NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

UNIVERSAL AIRWAYS, INC.
BEECH 65-A80/EXCALIBUR CONVERSION, N100UV
NEAR MADISONVILLE, TEXAS

JULY 2, 1981

NTSB-AAR-81-17

UNITED STATES GOVERNMENT

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16. Abstract
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The National Transportation Safety Board determines that the probable cause of the accident was a pilot induced airframe overload following loss of aircraft control which resulted in the structural breakup of the aircraft. The reason(s) for the loss of aircraft control could not be determined. Contributing to the loss of control was the pilot's lack of instrument proficiency in multiengine aircraft.

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Adopted: December 17, 1981

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NEAR MADISONVILLE, TEXAS
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SYNOPSIS

About 1230 c.d.t., on July 2, 1981, a Universal Airways, Inc. Beech 65-A80, N100UV, crashed into an open, level field about 7 nautical miles east southeast of Madisonville, Texas. Witnesses heard a small explosion and saw the aircraft descend from a dark cloud; the wings and the empennage were not attached during the observed portion of the aircraft's descent. The pilot and two passengers were killed. The aircraft was destroyed.

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1. FACTUAL INFORMATION

1.1 History of the Flight

On July 2, 1981, a Universal Airways, Inc., Beech 65-A80 with the Excalibur Conversion, N100UV, was being operated as a business flight to transport Universal Weather, Inc., 1/ personnel from William P. Hobby Airport, Houston, Texas, to Love Field, Dallas, Texas. Between 0900 2/ and 1000, the pilot visited the aviation section of Universal Weather, Inc. According to weather briefers on duty at the time, the pilot "started looking around at the various charts to include the surface analysis, surface progs, winds aloft panels, and the radar charts (both the National Weather Service and the Galveston charts)." He inquired about the latest observation for Dallas. A briefer relayed "the 1400Z (0900 c.d.t.) observation for Dallas Love Field."

About 1045, the pilot taxied to the Sky Travel 3/ service ramp at Hobby Airport and requested fuel; however, Sky Travel was out of fuel. At 1112, the pilot telephoned an instrument flight rules (IFR) flight plan to the Houston Flight Service Station (FSS). The flight plan record at Houston FSS indicated that: (1) N100UV did not have Mode C (altitude reporting) capability; (2) the true airspeed for the flight was to be 160 knots; (3) the estimated time en route was to be 1 hour 40 minutes; (4) the fuel on

1/ Universal Weather, Inc., and Universal Airways, Inc., are both subsidiaries of Universal Weather/Aviation, Inc.
2/ All times herein are central daylight, based on the 24-hour clock.
3/ A fixed base operation at Hobby airport where Universal purchased aviation fuel.

board was estimated to be the equivalent of 6 hours 30 minutes; 4/ and (5) the requested cruise altitude was 8,000 feet. 5/ According to the Houston FSS Specialist who received N100UV's flight plan, no weather briefing was requested and none was given.

Shortly thereafter, the two passengers (the president and chairman of the Board for Universal Weather/Aviation, Inc., and a company agent) arrived for the Dallas bound flight. The president asked the pilot if he was ready to go and the pilot replied with words to the effect, "we are waiting for fuel." The president then asked if they had enough fuel to get where they were going, and the pilot replied in the affirmative. The president then said words to the effect of "lets go." A line serviceman for Sky Travel who saw these events and heard the conversation commented that nothing appeared to be wrong with the aircraft. Both the pilot and the passengers appeared to be in good spirits when they boarded the aircraft. A medium suitcase (two suiter) and a suit carrier were placed in the rear baggage compartment.

About 1150, N100UV departed Hobby Airport. The flight was conducted within the aircraft's weight and balance limitations.

At 1215:29, N100UV notified the Houston Air Route Traffic Control Center (ARTCC) that it was "with you, level at eight thousand." This was the last known radio transmission from the aircraft.

At 1227:41, Houston ARTCC advised N100UV that radar contact had been lost and to report over the Leona VOR. The VOR was about 12 nautical miles (nmi) northwest of the flight's last known radar position. No response to the advisory and request was received from N100UV. Subsequent attempts by Houston ARTCC to contact the flight were unsuccessful.

About 1230, two witnesses located about 7 nmi east southeast of Madisonville, Texas, reported hearing an aircraft making "popping" noises and sounds similar to an engine increasing power. Both witnesses who were outdoors about 1 mile apart did not report any significant rain or wind. One witness saw lightning "a long way off" to the north and both witnesses heard thunder north of where they saw pieces falling from the aircraft.

The first witness, who was about three-fourths of a mile from the impact point of the main fuselage, stated that when he initially heard the aircraft, it was traveling in a northerly direction and "sounded okay." At the time, he could not see the aircraft because it was obscured by clouds. Shortly afterward, he heard the aircraft engines sound as if they "went wide open," followed by a "small explosion," and saw the aircraft descend through the clouds, "rotating to the right." This witness stated that he saw an object, white in color with a black stripe, trailing behind the aircraft.

The second witness, who was about one-fourth of a mile from the impact point of fuselage, heard sounds similar to those described by the first witness. He saw the main fuselage descend. According to the second witness, there was no tail or wings attached to the fuselage.

The accident occurred during the daylight hours at latitude 30°54' N and longitude 95°47' W.

4/ This time approximates aircraft endurance with all fuel tanks full.
5/ All altitudes herein are above mean sea level.

1.2 Injuries to Persons

Injuries	Crew	Passengers	Others	Total
Fatal	1	2	0	3
Serious	0	0	0	0
Minor/None	0	0	0	0
Total	1	2	0	3

1.3 Damage to Aircraft

The aircraft was destroyed.

1.4 Other Damage

None

1.5 Personnel Information

The pilot was certificated and trained to conduct the flight. (See appendix B.) However, he was not currently qualified for the flight in instrument meteorological conditions because he had not obtained the required 6 hours of instrument time and six instrument approaches within the previous 6 months as prescribed by 14 CFR 61.57(e).

