43 indicated that N9353Q was at an altitude of 2,300 feet altitude at a calculated 54 KIAS. At 1024:42, Washington ARTCC telephoned the Charlottesville Tower controller and asked if N9353Q was in sight, commenting, "...we saw him make a funny turn..." The Charlottesville controller attempted to contact N9353Q by radio, but there was no response.

The wreckage was located about 1.5 nautical miles northwest of the IAF (Azalea Park Nondirectional Beacon). The wreckage was confined within a 60-foot radius in the median of Interstate Highway 64 about 1 mile west of U.S. Highway 29, except for the right wing which was 360 feet northeast of the main wreckage. There was no fire.

The engine and propeller, the instrument panel, all seats, both wings, and the right stabilizer were detached from the fuselage, which was in the center of the wreckage pattern. The fuselage was collapsed laterally, but there was continuity of the flight and power control cables to the areas of separation of other components. The landing gear were found up and locked.

Each wing remained in one piece, and each had about 19 inches of the front spar carry-through structure still attached. The spar upper cap members on each wing carry-through were deformed downward, typical of compression buckling separation, and the lower spar cap members were bent upward at the fracture area, consistent with excessive upward loading.

The left stabilizer remained attached to the fuselage. The outboard portion of the stabilizer was folded downward along a crease which originated at the leading edge of the inboard end and went aft to the trailing edge, as if the leading edge had rotated down. The right stabilizer, found adjacent to and partially underneath the left wing, was separated from the airplane tail structure at the front and rear spar attachment locations. The front spar was bent forward and upward at the fracture area, as if the leading edge had rotated up.

The elevator trim tab actuator jackscrew position found in the wreckage equated to full nose-down trim; the right flap actuator position equated to about 20 degrees, and the left flap actuator was not extended. However, because of the breakup and impact forces, no conclusions can be reached based on the flight control positions.

Metallurgical examination of the wing carry-through structure showed features typical of overstress separations, and no evidence of fatigue or preexisting cracking was found. The vacuum pump drive, which powers the flight Instruments, was found fractured from overload forces.

The pilot's flight logbook was not found, but FAA records showed that he was issued a private pilot certificate, airplane single engine land rating, on July 12, 1973, at which time he was required to take a Special Medical Flight Test because he had vision in only one eye. An instrument rating was issued on December 17, 1974, and a commercial pilot certificate on September 27, 1979, at which time he again was given a Special Medical Flight Test and issued a Statement of Demonstrated Ability waiver for "no useful vision, 'Left eye.'"

The pilot held a current, valid, Second Class Medical Certificate, issued June 9, 1983. On his application for the certificate, he listed 1,640 total flight hours, with 61 hours in the previous 6 months. His commercial certificate application in 1979 showed 172.9 hours instrument flight time, but his current total instrument time, recent experience, and proficiency were not established. A friend of the pilot, who was an instructor, reported the pilot recently had had a Biennial Flight Review. However, he could not remember the date nor locate the examiner who had administered the test. The pilot had participated in a Civil Air Patrol (CAP) search mission on February 2, 1984, but there was no conclusive evidence that he had flown between that date and the day of the accident.

Friends of the pilot said he had a cold and associated nasal drainage. Two days before the accident the pilot told a friend that he had stopped smoking his pipe temporarily because of the cold. He also said he felt dizzy, and had asked what medication was legal to take and still fly. The Virginia Medical Examiner's toxicology report was negative for alcohol, but was positive for Chlorpheniramine, an antihistamine that can produce drowsiness and dizziness in some people; the report from the Civil Aeromedical Institute (CAMI) was negative for both alcohol and drugs. No explanation could be discovered for the difference.

The pilot was a contributing editor for Aviation Consumer. He had written articles relating to the Beech 35, and was aware of its flight characteristics. Witnesses described him as extremely safety-conscious, a competent pilot, and one who attended safety seminars regularly.

