Aviation Investigation Final Report

Location:	Santa Monica, California	**Accident Number:**	LAX06FA129
Date & Time:	March 13, 2006, 09:43 Local	**Registration:**	N16JR
Aircraft:	Beech A36	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The engine lost power during the takeoff-initial climb and the pilot ditched the airplane in the ocean. Examination showed that the number 2 connecting rod fractured from the crankshaft. Metallurgical examination of the connecting rod, and associated bolts, nuts, and bearings, showed that following the first nut and bolt separation, the overall separation was not instantaneous. After the first nut unthreaded from its respective bolt, subsequent increased loads on the opposite bolt then stripped the threads of the other nut that had partially unthreaded from its bolt. Furthermore, there was no evidence of cotter pin installation. In general, a properly torqued nut and connecting rod bolt will not loosen under normal operational conditions. The engine underwent a field overhaul 735.31 hours prior to the accident. At 233.59 hours prior to the accident, the cylinders were removed for a blow by condition during an annual inspection; however, the aviation maintenance technician who performed this work stated that he did not remove the connecting rods from the crankshaft. Review of the autopsy results and impact damage to the wreckage indicated that the occupants' use of shoulder harnesses would have significantly increased their chances of survival.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The failure of an aviation maintenance technician to properly torque and cotter pin the number 2 connecting rod bolts at their attach point to the crankshaft, which resulted in the separation of the connecting rod in flight, and complete power loss.

Findings

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

Findings
1. (C) ENGINE ASSEMBLY,CONNECTING ROD - SEPARATION
2. (C) MAINTENANCE,ANNUAL INSPECTION - INADEQUATE - OTHER MAINTENANCE PERSONNEL

Occurrence #2: DITCHING
Phase of Operation: DESCENT - EMERGENCY

Occurrence #3: ON GROUND/WATER ENCOUNTER WITH TERRAIN/WATER
Phase of Operation: LANDING - FLARE/TOUCHDOWN

Findings
3. TERRAIN CONDITION - WATER
4. MISC EQPT/FURNISHINGS,SHOULDER HARNESS - NOT INSTALLED

Factual Information

1.1 History of the Flight

On March 13, 2006, at 0943 Pacific standard time, a Beech A36, N16JR, was ditched into the ocean following a loss of engine power after departure from Santa Monica Municipal Airport, Santa Monica, California. The instrument rated private pilot, who was also a registered co-owner of the airplane, was operating it under the provisions of 14 CFR Part 91. The pilot and one passenger sustained fatal injuries; a third occupant listed on the instrument flight plan was not located. The airplane was destroyed. The pilot was destined for Brown Field Municipal Airport, San Diego, California to pick up a passenger and intended to return to Santa Monica later that day. Visual meteorological conditions prevailed and an instrument flight plan was in effect.

The airplane impacted the water off of Santa Monica beach approximately 2.5 statute miles west-southwest of the Santa Monica Airport and about 250 yards off shore. It was submerged in 20 feet of water. The pilot and one occupant were recovered from the airplane. Searches for the third occupant continued but were unsuccessful. Acquaintances of the pilot were unaware of who the third person would have been and at the time of this report, there was no additional information of a third person onboard the airplane.

According to the co-owner of the airplane, he and the pilot normally kept the utility doors locked when there were no aft seat passengers. They also agreed that when ditching the airplane, the cabin door would be unlatched prior to impact with the water. Initial responders reported that the cabin door was unlatched and that the utility doors were locked.

1.1.1 Witness Information

A lifeguard reported that he was 1 mile north of the airplane when he saw it at 400 feet above water level. It appeared to be at lower than normal altitude for airplanes flying in the area and continued a descent toward the ocean. The flight path of the airplane was toward Santa Monica airport from the southwest to the northeast. The lifeguard stated that the pilot appeared to be in control of the airplane and that from the time he first noticed the airplane until its impact with the water, approximately 5 seconds had gone by.

An additional witness was on the beach and took photos of the airplane as it approached the water. The photos show the airplane in a level flight attitude descent, approaching the beach from the west with the landing gear retracted. As the airplane impacted the water, it was in an upright attitude and moving in an easterly direction toward the beach. Upon impact, the airplane turned to a west-southwest heading on the surface of the water, and subsequently sank.