He was employed by Universal Weather, Inc., as a maintenance supervisor of Universal's weather equipment. However, his job title/description did not include pilot duties. According to a spokesperson for Universal Airways, he had received no compensation for flying Universal's aircraft.

Universal Airways had no record of the flight times or duty times the pilot had accumulated while flying for the company nor did it have any record or knowledge of his pilot qualifications. According to company records, the pilot had completed an airmen's proficiency/qualifications check in N100UV which authorized him to act as pilot-in-command of a 14 CFR 135 flight under visual flight rules.

The pilot's airman certificate required him to wear glasses "for near and distant vision"; however, it was not possible to verify whether the glasses were used on the accident flight.

1.6 Aircraft Information

N100UV was certified and maintained in accordance with current regulations. (See appendix C.)

The aircraft was configured as an executive passenger transport. Its empty gross weight was 5,616 pounds, and its maximum authorized takeoff weight was 8,800 pounds. The center of gravity limitations at maximum weight were from 150.7 inches forward to 160.4 inches aft. Center of gravity limitations at weights of 7,750 pounds or less were from 147.6 inches forward to 160.4 inches aft.

The actual weight and balance information for the takeoff and flight are not known because completion of a formal weight and balance form is not required for a flight operating under 14 CFR 91. However, an approximation of these conditions was made, using known and estimated weights for the aircraft, pilot, passengers, baggage, and fuel. N100UV's takeoff weight and balance were computed to have been 7,415 pounds and 153.8 inches.

At the time of takeoff, the aircraft had an estimated 200 gallons of 100 octane low-lead fuel aboard--36 gallons in the main tanks and 164 gallons in the auxiliary tanks. The main tanks held 88 gallons when fueled to capacity; an interview with the pilot who flew the aircraft on the previous flight revealed that about 52 gallons had been used from the main tanks. The aircraft had not been refueled between flights. The fuel system of the Beech 66-A80 aircraft is not designed to permit the transfer of fuel from the auxiliary tanks to the main tanks. Fuel used from the auxiliary tanks must be supplied directly to the engines through the use of the fuel selector valves.

The aircraft was equipped with a Mode C transponder and an encoding altimeter; however, the pilot had indicated on his flight plan that there was no altitude reporting capability. The aircraft's autopilot was inoperative.

1.7 Meteorological Information

The following surface weather observations were taken by National Weather Service (NWS) certified Federal Aviation Administration (FAA) personnel before and after the accident:

College Station, Texas (About 31 nmi southwest of the accident site.)

1153: 2,000 feet scattered; estimated ceiling--25,000 feet broken; visibility-- 7 statute miles; temperature--86° F; dew point--76° F, wind--250° at 10 knots; altimeter setting--29.95 inHg.

1258: 3,000 feet scattered, 25,000 feet thin scattered; visibility--7 statute miles; temperature--87° F; dew point--76° F; wind--280° at 10 knots; altimeter setting--29.93 inHg.

Lufkin, Texas (About 61 nmi east of the accident site.)

1156: estimated ceiling--2,500 feet broken; visibility--7 statute miles; temperature--89° F; dew point--76° F; wind--270° at 8 knots; altimeter setting--29.93 inHg.

1253: 3,500 feet scattered; estimated ceiling--25,000 feet broken; visibility-- 7 statute miles; temperature--90° F; dew point--72° F; wind--230° at 10 knots; altimeter setting--29.90 inHg; towering cumulus all quadrants cumulonimbus northeast-east-west.

Weather radar photographic film from the Galveston, Texas, weather radar showed that, at 1222, the center of a Video Integrator and Processor (VIP) level 2 radar weather echo 6/ was located about 20 nmi north of the accident site. The VIP level 1 and VIP level 2 weather echo contours shown closest to the accident site at that time were about 8 nmi north and about 11 nmi northeast, respectively.

The film from the Galveston weather radar also showed the center of a VIP Level 3 weather echo located about 18 nmi north of the accident site at 1229. The closest VIP Level 1, VIP Level 2, and VIP Level 3 weather echo contours to the accident site at this time were about 6 nmi northeast, 9 nmi northeast, and 17 nmi north, respectively.

There were no Convective SIGMETS, SIGMETS, or AIRMETS issued by the NWS for the area surrounding the accident site at or near the time of the accident.

The pilot of a Piper PA-31 stated that he was in the area of the Leona VORTAC 7/ about 1240. He stated that the only significant weather was over the Leona VORTAC. He also stated that over the entire area there were small buildups with tops at 8,000 to 10,000 feet. The pilot further stated that he felt he would have experienced a "rough ride" at 8,000 feet in the buildups.

The pilot of a Piper PA-24 reported that he had encountered smooth flight conditions about 1220 when he was about one-half mile west of the Leona VORTAC at 8,500 feet. The pilot of a twin Cessna reported that he had encountered "light chop" about 1239 while he was in the area of the accident site at an altitude of 10,000 feet.

1.8 Aids to Navigation

Not applicable.

1.9 Communications

There were no reported communications difficulties.

1.10 Aerodrome Information

Not applicable.

6/ Radar Weather Echo Intensity Levels--Existing radar systems cannot detect turbulence. However, there is a direct correlation between the degree of turbulence and other weather features associated with thunderstorms and the radar weather echo intensity. The Weather Service has categorized six (6) levels of radar weather echo intensity. The following gives the weather features likely to be associated with levels during thunderstorm weather situations:

1. Level 1 (WEAK) and Level 2 (MODERATE). Light to moderate turbulence is possible with lightning.
2. Level 3 (STRONG). Severe turbulence possible, lightning.
3. Level 4 (VERY STRONG). Severe turbulence likely, lightning.
4. Level 5 (INTENSE). Severe turbulence, lightning, organized wind gusts. Hail Likely.
5. Level 6 (EXTREME). Severe turbulence, large hail, lightning, extensive wind gusts and turbulence.