The airplane was registered to the current owner on August 8, 1978. It was equipped for instrument flight and had a Brittain wing leveler autopilot. The maximum gross weight of the airplane was 3,400 pounds with center of gravity (c.g.) limits from 82.1 inches to 84.4 inches. It was equipped with 80-gallon capacity, extended-range fuel tanks, which had been filled after the CAP search mission on February 2. Since it could not be verified that the airplane was flown to Allentown, Pennsylvania, after February 2, as believed by one witness, and a search failed to locate evidence of subsequent fueling elsewhere, it was assumed that the fuel tanks were full at takeoff. Therefore, based on all evidence, the takeoff gross weight was computed to be 3,404.8 pounds with a c.g. of 86.6, and the landing gross weight and c.g. were computed to be 3,194.8 pounds and 87.3 with 270 pounds of fuel remaining at the time of the accident. The c.g. moves rearward as fuel decreases,

### Summary

The investigation revealed no evidence of metal fatigue failure or preexisting conditions that would have contributed to the in-flight breakup, or of mechanical or structural evidence that would have caused the airplane to enter an overspeed or dive condition. The damage observed to the wing and empennage structures indicated that the airplane was subjected to high positive g loads, as would normally occur during a pull-up maneuver to recover from an overspeed or dive condition. Structural analysis demonstrated that the right wing, recovered apart from the main wreckage, failed initially. The upward bending of the wing spar structure, indicative of the positive g overload condition, in turn indicated that the tail section was not an initial item to fail. Upon separation of the right wing, the resultant asymmetric lift caused the airplane to roll violently to the right, consistent with the observed negative deformation of the left stabilizer and the positive bend of the right stabilizer front spar.

The performance of N9353Q was calculated from radar plots taken at 1/2-second intervals, and therefore exact performance values could not be established conclusively. Nevertheless, the approach to the IAF was erratic, and the analysis of the data showed large changes in both speed and heading.

No information was available to assess the pilot's current proficiency, especially for instrument flight. Monocularity per se is not disqualifying for pilot certification, and this pilot had passed Special Medical Flight Tests in 1973 and 1979, demonstrating successfully his ability to perform airman duties. Persons with monocular vision learn to compensate for the inability to see in one eye, and in this case there was no evidence to conclude that monocularity would have had more than a minimal effect on head movements during instrument flight. However, abrupt head movement during a prolonged turn can result

in fluid movement in the semicircular canals of the vestibular organs and induce an overwhelming sensation of movement in another direction, i.e., the "Coriolis Illusion."

Federal Aviation Regulations, 14 CFR 91.11(a)(3) prohibits acting as a crewmember while using any drug that affects the faculties in any way contrary to safety. Nevertheless, the concentration of Chlorpheniramine detected by the toxicology tests, presumably taken by the pilot to relieve distress from his cold, probably would not have affected the pilot's vestibular organs or have made him significantly more prone to spatial disorientation. On the other hand, sinus blocks and the inability to equalize pressure on the eardrum can be extremely painful.

While it is known that control of an airplane becomes more difficult when the c.g. moves beyond prescribed parameters, there was no evidence that the out of limit c.g. of N9353Q contributed directly to this accident.

The Safety Board's investigation could not substantiate that any one of the above factors, in isolation, would result in loss of control of the airplane. In normal circumstances, the pilot's experience level and familiarity with the airplane should have been sufficient to overcome his physical disability of one eye. However, flying with a cold, using medication while flying, and flying the airplane well aft of its c.g. limit, illustrates poor judgment and/or overconfidence in his abilities. The Board concludes that these factors, combined, may have led to spatial disorientation and loss of control in instrument meteorological conditions.

The attached Brief of Accident contains the Safety Board's conclusions, findings of probable cause, and related factors.

