



National Transportation Safety Board Aviation Accident Final Report

Location:	ATLANTIC OCEAN, AO	Accident Number:	NYC96FA012
Date & Time:	10/18/1995, 2055 EDT	Registration:	N711EX
Aircraft:	Piper PA-31-350	Aircraft Damage:	Substantial
Defining Event:		Injuries:	1 Fatal, 1 Minor, 4 None

Flight Conducted Under: Part 135: Air Taxi & Commuter - Non-scheduled

Analysis

While descending from 5,000 feet to 3,000 feet, the pilot informed ATC that the left engine had failed and the engine cowling was open. The crew said that after feathering the left propeller, and with the right engine at full power, they could not arrest a 300-500 fpm rate of descent. The crew informed ATC that they would be landing in the water. All the occupants exited the airplane from the left front pilot's emergency door. The victims were in the water for approximately 30 minutes before being rescued. One of the passengers was in cardiac arrest when he was retrieved from the water. Examination of the left engine revealed that the #2 cylinder had separated from the engine in flight as a result of high stress fatigue cracking of the cylinder hold down studs and the #3 main bearing thru-studs. The fatigue in the studs occurred as a result of the cylinder fastener preload forces either initially inadequate or lost during service. Maintenance records indicated that the thru-stud was replaced 80 service hours prior to the accident. Examination of the cylinder hold down studs and the #3 main bearing thru-studs revealed that they were improperly torqued, resulting in low initial preload on the fasteners. Incorrect installation of the oversize thru-studs, per existing service information, could have also been a factor in the improper torquing of the studs. The locations of the fatigue origins and the edge worn into the deck indicate that the upper studs were probably the first to fail, allowing the cylinder to rock on the lower rear corner of the cylinder flange.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: a total loss of left engine power as a result of an in-flight separation of the #2 cylinder. The cylinder separated due to high stress fatigue cracking of the cylinder hold down studs and the #3 main bearing thru-studs. Factors in this accident were: improper torquing of the studs and failure of maintenance personnel to properly comply with service information.

Findings

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

Findings

1. 1 ENGINE
2. (F) ENGINE ASSEMBLY,CYLINDER - OVERTORQUE
3. (F) MAINTENANCE,MAJOR REPAIR - IMPROPER - OTHER MAINTENANCE PERSONNEL
4. (C) ENGINE ASSEMBLY,CYLINDER - FATIGUE
5. ENGINE ASSEMBLY,CYLINDER - SEPARATION

Occurrence #2: DITCHING

Phase of Operation: EMERGENCY LANDING

Occurrence #3: IN FLIGHT COLLISION WITH TERRAIN/WATER

Phase of Operation: EMERGENCY LANDING

Findings

6. TERRAIN CONDITION - WATER

Factual Information

History of Flight

On October 18, 1995, about 2055 eastern daylight time, a Piper PA-31-350, N711EX, ditched in the Atlantic Ocean, approximately 6 miles south of John F. Kennedy International Airport (JFK) Jamaica, New York, and was substantially damaged. The airline transport pilot (captain) and three passengers were not injured. The commercial pilot (first officer) received minor injuries, and one passenger was fatally injured. Visual meteorological conditions prevailed, and an IFR flight plan had been filed for the flight, which departed Atlantic City, New Jersey, approximately 2010. The on-demand air taxi flight was being conducted in accordance with 14 CFR Part 135.

While descending from 5000 feet to 3000 feet, en route to Farmingdale, New York, the pilot was in contact with JFK Approach Control. He informed the controller at JFK that the left engine had failed and the engine cowling was open. The pilot declared an emergency and requested a landing at JFK. The controller cleared the pilot to land on runway 4.

The crew performed the emergency checklist and feathered the left propeller. The captain said that he could see the three propeller blades, but could not determine if the blades were feathered. The crew said that after everything was secured and the right engine was at full power, they could not arrest a 300 to 500 feet-per-minute rate of descent. The captain then told the first officer to instruct the passengers to don their life vests, and to advise them that they were going to ditch in the water. The crew also informed JFK that they could not make the airport and would be landing in the water. The pilot asked JFK to send rescue help.

After landing in the water, all the occupants exited the airplane from the left front pilot's emergency door. The airplane sank in approximately 85 feet of water. The victims were in the water for approximately 30 minutes before being rescued by a Coast Guard Helicopter and a New York City Police Boat. One of the passengers was in cardiac arrest when he was retrieved from the water.