7/ The Leona VORTAC is located about 15 nmi northwest of the accident site.

1.11 Flight Recorders

The aircraft was not equipped, nor was it required to be equipped, with a cockpit voice recorder or a flight data recorder.

1.12 Wreckage and Impact Information

Both wings outboard of the engines and the entire empennage had separated from the aircraft before it struck the ground inverted on a magnetic heading of about 147°. (See appendix D.) Two gouged areas in the dirt marked the initial impact point. Parts of the corresponding propeller blades, as well as the propeller blade slicing, were found in the gouges. After impact, the aircraft slid through the pasture grass for about 50 feet and came to rest, still inverted, on a magnetic heading of about 135°. The main wreckage consisted of the majority of the fuselage, the left and right wing center sections, the engines in their nacelles, and the retracted landing gear assemblies.

The fuselage nose cone had separated from the aircraft. The fuselage section forward of the instrument panel was crushed and torn on the top and the bottom. The instrument panel, controls, and instruments were distorted extensively. The windshield and all cabin windows were broken. The top of the fuselage at the cabin area was fragmented, and the bottom of the fuselage at the cabin area was compressed.

A vertical measurement taken at the trailing edge of the flaps showed that the entire fuselage was compressed to about 18 inches. The fuselage showed massive compressive damage. The entire length of the top of the fuselage was split open. The left side of the fuselage was buckled and torn. The right side of the fuselage was torn open and displayed deep vertical buckles. A portion of the aft fuselage had separated. Heavy impact indentations with black rubber smears and metal scratch marks were found just forward of the separation, on the right side of the fuselage. The scratch marks were similar to those that would be made by an aileron control cable striking the skin. The black rubber smears matched the deicer boot rubber on the leading-edge of the wing. A deep diagonal buckle, with skin separation, was found just forward of the main entrance door on the left side of the fuselage. The buckle and the fractured skin progressed aft from the bottom to the top of the fuselage at an angle of about 30°.

The main entry door and the emergency exit hatch had separated from the fuselage and were found along the wreckage path. The entry door displayed severe compression damage running diagonally from the top forward corner to the lower aft corner. Black rubber smears were found on the door. No ground impact damage was noted. The locking pin was in the engaged position and the safety chain was broken at the top attach point.

The emergency exit hatch showed moderate compression damage and diagonal cable marks, but no ground impact damage. The exit hatch-latching mechanism was intact but had been forced open by distortion during the crash sequence.

The left and right center wing sections were found attached to the fuselage in the main wreckage. The left and right wing sections had separated at Wing Station (WS) 98.250. The top surfaces of the wing center sections were shredded and the bottom surfaces showed buckling with several areas of skin ruptured.

The bottom of the left engine nacelle had separated span-wise in two locations, and the top showed severe deformation. The bottom of the right engine nacelle had separated into three sections, and the top showed severe deformation.

The left outboard wing section was inverted. The wing section, including the flap and the aileron, was intact. The wing section had separated at the joint between the outer wing panel and the wing center section. The separation was at the inboard end of the wing and in a downward direction. There was evidence of downward bending with a tension separation of the upper front wing bolt (missing and not recovered). The upper forward wing "bathtub" fitting area showed markings and indentations that evidenced bolt recoil after the bolt broke. The lower forward wing "bathtub" fitting had separated through the heavy inboard portion of the fitting in downward bending. The outer panel rear spar had separated through the "bathtub" area of the upper fitting and immediately outboard of the "bathtub" area of the lower fitting. The deicer boot and the wing tip navigation light assembly were intact.

Three pieces of the right wing were found within the wreckage scatter path. The leading edge outboard of the tiedown fitting and the wing tip had separated from the outer right wing panel, and the outer wing panel had separated from the wing center section. The inboard end of the panel was buckled and torn. The top skin surface showed a span-wise tear with the aileron cable protruding from the tear.

The outboard end of the right outboard wing panel was severely torn and compressed with rib structure and skin missing. The separated leading edge showed numerous chordwise buckles and abrasions to the leading edge deicer boot. The separated section was about 50 inches long and extended from the front spar to the leading edge.

The wing tip, with the navigation light attached, displayed an approximate 45° diagonal buckle at the inboard leading edge. The remainder of the wing tip section had severe skin buckling as well as evidence of orange/red paint transfer. The fractures in the right wing did not indicate any evidence of ground impact damage.

The right wing had separated at the joint between the outer wing panel and the wing center section in an upward direction by tensile separation of the lower front outboard wing fitting through the "bathtub" area; upward bending separation had occurred in the upper front center section "bathtub" fitting through the heavy outboard portion of the fitting. There was another upward bending separation of the outer wing panel rear spar, immediately outboard of the "bathtub" area of the lower fitting and at the outboard end of the upper fitting.

The right wing flap attached to the aft wing spar was intact and showed minor damage. The right aileron outboard half section had separated just outboard of the second hinge from the inboard end with the skin and aileron torn. The aileron tab, connected to the aileron by the "piano" hinge, was intact and not damaged. The trim tab push rod was intact and in place. The attached inboard section showed minor damage except at the point of separation.

The detached left horizontal stabilizer was located within the wreckage path. The stabilizer had severe span-wise downward bending deformation and had separated from the fuselage through the root areas of the stabilizer front and rear spars. The separation was in an up and aft direction, as evidenced by black streaks across the left side of the vertical fin and rudder that indicated contact with the rubber deicer boot on the leading edge of the stabilizer. The stabilizer leading edge showed evidence of severe compression buckling and torsional bending in the inboard one-third of the surface. No repetitive abrasion was found at the stabilizer's root seal.

The left elevator was found within the wreckage path. The left elevator inboard third and the spar were still attached to the left horizonal stabilizer at the two middle hinges. The trim tab had separated through the hinge and was not recovered. The section of elevator between the outboard hinge and the next inboard hinge was missing and not recovered. The areas of separation of this section of the elevator were at the hinges. All balance weights were in place for the sections recovered. No preexisting cracks or tears were evident.