**BY THE NATIONAL TRANSPORTATION SAFETY BOARD**

/s/ JIM BURNETT  
Chairman

/s/ PATRICIA A. GOLDMAN  
Vice Chairman

/s/ G. H. PATRICK BURSLEY  
Member

November 15, 1985

National Transportation Safety Board  
Washington, D.C. 20544

Brief of Accident

File No. - 1392      2/17/84      CHARLOTTESVILLE, VA      A/C Reg. No. N93530      Time (Lcl) - 1021 EST

-----Basic Information-----

Pure Operating Certificate-NONE (GENERAL AVIATION)

Type of Operation - PERSONAL  
Flight Conducted Under - 14 CFR 91  
Accident Occurred During - DESCENT

Aircraft Damage  
DESTROYED  
Fire - NONE

	Fatal	Injuries		
		Serious	Minor	None
Crew	1	0	0	0
Pass	3	0	0	0

-----Aircraft Information-----

Make/Model - BEECH V35B  
Landing Gear - TRICYCLE-RETRACTABLE  
Max Gross Wt - 3400  
No. of Seats - 5

End Make/Model - CONTINENTAL IO-520-BA  
Number Engines - 1  
Engine Type - RECIP-FUEL INJECTED  
Rated Power - 285 HP

ELT Installed/Activated - YES/NO  
Stall Warning System - YES

-----Environment/Operations Information-----

Weather Data

Wx Briefing - FSS  
Method - ACFT RADIO  
Completeness - PARTIAL, LMTD BY PILOT  
Basic Weather - IVC  
Wind Dir/Speed - 170/007 KTS  
Visibility - 5.0 SM  
Lowest Sky/Clouds - 500 FT  
Lowest Ceiling - 500 FT OVERCAST  
Obstructions to Vision - FOG  
Precipitation - NONE  
Condition of Light - DAYLIGHT

Itinerary

Last Departure Point - HARTFORD, CT  
Destination - SAME AS ACC/INC

ATC/Airspace

Type of Flight Plan - IFR  
Type of Clearance - IFR  
Type Arch/Lnds - ILS-COMplete

Airport Proximity

OFF AIRPORT/STRIP

Airport Data

CHARLOTTESVILLE ALBEMARLE  
Runway Ident - 03  
Runway Lth/Wid - 6001/ 150  
Runway Surface - ASPHALT  
Runway Status - DRY

-----Personnel Information-----

Pilot-In-Command  
Certificate(s)/Rating(s)  
COMMERCIAL  
SE LAND

Age - 43  
Biennial Flight Review  
Current - YES  
Months Since - UNK/NR  
Aircraft type - UNK/NR

Medical Certificate - VALID MEDICAL-WAIVERS/LIMIT  
Flight Time (Hours)  
Total - 1640  
Make/Model - UNK/NR  
Instrument - UNK/NR  
Multi-Eng - UNK/NR  
Last 24 Hrs - UNK/NR  
Last 30 Days - UNK/NR  
Last 90 Days - UNK/NR  
Rotorcraft - UNK/NR

