National Transportation Safety Board
Aviation Accident Final Report

Location:	KETCHIKAN, AK	**Accident Number:**	ANC97FA143
Date & Time:	09/06/1997, 1300 AKD	**Registration:**	N543AN
Aircraft:	Aero Commander AC-500A	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General Aviation - Personal		

Analysis

The aircraft had an in-flight breakup when the left wing and tail section separated. Postaccident inspection revealed a right engine main fuel supply line progressive rupture, only trace amounts of fuel in the fuel lines, and no rotational damage to the right engine. Preaccident, long term, fuel leak evidence surrounded the ruptured line. The right propeller was not feathered. The left wing D-tube rib at station 127 exhibited compressive buckling. Left wing fractures were upward, and horizontal stabilizer deformation was downward. During an actual loss of engine power in the airplane 17 months before this accident, the pilot had feathered the incorrect propeller. Both a mechanic, and an FAA safety counselor, who were familiar with the pilot, described him as able to be disoriented, and reliant on GPS for navigation. He had stated five months before the accident that he did not feel his instrument flying skills were proficient, and desired training. On the day of the accident, weather was visual meteorological conditions, with layered clouds above 2,200 feet mean sea level. The pilot stated to the FAA weather briefer that he wanted to make the flight under visual conditions. The flight route and altitude was unknown.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The rupture of the right engine fuel supply line as a result of inadequate inspection by the pilot/mechanic, and the pilot's excessive pull up which resulted in exceeding the design stress limits of the airplane. Factors were the improper emergency procedures and failure to feather the propeller.

Findings

Occurrence #1: LOSS OF ENGINE POWER(TOTAL) - MECH FAILURE/MALF
Phase of Operation: CRUISE

Findings
1. (C) FUEL SYSTEM,LINE - RUPTURED
2. (C) MAINTENANCE,INSPECTION - INADEQUATE - OWNER/PILOT MECHANIC
3. (F) EMERGENCY PROCEDURE - IMPROPER - PILOT IN COMMAND
4. (F) PROPELLER FEATHERING - NOT PERFORMED - PILOT IN COMMAND

Occurrence #2: ABRUPT MANEUVER
Phase of Operation: CRUISE

Findings
5. (C) PULL-UP - EXCESSIVE - PILOT IN COMMAND

Occurrence #3: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation: CRUISE

Findings
6. WING,WING RIB - BUCKLED
7. (C) DESIGN STRESS LIMITS OF AIRCRAFT - EXCEEDED - PILOT IN COMMAND

Occurrence #4: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: DESCENT - UNCONTROLLED

Factual Information

HISTORY OF FLIGHT

On September 6, 1997, about 1300 Alaska daylight time, a Twin Commander AC-500A airplane, N543AN, was destroyed when it impacted mountainous terrain about twenty-eight miles north of Ketchikan, Alaska. The private pilot and the sole passenger sustained fatal injuries. The flight was conducted under 14 CFR Part 91 as a personal flight from Wrangell, Alaska, to Everett, Washington. Visual meteorological conditions prevailed in the general vicinity of the accident site, and no flight plan was filed. The airplane departed Wrangell between 1200 and 1300.

Cruise altitude of the airplane, and the intended route of flight is unknown. There are no known witnesses to the accident. The exact purpose of the flight is unknown.

The sole passenger was the pilot's wife. She was seated in the aft cabin seat. Acquaintances of the couple stated to the NTSB investigator that she regularly would fly with her husband, and preferred to sit in this location. Located with her was their dog.

DAMAGE TO AIRCRAFT

The airplane came to rest with the main fuselage, right wing, and both engines, approximately 2,000 feet from the tail section. The outboard 129 inches of the left wing was not located. Several small, light, sheet metal pieces were located downwind of the tail section.

PERSONNEL INFORMATION

The 81-year-old pilot held a private pilot certificate with airplane, single and multiengine, land and sea, and instrument ratings. His original private pilot certificate was issued on August 30, 1945, with an airplane-single engine rating. He obtained a multiengine rating on July 10, 1961, and an instrument rating on August 23, 1967. He also held aircraft and engine mechanic certificates initially issued November 12, 1941. According to friends, and the mechanic who assisted him with the most recent annual inspection, he occasionally performed his own airplane maintenance.

The pilot held a Third Class medical certificate, issued on August 29, 1997, with the restrictions of having glasses available for near vision.

