



National Transportation Safety Board

Washington, D. C. 20594

Safety Recommendation

Aug 2090

Date: September 19, 1988
In reply refer to: A-88-110

Honorable T. Allan McArtor
Administrator
Federal Aviation Administration
Washington, D.C. 20591

On July 20, 1987, a student pilot was climbing to cruise altitude approximately 10 minutes after takeoff from Reid-Hillview Airport in San Jose, California. The airplane was a Piper PA 28-161, N91338, powered by an Avco Lycoming O-320 engine. At the time, the pilot heard a loud noise, followed by "violent vibrations" coming from the engine area. The pilot reduced the throttle, and the noise and vibrations became less severe. However, when he advanced the throttle, the noise and vibrations returned to their previous level. The pilot chose to land in a newly excavated construction site. The airplane was substantially damaged and the pilot suffered minor injuries.¹

Examination of the engine revealed deformation of the No. 4 cylinder valve cover. The valve cover was removed and the No. 4 exhaust valve rocker arm (P/N 18790) was found broken. The broken rocker arm was submitted to the National Transportation Safety Board Materials Laboratory for analysis. The rocker arm was determined to have fractured due to high-cycle fatigue emanating from the outside surface of the sharp-edged corner of the oil drip hole.

Presently, the Federal Aviation Administration (FAA) addresses the inspection of P/N 18790 rocker arms in airworthiness directive (AD) 87-10-06. This AD, which incorporates Avco Lycoming Service Bulletin 477A, specifically addresses P/N 18790 rocker arms that have been installed in Avco Lycoming engines manufactured, remanufactured, or overhauled between July 1, 1985, and October 8, 1986, or rocker arms that were purchased from Avco Lycoming during that same time period.

The AD requires that the bushing bore wall thickness of the rocker arm be measured and that rocker arms with a wall thickness less than 0.075 inch minimum be replaced with new or serviceable P/N 17F19353 rocker arms. If the rocker arm meets the thickness requirement, the AD further requires that the oil drip hole be "burred" to achieve an approximate 0.030-inch radius. All subject rocker arms that

¹For more detailed information, read Field Accident Brief No. 1584 (attached).

are found in compliance with the AD are to have a letter "B" inscribed on the outside surface.

Review of the aircraft maintenance records for the subject airplane revealed that AD 87-10-06 was complied with 78.7 service hours prior to the accident. The separated rocker arm on airplane N91338 had an inscribed letter "B" opposite the part number indicating compliance with the AD. However, when the wall thickness of the separated rocker arm was gauged using a measuring microscope (an instrument not normally found in a maintenance facility), the wall thickness measured 0.055 inch, well below the required 0.075-inch minimum. Due to the barrel-shaped profile of the bearing bore, obtaining an accurate wall thickness measurement with common tools is extremely difficult. When the wall thickness of the separated rocker arm was gauged using calipers or a rounded anvil micrometer (ordinary tools that a maintenance facility would typically have), erroneously high wall thickness measurements were obtained which, taken alone, would indicate an acceptable minimum thickness.

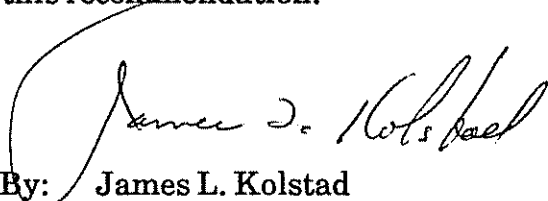
Metallurgical examination also disclosed what appeared to be improper "burring" of the edge of the oil drip hole. Apparently, attempts had been made to round the outside edge using a drill bit or other sharp tool. The effective radius was judged to be nonuniform and generally sharper than the 0.030-inch radius specified in the AD. The diameter of the oil drip hole is extremely small (approximately 0.090 inch) and, therefore, specialized tooling may be required to accomplish a uniform 0.030-inch edge radius.

A review of Service Difficulty Reports revealed that six other cases of inflight loss of power caused by breakage of P/N 18790 rocker arms were reported after Service Bulletin 477A was issued on February 16, 1987. In two of these cases, the incidents had occurred after complying with Service Bulletin 477A.

The Safety Board is concerned that further incidents involving the subject rocker arms will occur. Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Revise airworthiness directive 87-10-06 to include accurate measurement technique(s) so that the subject rocker arms are inspected properly and include instructions for recontouring the edge of the oil drip hole to obtain the specified 0.030-inch radius. If the two corrections are impractical, require replacement of the subject rocker arms with new or serviceable P/N 17F19353 rocker arms. (Class II, Priority Action) (A-88-110)

KOLSTAD, Acting Chairman, and BURNETT, LAUBER, NALL, and DICKINSON, Members, concurred in this recommendation.


