Aviation Investigation Final Report

Location:	CARLYLE, Illinois	**Accident Number:**	CHI96FA083
Date & Time:	January 22, 1996, 16:14 Local	**Registration:**	N800CE
Aircraft:	Piper PA-46-350P	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation		

Analysis

During flight, the airplane was cruising at flight level 210 in IFR conditions with turbulence and with the wind from about 255 degrees at 70 knots. The airplane drifted off course at about 1600 cst. At 1610:09, after about ten minutes of unrecognized heading changes, the pilot stated '. . . I've lost my gyro.' At 1610:15, the controller issued a no-gyro vector. At 1611:29, as the airplane was still turning (to a heading that would intercept the original course), the pilot stated 'we've lost aLL our instruments . . . please direct me towards VFR.' He was cleared to descend to 14,000 feet. At about that same time, he stated 'we're in trouble' and 'we've lost all vacuum,' then there was no further radio transmission from the airplane. The airplane entered a steep, downward spiraling, right turn. The left outer wing panel separated up and aft (in flight) from overload and impacted the left stabilizer. The airplane crashed, and parts that separated from the airplane were found over a four mile area. Investigation revealed evidence that the HSI heading card can fail without the HDG flag appearing. Although the pilot had reported the loss of instruments and vacuum, examination of the airplane revealed that the engine, flight controls, electrical system, pitot/static system and vacuum systems exhibited continuity. No malfunction was found that would have led to loss of pressurization or hypoxia.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: spatial disorientation of the pilot, and his failure to maintain control of the airplane, which resulted in his exceeding the design stress limits of the airframe. A factor relating to the accident was: turbulence in clouds.

Findings

Occurrence #1: LOSS OF CONTROL - IN FLIGHT
Phase of Operation: CRUISE

Findings
1. (F) WEATHER CONDITION - TURBULENCE IN CLOUDS
2. FLIGHT/NAV INSTRUMENTS,HORIZ SITUATION IND(HSI) - MALFUNCTION
3. (C) AIRCRAFT CONTROL - NOT MAINTAINED - PILOT IN COMMAND
4. (C) SPATIAL DISORIENTATION - PILOT IN COMMAND

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

Findings
5. (C) DESIGN STRESS LIMITS OF AIRCRAFT - EXCEEDED - PILOT IN COMMAND
6. WING - OVERLOAD
7. WING - SEPARATION

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

Factual Information

History of Flight

On January 22, 1996, at 1614 central standard time (All times are cst), a Piper PA-46-350P, N800CE, was destroyed when it impacted the ground near Carlyle, Illinois. The private pilot received fatal injuries. The 14 CFR Part 91 flight departed Des Moines, Iowa, en route to Nashville, Tennessee, on a business flight. The pilot reported losing a gyro and was issued a no-gyro vector to Nashville, Tennessee. He was cleared to descend to 14,000 feet. The pilot reported that he was in trouble and subsequently radar and radio contact was lost. Instrument meteorological conditions prevailed at flight level 210 and an instrument flight plan was filed.

The pilot had contacted the Fort Dodge Automated Flight Service Station (AFSS) at 1142, to obtain a preflight briefing for a flight from Des Moines, Iowa, to Nashville, Tennessee, and to file an IFR flight plan. The pilot received a standard weather briefing from AFSS, and subsequently requested to file an IFR flight plan. The pilot requested to fly IFR, flight level 230 (23,000 feet), direct to Nashville, requiring 2+35 hours en route with 6.5 hours of fuel on board.

At 1441, he contacted the Des Moines clearance delivery and received his clearance to Nashville. He was cleared for the Des Moines 5 Departure, then as filed. The transponder code was 3032.

The pilot departed Des Moines at 1447. He contacted Des Moines departure control at 1449 and was cleared on course direct to Nashville, heading 130 degrees. The altitude clearance was amended at 1504 to flight level 210 (21,000 feet) and it remained the highest assigned altitude for the flight.

About an hour after takeoff, the pilot contacted the Kansas City Air Route Traffic Control Center (ARTCC) and requested information concerning reported turbulence along his remaining route. The controller informed the pilot that he could expect continuous light chop "till at least fifty, sixty miles southeast of Saint Louis." The pilot inquired if it was better up at 23,000 feet. The controller responded that jets were reporting light to occasional moderate turbulence at 23,000 feet.