The detached right horizontal stabilizer was located within the wreckage path. The stabilizer had moderate span-wise downward bending deformation along about one-third of the top surface and along about one-half of the lower surface inboard area. It had separated from the fuselage through the root areas of the stabilizer front and rear spars. No repetitive abrasion was found at the stabilizer's root seal. The separation was in an up and aft direction as evidence by black streaks across the right side of the vertical fin and rudder which indicated contact with the rubber deice boot on the leading edge of the horizontal stabilizer. The leading edge showed evidence of moderate compression buckling and torsional bending in the inboard one-third of the surface. A section of skin (upper and lower) from the rear spar outboard and aft to the first elevator hinge was separated and attached to the elevator.

The right elevator was found within the wreckage path. The elevator had been torn into four separate sections. The trim tab was still partially attached to the inboard section of the elevator. A portion of the stabilizer rear spar and its skin was attached to the inboard section of the elevator through the inboard hinge. All balance weights were in the proper positions. All separations were in the chordwise direction and coincided with the hinge locations. No preexisting cracks or tears were evident. Chordwise deformation was noted.

The vertical stabilizer was found within the wreckage path. The vertical stabilizer front and rear spars were attached to their mating bulkheads in the aft fuselage section. The lower leading edge of the vertical stabilizer was deformed to the left between 10° and 20°. The dorsal fairing was missing, except for fragments which remained connected at the attachment screws. There was evidence of impact damage and buckling to the lower forward area of the left side of the vertical fin. Rubber smears were evident on both sides of the vertical stabilizer. There was spanwise compression buckling at the rear spar from the top near the rivetline extending down and aft. No evidence of lateral movement was noted at the attachment bolts through the spar and empennage bulkhead. There was no evidence of repetitive or cyclic deformation.

The detached rudder was located within the wreckage path; it had separated into two pieces in the area of the rudder middle hinge. The lower section consisted of the trim tab with the bottom hinge bracket and middle hinge bracket still attached. The upper piece contained the rudder balance weight with the top hinge attached. Black rubber smear marks were on both sides of the lower section. The rudder showed moderate skin buckling in the lower portion adjacent to the bottom of the tab. The rudder bellcrank was found in two pieces with fractures that appeared to be caused by overload failures. Two bellcrank bolts had been pulled straight out with no evidence of side movement in the bolt holes. The bellcrank's right side rubber stop screw head showed a heavy force application mark all the way to the metal. No chatter marks or wear was seen on the rubber stop screw. The mark on the stop screw was white and had a span of 5/8 inch. Both rudder cables showed contact with the left side of metal in the bulkhead area, evidenced by distinctive cable scars. The cables showed evidence of having been pulled forward, deforming surrounding structures in a forward and to the right direction.

The primary control systems (aileron, elevator, and rudder) cables, bellcranks, and push rods were impact damaged or separated during structural breakup. No preexisting conditions that would have prevented normal operation were noted.

The secondary control systems (aileron, elevator, and rudder trim tabs) cables, actuators, and push rods were impact damaged and separated during structural breakup. The trim tab positions could not be established because of the damage.

The flap actuators were inaccessible for measurement. However, the flaps were in the fully retracted position.

All major aircraft components were accounted for. The aircraft and the detached components had no fire damage. No evidence of preexisting structural damage or control malfunction was found. All fractures were typical of those caused by overloads.

Both powerplants and their associated propellers were found in the main wreckage area. All of these components were damaged heavily from the ground impact; however, there was no indication of preimpact failure or malfunction.

1.13 Medical and Pathological Information

The postmortem examination of the pilot and a review of his medical records revealed no evidence of any medical problems which would have affected his performance. The pilot and two passengers died from impact trauma.

Selected toxicological tests of the remains of the pilot and both passengers were conducted by the Harris County Medical Examiner; however, results were inconclusive because samples had putrefied before laboratory testing. By the time the victims' bodies had been removed from the wreckage and transported to the county morgue, the bodies had been without refrigeration for about 9 1/2 hours, and outside temperatures in the area were reported as high as 93° for that day.

1.14 Fire

There were no signs of inflight or postimpact fire.

1.15 Survival Aspects

The accident was not survivable primarily because the occupiable area of the aircraft was compromised to the extent that there was no room for either the pilot or the passengers to live when the top of the fuselage was crushed to the cabin floor level.

1.16 Tests and Research

Safety Board investigators conducted balance tests and point thickness tests because the control surface flutter could have been a factor in the accident, since the surfaces had been repainted in August 1978.

The left and right elevators, the rudder, and the left aileron were balance checked using a K-Tron 15 Kg (33 pound) electronic scale, accurate to within 0.002 pound, a balance platform device capable of measuring the center of gravity to within 0.1 inch, and a steel linear scale, accurate to within 0.01 inch. The rudder's center of gravity was determined by hanging it next to a plumb line reference.

The four pieces of the right elevator were measured for balance about the hinge line and added together by calculations. The result was a balance of +9.30 ±2.00 (allowance for measurements) pound-inches (tail heavy). The manufacturer's established elevator balance limit is a maximum of +18.7 pound-inches (tail heavy).

Measurement of the left elevator, minus the elevator tab, was checked for balance, and it agreed with the balance of the right elevator. It was also within the manufacturer's established elevator balance limit of 18.7 pound-inches (tail heavy).

The rudder measurements for balance were found to be 26.69 ±2.00 (allowance for measurements) pound-inches (tail-heavy). The established manufacturer's limit is a maximum of 49.00 pound-inches (tail-heavy). The rudder weight of 26.30 pounds was well within the manufactuer's limits.

The left aileron was balanced intact. The measurement was 0.85 pound-inch (nose heavy) at a weight of 15.24 pounds. The aileron was well within the limits of 0.2 to 1.5 pound-inches (nose heavy) established by the manufacturer. The right aileron could not be balance checked because of extensive damage.