By: James L. Kolstad
Acting Chairman

Brief of Accident

File No. - 1584 Date: 7/20/87 Aircraft: MILFITAS,CA A/C Reg. No. N91339 Time (Lcl) - 1230 PDT

---Basic Information---
 Type Operating Certificate-NONE (GENERAL AVIATION) Aircraft Damage
 SUBSTANTIAL
 Type of Operation - INSTRUCTIONAL Fire Fatal Serious Minor Injuries None
 Flight Conducted Under -14 CFR 91 Pass 0 0 1 C
 Accident Occurred During -LANDING

---Aircraft Information---
 Make/Model - PIPER PA-28-161 Eng Make/Model - LYCOMING O-320-D3G ELT Installed/Activated - YES/NO
 Landing Gear - TRICYCLE-FIXED Number Engines - 1 Stall Warning System - YES
 Max Gross Wt - 2150 Engine Type - RECIPROCATING-CARBURETOR
 No. of Seats - 4 Rated Power - 160 HP

---Environment/Operations Information---
 Weather Data
 WX Briefing - FSS Itinerary Airport Proximity
 Method - TELEPHONE Last Departure Point OFF AIRPORT/STRIP
 Completeness - FULL Destination SAN JOSE,CA
 Basic Weather - VMC ATC/Airspace REID HILLVIEW
 Wind Dir/Speed - 270/008 KTS Type of Flight Plan - VFR Runway Ident - N/A
 Visibility - 50.0 SM Type of Clearance - NONE Runway Lth/Wid - N/A
 Lowest Sky/Clouds - 20000 FT SCATTERED Type APch/Lnds - FORCED LANDING
 Lowest Ceiling - NONE Precipitation - NONE
 Obstructions to Vision - NONE Condition of Light - DAYLIGHT

---Personnel Information---
 Pilot-In-Command STUDENT Age - 50 Medical Certificate - VALID MEDICAL-WAIVERS/LIMIT
 Certificate(s)/Rating(s) Biennial Flight Review Current - N/A Total Flight Time (Hours) 101 Last 24 Hrs - 3
 Months Since - N/A Make/Model- 101 Last 30 Days - 16
 Aircraft Type - N/A Instrument- 0 Last 90 Days - 49

Instrument Rating(s) - NONE
 ---Narrative---
 WHILE CLIMBING TO CRUISE FLT HEARD A LOUD KNOCKING NOISE FOLLOWED BY "VIOLENT VIBRATIONS" & A LOSS OF POWER. FLT MADE A
 FRCD LNDING IN A NEWLY EXCAVATED CONSTRUCTION SITE & WENT OVER AN EMBANKMENT. INVES REVEALED DEFORMATION OF THE #4
 CYLINDER VALVE COVER. #4 EXHAUST VALVE ROCKER ARM WAS FOUND TO BE BROKEN. REVIEW OF ACFT MAINTENANCE RECORDS REVEALED
 THAT AD 87-10-06 WHICH INCORPORATES LYCOMING SERVICE BULLETIN (SB) 477A WAS ACCOMP 78.7 HRS PRIOR TO THE ACCIDENT. THE
 SB REQUIRES ROCKER ARMS THAT DO NOT HAVE A WALL THICKNESS OF .075 BE REPLACED. IF THE ROCKER ARM PASSES THE THICKNESS
 EXAM THE ROCKER ARM OIL DRIP HOLE OUTER EDGE MUST BE "BURRED" TO THE APPROX .030 RADIUS PRIOR TO REASSEMBLY. THE ROCKER
 ARM WAS MEASURED USING A ROUND ANVIL MICROMETER. THE MEASUREMENT MFT THE MIN DIMENSION OF .075. AFTER THE ACCIDENT, MET
 LAB EXAM REVEALED FRACTURE FEATURES OF HIGH CYCLE FATIGUE & OVERSTRESS. THE ORIGIN OF THE FATIGUE WAS TRACED TO THE
 REMORKED OIL DRIP HOLE WHICH DID NOT MEET .030 RADIUS. THE WALL THICKNESS MEASURED .055 USING A MEASURING MICROSCOPE.

Brief of Accident (Continued)

File No. - 1584 7/20/87 HILPITAS, CA

A/C Reg. No. N91338

Time (Lcl) - 1230 PDT

Occurrence #1 LOSS OF ENGINE POWER(PARTIAL) - MECH FAILURE/KALF
Phase of Operation CLIMB - TO CRUISE

Findings(s)
1. ENGINE ASSEMBLY,ROCKER ARM/TAPPET - FRACTURED
2. MAINTENANCE,COMPLIANCE WITH AD - IMPROPER - OTHER MAINTENANCE PSNL
3. MAINTENANCE,SERVICE BULLETINS - INADEQUATE - MANUFACTURER

Occurrence #2 FORCED LANDING
Phase of Operation DESCENT - EMERGENCY

Occurrence #3 ON GROUND COLLISION WITH TERRAIN/WATER
Phase of Operation LANDING - ROLL

Findings(s)
4. TERRAIN CONDITION - ROUGH/UNEVEN

-----Probable Cause-----

The National Transportation Safety Board determines that the Probable Cause(s) of this accident is/are findings(s) 1,2,3

Factor(s) relating to this accident is/are findings(s) 4