

Log 2294



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: April 29, 1992

In reply refer to: A-92-22 thru -24

Honorable Barry L. Harris
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

On June 23, 1989, a Consolidated Aeronautics Colonial C-1 amphibian, N260B, sustained a total loss of engine power in-flight 9 minutes after takeoff and crashed while attempting an emergency landing at Bremerton, Washington. The airplane struck a tree stump after touchdown, nosed over and was destroyed. The pilot, who was receiving amphibian airplane operations training, was seriously injured, and the instructor pilot died of crash-related injuries on June 25, 1989.

An investigation by the National Transportation Safety Board disclosed that the loss of engine power resulted from a failure in the airplane's ignition system. Both the left and right Bendix S4LN-20 magnetos were capable of producing a spark at ambient temperature but would not operate when heated to normal in-flight engine operating temperatures. The ignition coil in each magneto was cracked, and when the coils were replaced, the magnetos operated normally. In order to prevent failures of this type, Airworthiness Directive (AD) 73-07-04, effective April 2, 1973, applicable to a multitude of Bendix S-20, S-200, S-600, and S-1200 series magnetos, required compliance with Bendix Service Bulletin No. 560A, "Replacement of Magneto Transformer Coils and Rotating Magnets." The AD indicates that older, obsolete ignition coils, like those installed in N260B, and rotating magnets in these magnetos must be replaced with improved components prior to the accumulation of approximately 2,000 hours of flight time. Although N260B, a 1957 model, had been subjected to an annual inspection immediately prior to the accident flight, on June 20, 1989, the aged obsolete ignition coils were not replaced because the airplane had accumulated a total flight time of only 1,295 hours.

On July 27, 1990, a Bell Continental Copters Model 47G, N7153, on an aerial application mission, sustained a partial loss of engine power in-flight because of a similar failure of the aircraft's left magneto ignition coil. The pilot was seriously injured, and the aircraft was substantially damaged following an autorotative landing in trees. When the ignition coil was replaced, the magneto fired and operated properly. According to

maintenance records, the defective Bendix Model S6RN-21 magneto had operated for a total of 334 flight hours and was last overhauled in 1980. The aircraft was given an annual inspection shortly before the accident on June 5, 1990. However, it is unlikely that the magneto coils were specifically tested or inspected for defects.

Since 1985, the Safety Board has cited magnetos as a cause or factor in 92 accidents involving 22 fatalities and 21 serious injuries. Thousands of Service Difficulty Reports (SDR's) regarding magnetos produced by various manufacturers were submitted to the Federal Aviation Administration (FAA) during this period, including 130 reports referencing cracking, burning, arcing, leaking or other deficiencies in Bendix magneto ignition coils.

The Safety Board believes that periodic inspection, overhaul, and replacement of critical components are important, fundamental facets of magneto remedial maintenance. However, perusal of accident reports and SDR's makes it clear that the current level of magneto inspection, maintenance and service is much too infrequent. Magnetos are often viewed as integral ignition modules and are inspected, serviced, overhauled, or replaced only when gross malfunction or failure occurs. For example, on October 7, 1990, a Mooney M20C, N1389W, sustained a loss of engine power in-flight due to faulty ignition and crashed at Kissimmee, Florida. The magnetos, which were removed for testing and disassembly, had been in the airplane for 27 years.

A review of maintenance records disclosed that the magnetos had been overhauled 21 years ago but had not been thoroughly inspected since that time. In fact, although annual or 100-hour inspections of the airplane had been performed by several different inspection/repair facilities, AD 73-07-04, which should have been complied with in 1981, at the time the aircraft reached 2,000 flight hours, was never accomplished. When the Bendix S-200 series magnetos were mounted on a test stand, both units began to malfunction after 15 to 20 minutes of operation. The obsolete coils in these units were cracked and leaking, and test personnel indicated that the in-flight performance of the magnetos would have been worse than experienced on the test stand because of the increased operating temperature.

In performing annual and 100-hour inspections of reciprocating-engine-powered aircraft, maintenance personnel are required to run the engine(s) to determine satisfactory performance in accordance with the manufacturers recommendations regarding power output (static and idle r.p.m.) and magnetos. However, the latter requirement relates only to determining that engine r.p.m. using both magnetos does not drop excessively when individual (left or right) magnetos are selected and that the variance in r.p.m. drop between magnetos is not excessive. The magnetos are not removed and inspected unless a problem is evidenced. As a result, there is no assurance of the integrity of the magnetos' components

or that the magnetos are capable of continued safe, reliable operation. Although the magneto manufacturers, Teledyne Continental Motors (TCM), Bendix¹, and Slick Aircraft Products, have issued service bulletins prescribing specific overhaul and inspection intervals, and although various AD's have been issued concerning directed remedial actions such as AD 73-07-04, there is no specific regulatory requirement for routine, periodic removal, overhaul or comprehensive inspection of magnetos.