Instrument Rating(s) - AIRPLANE

-----Narrative-----

WHILE PROCEEDING ON AN IFR FLT PLAN, THE PLT REQUESTED HE BE ASSIGNED AN ALT BELOW 8000 FT DUE TO "A PASSENGER WITH AN EAR PROBLEM." OTHERWISE, THE EN ROUTE PORTION OF THE FLT PROCEEDED WITHOUT INCIDENT. DURING ARRIVAL, THE PLT WAS CLEARED FOR AN ILS APCH TO RWY 3, HIS LAST TRANSMISSION WAS MADE AT 1019145 EST WHEN HE REPORTED INBOUND ON THE AZALEA NDB, WHICH WAS 7.8 MI FROM THE RWY ON THE ILS LOCALIZER. SHORTLY AFTER THAT THE ACFT CRASHED 1.5 MI NW OF THE NDB. AN INVESTIGATION REVEALED THE PLT HAD A HEAD COLD, 2 DAYS EARLIER, & HAD TAKEN MEDICATION, BUT A TOX CHECK (LIVER SAMPLE) SHOWED ONLY 1.8 MG/KG OF CHLORPHENIRAMINE. RADAR DATA SHOWED THAT WHEN THE ACFT WAS NEAR THE NDB, IT MADE SHARP L & R TURNS & HAD DESCENDED FROM 3000 TO 2300 FT BEFORE RADAR CONTACT WAS LOST. THE R WING HAD SEPARATED & WAS FOUND 360 FT FROM THE MAIN WRECKAGE. AN EXAM OF THE V-TAIL SHOWED DEFORMATION OF THE L STAR & UPWARD DEFORMATION OF THE R STAR. NO PRE-ACCIDENT MECHANICAL PROBLEM WAS FOUND. CG ESTIMATED 2.1 INCHES BEHIND AFT LIMIT. PLT DEND, NO USEFUL VISION, L EYE.

Brief of Accident (Continued)

File No. - 1392

2/17/84

CHARLOTTESVILLE,VA

A/C Reg. No. N9353D

Time (Lcl) - 1021 EST

Occurrence #1      LOSS OF CONTROL - IN FLIGHT  
Phase of Operation      APPROACH - IAF TO FAF/OUTER MARKER (IFR)

Findings(s)

1. PLANNING-DECISION - IMPROPER - PILOT IN COMMAND
2. AIRCRAFT WEIGHT AND BALANCE - EXCEEDED - PILOT IN COMMAND
3. WEATHER CONDITION - LOW CEILING
4. AIRCRAFT HANDLING - NOT MAINTAINED - PILOT IN COMMAND
5. IMPROPER USE OF EQUIPMENT/AIRCRAFT, SPATIAL DISORIENTATION - PILOT IN COMMAND
6. IMPROPER USE OF EQUIPMENT/AIRCRAFT, PHYSICAL IMPAIRMENT (OTHER ORGANIC PROBLEM) - PILOT IN COMMAND

Occurrence #2      AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION  
Phase of Operation      DESCENT

Findings(s)