The winds at 21,000 feet were about 255 degrees at 70 knots.

The radar data indicates that the aircraft maintained a direct track from Des Moines to Nashville for the first one hour and thirteen minutes of the flight. At about 1600, the aircraft started a gradual left turn to the east and maintained a ground track of about 095 degrees for 10 to 15 miles. (Refer to Recorded Radar Study, Attachment II-2, and Attachment III- 9,10,11)

At 1604:04, the controller asked the pilot, "Are you turning back to the southeast? There about 20 miles ago I thought your were just kind of correcting back on course. But, uh, looks like you were tracking about a 095 degrees. Just want to make sure you were turning back toward Nashville."

The pilot responded, "We're showing on course. So we need to go to the right a little bit?"

At 1604:28, the controller said, "Uh, yes, sir, uh, about ten degrees now to the right."

The radar data indicates that the airplane turned toward the south. However, the aircraft continued in a right turn and accomplished about 180 degrees of turn and was headed to the north. At 1606:15, the controller asked the pilot what his heading was, but received no answer.

At 1607:20, the controller again asked the pilot his heading.

The pilot responded, "Uh, one five five."

At 1607:26, the controller informed the pilot, "Malibu, Eight Hundred Charlie Echo, uh, right now, sir, you're tracking to the northwest. You just did, uh, pretty much, you're working on a three sixty there, after I told your about the ten degree right correction. Showing you tracking now, uh, three forty."

The pilot responded, "Ok, we'll go ten right, Charlie Echo."

At 2207:40, the controller told him, "No, Eight Hundred Charlie Echo. Fly heading one four zero, one four zero.

At 1607:40, the pilot responded, "One four zero, Charlie Echo."

The radar data indicates that for the next two minutes of the flight, the aircraft continued heading to the north and then turned to the northwest.

At 1609:17, the controller asked the pilot, "You showing yourself established on the one forty heading now, one four zero heading?"

The pilot responded, "Uh, we're on one four zero. Uh, we're showing that, that's gonna take us a little over to the left."

At 1609:27, the controller stated, "Ok, sir, I think your, uh, gyros are messed up. You're tracking right now about, uh, three forty on your present heading. Turn another thirty degrees to the right, and, uh, report established on that heading."

At 1609:40, the pilot responded, "Charlie Echo, thank you."

The radar data indicates that the airplane's altitude had remained level at 21,000 feet during the flight until soon after he had been instructed to turn right thirty degrees. Then at 1609:42.87, the aircraft climbed to 21,100 feet.

The radar data indicates that for about two and a half minutes, from 1609:38 to 1612:19.91, the airplane went into a right turn. The angle of bank in the turn varied between 12 degrees to 32 degrees.

At 1610:09, the pilot informed the controller, "Uh, this is Eight Hundred Charlie Echo. You're correct. I've lost my gyro."

At 1610:15, the controller responded, "Eight Hundred Charlie Echo, uh, roger, and, uh, this will be a no-gyro vector to Nashville. Turn right."

The radar data indicates the airplane continued in a right turn. At 1610:24.23, the airplane descended to 21,000 feet.

At 1610:50, the pilot asked if Nashville was VFR. The controller informed the pilot that Nashville was VFR and reported the current Nashville weather.

The radar data indicates that the aircraft continued in a right turn and that between 1611:10.48 and 1611:19.72, the airplane descended to 20,800, with a vertical velocity of about 1,300 feet per minute descent. Between 1611:24.3 and 1611:42.78, the airplane climbed to 21,200 feet, with a vertical velocity of about 1,300 feet per minute climb.

At 1611:29, the pilot reported, "Uh, Kansas City, we've lost all our instruments, Eight Hundred Charlie Echo. Please direct me towards VFR."

At 1611:36, the controller responded, "November Eight Zero Zero Charlie Echo, understand, uh, you're requesting descent to VFR conditions?"

At 1611:41, the pilot responded, "We, uh, we're in trouble."

At 1611:44, the controller cleared the pilot to descend to 14,000 feet.

At 1611:58, the pilot stated, "We've lost all vacuum."

There were no further radio transmissions from the pilot.

The radar data indicates that between 1611:56.64 and 1612:01.41, the airplane descended from 21,100 to 21,000 feet, with a vertical velocity of 629 feet per minute.