Teledyne Continental Motors recommends that all of the magnetos in their product line be disassembled and given a detailed inspection at 500-hour intervals. Service Bulletin No. 632, "Maintenance Intervals for All TCM and Bendix Aircraft Magnetos," issued by TCM in November, 1989, further emphasizes several other important inspection/overhaul intervals:

1. MAGNETO-TO-ENGINE TIMING CHECK.

Timing checks will be conducted at 100-hour intervals or as specified in a progressive maintenance schedule. Should the timing fall outside the limits specified by the engine manufacturer and the magneto needs to be "Bumped," a visual inspection of the magneto contact assemblies will be performed. Follow procedures in the PERIODIC MAINTENANCE section of the appropriate Series Magneto Service Manual, included in TCM Ignition Systems Form X-40000 Master Service Manual. If internal magneto components require replacement or adjustment, the magneto must be removed from the engine.

2. 500-HOUR IMPULSE COUPLING INSPECTION.

All affected magnetos equipped with impulse couplings must be inspected for wear at the 500-hour interval as specified in the latest revision of Service Bulletin 599C.

3. ENGINE OVERHAUL OR FOUR YEAR INTERVAL.

Magnetos are electro-mechanical devices which use rotating parts and are subject to the same service treatment, environmental conditions and wear as the engine. Therefore, magnetos will be overhauled when the engine is overhauled. Also at engine overhaul,

¹The Bendix ignition system product line has been acquired by Teledyne Continental Motors.

harnesses should be replaced, and ignition switches and starting vibrators should be internally inspected and functionally tested for airworthiness.

Severe environmental effects, engine overspeeds, sudden stoppage, immersion and other unusual circumstances may require complete or partial engine overhaul prior to the overhaul time recommended by the engine manufacturer. The magneto is an integral part of the engine and is subjected to the same degenerating forces as the engine under the abnormal conditions listed above. In such circumstances the magneto, regardless of "in service" time, will be overhauled with particular attention focused on all rotating parts, bearings and electrical components.

In addition to the guidelines listed above, magnetos will be overhauled at the expiration of four years without regard to the accumulated operating hours since new or last overhaul. Lubricants will have deteriorated beyond their useful life in magnetos older than four years.

There are unknown numbers of airplanes which, because they have been stored or otherwise utilized infrequently, may not yet have accumulated sufficient total flight time to require that the obsolete Bendix magneto ignition coils and/or rotating magnets be replaced with more reliable parts in accordance with AD 73-07-04. However, it is clear, based on the accident involving N260B and from the SDR's, that these components, particularly the ignition coils, can be adversely affected by the environment over relatively long periods of time. As a result, they should be replaced and subsequently inspected at conservative intervals of calendar and flight time. Therefore, the Safety Board believes that all obsolete Bendix ignition coils and rotating magnets that are still in service should be replaced at the next appropriate maintenance interval, irrespective of total flight time. Moreover, all aircraft magnetos should be subject to detailed inspections and overhaul at appropriate intervals in accordance with the manufacturers maintenance instructions.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

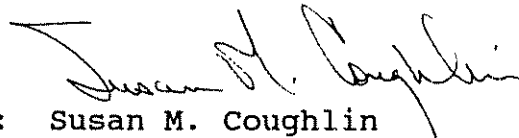
Issue an airworthiness directive applicable to all Bendix S-20, S-200, S-600, and S-1200 series magnetos requiring, unless already accomplished, compliance with Bendix Service Bulletin No. 560A, "Replacement of Magneto

Transformer Coils and Rotating Magnets," at the next annual or 100-hour inspection, whichever occurs first. (Class II, Priority Action) (A-92-22)

Issue an airworthiness directive applicable to all Teledyne Continental Motors, Bendix, and Slick Aircraft Products aircraft magnetos requiring: (1) That they be removed, disassembled, and inspected in accordance with the respective manufacturers periodic maintenance instructions at the next annual or 100-hour inspection, and at every 500 flight hours thereafter unless such an inspection has already been conducted within the past 500 hours of flight, or the magnetos have not yet accumulated 500 hours of flight time; and (2) That they be overhauled at appropriate intervals in accordance with the manufacturer's maintenance guidelines and detailed overhaul procedures. (Class II, Priority Action) (A-92-23)

Publish an advisory in the "General Aviation Airworthiness Alerts" (AC No. 43-16) emphasizing the importance of periodic aircraft magneto maintenance, service, inspection, and overhaul in accordance with the magneto manufacturer's maintenance guidelines and detailed overhaul procedures. (Class II, Priority Action) (A-92-24)

Acting Chairman COUGHLIN, Members LAUBER, HART, HAMMERSCHMIDT, and KOLSTAD concurred in these recommendations.



By: Susan M. Coughlin
Acting Chairman