1.1.2 Radar Information and Communications

The pilot was in communications with the Southern California Terminal Radar Approach Control at the time of the power loss, and was then transferred back to Santa Monica Air Traffic Control Tower. In summary, the pilot indicated that he had a power loss and was returning to Santa Monica Airport. He then indicated that he would not be able to make it to the airport, and he was going to attempt to land the airplane on the beach.

Recorded radar information was obtained from the Southern California Terminal Radar Approach Control Facility. The airplane was assigned a discrete transponder code of 4711 and the first target associated with the accident airplane initiated at 0935:55. At 0936:00, the target showed an altitude of 600 feet. The target showed a climb to 3,200 feet on a west-northwest ground track. At 0939:04 the squawk code changed to 7777 and remained there throughout the remainder of the flight. The radar track then showed a descent from 0939:32 and a 180-degree turn to the east-southeast. The last radar hit was at 0942:04 at an elevation of 600 feet.

1.2 Personnel Information

The pilot held a private pilot certificate for single-engine airplanes with an instrument rating. He was issued a third class medical certificate in July of 2005 with the restriction that he must wear corrective lenses during flight.

Copies of the pilot's personal flight logbook were obtained from his family. The logbook was dated from October of 1991 until the last entry date of February 20, 2006. The total flight time logged was 428.4 hours. The pilot obtained his instrument rating on October 15, 2004, in the accident airplane, which equated to his most recent flight review. The pilot logged 70.6 hours in the last 12 months, 15 hours in the last 6 months, and 2.2 hours in the past 30 days.

1.2.1 Pilot Information

According to Angel Flight personnel, the pilot had volunteered his time and airplane services to assist in the transport of a medical patient from San Diego to the Los Angeles area. The pilot was on the initial leg of the trip to pickup the patient when the accident occurred. The purpose of Angel Flight is to assist those in need of air transportation due to medical services, national crisis, or specific human need by providing flights at no charge. The pilot received an Angel Flight checkout in August of 2005 and the accident flight was his first mission.

1.3 Aircraft Information

1.3.1 General Aircraft History

The airplane was manufactured in 1973. At the time of the accident, the tachometer indicated

3,555.20 hours. It was powered by a Teledyne Continental IO-520-BA (serial number 551008) six-cylinder piston engine, which had accumulated 735.31 hours since the last field overhaul. The engine was equipped with a McCauley model 3A32C76S-MR propeller.

1.3.2 Maintenance Information

An engine logbook entry showed that the engine was overhauled on December 30, 1977, at a total time of 1,775 hours. On February 3, 1998, the engine was field overhauled; there was no tachometer time noted in the maintenance entry. The connecting rod bearings and bushings, and the associated nuts and bolts, were replaced during this overhaul. Following the overhaul, mineral oil was installed in the engine. The engine was placed into storage.

On February 2, 1999, an engine logbook entry indicated, in part, "Due to the long period of storage, it was disassembled, cleaned, inspected, and reassembled in accordance with the TCM IO-520 Overhaul manual, applicable Service Bulletins, and Airworthiness Directives." The engine was reinstalled on the airplane on May 26, 1999, at a tachometer time of 2,819.89 hours.

On July 31, 2004, an annual inspection was performed on the airplane. The tachometer time for the airplane was 3,321.61, and the time since major overhaul (TSMOH) of the engine was 502.72. The logbook entry indicated that all six cylinders were removed due to a blow by condition.

The aviation maintenance technician (AMT) that performed the annual inspection was interviewed on March 23, 2006. At the time of the annual inspection, the pilot was employed part-time at Corporate Jet Support, Hayward, California, about 5 hours per day. He worked full-time as a Production Supervisor for American Airlines, approximately 8 hours per day. Due to his schedule, he ceased his employment at Corporate Jet Support after about one year of employment.

The AMT performed two annual inspections on the airplane; one on July 10, 2003, and one on July 31, 2004. The July 10, 2003, annual inspection was unremarkable. The AMT noted that during the July 31, 2004, inspection, the engine was removed from the airplane because the cylinders had to be removed. The exhaust and intake tubes were detached and the cylinders were pulled, as well as the pistons. The connecting rods were not removed. The cylinders were removed due to a blow by condition that was causing low compression. After the cylinders were repaired, they were reinstalled and the engine operated normally.