The radar data indicates that the airplane's angle of bank during the right turn from 1609:59 to 1612:00 had varied between about 12 degrees to 32 degrees angle of bank.

The radar data indicates that between the times of 1612:19.91 to 1612:52.26, the airplane went into a steep right, descending turn. The angle of bank increased from 33 degrees to about 80 degrees angle of bank. During the same time frame, the airplane's altitude went from 20,900 feet to 17,900 feet, with vertical velocities varying from about 1300 feet per minute to about 12,600 feet per minute. The indicated airspeed reached 189.9 knots indicated airspeed (KIAS) in the descent.

At 1612:26 and at 1612:43, the controller told the pilot to, "Stop turn," but received no response.

The radar data indicated that the aircraft continued in its rapid descent. The last radar return picked up from the airplane's transponder indicated that the airplane was at 1500 feet at 1614:25.59. The airplane impacted the ground shortly, thereafter, near Carlyle, Illinois.

Personnel Information

The pilot had a private pilot's certificate with an instrument rating.

The pilot's logbook recovered after the accident indicated that he had a total of 3,858 total hours, 2,927 hours of actual instrument time, and 806 hours of night time. However, the last recorded flight in the logbook was dated on June 26, 1995. The aircraft maintenance records indicate that the pilot had flown his airplane for about 80 more hours which were not reflected in the pilot's logbook. Additionally, the logbook recovered was the pilot's fourth logbook; the others had been destroyed by fire in a previous aircraft accident. There was no record of the pilot's last biennial flight review. The last approaches the pilot had logged were three instrument approaches on February 22, 1995.

The pilot had completed a recurrent training course at Attitude International, Inc., Vero Beach, Florida, on February 22, 1995. The training course was designed for Piper Malibu owners to maintain currency in the systems and procedures of the Piper Malibu Mirage, PA-46-350P.

The pilot had owned two other Piper Malibu's. The first was destroyed in an accident in August 1987, and the second was destroyed in an accident in July 1993.

Aircraft Information

The airplane was a Piper PA-46-350P, Malibu Mirage, with a Lycoming 350 horsepower engine. It was owned and operated by the pilot. The last annual inspection was performed on May 11, 1995. The total airframe and engine hours at the annual inspection were 112.1 hours. The total airframe hours and engine hours at the time of the accident were 201.5 hours. The engine had been overhauled on September 5, 1995. The total engine hours at the accident since the time of the overhaul were 51.7 hours.

The pilot's attitude gyro, KI-256, had been replaced on May 17, 1995. The KI-256 was replaced again on June 6, 1995.

The right wing outboard assembly had been replaced by the Des Moines Flying Service, Des Moines, Iowa, between November 21, 1995 and January 9,1996. The aircraft was flown 30 to 40 minutes and all systems were reported normal.

The aircraft was fueled with 91 gallons of fuel in Des Moines, Iowa, on January 8, 1996. There were no records that the aircraft had been flown after the maintenance check flight which occurred on or about January 9, 10, or 11, 1996, and January 22, 1996.

Meteorological Conditions

The pilot had contacted the Fort Dodge AFSS for a weather brief at 1742. The briefer reported the following conditions:

Des Moines was reporting 1,200 foot overcast ceilings, 4 miles visibility in haze, winds 340 degrees at 14 knots.

St. Louis was reporting 15,000 foot overcast with 10 miles visibility.

Nashville was reporting clear below 12,000 feet, visibility 10 miles, winds 360 at 15.

The Des Moines forecast for a 1400 departure time was 7,000 broken, winds 340 at 12 knots.

The St. Louis forecast was 4,000 broken until 1600, light rain developing after 1600.

The Nashville forecast from 1200 until 2400 was 10,000 scattered, winds 10 knots.

The Fort Dodge AFSS briefer also informed the pilot that he could expect moderate turbulence below 8,000 feet the entire route of flight. Turbulence was also forecast above 16,000 feet from Des Moines through Owensboro, Kentucky.

The briefer informed the pilot that a cold front was right over Des Moines on a northeast/southeast line. The radar was not showing any significant precipitation at the present time. The briefer informed the pilot that IFR conditions existed from southern Iowa, southern Illinois, and western Tennessee and Kentucky.