The left elevator, right elevator, rudder, and left aileron paint thickness measurements were taken on their surface skin to determine if the repainted surfaces exceeded the manufacturer's factory paint thickness - between .0029 and .0054 inch. The results of the thickness measurements were as follows:

Identity	Average Paint Thickness
Left Elevator	
Upper surface	.0018-.0026
Lower surface	.0021-.0028
Right Elevator	
Upper surface	.0020-.0029
Lower surface	.0025-.0031
Rudder	
Right surface	.0027
Left surface	.0025
Aileron surface (left wing)	.0024-.0028

The less than nominal paint thickness is one reason for the control surfaces being at or near the midpoint balance range. Exposed areas on the control surfaces showed that the surface had been stripped and repainted without being removed from the aircraft.

1.17 Other Information

1.17.1 Powerplants Tests

The powerplants were removed from the accident site and shipped to the manufacturer. Engine inspection and teardown, conducted under Safety Board supervision, revealed that a majority of the cylinder base bolts on the right engine were undertorqued, and the cylinder boss area under the nuts had been painted, probably during the last overhaul. Section 3, paragraph 3-28, of the engine manufacturer's Overhaul Manual specifies that "...all machined bosses should be masked before painting. Do not paint areas under hold down nuts where torque is required."

1.17.2 Fuel Usage

About 46 minutes elapsed from the time N100UV called ground control for taxi instructions until the flight disappeared from Houston ARTCC radar. About 8 minutes of this time was used for start, taxi, and perhaps engine runup. It is not known how much fuel was consumed during the ground portion of the flight. However, if the average fuel flow for both engines during the 8-minute period was 22 gallons per hour, about 3 gallons of fuel would have been used.

About 22 minutes elapsed from the time N100UV was cleared for takeoff until the flight reported level at 8,000 feet. During this time, the aircraft's phases of operation included a takeoff and climb to maneuvering altitude, about 10 minutes of en route climb, and about 13 minutes of level flight. According to the engine manufacturer, the aircraft could have been consuming as much as 68 gallons of fuel per hour during the takeoff and climb to maneuvering altitude. Because of its location in the median range of fuel consumption data contained in the aircraft flight manual, a power setting of 65 percent (37 gallons per hour) was selected to calculate the fuel consumption for the level cruise portion of the flight. The rate of fuel consumption during the en route climb could have ranged from 51 gallons per hour at 80 percent power to 68 gallons per hour at 100 percent power. A climb power of 90 percent was selected for these calculations because of its location in the median range of climb power fuel flow data obtained from the engine manufacturer. Based upon the above considerations, about 17 gallons of fuel would have been consumed during the takeoff and climb to 8,000 feet.

The last 15 minutes of radar observed flight is believed to have been in level cruise. If this portion of the flight was conducted at 65 percent power, about 10 gallons of fuel would have been consumed.

The aforementioned estimates of fuel used during N100UV's approximate 46-minute flight indicates that about 30 gallons of fuel would have been consumed. If climb and cruise power settings were greater than previously mentioned, the amount of fuel consumed could have been equal to the total amount of main tank fuel estimated to be onboard the aircraft.

Because of the destruction of the cockpit, the position of the fuel selector valves could not be determined.

1.18 Useful or Effective Investigation Techniques

No new or unusual investigation techniques were used during this investigation.

2. ANALYSIS

2.1 General

The pilot was properly certificated in accordance with Universal Airways and FAA requirements and regulations. However, he was not authorized for flight in instrument meteorological conditions because he lacked the six approaches and 6 hours of instrument time in the previous 6 months as required by regulation. There was no evidence of a preexisting medical problem that could have affected his performance.

The aircraft was certificated and maintained in accordance with applicable regulations. There was no evidence of preimpact failure, malfunction, or abnormality of the aircraft's systems or powerplants.

The aircraft's weight and balance values were within the authorized limits. The loading of the aircraft was arranged in such a manner that it should not have imposed any adverse inflight handling characteristics and/or structural loads.

There was no distress call received from N100UV, which indicates that some emergency condition occurred suddenly and fully engrossed the pilot's attention.

2.2 Aircraft Breakup

Witnesses saw the aircraft fall from a cloud. They also saw that both wings and the tail were missing from the aircraft before it struck the ground.

The wreckage distribution revealed that the fairly compact scatter path was about 1,150 feet wide (north to south) and 1,600 feet long (east to west). With a surface wind of 10 knots from the west, some components could have been subjected to wind drift. The inflight breakup probably occurred somewhere between the time the aircraft was at its assigned cruise altitude of 8,000 feet and when it was seen coming out of the cloud before ground impact. Taking into consideration that the breakup occurred at altitude, the wind drift of the components, and the relatively confined scatter path, the Safety Board concludes that the separation of the aircraft components -- horizontal and vertical stabilizers, elevators, rudder, and wings -- occurred, in sequence, within a few seconds.

The sequence of the separation was established by the mode of separation. The horizontal stabilizers probably received an excessive downward loading force, as evidenced by the downward spanwise bending deformation on both stabilizers. The source of this loading was most likely a nose-up control input initiated by the pilot at high speed. As the elevator deflected upward in response to the nose-up control input, the center of pressure acting on the horizontal stabilizers would travel aft, creating a leading edge up twisting moment. It was under this loading that the stabilizers failed and separated.

The horizontal stabilizers separated in an upward direction as evidenced by the black rubber smear marks across both sides of the vertical fin. The marks were made by the horizontal stabilizer deicer boots. Since both horizontal stabilizers appeared to have failed simultaneously and separated in a symmetrical manner, the aircraft wings were intact before the horizontal stabilizer failure. If a wing had failed first, the resultant rolling forces created by the unsymmetrical aerodynamic condition, would make a symmetrical failure and separation of the stabilizers unlikely.

Upon failure and separation of the horizontal stabilizer, the normal flight downward force acting on the aircraft tail would be released which would allow the aircraft to pitch nose down violently. At that point, the aircraft was beyond controllable flight and the continued inflight breakup and failures of the aircraft structure should be considered secondary.