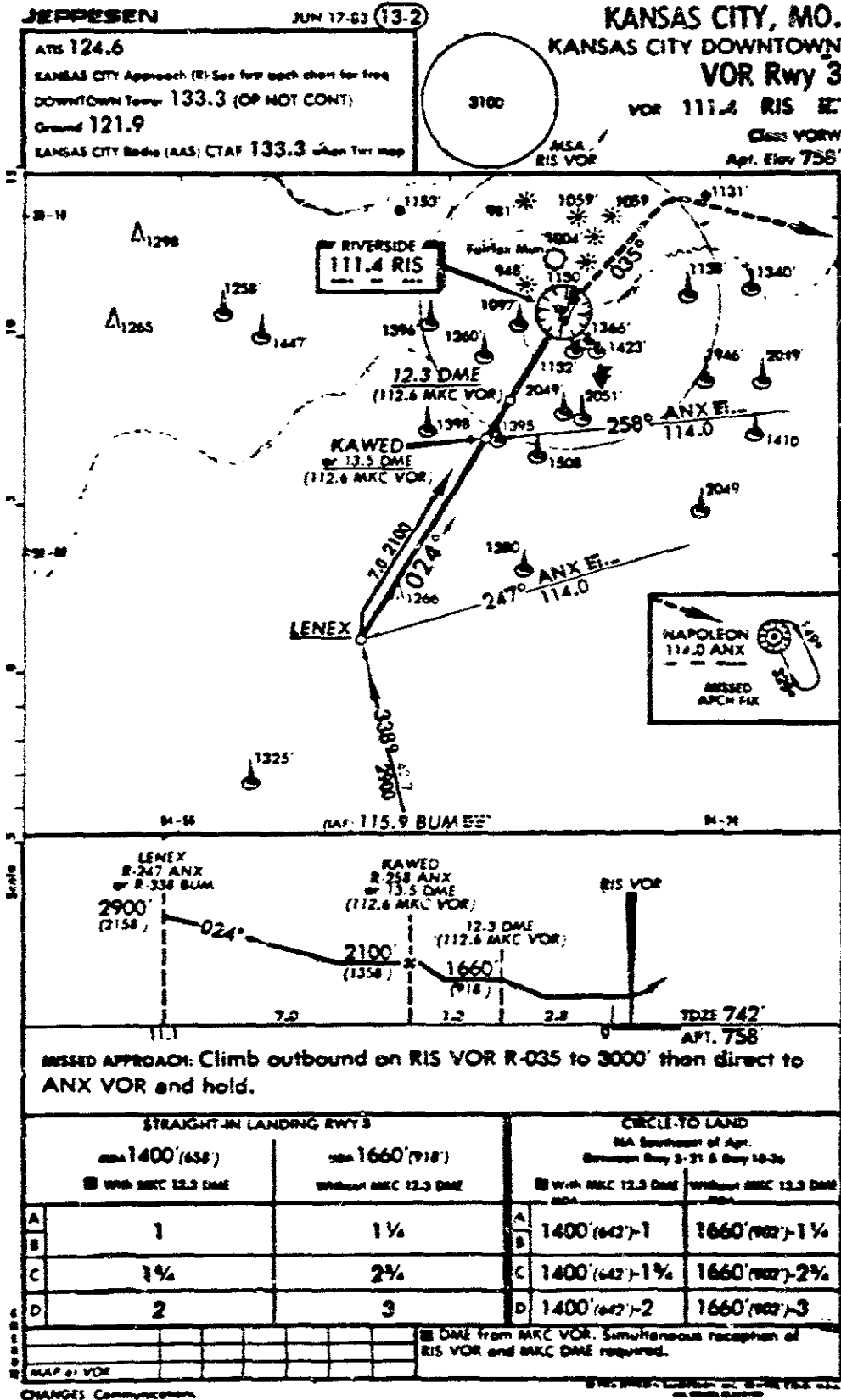
7. REMEDIAL ACTION - INITIATED - PILOT IN COMMAND
8. DESIGN STRESS LIMITS OF AIRCRAFT EXCEEDED - PILOT IN COMMAND
9. WING - OVERLOAD
10. WING - SEPARATION
11. STABILIZER - OVERLOAD
12. STABILIZER - SEPARATION

Occurrence #3      IN FLIGHT COLLISION WITH TERRAIN  
Phase of Operation      DESCENT - UNCONTROLLED

-----Probable Cause-----

The National Transportation Safety board determines that the Probable Cause(s) of this accident is/are finding(s) 4,5,8

Factor(s) relating to this accident is/are finding(s) 1



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Figure 1.—Approach chart-Kansas City, Missouri, VOR Runway 3.



Shortly after overflying the Downtown Airport, the captain lost sight of the airport. The first officer stated that the airport was "right underneath." The captain then instructed the first officer to "get it up to two thousand and circle around" to which the first officer responded, "I am at two thousand —twenty three hundred." Then another crewmember (unidentified) said, "you mean 2,900." Shortly thereafter the tower asked the flight, "Do you have Downtown in sight? It looks like you might be lining up on Fairfax." The airplane was at that time heading southeast about 1,800 feet.