The accident occurred during the hours of darkness at approximately 40 degrees, 31 minutes north, and 73 degrees, 45 minutes west.

PERSONNEL INFORMATION

Information on the pilot is contained in this report under First Pilot Information and Second Pilot Information, Supplement "E".

AIRCRAFT INFORMATION

The engine log books showed that the left engine was overhauled by T. W. Smith Engine Co., Inc. on January 31, 1994, with a total accumulated time of 4970.5 hours. The log book listed the AD notes and service bulletins that had been complied with at the time the engine was rebuilt. These included Service Instruction 1123C, which is discussed in the Additional Information section below. At 268.2 service hours since overhaul; all cylinders were removed from the engine and oversize thru-studs were installed. The engine log book entry reported that the thru-stud installation was performed in accordance with Lycoming's, service instruction (SI) 1290D, with T. W. Smith Co., performing the over sizing of the bores. The engine was then reassembled by a second mechanic for the operator. The accident occurred approximately 80 hours after the thru-studs were replaced. Further information on the

aircraft is contained in this report under Aircraft Information.

METEOROLOGICAL INFORMATION

Visual meteorological conditions prevailed at the time of the accident. Meteorological information is contained in this report under Weather Information.

WRECKAGE AND IMPACT INFORMATION

The aircraft crashed in the waters of the Atlantic Ocean, approximately 6 miles south of JFK Airport. The airplane was found and recovered from the ocean on November, 3, 1995, and examined at parking lot near Jamaica, New York.

Examination of the wreckage revealed that it was intact and had sustained very little damage during impact with the water. Several sections of the airplane's fuselage, wings and nose section were damaged during the removal of the airplane from the water. The left engine cowling was not recovered from the water, and was not examined.

Continuity of the flight control systems was established. The flaps and the landing gear were found retracted.

Examination of the engines revealed that cylinder #2 on the left engine had separated and was found lying on the bottom of the ocean, about 20 feet from the wreckage. Both engine's were corroded by the salt water. The left engine was removed from the airframe for further examination. Examination of the right engine revealed no discrepancies.

TEST AND RESEARCH

The left engine was shipped to Lycoming's facilities, in Williamsport, Pennsylvania, and was disassembled under the supervision of the NTSB on December 19, 1995.

The exterior examination of the engine revealed that it was corroded and some of the steel parts were rusting. The #2 cylinder was separated from its mounting pad. The #2 connecting rod and piston were not located.

The engine was completely disassembled and the crankcase showed that "o" ring seals were used to seal the outside two forward nose bolts, the two forward, #2 cylinder hold down studs, and the two rearward, #5 cylinder hold down studs. According to Lycoming this is "not approved" by the engine manufacturer. The interior of the crankcase revealed crankcase dowels and rubber "o" rings at thru-studs locations.

It was determined that markings on the crankcase indicated that the crankcase had been reworked, to include welding, and the installation of oversize thru-studs. It was determined that the oversize thru-studs were installed the doweled crankcase with an incorrect fit.

A section of the left crankcase was cut, and shipped to the NTSB Materials Laboratory in Washington, DC, for further examination.

The forward portion of the left crankcase half, #2 cylinder with piston and thru-studs (2), were examined at the NTSB Materials Laboratory. According to the Metallurgist's Factual Report, initial examination showed that the engine case half was fractured in several locations. The lower three cylinder studs were fractured and the upper three studs were not received. The two thru-studs were fractured with the fracture ends on the left (#2 cylinder) side of the crankcase. The #2 cylinder head and barrel were mechanically damaged and the aluminum head showed "extensive corrosion." The #2 piston was found intact, but had "suffered

corrosion attack to the dome."

Optical inspection of the case fracture surfaces uncovered features typical of "overstress separations" in cast aluminum with no indications of "preexisting cracks." "No evidence of weld repair was visible on the received portion of the case."

Fretting damage was observed on the parting surface of the case, and polishing on the "faying" surfaces of the propeller bearing bosses around the #2 main bearing thru-stud holes. The upper bosses exhibited light polishing while more wide spread polishing and areas of light to moderate fretting were present on the lower boss surface. The #3 main bearing bosses showed light wear and fretting, and the lower boss had a "prominent" impression adjacent to the bearing surface. The impression was consistent with contact by the "anti-rotation tang" of the right half of the bearing shell.