The weather observations at Scott Air Force Base, Illinois, 21 nautical miles west of the accident location, indicated the following weather just prior to and after the accident:

Time-1555; 1,400 feet scattered, 3,000 feet scattered, estimated ceiling 14,000 feet broken, 7 miles visibility, 42 degrees F temperature, 38 degrees F dew point, wind 200 degrees at 13 knots, altimeter 30.01.

Time-1627; 800 feet scattered, measured ceiling 1,200 feet overcast, 3 miles visibility, light drizzle and fog, wind 170 degrees at 9 knots, altimeter 30.02, scattered variable broken, tower visibility 2.5 miles.

The winds and temperatures aloft in the Saint Louis area between 1100 to 1500 were:

3,000 feet: 230 degrees at 36 knots.

6,000 feet: 240 degrees at 38 knots, +4 degrees C.

9,000 feet: 240 degrees at 33 knots, -1 degrees C.

12,000 feet: 240 degrees at 36 knots, -7 degrees C.

18,000 feet: 250 degrees at 53 knots, -21 degrees C.

24,000 feet: 260 degrees at 84 knots, -31 degrees C.

The air traffic controller (ATC) transcripts indicate that the pilot was IFR at 21,000 feet and had experienced some turbulence.

The ATC transcripts also indicated that there were layers of clouds between 14,000 feet to 21,000 feet. At 1616:01, the controller was informed by TWA 364 that he was in between cloud layers at 18,000 feet.

In-flight Advisories (AIRMETs) were valid for the pilot's route of flight. The AIRMET's had forecast IFR conditions, occasional moderate turbulence between 14,000 feet and 34,000 feet, and occasional moderate rime icing below 16,000 feet.

No SIGMETs, Convective SIGMETs, or Center Weather Advisories were issued valid for the accident area.

For detailed weather information see the Meteorology Group Chairman's Factual Report and the FAA weather reports.

Wreckage and Impact Information

The aircraft impacted the ground at 383 Juniper, Royal Lakes Subdivision, Carlyle, Illinois. The coordinates were N 38.34.00 Latitude, W 089.23.80 Longitude. The aircraft impacted the ground inverted, heading about 150 degrees. The aircraft did not hit the mobile home, telephone lines, or trees that were located at the accident site.

The aircraft impacted the ground in an inverted, nose down attitude. The aircraft did not skid

after the impact. A crater about a foot and a half deep was formed in the soft soil which buried the top half of the engine and a propeller blade.

The on-site investigation found pieces of the airplane wreckage distributed over approximately four miles in a line oriented in the northeast direction. The fuselage came to rest in the inverted position with the right wing still attached but broken at the wing splice. The right horizontal stabilizer and elevator were about 60 feet aft of the fuselage. The left elevator was located about 1.2 miles northeast of the fuselage. The outboard half of the left wing was found about 3.2 miles from the main wreckage. The rudder, which was broken into two pieces, was located in the same area as the left wing. The most remote piece of wreckage, the vertical stabilizer, was located about 4 miles from the main wreckage.

Examination of the wreckage revealed that the left wing spar exhibited a fracture consistent with the wing separating in the upward and aft direction. Light blue paint was found on the upper leading edge of the separated section of left wing that matched the color of the horizontal stabilizer and elevator. The left elevator exhibited compression damage to the outboard end consistent with the shape and dimensions of the leading edge of the separated left wing. All control surfaces except for the outboard right wing flap, and the vertical stabilizer forward fairing were located throughout the wreckage path. No fire damage was observed. Examination of the airplanes navigational lights revealed no evidence of stretched light bulb filaments. No evidence of fatigue of fracture surfaces, or over-travel, or hammering of the flight control stops were observed during the examination of the airplane structure.

For detailed information of the in-flight breakup of the aircraft see the Structures Group Chairman's factual report.

The fuel tanks in both wings were ruptured. The calculated fuel on board the aircraft at the time of the accident was about 79 gallons. No fuel was found at the wreckage site.

The bottom of the fuselage and right stabilizer and elevator that were located with the fuselage at the accident site were coated with oil. The left stabilizer and elevator that had separated in the in-flight breakup had no oil film on them.

The examination of the engine revealed that the engine had continuity and compression. The accessory case was removed to examine the accessory gears. All the gears were found intact and rotated during hand rotation of the crankshaft. The pushrod tubes sustained severe crush damage, but valve train movement was evident.