On April 2, 1996, the pilot was involved in an accident with the same airplane. During this accident, the airplane sustained a loss of engine power of the right engine. While conducting the emergency procedures, the pilot feathered the left (incorrect) engine. The airplane was then landed at an off airport location and received substantial damage.

On July 15, 1996, he was reexamined by an FAA inspector and successfully completed a competency check flight.

A general aviation, FAA designated, safety counselor familiar with the pilot, was interviewed by the NTSB investigator after the accident. This counselor stated that in April 1997 he had met with the pilot, who indicated he did not feel his instrument flying skills were proficient, and that he desired to receive some training and practice. This counselor observed the pilot make several small mistakes while preparing to depart on a flight. These were specifically, cross threading an oil cap, starting an engine with a boost pump on which resulted in a flooded start, and stalling an engine during the preflight check. The counselor indicated that there was

"room for disorientation with this pilot."

A mechanic who flew with the pilot on September 3, 1997, stated that the pilot became disoriented, and relied heavily on GPS for navigation.

AIRCRAFT INFORMATION

The airplane was powered by two 260 horsepower reciprocating engines.

Both engines were overhauled and replaced on June 7, 1996, after the April 2, 1996, emergency landing. This was 37 hours prior to the accident.

The airplane last received an annual inspection on May 10, 1997, 19 hours prior to the accident. The pilot/owner performed some of the maintenance, while a contracted mechanic who held an Inspection Authorization (IA), inspected the pilot's work.

Three days prior to the flight, both engine driven hydraulic pumps were replaced by the owner. At completion of the pump replacement, the pilot and an IA mechanic flew the airplane. The IA stated during an interview with the FAA that the airplane flew smoothly.

Inspection of the wreckage confirmed that all structural wing Airworthiness Directives (AD) had been complied with. AD 75-12-09 R2, for installing an elevator "Bob Weight" into the flight control system to prevent inadvertent pilot induced structural failure, had been installed.

The airplane weight and balance at the time of the accident was calculated to be within limits.

The mechanic who had assisted the pilot with the last annual inspection stated to an FAA inspector that the pilot had occasionally complained of a fuel smell in the airplane.

METEOROLOGICAL INFORMATION

Weather reports from the surrounding stations indicated ceilings varying from 2,200 feet to 5,500 feet, with higher layers.

The nearest weather reporting station to the accident site was Ketchikan. At 1200, Ketchikan weather was reported to be variable winds at 4 knots, 10 miles visibility in rain, scattered clouds at 1,100 feet, broken clouds at 2,200 feet, and overcast clouds at 3,000 feet.

Various pilots interviewed by the NTSB investigator-in-charge reported that ceilings in the areas surrounding the large island where the accident occurred were layered. The ceilings described varied from 2,000 feet to 4,000 feet, with higher layers above.

AIDS TO NAVIGATION

Navigational equipment in the airplane consisted of VOR, DME, and ADF radio receivers. The mechanic who recently flew with the pilot, told an FAA inspector that the pilot relied on his handheld Global Positioning System (GPS) receiver for navigation information.

COMMUNICATIONS

No record of in-flight ATC communication was found. No radar coverage exists in the area surrounding the accident site.

The pilot received a weather briefing at 1930 on September 5, from the FAA Juneau, Alaska, Flight Service Station. A review of the transcripts of the weather briefings received reveal the pilot stated he wanted to travel VFR to Paine Field in Everett, Washington. The forecast he received called for VFR conditions, and marginal VFR conditions in showers, between

Wrangell and Paine Field.

At 1021 on September 6, the pilot received another weather brief. He stated, "I'd like to fly VFR from Wrangell to Paine Field." At the time of the brief, the Wrangell weather was IFR. Ketchikan weather was VFR with 6 miles visibility in rain, scattered clouds at 1,200 feet, and broken clouds at 2,300 feet.

The pilot did not request or receive the Area Forecast for Southern SE Alaska.

WRECKAGE AND IMPACT INFORMATION

The fuselage, with both engines and the right wing attached, came to rest about 1,522 feet msl in position 55-44.51 degrees north latitude, 131-25.00 degrees west longitude. The nose was pointing 210 degrees magnetic. The terrain consisted of a 30 degree slope, heavily timbered with numerous 200 feet tall spruce trees. The fuselage came to rest at the bottom of a large tree. Scrape marks exposing fresh wood were visible along the entire length of this tree. No surrounding trees appeared to have damage.