The #2 cylinder mounting pad exhibited several areas of denting and other mechanical damage. Two of the dents matched the shape of the inboard edge of the piston skirt. The cylinder pad displayed several areas of light to moderate fretting, in the lower aft quadrant around the lower thru-stud and on the case at the upper left stud.

The three cylinder hold down studs were fractured. The lower forward 1/2 inch diameter (large), and the lower aft 3/8 inch (small) studs were fractured through the forward fine nut threads about 0.4 inches above the deck. The lower forward small stud was fractured flush with the deck through the coarse case threads.

The NTSB Metallurgist's Factual Report stated; "...magnified optical examinations revealed high stress fatigue features through about 2/3 of the small lower aft stud...the fatigue initiated at multiple origin sites in a thread root on the cylinder hole side of the stud...the fatigue penetrated...about 2/3 of the stud cross section, with the remainder having overstress features. The lower forward small stud also displayed similar high stress fatigue features...but the extent was not optically apparent..."

All three studs were sectioned from the case, ultrasonically cleaned in acetone, and each stud was examined with a scanning electron microscope (SEM).

According to the NTSB Metallurgist's Factual Report; "SEM viewing confirmed the observations on the lower aft small stud, as high stress fatigue from multiple origins with about 60 to 80% penetration of the stud. The lower forward small stud fracture also displayed fatigue features from multiple origins. The extent of the fatigue progression through the bolt was found to be 60 to 80% of the studs cross section...the large stud...surface damage...flatten [sic] the taller fracture features giving the surface a polished appearance...fatigue striations were detected between the damage areas on about 80 to 90% of the stud surface...specific fatigue initiations sites were not found, however the striation orientations suggest that the fatigue progressed from the thread root on the cylinder centerline side of the stud...examination also revealed a small crack in the adjacent thread root that was opened during the fracture of the stud. The crack was fatigued from multiple initiation sites."

The upper and lower #3 main bearing thru-bolt studs were both fractured through the threads of the #2 cylinder. The upper thru-stud was cut off and SEM examined. Examination revealed "heavy fracture face rubbing damage" that obscured much of the fracture topography in the traverse area. "Fatigue striations" were found in undamaged areas that "indicated initiation in the adjacent thread root." Fatigue striations were only found on the traverse fracture which accounted for "about 10 to 20% of the bolt cross section."

The NTSB laboratory factual report stated; "Ductile dimples indicative of overstress fracture were found on the remaining fracture area. Fracture face markings on the lower bolt were typical of high stress fatigue propagation with initiation at multiple locations in a thread root...the fatigue progressed through about 60 to 80% of the thru-stud cross section before final overstress separation."

For detailed information see the NTSB Metallurgist's Factual Report, number 96-109, enclosed with this report.

ADDITIONAL INFORMATION

Two Lycoming service instructions (SI), No. 1123C, dated April 25 1986, and No. 1290D, dated October 31 1988, deal with the installation of dowels and oversize thru-studs.

Service Instruction 1123C details the applicability and procedures for installation of p/n 75302 dowels and p/n STD-2013 O-ring seals at crankcase thru-stud locations. The dowel repair is applicable to all standard cylinder flange engines with piston cooling nozzles and to those wide cylinder flange engines with thru-stud bores that are greater than 0.010 inch oversize. The repair consists of counter boring the thru-stud holes and inserting hollow dowels then using standard size thru-studs. There are no provisions for enlarging the inner diameters of the dowels to allow oversize thru-studs. The SI also allows installation of O-ring seals at the dowel locations, but only after machining a recess into one of the case halves. The case half examined at the NTSB Laboratory, was not machined for O-rings, but halos were visible in the wear patterns indicating that recesses had been cut in the mating right case. Crankcases that are modified with the dowels are to be identified with a "-4" added to the part number. The portion of case with the part number was not received. There was no "-4" identification found on the other pieces of the case. The dowel repair appears to be in accordance with SI 1123C. However, the threading inside the dowels indicates that the dowels had been previously removed and reinserted into the case.