The left magneto produced spark during hand rotation. The right magneto could not produce spark as a result of impact damage.

The top spark plugs sustained severe crush damage but the electrodes were undamaged. The bottom spark plugs were undamaged and all the wires were found properly installed. The bottom spark plug electrodes were undamaged. Both top and bottom plugs displayed some

mud debris as a result of being submerged in mud and water at the accident site. The ignition harness was destroyed by impact forces and recovery.

The fuel injection servo and induction system had broken off of the engine, however, it was free of obstruction. The throttle/mixture controls were found securely attached. The fuel flow divider was destroyed. The fuel pump was attached to the engine.

The propeller was securely attached to the crankshaft. One blade was bent aft about 30 degrees near the hub. The blade did not have any damage to its leading edge. The other blade was bent slightly aft at the hub but was otherwise undamaged.

The propeller governor sustained damage and was almost broken off its mounting. The control cable was securely attached to the control wheel.

The top and bottom vacuum pumps were opened for examination. The rotors were crushed by impact forces. The vanes were normal. Both plastic drive couplers were found intact and undamaged.

The instrument pneumatic system was examined from both vacuum pumps to each instrument. Continuity was established between the air inlet of the filter and the pilot and copilot gyros. The vacuum regulators and inline air filter had been damaged from impact. The cabin altitude controller was broken in two from impact forces. The cabin pressure gauge was destroyed; the differential pressure needle indicated 7 psi differential pressure. The vacuum manifold/check valve was intact with the hoses and clamps attached.

The suction gauge was examined. The right flow button was found in the "out" position (no suction) at the accident site. The left flow button was found in the "in" position. The black face on the instrument had been pushed down from impact. The left flow button popped out during recovery. Both the left and right flow buttons had black marks on the top of the buttons. When suction was applied to the instrument, the right and left flow buttons retracted into the instrument. When suction was removed, the left and right flow buttons would pop out.

Medical and Pathological Information

An autopsy was performed on the pilot at the Zieren-Day Funeral Home, Carlyle, Illinois, on January 23, 1996,

A Forensic Toxicology Fatal Accident Report was prepared by the Federal Aviation Administration's Civil Aeromedical Institute. The report indicated the following results:

Carbon monoxide analysis was not performed due to a lack of suitable specimen.

Cyanide analysis was not performed due to a lack of suitable specimen.

No ethanol detected in brain fluid.

No drugs detected in liver fluid.

Tests and Research

An examination of the Bendix/King avionics equipment, which included the autopilot system, gyros, and communication and navigation equipment, was conducted. Full details of the examination can be found in the laboratory notebook attached to the report.

The KC 192 Autopilot computer could not be tested due to impact damage. The annunciator lamps were examined. The yaw damper annunciator lamp showed some stretching of the filament. No filament stretching was observed on any of the other annunciator lamps.

The gyro from the pilot's attitude gyro, KI-256, was found to be loose in the gimble housing. The gyro and gimble housing both exhibited scoring around their circumferences. The gyro bearings were both found to be broken. The KI-256 was powered by the vacuum system.

The pilot's HSI, KI-525A, sustained impact damaged and could not be electrically tested as a unit. The indicated magnetic heading was 165 degrees. The heading select bug was at 180 degrees. The NAV (navigation) and HDG (heading) flags were both in view. The HDG flag was functional and retracted when powered, but the NAV flag was not.

The HSI's stepper motor did not exhibit any signs of shorting or arcing. The drive train from the stepper motor to the card face and heading bug exhibited continuity. Neither the HDG and NAV flags indicated any "slash" marks on the flags or on the compass ring. The unit's electrical connector was broken from impact.

The KG-102A Directional Gyro, which provides heading information the pilot's HSI, sustained impact damage which prohibited useful testing on the unit. The gyro was disassembled and about 30 degrees of scoring was found on both the rotor and the gimble housing. There was no indication of moisture contamination in the unit. The circuit board did not exhibit any apparent impact damage, but the power supply section had a short in it which prevented further testing.

Both the KI-525A HSI and the KG-102A were powered by the aircraft's electrical system.

Examination of the copilot's vacuum powered directional gyro revealed that the heading indicated was 035 degrees. 360 degrees of rotational scoring was evident on the rotor, and about 70 degrees of scoring on the rotor's edge. The gimble housing had 360 degrees of scoring on the bottom of the housing, and rotational scoring in the housing.