The tail section of the airplane, aft of fuselage station 252, was located about 2,000 feet to the east-northeast of the main fuselage. All longerons and rivet lines were deformed in a direction consistent with the tail separating in an aft and right direction.

A section of left wing leading edge skin from wing station 98 to wing station 145 was recovered approximately 600 yards northeast of the main fuselage. This section included the leading edge rib at wing station 127. This rib exhibited compressive buckling. The attached upper wing surface sustained compressive buckling. The outboard ends of this section displayed no indications of impact damage from contacting terrain.

Several pieces of light debris were located about 200 yards further north of the tail.

The 129 inches of left wing and aileron, outboard of wing station 145, were not recovered.

Forward fuselage damage consisted of upward crushing of the lower fuselage. The nose cone exhibited no crushing in an aft direction. Upper fuselage damage aft of station 180 consisted of downward crushing, aftward scraping and paint transfer. The upper surface antennas were deformed aft.

The right horizontal stabilizer had a 'V' shaped gouge in the leading edge 1/3 span outboard from the stabilizer root. One foot inboard from the tip were metallic scratches in the pattern of cable strands.

The left horizontal stabilizer contained two leading edge depressions that had brown vegetable matter in them. These depressions matched the tree stumps where the tail section came to rest.

The vertical stabilizer had no leading edge damage.

No permanent spar deformation was evident on the horizontal stabilizers. The lower skin surfaces of both horizontal stabilizers exhibited a visible pattern of 45 degree wrinkles. The pattern was oriented from outboard to inboard, from fore to aft. The upper surfaces were unremarkable. All rivet lines remained intact.

The upper skin adjacent to the four elevator hinges exhibited over-travel tearing. The lower skins were not damaged in the hinge area.

The right wing remained attached, and had no leading edge damage. Inspection of the aileron hinges revealed no evidence of overtravel in either direction. The aileron stops were not damaged.

The left wing outboard of wing station 145 was not located. The inboard fracture surfaces did not exhibit impact damage with the ground. The structural members all appeared deformed up and aft. The fracture ends surrounding wing station 145 were removed as an assembly and examined at the NTSB metallurgical laboratory.

The landing gear and flaps were up.

No prebreakup flight control cable anomalies were noted.

Both engines remained attached to the wings. The engine mounts were broken and deformed in a downward direction.

No preimpact anomalies were noted with the left engine or fuel system. The left engine propeller blades exhibited torsional twisting, chordwise scratching, and leading edge gouges. The blades were broken free in the hubs. The left engine tachometer indicated 1,500 rpm.

The right propeller blades were bent aft 90 degrees along the nacelle. The right propeller blades were in the fine pitch (high rpm) position. The right engine tachometer indicated 0 rpm. Only trace amounts of fuel existed in the lines, filters, or fuel manifold. This engine was retained for disassembly.

Both propeller control levers were in the full forward (low pitch/high rpm) position.

Both main fuel valve selector switches were in the "ON" position.

According to the Alaska state trooper originally on scene, the pilot's right hand was found gripping both fuel mixture control levers. These were in the full aft, or "idle cutoff," position.

Fuel was present in the integral center and wing fuel tanks.

Fuel seepage stains were evident on the fuel collector tank. A large amount of rubberized sealant was present on the collector tank, and around the gasket seal of the right engine fuel boost pump.

The right engine main fuel supply line from the electric boost pump to the engine appeared frayed, worn, and broken open. It was examined at the NTSB metallurgical laboratory.

MEDICAL AND PATHOLOGICAL INFORMATION

An autopsy was performed under the authority of the State of Alaska Medical Examiner on September 8, 1997. No remarkable preexisting conditions were noted. Toxicological tests were unremarkable.

TESTS AND RESEARCH

Inspection in the NTSB metallurgical laboratory of the left wing fracture surfaces surrounding station 145 revealed damage consistent with overstress. The failed structural members revealed damage in a consistently upward and aftward direction. No indication of corrosion or fatigue was found in this area. All fracture surfaces appeared ragged and shiny.

The right engine was disassembled and examined by an NTSB investigator at the manufacturer's facility on February 5, 1998. No preimpact anomalies were noted.

The right engine main fuel supply line, from the center fuel collector can and electric boost pump, was examined at the NTSB metallurgical laboratory. The line exhibited external deformation and chafing of the protective layers, and a complete rupture of the internal hose.

Disassembly of the right engine, electric fuel boost pump, revealed it to be internally dry and corroded. The pump could not be turned by hand.