The last annual inspection was performed on August 19, 2005, at a tachometer time of 3,510 hours and 691 hours TSMOH at Santa Monica Aviation, Santa Monica, California. The engine logbook showed that 233.59 hours had accumulated since the cylinders had been removed and reinstalled during the July 2004 annual inspection.

On August 11, 2004, September 29, 2004, January 24, 2005, and February 21, 2006, the oil was

changed on the engine and an oil analysis was taken. The analyses were completed at Aviation Oil Analysis, Phoenix, Arizona. The analysis results taken in August and January were identical. Each showed that the aluminum appeared slightly high, silicon appeared slightly high, and to resample to check for dirt/wear. On the September sample, the analysis report also suggested a resample to check for dirt/wear in addition to checking the air induction system for the source of dirt entry due to the high silicon levels. The most recent analysis indicated that the wear metals were high due to possible piston wear, and to resample at the next oil change to check wear trend.

1.3.3 Fueling

The airplane was fueled on March 5, 2006, at Mercury Air in Santa Barbara, California with the addition of 9.6 gallons of 100 low lead. The co-owner of the airplane said that he topped-off the fuel tanks in Santa Barbara and returned to Santa Monica. He estimated that the return trip from Santa Barbara was 40 minutes in duration.

1.4 Meteorological Information

The County of Los Angeles Fire Department Underwater Operations personnel reported the following weather conditions at the time of the accident: 1 to 2-foot waves; swell out of the south; wind, from the west at 5; surface, rippled; water temperature, 54 degrees Fahrenheit.

At 0951, an aviation routine weather report (METAR) at Santa Monica was reporting the following weather conditions: wind, variable at 4 knots; surface visibility, 10 statute miles; sky conditions, clear; temperature, 55 degrees Fahrenheit; dew point, 35 degrees Fahrenheit; altimeter, 30.27 inches of Mercury.

1.5 Wreckage and Impact Information

The airplane impacted offshore of the Santa Monica beach. Divers assisted in the recovery of the airplane that was floated to the surface, and pulled ashore. During the airplane recovery from the water, the cabin door departed from the rest of the structure and was not recovered. Local fire department personnel hosed the wreckage down with fresh water upon its removal from the ocean.

1.6 Medical and Pathological Information

The Los Angeles County Coroner completed autopsies on the pilot and passenger. The cause of death for both occupants was attributed to drowning with complications from blunt force trauma. The FAA Bioaeronautical Research Laboratory performed toxicology testing on specimens of the pilot and passenger. Refer to the toxicology reports (contained in the public docket) for specific test parameters and results.

1.7 Survival Aspects

The airplane was not equipped with shoulder harnesses. In June of 1985, Raytheon Aircraft Company issued mandatory Service Bulletin 2031 to announce the availability of shoulder harness kits on the accident model airplane and many others. In September of 1990, the SB was revised to offer an incentive to owners who upgraded their airplanes with the shoulder harness kits prior to October 31, 1992.

The FAA published Seat Belts and Shoulder Harnesses, Smart Protection for Small Airplanes (AM-400-90/2). In the publication it states that if an airplane was manufactured without shoulder harnesses, the owner should obtain a kit to install them from the manufacturer or manufacturer's local representative. In addition, the publication notes that seat belts alone will only protect the occupant in very minor impacts and that using shoulder harnesses in small aircraft would reduce injuries by 88 percent and fatalities by 20 percent.

1.8 Tests and Research

The wreckage was examined on March 15, 2006. The NTSB investigator, three Federal Aviation Administration inspectors, and representatives from Raytheon Aircraft Company and Teledyne Continental Motors, both parties to the investigation, were present.

1.8.1 Airframe

The airframe and seats were examined. The throw-over control yoke was positioned to the left side of the cockpit. The airplane was equipped with six seats which were outfitted with lap seatbelts. The two rearmost seats were stowed (latched up). The rear seats had lap belts that had airframe manufacturer identification tags sewn onto the belt material. The center and front seat lap seatbelts had no identification tags. Investigators examined the center and forward seatbelts. There was no visible evidence of webbing stretch or separated threads. The forward seats moved fore and aft on the seat tracks and would lock in position. The forward seats were removed and no deformation was evident to the seats or seat pans. The cockpit area remained intact and crushing was evident on the right and left fuselage sidewalls in the areas over the wing front spar. The cabin door latch bolt receivers on the fuselage were undamaged. The cabin emergency windows were found in the closed position. According to the aircraft manufacturer, the emergency windows opened normally when activated.