Although the flight control surfaces were examined during the on-scene investigation for evidence of possible flutter, further examination and testing of the control surfaces was conducted after it was learned that the aircraft had been repainted and the control surfaces had not been balanced after being repainted. Close examination of the control surfaces showed areas where the skin surface had been stripped and repainted without the control surface being removed from the aircraft.

The left and right elevators, the rudder, and the left aileron were balance checked. The right aileron could not be balance checked because of extensive damage. The control surfaces were found to be within the balance limits, as established by the manufacturer. Paint thickness measurements of the repainted control surfaces revealed that the measurements were slightly less than the manufacturer's factory paint thickness average range. Consequently, the control surfaces were at or near the midpoint balance range of well-balanced control surfaces. Therefore, based on these tests and the type of damage on the control surfaces, the Safety Board concludes that flight control flutter was not involved in the breakup of the aircraft.

2.3 Weather and Operational Factors

Thunderstorm activity was forecast along the aircraft's route of flight. Based upon the meteorological information the pilot obtained from Universal Weather on the morning of July 2, 1981, he should have been aware of the possibility of encountering phenomena associated with thunderstorms. However, there was evidence to indicate that N100UV did not enter an area of severe weather that would have imposed excessive structural loads on the airframe. This was substantiated by weather condition observations from eyewitnesses to the accident and pilot reports of weather conditions in the Madisonville area about the time of the accident. Additionally, the aircraft disappeared from air traffic control radar about 15 nmi from the nearest VIP Level 3 thunderstorm and more than 5 nmi from the nearest VIP Level 1 weather radar echo contour.

While cruising at 8,000 feet, N100UV probably flew in and out of scattered cumulus cloud buildups. In the cloud buildups, light-to-moderate turbulence and inflight visibilities near zero miles were likely. The inflight environment clear of the clouds was likely characterized by light turbulence and visibilities greater than 3 nmi.

The pilot had limited experience flying multiengine aircraft in instrument meteorological conditions and no dual multiengine instrument instruction - either actual or simulated - which would have included formal training in how to satisfactorily cope with inflight emergencies, such as unusual attitudes, attitude instrument failure, or engine failure. As a result of acquiring an instrument rating in a single-engine aircraft, the pilot was not required to demonstrate instrument proficiency in multiengine aircraft. However, the differences are so diverse between the handling characteristics and emergency procedures of single-engine and multiengine aircraft, applicants for multiengine ratings who possess a single-engine instrument rating should be required to demonstrate their ability to conduct safe multiengine operations under actual or simulated instrument conditions. When an inflight emergency occurs, there is little time to decide the proper action to be taken. A preestablished plan of action and a thorough knowledge of the aircraft are requisites for the safe and efficient management of unusual, unexpected deviations from normal flight conditions, especially when the pilot is burdened by the extra tasks associated with flight by instrument reference.

The pilot had previously flown about 11 cross-country flights in N100UV. His longest flight was 1 8/10 hours. The average time for each cross-country flight was about 1 1/2 hours. It is possible that the pilot may have flown either all or most of these flights using only the main fuel tanks. Just as likely, however, is the possibility that he may have been accustomed to switching to reserve fuel further along in the flight, rather than shortly after leveling off. Since the amount of fuel onboard at takeoff, the fuel tank selection, the fuel distribution within the tanks, and the pilot's preferred procedures for takeoff, climb, and cruise are matters of conjecture, no significant conclusions could be drawn from the available fuel information.

Additional evidence indicates that the aircraft's engine(s) may have stopped because of fuel starvation. Witnesses reported hearing the aircraft making "popping" noises. The engine manufacturer indicated that an interruption of fuel flow to a Lycoming IO-720 engine could result in a popping noise or backfiring.

At the first indication of abnormal engine operation, the pilot should have advanced the mixture, prop, and throttle controls to the full rich/high RPM/high manifold position. Having done so, he may have recognized his fuel management error and attempted to correct it by turning the fuel boost pumps on and selecting auxiliary fuel. The surge or increase in engine power as described by witnesses may have been due to the resumption of fuel flow to the engines as a result of the pilot's selection of auxiliary fuel.

The fuel tank selectors and boost pumps were located on the fuel control panel, which was located approximately 90° to the left and below the pilot's view of the primary flight instruments. Switching tanks would therefore have required the pilot to move his head down and to the left, thus diverting his attention from flying the aircraft.

If, while under actual instrument conditions, the pilot's eyes were diverted from the flight instruments and his head was moved downward and turned (as when changing frequencies, checking flight log data, or changing fuel selectors), the aircraft rolled or turned at the same time and he suddenly returned his head to the normal position, a disorientation would most likely have occurred. A false sensation of diving or rolling beyond the vertical plane would have been produced. As a result, there may have been a strong, instinctive tendency to pitch or roll the aircraft in the opposite direction. This urge is even stronger when there is no autopilot available and the pilot has to rely upon his own perceptions and instincts. A reflex movement by the pilot could well have been introduced into the flight controls as a result of these events.

The aircraft's flight manual directed the pilot to use the flight controls with caution above 169 knots (Va-maneuvering speed). The Houston ARTCC D Log indicates N100UV was operating near its maneuvering speed at the time radar contact was lost. Having never received instrument training in multiengine aircraft, it is easy to visualize the pilot's reflex action as being abrupt and excessive. Under such circumstances, the required caution in the use of the flight controls is not likely to have been exercised.

Since N100UV was not equipped with a cockpit voice recorder or a flight data recorder, the Safety Board had little evidence to determine positively the actions of the pilot. However, the Safety Board believes that spatial disorientation could have led to the excessive control force inputs by the pilot which caused the massive inflight failure of the aircraft's structure.

2.4 Powerplant Teardown

During the teardown inspection of N100UV's powerplants, investigators found that some of the engine cylinder base nuts on the right engine were not, and could not be, properly torqued because of paint on the boss area under the nuts. This painting procedure is contrary to procedures set forth by the engine manufacturer.

