Aviation Investigation Final Report

Location:	Paso Robles, California	**Accident Number:**	LAX05LA140
Date & Time:	April 19, 2005, 18:23 Local	**Registration:**	N299X
Aircraft:	Beech 35-C33A	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	2 Serious
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The number 4 cylinder and piston separated from the engine during cruise flight and the airplane collided with vine trellises and terrain during an emergency landing in a vineyard. While in flight at 8,500 feet mean sea level, the pilot heard a loud noise and the engine started running rough. He started to divert to a nearby airport when there was another loud bang from the engine compartment; engine rpm dropped dramatically, and the cockpit started to fill with white smoke. He was being vectored to a nearby airport when the cowling popped open and remained open, substantially increasing the airplane's rate of descent. The pilot set up to land in a vineyard by lowering the airplane's landing gear and approaching the field at 45 degrees to the vineyard rows. He started the landing at 75 knots when the left main landing gear snagged a grape vine row pole and wires. The plane veered to the left, and stopped almost immediately. He recalled that his head hit the dashboard during the landing and his passenger in the right seat was unconscious after the landing. Shoulder harnesses or straps were not installed on this airplane, only lap belts. The calculated landing decelerating force was about 19.5 g's, which resulted in both occupants receiving serious head injuries. Post accident examination of the engine revealed that the number 4 cylinder had departed the engine along with the piston. The engine case halves were fractured directly above the number 4 cylinder location. The two upper right cylinder hold down studs were present and appeared undamaged, while the bottom studs were sheared across their diameter above the engine case, and left-hand side studs were sheared across their diameters at the engine case surface. The number 4 cylinder base pad surface of the crankcase exhibited fretting at the 3 and 9 o'clock positions. This condition is consistent with the right-hand and bottom cylinder hold down nuts backing off during engine operation allowing the number 4 cylinder to move in rhythm with the piston until the remaining cylinder studs on the left side failed under the cyclic load. The backing off of the cylinder hold down nuts would not normally occur if the nuts had been properly torqued when installed. The number 2, 4, 5, and 6 cylinders had been removed and replaced or reinstalled 186.2 hours prior to the accident. The under-torqued cylinder hold down nuts were not detected during the 100-hour inspection that was performed 88.1 hours

prior to the accident.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: the separation of the number 4 engine cylinder due to improperly torqued cylinder hold down nuts. A finding in this accident was the lack of a shoulder restraint system in the airplane, which contributed to the occupants' injuries.

Findings

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

Findings
1. (C) ENGINE ASSEMBLY,CYLINDER - SEPARATION
2. (C) MAINTENANCE,INSTALLATION - IMPROPER - OTHER MAINTENANCE PERSONNEL

Occurrence #2: FORCED LANDING
Phase of Operation: DESCENT - EMERGENCY

Occurrence #3: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: EMERGENCY DESCENT/LANDING

Findings
3. TERRAIN CONDITION - HIGH VEGETATION
4. (F) SHOULDER HARNESS - UNAVAILABLE - PILOT IN COMMAND
5. (F) SHOULDER HARNESS - UNAVAILABLE - PASSENGER

Factual Information

HISTORY OF FLIGHT

On April 19, 2005, at 1823 Pacific daylight time, a Beech 35-C33A, N299X, experienced a loss of engine power and collided with terrain during a forced landing at Paso Robles, California. The airplane was operated by Squadron Two at Reid-Hillview of Santa Clara County Airport, San Jose, California, as a rental airplane under the provisions of 14 CFR Part 91. The commercial pilot and passenger were seriously injured, and the airplane sustained substantial damage. Visual meteorological conditions prevailed, and a visual flight rules flight plan had been filed. The flight originated at Van Nuys, California, at 1730.

The pilot stated in the Pilot/Operator Accident Report that about 5 miles west of the Avenal VOR, cruising at 8,500 feet mean sea level (msl), he heard a loud noise and the engine started running rough. The pilot checked the oil temperature and pressure and noted that they were normal in the green arc. He reduced power to 16 inches of manifold pressure, and noticed that the airplane was not maintaining level flight. He contacted Oakland center and started to divert to Paso Robles. At this time there was another loud bang from the engine compartment; the engine rpm dropped dramatically, and the cockpit started to fill with white smoke. The pilot made a mayday call and Oakland center gave him vectors to the Paso Robles Airport. He established an 80-knot glide and set the power at 13 inches of manifold pressure (1,500 rpm). The smoke cleared from the cockpit, and he determined he was within gliding distance of the airport when the engine cowling popped open and stayed open. The increased drag from the cowling increased his rate of decent to greater than 800 feet per minute; he realized he now would not make the airport and set up for an off field emergency landing into what he thought was a green farm field but turned out to be a vineyard. He lowered his landing gear and approached the vineyard at 45 degrees to the rows. He had started the landing at 75 knots when the left main landing gear snagged a grapevine row pole and wires. The plane veered to the left, and stopped almost immediately. He recalls that his head hit the dashboard during the landing and the passenger in the right seat was unconscious after the landing.