At 0659:15, the flight contacted the tower and said that they were going to make a missed approach. The flight was told to fly a heading of 360 degrees and to remain on the frequency. Shortly afterward, while the airplane was about 1,800 feet, the flight engineer said, "pull up, there's something straight ahead of us." The first officer called for climb power and shortly thereafter the flight engineer advanced the power levers. There were a number of concerned comments by the first officer addressed to the captain that the airplane was stalling. The flight data recorder (FDR) showed that the airplane climbed from about 1,700 feet to about 3,100 feet in 20 seconds — an average rate of climb of about 4,200 feet per minute. According to a ground witness the airplane "appeared to stop in midair and then fall out of the sky." The FDR also showed that the airspeed decreased rapidly from an average speed of 155 KIAS to less than 80 KIAS, and seconds later the trace ended. The stall speed of the airplane at 97,000 pounds gross weight, landing gear retracted, and flaps extended to the 18-degree (78 percent) position was 96 KCAS. 6/

The air traffic control (ATC) radar data indicated that after the airplane stalled, it descended from about 3,000 feet to 1,400 feet in 14 seconds, a very high rate of descent. Since the crash site elevation was about 780 feet high and the altitude of the stall was about 3,000 feet, the airplane descended about 2,220 feet in 22 seconds, an average rate of descent of 6,660 feet per minute.

Except for the cockpit area and a portion of the right outboard wing and the forward fuselage, the major portion of the airplane came to rest in the east water sediment tank at the treatment plant. The right outboard wing section separated and fell in the west tank. The tanks are 196 feet in diameter and 25 feet deep, and each tank holds 4.9 million gallons of water. The steel catwalk on top of the east tank was destroyed, and two utility power poles and electrical wires were damaged.

The airplane was within its weight and center-of-gravity limitations, and there was no evidence that the cargo had shifted. Examination of the wreckage and the witness statements indicated that the airplane crashed in an almost level attitude and with the left wing slightly down. The landing gear was retracted, and the flaps were extended to the 18-degree (78 percent) setting. The engines and propellers exhibited extensive rotational damage, and the propeller blade angles were in the flight-idle thrust regime. There was no evidence of any preexisting failure or malfunction of the airplane engines, systems, or components.

The flight crew was properly certificated to conduct the flight; however, there were no records to indicate that the captain or the first officer met currency requirements to conduct the flight; investigators were unable to determine conclusively whether the captain and first officer had received the required six-month proficiency checks. The results of postmortem toxicological examinations of the crew were negative for alcohol and drugs for each crewmember.

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6/ Knots of calibrated airspeed.

Examination of the CVR indicated that the first officer flew the airplane during the descent, approach, and circle maneuver and that the captain took control of the airplane shortly after announcing the missed approach. Since there was no requirement for an aural stall warning device when the L-188 was certificated, none was installed. However, the airplane had at the time of certification, sufficient aerodynamic and mechanical control buffet to warn of an impending stall, and it was evident from the CVR transcript that the first officer was well aware of the impending and actual stall of the airplane-

The CVR clearly showed that the first officer also was selecting the radio frequencies even though the captain was talking on the radios. The first officer's error in configuring the communications radio may have distracted the flightcrew and may have contributed to their lack of awareness of the actual position of the airplane while in instrument meteorological conditions (IMC) during the final portion of the approach. The flightcrew's indecisiveness in determining the exact altitude for the circling maneuver and their failure to use all of the navigational aids available to identify their position relative to the Downtown Airport probably contributed to the first officer's loss of awareness of the exact airplane position and resulted in the airplane traveling farther to the northwest than was necessary to maneuver for the approach. This factor resulted in the increasing concern of the captain with regard to altitude and position as evidenced by several terse comments made during the circling maneuver. Finally, the captain made the decision to declare a missed approach, and the first officer responded by turning to a heading of 360 degrees. The lack of position awareness led to a radical climb-to-altitude when the flight engineer called their attention to an obstacle directly ahead. Actually, there was no obstacle that was critical to the airplane's position. The nearest obstacle, and most likely the one called out by the flight engineer, was the lighted smokestack at the public utility plant which was about 700 feet below the flight's circling altitude of 1,800 feet.