The copilot's vacuum powered attitude gyro was examined. The rotor and gimble housing indicated about 200 degrees of rotational scoring, and about 30 degrees of rotational scoring

on the top of the rotor.

The pilot's electrically powered turn coordinator indicated about 40 degrees of rotational scoring in the housing.

The copilot's electrically powered turn coordinator had two areas of rotational scoring of about 20 degrees each.

The static pressure switch which controlled the source of static air pressure was examined. The position of the static system switch was found in the "up" (alternate static air source) position. The examination of the valve revealed that air passed through both the primary and alternate lines when the switch was operated and air was blown through the respective static lines.

The switch to the pitot heat was destroyed. Power was applied to the pitot heat and the pitot tube became hot.

Additional Information

A pilot who had flown 100 to 125 hours with the accident pilot reported that the accident pilot usually engaged the autopilot upon reaching pattern altitude after takeoff. Additionally, the accident pilot did not use the autopilot coupled to the VOR, RNAV, or GPS for cross country navigation. The witness reported that the pilot usually determined the desired course or track, established a heading, and engaged the heading function of the autopilot and made corrections by using the heading bug of the HSI.

The airplane's autopilot included a typical autopilot design feature which disabled the altitude hold as well as the heading hold if the autopilot was in the heading and altitude hold mode, and the autopilot was disengaged by the pilot.

During the examination of the KCS 55A compass system, it was learned the system monitors two parameters which will cause the HDG flag to appear on the pilot's HIS, indicating unreliable heading information. These are: 1) Low gyro rotor RPM, and 2) Positive or negative 15 volt d.c. power supply failure(either totally failed or out of tolerance).

During the investigation, it was determined that the HSI's heading card can fail to rotate without the HDG flag coming into view. The examination of the HSI, KI-525A, revealed that the instrument exhibited continuity from the stepper motor to the heading card and heading bug. However, the connector from the Directional Gyro, KG-102A, to the HSI was broken by impact forces and could not be tested. A loose connection or broken wire in any of the four wires connecting these instruments could cause the heading card not to move without the HDG flag appearing.

From about 1600 to 1604, the airplane had drifted from a direct course of about 130 degrees

to a course of 095 degrees. The pilot was unaware of any problem with his heading. It was not until 1610:09 that the pilot indicated that he lost his gyro. The pilot's HSI, the airplane's primary instrument providing the pilot with heading information, was an electrically powered instrument. The instruments available to the pilot for cross checking his heading included the copilot's vacuum driven directional gyro, the wet compass, and the aircraft's navigational equipment which included a GPS.

The pilot's attitude gyro, KI-256, a vacuum driven instrument, provided pitch and roll information. The copilot's vacuum driven attitude gyro also provided pitch and roll information. Additionally, the pilot's and copilot's electrically powered turn coordinators provided roll information to the pilot.

At 1611:29, the pilot reported that he had lost "all" his instruments. The pilot did not indicate which instruments had failed, whether it included the pitot static instruments, the navigational instruments, engine instruments, or communication instruments.

The pitot static instruments included the pilot's and copilot's airspeed indicator, altimeter, and vertical speed indicator. The radar data indicates that the indicated airspeed varied between 130 KIAS to 160 KIAS from 1601:47.33 until the airplane entered the steep right, descending turn at 1612:52.26. Then the radar data indicates the airspeed increased to about 190 KIAS.

The radar data indicates that the pilot's altimeter, KEA-130A Encoding Altimeter, reported a constant altitude of 21,000 feet until 1609:47.45, when the airplane had climbed to 21,100 feet. The pilot reported that he had lost his gyro at 1610:09. At 1611:29, the pilot reported that he lost all his instruments. Just prior to his report, the altitude encoder indicated a 200 foot descent to 20,800 feet. Then the altitude encoder indicated a 400 foot climb to 21,200 feet. When the airplane entered its steep descent, the altitude encoder continued to report the airplane's altitude to 1,500 feet above the ground, which was the last altitude recovered by the radar data.

The pilot's HSI was an electrically powered instrument. The airplane's radio and transponder continued to work after the pilot had reported that he lost all his instruments. Also, the pilot's and copilot's electrically powered turn and bank coordinators indicated scoring on impact.