AIRCRAFT INFORMATION

The airplane was a Beech Debonair C33A, serial number CE-37. Review of the airplane logbooks revealed a total airframe time of 6,083.1 hours as of March 4, 2005. The tachometer time read 0186.2 after the accident, which corresponds to a total time of 6,106.8 hours at the time of the accident. The last 100-hour inspection was performed on September 28, 2004, at 6,018.7 hours, and a 50-hour inspection was performed on January 31, 2005, at 6,068.2 hours.

The engine was a Continental IO-550-CCB, serial number 676637. The engine logbook recorded a total time (TT) of 2,770.9 hours and 1,673.6 hours since maintenance overhaul

(SMOH) as of the last oil change on January 31, 2005. The total time accrued on the engine at the time of the accident was 2,809.5 hours. An engine logbook entry dated September 28, 2004, (1,624.1 hours SMOH) corresponds to an airframe logbook entry of the same date annotating the compliance of a 100-hour inspection and records an oil change, oil filter exam, compression check, gapped spark plugs, checked magneto timing, and a leak check. This engine logbook entry is consistent with a 100-hour engine inspection.

This airplane was equipped with lap belts for the occupants but not shoulder harnesses or shoulder straps.

WRECKAGE AND IMPACT INFORMATION

The San Luis Obispo County Sheriff's report described the airplane as being in a vineyard facing south when they arrived on scene. The landing gear was down and it appeared that it may have hooked the onto the grapevine tension wires. There seemed to be little or no skidding with the plane having stopped on impact.

Examination of the on scene photographs by the National Transportation Safety Board Investigator depicts the airplane in about a 10-degree nose down attitude in the vineyard. The engine was displaced downward about 25 degrees with the pivot point of rotation at the bottom center of the engine firewall. The left wing root trailing edge was peeled up from the inside corner towards the middle of the wing, exposing the left landing gear structure. There appeared to be no buckling of the cockpit cabin area structure and the windscreen was in one piece affixed to the airframe. The seats remained attached to their respective seat rails. The propeller was detached from the engine crankshaft flange.

SURVIVAL ASPECTS

To estimate the landing forces that the occupants would have experienced the following calculation utilizes the "Quick Look Analysis" technique as described in NTSB/SR-83/01. The pilot reported a landing airspeed of 75 knots. The sheriff's report stated that the airplane left little evidence of a ground scar and appeared to have stopped on impact; therefore, it was assumed that the airplane stopped in a distance equal to its own length, 7.8 meters. The shallow angle of impact indicated that the majority of the decelerating forces would have acted along the airplanes' longitudinal axis. Using these values the approximate force that the occupants would have experienced was a peak impulse of around 19.5 g's over a pulse time period of about 1.4 seconds.

The Beech 35-C33A was certificated under the Civil Aeronautics Regulation (CAR) 3. CAR 3 paragraph 3.386, Emergency Provisions, dictates that the fuselage shall be designed to give reasonable assurance that each occupant, if he makes proper use of belts or harness for which provisions are made in the design, will not suffer serious injury during minor crash conditions as a result of contact of any vulnerable part of his body with any penetrating or relatively solid object given an assumed forward deceleration of 9 g's.

There was no observed failure of the lap restraint system or of the seats in this airplane. The main aspect of the occupant restraint design was the presence of a lap belt restraint system but no upper body (shoulder harness/strap) restraints. This restraint system conforms with the type certificate for this airplane, which is less restrictive than the current regulations due to the age of the design. A supplemental type certificate (STC), SA1583GL, for the addition of shoulder harnesses to this model of airplane is available.

Both occupants received serious head injuries.

TESTS AND RESEARCH

Engine Examination

On May 5, 2005, the airframe and engine was examined at Aircraft Recovery Services, Pearblossom, California. The examination was performed by the Safety Board investigator-in-charge (IIC) and a technical representative from Teledyne Continental Motors.