The Safety Board's investigation determined that the flightcrew misinterpreted the approach chart and did not execute the approach correctly, which resulted in the requirement to maneuver in order to return for a second approach. During the circling maneuver, the flightcrew became disoriented and unsure of their exact position, which resulted in the decision to execute a missed approach. Upon declaring a missed approach and after seeing indications of obstacles ahead, the flightcrew overreacted to the situation and performed a maneuver which resulted in an aerodynamic stall from which they were unable to recover.

It is evident that crew coordination was poor during the final segments of the flight. The Safety Board could not determine why the first officer, who was flying the airplane, also was controlling the radio frequencies. Poor coordination is also evidenced by the failure of the captain to check the first officer's approach briefing and note the distance error. The information required to make a proper approach was addressed adequately in TPI's Operations Manual. The captain's subsequent concern, as expressed to the first officer, during the final segments of the flight only exacerbated a tense cockpit environment. The lack of any prebriefed missed approach procedure added to an already difficult situation during the circle maneuver in the terminal area, a situation which demanded attentive flying aeronautical skills and coordination from the crew.

There had been no operational base inspections of TPI by the Federal Aviation Administration (FAA) in Miami, Florida, since the airplane had been placed into service in November 1984. Although the Safety Board believes that the flightcrew was qualified and had sufficient experience to conduct the flight safely, the recordkeeping inadequacies (lack of documentation of proficiency checks) noted by the Safety Board during the investigation are indicative of inadequate routine FAA surveillance. These factors are being evaluated as part of the Board's Ongoing safety study of FAA surveillance of air carrier operators.

The attached aviation accident brief contains the Safety Board's findings of probable cause relating to the accident.

**BY THE NATIONAL TRANSPORTATION SAFETY BOARD**

/s/ JIM BURNETT  
Chairman

/s/ PATRICIA A. GOLDMAN  
Vice Chairman

/s/ G. H. PATRICK BURSLEY  
Member

November 15, 1985

National Transportation Safety Board  
Washington, D.C. 20594

Brief of Accident

File No. - 311      1/00/85      KANSAS CITY, KS      A/C Reg. No. N3570      Time (Local) - 0701 CST

---Basic Information---

Type Operating Certificate - AIR CARRIER	FLAG - DOMESTIC	Aircraft Damage	Injuries			
Name of Carrier - TFI INTERNATIONAL AIRWAYS		DESTROYED	Fatal	Serious	Minor	None
Type of Operation - NON SCHED. DOMESTIC/CARGO		Fire	3	0	0	0
Flight Conducted Under - 14 CFR 121		NONE	Crew Pass	0	0	0
Accident Occurred During - DESCENT						

---Aircraft Information---

Make/Model - LOCKHEED 188A	Eng Make/Model - ALLISON D-501-B13	ELI Installed/Activated - YES/YES
Landing Gear - TRICYCLE-RETRACTABLE	Number Engines - 4	Stall Warning System - NO
Max Gross Wt - 118000	Engine Type - TURBOPROP	
No. of Seats - UNK/NR	Rated Power - 3750 HP	

---Environment/Operations Information---

<b>Weather Data</b>	<b>Itinerary</b>	<b>Airport Proximity</b>
WX Briefing - NO RECORD OF BRIEFING	Last Departure Point - BCTRUI, MI	OFF AIRPORT/SIRIP
Method - N/A	Destination - KANSAS CITY, MO	<b>Airport Data</b>
Completeness - N/A	AIC/Airspace	KANSAS CITY DOWNTOWN
Basic Weather - VMC	Type of Flight Plan - IFR	Runway Ident - 36
Wind Dir/Speed - 080/010 KTS	Type of Clearance - IFR	Runway Lth/Wid - 7001/ 150
Visibility - 5.0 SM	Type APCH/Lndg - VOR/DME	Runway Surface - CONCRETE
Lowest Sky/Clouds - 1000 FT		Runway Status - WET
Lowest Ceiling - 1000 FT (OVERCAST)		
Obstructions to Vision - FOG		
Precipitation - NONE		
Condition of Light - DAWN		