1.8.2 Engine

The Teledyne Continental IO-520-BA engine was examined. Both magnetos were severed from their attachment flanges on the engine and resting on the top of the engine casing, which had a hole that stretched from the top cylinder base nuts of cylinders 1 and 2, approximately 8 inches across and 6 inches wide at its widest section fore and aft.

The number 2 cylinder connecting rod was visible through the hole and portions of it and the connecting rod cap were fractured from the rod end. A 2.5-inch portion of the connecting rod

from the crankshaft end contained the top portion of an attachment bolt and was located loose in the engine, just below the connecting rod. Two sections of bearing were peened and bent; one was located within the engine and one was located on the outside of the engine, between cylinders number 1 and 3. A bottom section of the cap bolt was also located between cylinders number 1 and 3 as well as a fractured and deformed portion of a castellated nut. A 1.25-inch section of rod cap was identified between the two cylinders. The other castellated nut was located between cylinders number 1 and 3, outside of the engine. It was fractured at one end and twisted.

The oil pan was removed and investigators noted sand in the pan. The sand was strained through a sieve and a 2.0-inch section of rod cap and both top and bottom bolt sections were identified. A 0.25-inch piece of castellated nut was also identified. Following the removal of the oil pan, investigators noted a hole in the bottom of the engine case, in alignment with the number 2 cylinder connecting rod above. The number 2 cylinder connecting rod was still attached to the piston by the piston pin. Upon initial examination, there were no signs of heat distress on the connecting rod and rod cap pieces or upon borescope inspection of the engine through the damaged case hole.

The engine was disassembled at Teledyne Continental Motors (TCM), Mobile, Alabama on April 20 and 21. The NTSB investigator and representatives from TCM and Raytheon Aircraft Company were present. After the engine was disassembled, the components were examined. The crankshaft was removed with the connecting rods (excluding the number 2 connecting rod) still attached. The cotter pins were removed from the castellated nuts, the torque values and lengths were measured and all values, excluding the upper and lower torque values for the number 1 connecting rod hardware (399 and 307 inch-pounds) and the upper torque value for the number 3 connecting rod hardware (467 inch-pounds), were within the manufacturer's specified limits of 475- 525 inch pounds. Investigators noted that the area surrounding the number 1 connecting rod appeared battered.

1.8.3 Materials Laboratory Report

The number 2 connecting rod, cap, bearings, bolts, nuts, and metal slivers from the engine were submitted to the NTSB Materials Laboratory for further examination. The examination commenced on November 17, 2006.

The cap and one arm of the connecting rod were fractured, both bolts and nuts were fractured and separated and the bearing was highly distorted. The assembly orientations were found by fracture matching the bolts and by aligning the bearing anti-rotation slots on the connecting rod pieces. One of the bolts had more damaged threads than the other, and one nut had a greater amount of deformation and fractures than the other nut.

The connecting rod was fractured through the cap and one arm of the yoke. Magnified visual examinations of the fracture surfaces and surrounding areas revealed features such as surface topography and deformation patterns, which according to the metallurgist, was

indicative of bending overstress separation at both fractures. No indications of preexisting cracking were found.

The fractured bolt, PN 629340, from the numbered side of the connecting rod, was fractured through the grip slightly outboard of the rod split line. Although heavily damaged by post separation and mechanical contact, the fracture contained features and deformation patterns, according to the metallurgist, indicative of an overstress separation with no indications of preexisting cracking. The majority of the bolt threads were heavily deformed and distorted with the thread crest flattened toward the centerline of the bolt and lipped over on both sides of the thread flank, as if they were radially contacted and smashed. One region of the threads was sheared on one side of the bolt and no remnants of the cotter pin were found in the holes.

The bore of the mating bolthole in the connecting rod arm showed significant axial scraping and damage. The metallurgist stated that the scraping and damage appeared consistent with contact by the bolt threads.