The engine was a Continental IO-550-CcB, serial number 676637. Examination of the engine logbook revealed that the engine was overhauled on July 15, 1999, and installed into N299X on August 11, 1999. The last annual inspection was performed on June 21, 2004, at an engine total time since maintenance overhaul (TTSMO) of 1,463.5 hours. The engine logbook entry for the annual inspection included the following entry: "Four cylinders removed (#2, 4, 5 & 6) for overhaul. Installed 4 each customer supplied cylinders, repaired by Gil's Engines, reassembled engine, baffles, intakes, exhaust, ect. torqued cylinder, finished engine. Engine run up and ops checked okay." The TTSMO on the engine at the time of the accident was 1,653.0 hours.

Examination of the engine revealed a 3-inch by 7-inch hole in the top of the crankcase that extended past the crankcase parting line and into the engine data plate pad that was aligned with the connecting rod above the number 4-cylinder position. The number 4 cylinder and piston were not present on the engine. The number 4 connecting rod and cylinder attaching hardware were recovered from the inside bottom of the engine cowling. Examination of the number 4 cylinder mounting pad revealed that the bottom two cylinder hold down studs at the 5 o'clock and 7 o'clock positions were fractured about mid thread line, extending above the case 0.369 and 0.406 inches, respectively. The cylinder hold down studs at the 2 and 3 o'clock (seventh stud) position were intact with very little damage. The 4 o'clock stud had slight smearing of its last three threads. The 10 and 8 o'clock through bolts were fractured flush with the engine case. The 9 o'clock seventh stud was not present, but the number 2 cylinder base flange on the right side had rub marks consistent with fretting adjacent to the seventh stud location. There was dark discoloration of the cylinder pad surface consistent with fretting at the 3 and 9 o'clock positions.

Fastener items collected from the inside the engine cowling were: the fractured ends of both

number 4 cylinder bottom cylinder studs with flat bottomed nuts present; one complete top cylinder stud without nut; both number 2 and 3 cylinders left seventh stud plates; the fractured end of the number 3 bottom through bolt with nut present; the left number 3 seventh stud with conical nut present and aluminum metal in the crankcase end threads; one 3/8-inch cylinder hold down nut (flat bottom flange); and one 5/16 inch bolt with aluminum present in its threads. Both 7th stud plates recovered exhibited rub marks consistent with fretting on both faces.

The number 2 cylinder hold down base flange clamp was not present on the 7th stud, and the stud threads contained dirt and grease.

The nut on the number 5 cylinder lower through bolt was not present.

ADDITIONAL INFORMATION

The wreckage was released on July 7, 2005.

Pilot Information

Certificate:	Commercial; Flight instructor; Foreign	**Age:**	32,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane single-engine	**Toxicology Performed:**	No
Medical Certification:	Class 1	**Last FAA Medical Exam:**	September 1, 2004
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	August 1, 2004
Flight Time:	550 hours (Total, all aircraft), 12 hours (Total, this make and model), 490 hours (Pilot In Command, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Beech	**Registration:**	N299X
Model/Series:	35-C33A	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	CE-37
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	June 1, 2004 Annual	**Certified Max Gross Wt.:**	3300 lbs
Time Since Last Inspection:	162.5 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	6106.8 Hrs at time of accident	**Engine Manufacturer:**	Teledyne Continental
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	IO-520
Registered Owner:	Daniel Weaver	**Rated Power:**	285 Horsepower
Operator:	Squadron Two	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KPRB,836 ft msl	**Distance from Accident Site:**	2 Nautical Miles
Observation Time:	18:53 Local	**Direction from Accident Site:**	360°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	11 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	200°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.92 inches Hg	**Temperature/Dew Point:**	15°C / 7°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Van Nuys, CA (KVNY)	**Type of Flight Plan Filed:**	IFR
Destination:	San Jose, CA (KRHV)	**Type of Clearance:**	VFR flight following
Departure Time:	17:30 Local	**Type of Airspace:**	

Airport Information

Airport:	Paso Robles KPRB	**Runway Surface Type:**	
Airport Elevation:	836 ft msl	**Runway Surface Condition:**	
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 Serious	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Serious	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Serious	**Latitude, Longitude:**	35.655277,-120.620552

Administrative Information

Investigator In Charge (IIC):	McKenny, Van
Additional Participating Persons:	Michael Chad; Federal Aviation Administration; San Jose, CA Michael Grimes; Teledyne Continental Motors; Mobile, AL
Original Publish Date:	April 25, 2006
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=61339