---Personnel Information---

Pilot-in-Command	Age - 54	Medical Certificate - VALID MEDICAL-WAIVERS/LIMIT
Certificate(s)/Rating(s)	Biennial Flight Review	Flight Time (Hours)
AIP	Current - UNK/NR	Total - 14500
ME LAND/SE SEA	Months since - UNK/NR	Last 24 Hrs - 5
	Aircraft Type - UNK/NR	Make/Model - 5000
		Instrument - 1450
		Last 30 Days - 64
		Last 90 Days - UNK/NR
		Multi-Eng - 12000

Instrument Rating(s) - AIRPLANE

---Narrative---

DURING ARRIVAL TO THE KANSAS CITY DOWNTOWN ARPT, THE FLT WAS VECTORED FOR A VOR RWY 36 APCH; THEN WAS CLEARED FOR THE APCH & TO CIRCLE & LAND ON RWY 36. ON FINAL APCH, THE ACFT WAS HI & WAS NOT IN A POSITION TO LAND, SO THE FLT WAS CLEARED TO CIRCLE LEFT FOR ANOTHER APCH TO LAND. THE AIRCREW ACKNOWLEDGED & BEGAN CIRCLING LEFT WHICH TOOK THEM IN THE VICINITY OF THE FAIRFAX ARPT. A SHORT TIME LATER, THE ATIS CONTROLLER CAUTIONED THAT THE FLT MIGHT BE LINING UP FOR THE FAIRFAX ARPT. SUBSEQUENTLY, THE CREW INITIATED A MISSED APCH & WERE INSTRUCTED TO TURN TO 360 DEG & CLIMB TO 3000 FT. THE ACFT BEGAN A STEEP CLIMB TO 3100 FT, STALLED & ENTERED A STEEP DESCENT, BEFORE THE DESCENT WAS ARRESTED, THE ACFT IMPACTED IN A PUBLIC WATER TREATMENT PLANT. CWR RECORDINGS INDICATED THAT THE 1ST OFFICER WAS FLYING THE ACFT DURING THE EN ROUTE DESCENT VOR APCH & CIRCLING APCH. THEN THE CAPTAIN TOOK CONTROL DURING THE MISSED APCH. AN EXAM OF THE WRECKAGE REVEALED NO EVIDENCE OF AN AIRFRAME OR POWERPLANT PROBLEM; ALSO, THERE WAS NO EVIDENCE THAT THE CARGO HAD SHIFTED.

Brief of Accident (Continued)

File No. - 311

1/09/85

KANSAS CITY, MO

A/C Reg. No. N3570

Time (UTC) - 0701 EDT

Occurrence #1      LOSS OF CONTROL - IN FLIGHT  
Phase of Operation      APPROACH - MISSED APPROACH (IFR)

Findings:

1. WEATHER CONDITION - LOW CEILING
2. WEATHER CONDITION - FOG
3. LIGHT CONDITION - DARK
4. IFR PROCEDURE - IMPROPER - COPILOT
5. SUPERVISION - INADEQUATE - PILOT IN COMMAND
6. MANEUVER - PERFORMED - COPILOT
7. BECAME LOST/DISORIENTED - INADVERTENT - COPILOT
8. BECAME LOST/DISORIENTED - INADVERTENT - PILOT IN COMMAND
9. MISSED APPROACH - INITIATED -
10. AIRSPEED - NOT MAINTAINED - PILOT IN COMMAND
11. STALL - INADVERTENT - PILOT IN COMMAND
12. REACTUAL ACTION - DELAYED -

Occurrence #2      IN FLIGHT COLLISION WITH TERRAIN  
Phase of Operation      DESCENT - UNCONTROLLED

---Probable Cause---

The National Transportation Safety Board determines that the Probable Cause(s) of this accident is/are finding(s) 10,11

Factor(s) relating to this accident is/are finding(s) 1,2,3,4,5,7,8