The bolt, also PN 629340, from the unnumbered side of the connecting rod had its head portion trapped in the deformed rod cap piece. The head was not removed. The metallurgist stated that the bolt was fractured just outboard of the split line and contained features typical of an overstress separation. The bolt threads were locally damaged and deformed but no threads were sheared. No remnants of the cotter pin were found in the holes.

The recovered nuts, PN 628109, could not be positively identified as to their original mating bolt. The nuts were arbitrarily labeled A and B.

Nut A was fractured in two pieces. It was heavily distorted and fractured in two places. The nut fractures were heavily damaged obscuring many of the features. The metallurgist stated that the undamaged fracture regions appeared typical of overstress separations. Although locally damaged, the internal threads were generally intact and not fractured or sheared. Contact patterns were apparent on the pressure flanks of the nut threads, consistent with prior full engagement with mating threads. The nut pieces had at least two smoothly curved deformation areas that approximated the major diameter of the bolt threads.

Nut B was fractured at one location at a cotter pin slot. The exterior of the nut was locally damaged in several areas including a severe dent in the washer face adjacent to the fracture. Contact patterns were apparent on the pressure flanks of the nut threads consistent with prior full engagement with mating threads. The majority of the internal nut threads were sheared as if the nut were pulled off the bolt. However, small regions that contained about 4 threads were not fractured. Four of these regions of intact threads were found evenly distributed around the inner diameter of the nut. The size and relative orientations of these regions matched the size and spacing of the cotter pin holes in the bolt. Additionally, the two threads furthest from the washer face were not sheared. According to the metallurgist, the pattern of intact threads indicates that at the time of shearing, the nut was rotated in the loosening direction approximately 4 threads from a position that would allow a cotter pin to be inserted through a

hole in the bolt and slots in the nut.

The rod bearings, PN 630826, from the number 2 piston were severely distorted, flattened, and gouged, but the inner bearing surfaces displayed very little operational wear. The outer surfaces were also heavily gouged and damaged. Each bearing was also marked with a date code "4-3" indicating they were manufactured in April of 1993.

1.9 Additional Information

1.9.1 Wreckage Release

The maintenance records were released to the co-owner of the airplane on March 27, 2006. An airplane logbook recovered from the accident site was released to Aircraft Recovery Services, Inc. on May 24, 2006. The airplane, excluding the engine, was released to Aircraft Recovery Services, Inc. on June 1, 2006. The engine was released to Aircraft Recovery Services, Inc. on November 30, 2006. No parts or pieces were retained by the NTSB.

Pilot Information

Certificate:	Private	**Age:**	63,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	July 1, 2005
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	October 1, 2004
Flight Time:	428 hours (Total, all aircraft), 189 hours (Total, this make and model), 342 hours (Pilot In Command, all aircraft), 22 hours (Last 90 days, all aircraft), 7 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Beech	**Registration:**	N16JR
Model/Series:	A36	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	E433
Landing Gear Type:	Retractable - Tricycle	**Seats:**	6
Date/Type of Last Inspection:	August 1, 2005 Annual	**Certified Max Gross Wt.:**	3600 lbs
Time Since Last Inspection:	3555.2 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	3510 Hrs as of last inspection	**Engine Manufacturer:**	Teledyne Continental
ELT:	Installed, not activated	**Engine Model/Series:**	IO-520-BA
Registered Owner:	Martin Carlin/Peter Tomarken	**Rated Power:**	285 Horsepower
Operator:	Peter Tomarken	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KSMO,177 ft msl	**Distance from Accident Site:**	2 Nautical Miles
Observation Time:	09:51 Local	**Direction from Accident Site:**	80°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	4 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.27 inches Hg	**Temperature/Dew Point:**	13°C / 2°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Santa Monica, CA (SMO)	**Type of Flight Plan Filed:**	IFR
Destination:	San Diego, CA (SDM)	**Type of Clearance:**	IFR
Departure Time:	09:35 Local	**Type of Airspace:**	

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	34.003612,-118.493888

Administrative Information

Investigator In Charge (IIC):	Dunks, Kristi
Additional Participating Persons:	Gary Kappa; Federal Aviation Administration; Los Angeles, CA John Kent; Teledyne Continental Motors; Mobile, AL Paul Yoos; Raytheon Aircraft Company; Wichita, KS
Original Publish Date:	March 26, 2007
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=63336