ADDITIONAL INFORMATION

The main wings of the AC-500A are constructed using a main spar located at the 35% chord, an aft spar located at the 67% chord, and a leading edge D-tube with a noncontinuous, false spar, stiffener. This stiffener is located at the leading edge of the forward D-tube, which defines the forward 35% of the wing chord. This D-tube is a cantilever assembly forward of the main spar.

The wing has a forward sweep. Increases in angle of attack increase the up and aft torsional loads applied to the leading edge D-tube. This rotational dynamic load is transmitted by the upper skin and D-tube ribs to the forward spar.

The airplane was certificated under CAR-3.11, which required load testing under a static condition, in pure vertical or horizontal directions. CAR-3.11 did not require dynamic load testing for certification.

The AC-500A Pilot Operator Handbook (POH) Emergency Procedure for ENGINE FAILURE DURING CRUISE states, "Correctly determine inoperative engine by checking with throttles. Feather engine as outlined in Propeller Section of Normal Operating Procedures... ."

The FEATHERING PROCEDURE states: 1. Throttle - CLOSED (inoperative engine) 2. Mixture control - IDLE CUTOFF (inoperative engine) 3. Fuel valves - CLOSED (inoperative engine) 4. Ignition switch - OFF (inoperative engine) 5. Propeller control - FEATH RANGE

The AC-500A POH performance charts for Single Engine Rate of Climb states that at Gross Weight of 6,250 pounds and 50 degrees Fahrenheit, a positive climb rate is possible up to 7,000 feet pressure altitude.

Maneuvering Speed (Vma) is 126 knots.

The wreckage was released to the pilot's estate representative on January 20, 1998.

Pilot Information

Certificate:	Private	**Age:**	81, Male
Airplane Rating(s):	Multi-engine Land; Multi-engine Sea; Single-engine Land; Single-engine Sea	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 Valid Medical--w/ waivers/lim.	**Last FAA Medical Exam:**	08/29/1997
Occupational Pilot:		**Last Flight Review or Equivalent:**	
Flight Time:	2577 hours (Total, all aircraft), 81 hours (Total, this make and model), 2577 hours (Pilot In Command, all aircraft), 17 hours (Last 90 days, all aircraft), 8 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Aero Commander	**Registration:**	N543AN
Model/Series:	AC-500A AC-500A	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Normal	**Serial Number:**	500A-908-17
Landing Gear Type:	Retractable - Tricycle	**Seats:**	7
Date/Type of Last Inspection:	05/10/1997, Annual	**Certified Max Gross Wt.:**	6250 lbs
Time Since Last Inspection:	18 Hours	**Engines:**	2 Reciprocating
Airframe Total Time:	6679 Hours	**Engine Manufacturer:**	Continental
ELT:	Installed, activated, aided in locating accident	**Engine Model/Series:**	IO-470-M
Registered Owner:	ROBERT KIRKE DENT	**Rated Power:**	260 hp
Operator:	ROBERT KIRKE DENT	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	**Condition of Light:**	Day
Observation Facility, Elevation:	KTN, 10 ft msl	**Distance from Accident Site:**	28 Nautical Miles
Observation Time:	1253 AST	**Direction from Accident Site:**	175°
Lowest Cloud Condition:	Scattered / 700 ft agl	**Visibility**	10 Miles
Lowest Ceiling:	Broken / 1300 ft agl	**Visibility (RVR):**	0 ft
Wind Speed/Gusts:	7 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	160°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29 inches Hg	**Temperature/Dew Point:**	11°C / 9°C
Precipitation and Obscuration:			
Departure Point:	WRANGELL, AK (WRG)	**Type of Flight Plan Filed:**	None
Destination:	EVERETT, WA (PAE)	**Type of Clearance:**	None
Departure Time:	0000	**Type of Airspace:**	Class G

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	

Administrative Information

Investigator In Charge (IIC):	MATTHEW L THOMAS	**Report Date:**	04/15/1999
Additional Participating Persons:	HUGH DEVLIN; JUNEAU, AK ROGER J ADERMAN; ARLINGTON, WA ROBERT S BOYLE; MOBILE, AL DAVID SCHWARTZ; RENTON, WA		
Publish Date:			
Investigation Docket:	NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at pubinq@ntsb.gov, or at 800-877-6799. Dockets released after this date are available at http://dms.ntsb.gov/pubdms/.		