Service Instruction 1290D describes the installation of oversize thru-studs to repair oil leaks on assembled and disassembled engines. For assembled engines, the thru-stud holes are to be inspected with a borescope, and if damaged, reamed to the new size and new oversize thru-studs installed. The cylinder pads near the modified thru-stud hole is to be stamped with the oversize designation, P1, P2, P5 or P10. No such markings were found on the case. SI 1290D does not address over sizing holes that have already been modified with p/n 75302 dowels. The SI does indicate that for thru-stud bores the installation of p/n 75302 dowels per SI 1123 is an acceptable repair when the thru-stud bores are worn or damaged to the extent that 0.010 inch oversize reaming does not remove the damage.

There was no documentation in the airplane's maintenance records to indicate that the mechanic performing the field repair followed the instructions of SI 1290. The mechanic further failed to mark the cylinder pads to denote the repair.

The aircraft wreckage was released on November 3, 1995, to the President of Executive Airline, Michael S. Pergine. The left engine, minus the parts that were sent to the NTSB Laboratory, were released after the engine teardown, and shipped to Executive Airlines on or about December 20, 1995. The parts that were examined at the NTSB Laboratory were sent to Executive Airlines from the laboratory on June 10, 1996.

Pilot Information

Certificate:	Airline Transport; Commercial	Age:	34, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	Seat Occupied:	Left
Other Aircraft Rating(s):	Helicopter	Restraint Used:	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane; Helicopter	Second Pilot Present:	Yes
Instructor Rating(s):	None	Toxicology Performed:	No
Medical Certification:	Class 1 Valid Medical--no waivers/lim.	Last FAA Medical Exam:	04/18/1995
Occupational Pilot:		Last Flight Review or Equivalent:	
Flight Time:	6950 hours (Total, all aircraft), 425 hours (Total, this make and model), 1950 hours (Pilot In Command, all aircraft), 225 hours (Last 90 days, all aircraft), 70 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Piper	Registration:	N711EX
Model/Series:	PA-31-350 PA-31-350	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	No
Airworthiness Certificate:	Normal	Serial Number:	7952075
Landing Gear Type:	Retractable - Tricycle	Seats:	10
Date/Type of Last Inspection:	10/05/1995, 100 Hour	Certified Max Gross Wt.:	7250 lbs
Time Since Last Inspection:	12 Hours	Engines:	2 Reciprocating
Airframe Total Time:	7335 Hours	Engine Manufacturer:	Lycoming
ELT:	Installed, not activated	Engine Model/Series:	TIO-540-J2BD
Registered Owner:	DON THURBER ENTERPRISES INC.	Rated Power:	350 hp
Operator:	DON THURBER ENTERPRISES INC.	Operating Certificate(s) Held:	On-demand Air Taxi (135)
Operator Does Business As:	EAST COAST AVIATION SERVICES	Operator Designator Code:	ECAA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Night/Bright
Observation Facility, Elevation:	JFK, 13 ft msl	Distance from Accident Site:	6 Nautical Miles
Observation Time:	2051 EDT	Direction from Accident Site:	180°
Lowest Cloud Condition:	Scattered / 25000 ft agl	Visibility	20 Miles
Lowest Ceiling:	None / 0 ft agl	Visibility (RVR):	0 ft
Wind Speed/Gusts:	6 knots /	Turbulence Type Forecast/Actual:	/
Wind Direction:	220°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	30 inches Hg	Temperature/Dew Point:	15° C / 9° C
Precipitation and Obscuration:			
Departure Point:	ATLANTIC CITY, NJ (ACY)	Type of Flight Plan Filed:	IFR
Destination:	FARMINGDALE, NY (FRG)	Type of Clearance:	IFR
Departure Time:	2010 EDT	Type of Airspace:	Class B

Wreckage and Impact Information

Crew Injuries:	1 Minor, 1 None	Aircraft Damage:	Substantial
Passenger Injuries:	1 Fatal, 3 None	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	1 Fatal, 1 Minor, 4 None	Latitude, Longitude:	

Administrative Information

Investigator In Charge (IIC):	ALAN J YURMAN	Report Date:	10/22/1996
Additional Participating Persons:	EDWARD STROSCHEIN; VALLEY STREAM, NY JAMES BROWN; WILLIAMSPORT, PA PAUL LEHMAN; VERO BEACH, FL		
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.nts.gov/pubdms/ .		

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The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available [here](#).