The radar data indicates that the airplane maintained an angle of bank that varied between 6 to 22 degrees from the time the pilot reported losing all his instruments at 1611:29, until he entered a steep turn at 1612:19.19, a period of about 50 seconds.

At 1611:58, the pilot stated, "We've lost all vacuum."

The airplane's vacuum instruments which provided pitch and roll information to the pilot included the pilot's attitude gyro, the copilot's attitude gyro, and the copilot's directional gyro. The cross-check instruments available to the pilot if a vacuum failure occurred were the two electrically powered turn coordinators for roll information. The wet compass was available for

heading information. The airspeed indicator, vertical speed indicator, and altimeter were available for pitch information. The examination of the vacuum powered gyros indicated scoring of the rotors and gamble housings on impact.

For about two and a half minutes, from 1609:38.24 to 1612:15.27, the airplane, while in instrument conditions, continued in a right turn that varied from 12 to 32 degrees angle of bank.

At 1611:44, the pilot was issued a clearance to descend to VFR conditions.

The radar data indicates that by 1612:29.14, the airplane was established in a 54 degree angle of bank, right turn with about a 5,200 feet per minute rate of descent. The radar data indicates that the airplane's airspeed was about 178 KIAS, and increased to about 190 KIAS.

The Airplane Flight Manual for the PA-46-350P identified the following airspeed limitations:

Maximum Structural Cruising Speed (Vno)-Do not exceed this speed except in smooth air and then only with caution.

Vno 168KIAS

Design Maneuvering Speed (Va)-Do not make full or abrupt control movements above this speed.

At 4300 LBS Gross Weight 133 KIAS

At 2450 LBS Gross Weight 100 KIAS

CAUTION

Maneuvering speed decreases at lighter weight as the effects of aerodynamic forces become more pronounced. Linear interpolation may be used for intermediate gross weights. Maneuvering speed should not be exceeded while operating in rough air.

The aircraft wreckage, components, and logbooks were released to Mr. David Nelson, an AAU Insurance Co. representative.

Parties to the investigation included the Federal Aviation Administration, the New Piper Aircraft, Inc., Textron Lycoming, Inc., and AlliedSignal, Inc.

Pilot Information

Certificate:	Private	**Age:**	59,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 Valid Medical--no waivers/lim.	**Last FAA Medical Exam:**	July 19, 1995
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	3858 hours (Total, all aircraft), 2626 hours (Pilot In Command, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Piper	**Registration:**	N800CE
Model/Series:	PA-46-350P PA-46-350P	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	4622171
Landing Gear Type:	Retractable - Tricycle	**Seats:**	6
Date/Type of Last Inspection:	May 11, 1995 Annual	**Certified Max Gross Wt.:**	4300 lbs
Time Since Last Inspection:	90 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	202 Hrs	**Engine Manufacturer:**	Lycoming
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	TIO-540-AE2A
Registered Owner:	BUDGET MARKETING	**Rated Power:**	350 Horsepower
Operator:		**Operating Certificate(s) Held:**	None
Operator Does Business As:		**Operator Designator Code:**	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	BLV ,453 ft msl	**Distance from Accident Site:**	22 Nautical Miles
Observation Time:	16:27 Local	**Direction from Accident Site:**	258°
Lowest Cloud Condition:	Scattered / 800 ft AGL	**Visibility**	3 miles
Lowest Ceiling:	Overcast / 1200 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	9 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	170°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	5°C / 3°C
Precipitation and Obscuration:	N/A - None - Fog		
Departure Point:	DES MOINES (DSM)	**Type of Flight Plan Filed:**	IFR
Destination:	NASHVILLE (BNA)	**Type of Clearance:**	IFR
Departure Time:	14:49 Local	**Type of Airspace:**	Class E

Airport Information

Airport:		**Runway Surface Type:**	
Airport Elevation:		**Runway Surface Condition:**	
Runway Used:	0	**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	38.609893,-89.369018(est)

Administrative Information

Investigator In Charge (IIC):	Silliman, Jim
Additional Participating Persons:	BOB SCOTT; SPRINGFIELD , IL MARK W PLATT; VAN NUYS , CA DAVID BORDEN; MARIETTA , GA PHIL GOETTEL; OLATHE , KS
Original Publish Date:	April 3, 1997
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Note:	
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