Although the undertorqued condition of these cylinder base nuts was not considered to be a factor in the accident, the Safety Board believes that it constitutes a potentially hazardous situation since the loss of any or all of these cylinders could have resulted from this incorrect maintenance procedure.

3. CONCLUSIONS

3.1 Findings

1. The pilot was properly certificated; however, he had not met the instrument recency of experience requirement to act as pilot-in-command of an aircraft on an instrument flight plan.

2. The pilot had not received instrument instruction in a multiengine aircraft, and his total instrument time in multiengine aircraft was 2 1/2 hours.

3. The flight departed Houston within the aircraft's prescribed weight and balance limitations.

4. It is not known if the pilot switched to the auxiliary fuel tanks after takeoff.

5. An unexpected emergency condition probably occurred which suddenly diverted the pilot's attention.

6. There is no evidence that the flight encountered weather that would have induced the extreme structural loads.

7. The duration of the flight could have exhausted the fuel believed to have been in the main tanks at takeoff.

8. When radar contact was lost, the aircraft was traveling at approximately 169 knots IAS (Va-maneuvering speed).

9. The aircraft's automatic pilot was inoperative.

10. The pilot's lack of multiengine instrument experience and the inoperative autopilot increased the probability of the pilot experiencing spatial disorientation in adverse meteorological conditions.

11. The accident occurred more than 15 nmi from the core of a VIP level 3 thunderstorm and more than 5 nmi from a VIP level 1 weather radar echo contour.

12. At an altitude of 8,000 feet, the aircraft flew in and out of scattered cumulus cloud buildups with light-to-moderate turbulence and in-flight visibilities near zero miles in the buildups.

13. Light turbulence and inflight visibilities greater than 3 miles existed in areas clear of cumulus cloud buildups.

14. The aircraft broke up in flight under aerodynamic loads which probably exceeded its structural capability.

15. The breakup was the result of aerodynamic overloads induced by the pilot.

16. Within a short span of time, the horizontal stabilizers separated, followed by left and right wing separations.

17. There was no evidence that flight control surface flutter occurred.

18. The main wreckage struck the ground inverted.

19. The loss of the cabin structural integrity compromised the occupiable space within the cabin when the top of the fuselage was crushed to floor level.

20. It was not possible to determine if the pilot was wearing required corrective lenses at the time of the accident.

3.2 Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was a pilot induced airframe overload following loss of aircraft control which resulted in the structural breakup of the aircraft. The reason(s) for the loss of aircraft control could not be determined. Contributing to the loss of control was the pilot's lack of instrument proficiency in multiengine aircraft.

4. SAFETY RECOMMENDATIONS

As a result of its investigation of this accident, the Safety Board issued the following recommendations to the Federal Aviation Administration:

> Issue a General Aviation Airworthiness Alert (Advisory Circular 43-16) to emphasize the importance of following the established procedures published in the manufacturer's engine overhaul manual. (Class II, Priority Action) (A-81-161)

> Require all holders of an instrument rating and a multiengine rating to demonstrate their ability to operate a multiengine aircraft under normal and emergency conditions by reference to flight instruments only as a prerequisite to exercising the privileges of an instrument rating in multiengine aircraft. (Class II, Priority Action) (A-81-162)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JAMES B. KING
Chairman

/s/ ELWOOD T. DRIVER
Vice Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ G. H. PATRICK BURSLEY
Member

PATRICIA A. GOLDMAN, Member, did not participate.

December 17, 1981

5. APPENDIXES

APPENDIX A

INVESTIGATION AND HEARING

1. Investigation

The Safety Board was notified of the accident about 1445 on July 2, 1981, and a team of six investigators was dispatched to the scene immediately. Investigative groups were established for the investigation in the areas of operations, air traffic control, structures, systems, powerplants, human factors, maintenance records, and weather. A metallurgical group was established at the Safety Board's Headquarters in Washington, D.C.

Parties to the investigation included the Federal Aviation Administration, Beech Aircraft Corporation, Universal Airways, Inc., and AVCO-Lycoming.

2. Hearing

No public hearing was held.

APPENDIX B

PERSONNEL INFORMATION

Robert Marion Allen

Robert M. Allen, 44, held Commercial Pilot Certificate No. 462527415 for airplane single- and multiengine land with instrument privileges. He also held a flight instructor certificate for airplane single-engine land. A second class medical certificate was issued to him on August 1, 1980, with the limitation that the "holder shall wear glasses for near and distant vision while exercising the privileges of his airman certificate." On April 10, 1981, Mr. Allen satisfactorily completed an airman proficiency/qualification check ride in N100UV.

Universal Airways, Inc., had no record of the flight and duty times Mr. Allen had accumulated flying for them nor did they have any record or knowledge of his pilot qualifications.

Mr. Allen had accumulated about 398 flight hours, of which approximately 237 hours was as pilot-in-command. He logged 48.9 hours of multiengine flight which consisted of the following:

17.4 hours-dual (Training)
31.5 hours-pilot-in-command of which 23.7 hours were in N100UV

His total instrument time consisted of 55 hours simulated (hood) and 8.2 hours actual. His pilot-in-command instrument time in multiengine aircraft was 2.5 hours, all of which was logged "actual" in N100UV. Mr. Allen's flight log indicates that he had not receive any instrument training (dual instruction) in multiengine aircraft. None was required under 14 CFR 61.65. His instrument time (logged as actual and in N100UV) the previous 30 days was .9 hour and the previous 90 and 180 days was 2.5 hours. He logged four instrument approaches during the previous 6 months.

There was no evidence that Mr. Allen had piloted an aircraft the 24-hour period before the accident, His previous flight in N100UV occurred on June 26, 1981. Mr. Allen logged 10.9 hours during the preceding 30 days (7.2 hours in N100UV) and 30.4 hours (15.2 hours in N100UV) during the preceding 90 days.

Passengers

Thomas Gregory Evans, 53, was President and Chairman of the Board for Universal Weather/Aviation, Inc.

Gerardo R. Hidalgo, 41, was an agent in Spain for Universal Weather/Aviation, Inc.

APPENDIX C

AIRCRAFT INFORMATION

Beech Aircraft Model 65-A80, Excalibur Converstion to Model 65-A80-800, N100UV, Serial No. LD 151, was issued a Certificate of Airworthiness in the Standard-Normal category on June 1, 1969.

The aircraft had been owned by several corporations, before it was purchased by Excalibur Aviation company on March 29, 1978. The aircraft total time on this date was 4209.8 hours. On April 11, 1978, the aircraft was purchased by Universal Weather and Aviation, Inc., d/b/a as Universal Airways, Inc. The records indicated that the aircraft was sold by Universal Weather and Aviation, Inc., to Universal Airways, Inc.; however, there were no dates on the bill of sale. The records further indicated that Universal Airways, Inc., on June 26, 1978, applied for a new registration certificate and on July 25, 1978, Universal Airways changed the aircraft registration number from N129TS to N100UV.

One of the aircraft data plates indicated the aircraft had been converted from a Model 65-A80 to a Model 65-A80-8800 on November 15, 1971. However, the aircraft records received from the FAA Aircraft Registration Branch did not reflect the conversion.

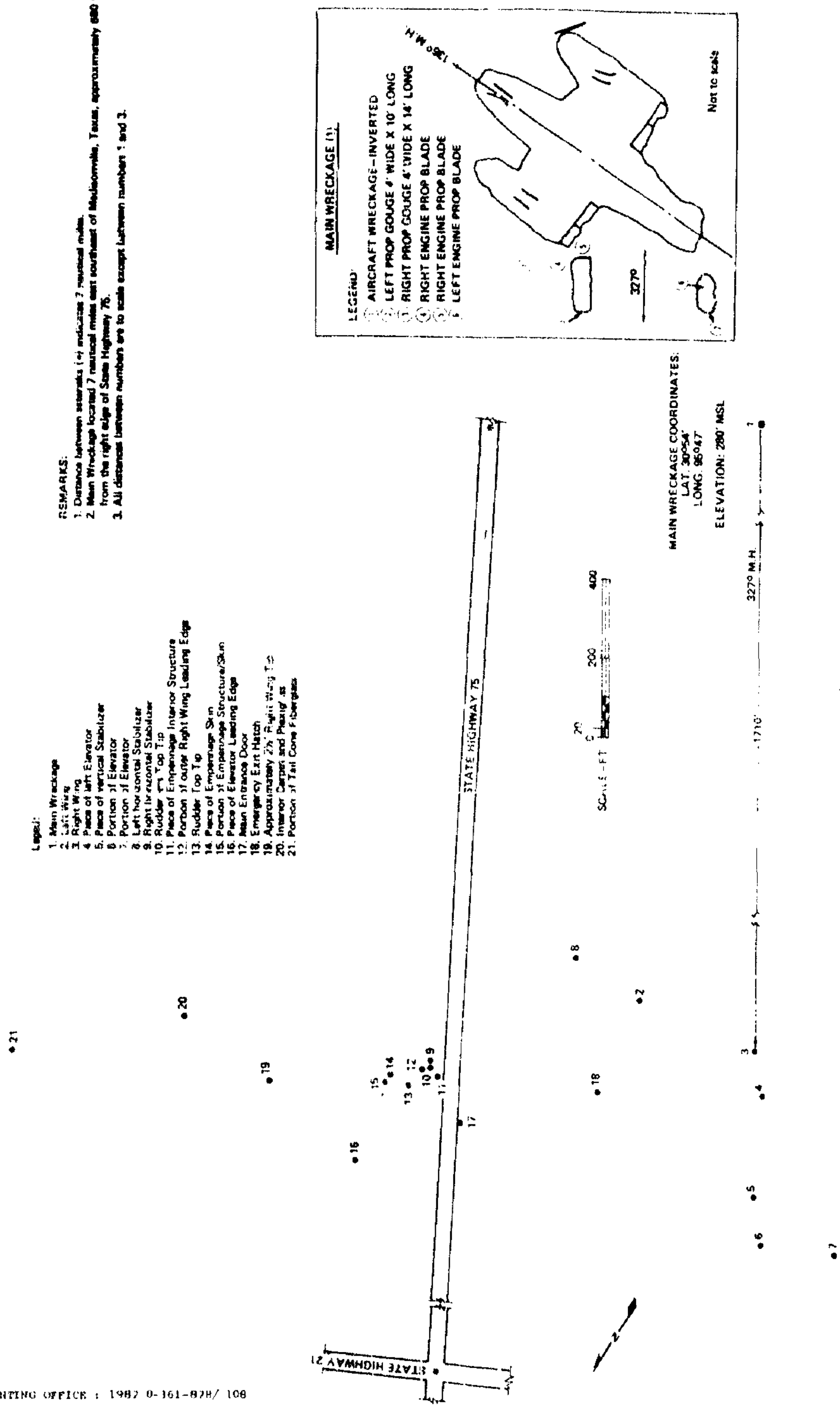
An FAA Major Repair and Alteration Form 337 indicated that the aircraft was equipped with two Avco Lycoming IO-720-AIB engines on July 17, 1978. It was also equipped with two Hartzell propellers Model HC-A3VK-2A/V8433NB-2R.

Engine Information	Left	Right
Serial Number	L643-54	L-7949-54-A
Date Installed	12/30/80	12/30/80
Time Since Overhaul	100.5 hours	100.5 hours
Time Since Inspection	2.5 hours	2.5 hours

Propeller Information	Left	Right
Serial Number	BJ 1269	BV 1268
Date Installed	8/1/78	12/30/80
Time Since Overhaul	551.4 hours	100.5 hours
Time Since Inspection	2.5 hours	2.5 hours

APPENDIX D

WRECKAGE DISTRIBUTION CHART



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