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National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: September 23, 1993

In reply refer to: A-93-117

Honorable David R. Hinson
Administrator
Federal Aviation Administration
Washington, D.C. 20591

A recent review and evaluation by the National Transportation Safety Board of the Federal Aviation Administration's accident/incident data (AID) and service difficulty reports (SDRs), applicable to Piper PA-28R series single-engine airplanes and PA-44 series twin-engine airplanes, disclosed that the nose landing gear in these airplanes frequently collapsed. Between January 1986, and June 1993, these airplanes were involved in 87 such occurrences, and 96 SDRs were submitted concerning nose landing gear malfunctions. In almost all cases, the occurrences were classified as "incidents" rather than accidents because few, if any, resulted in death or serious injury. Also, the resultant damage to an airplane's landing gear and propeller(s), although often extensive and costly to repair, was not considered substantial damage for the purpose of accident definition. Nonetheless, the Safety Board believes that remedial action to prevent such occurrences is in the public's best interest. Moreover, there is always some residual concern associated with these occurrences that certain engine or propeller sudden-stoppage damage, as a result of the landing gear collapse, may go undetected and subsequently precipitate an accident.

A significant number of the collapsed nosegear occurrences, primarily those involving PA-44 airplanes, are due to broken AN4-20 bolts, which are used to connect the nosegears' lower drag link to the upper drag link. For example, on May 5, 1993, the nose landing gear on a PA-44-180 airplane, N21427, collapsed during the landing roll because of such a bolt failure after a normal touchdown at the Spruce Creek Airport, Daytona Beach, Florida. As a result, both the left and right propellers struck the ground and were damaged beyond repair. The installation of replacement propellers cost $15,000. A metallurgical analysis of the broken AN4-20 bolt by the Safety Board disclosed that the fracture occurred because of fatigue cracking. Wear patterns were noted at the midspan of the shank of the bolt and on the diametrically opposite side, next to

the bolt head and threads. This wear is believed to have been induced by excess clearance and/or worn bearings at the lower link/upper link juncture. Reportedly, the bolt had been in service for only 52 flight hours.

Collapse of the nose landing gear in PA-28R and PA-44 airplanes is also frequently attributed to failure of the downlock mechanism, a failure which is often cited as a unique causal element in the AID and service difficulty reports. However, because of the contiguous structural loadpath between the airplanes' nosewheel trunnion assembly and the nose landing gear actuating cylinder, failure of the downlock mechanism, in some cases, is believed to be the result of excessive movement in the nosegear draglink assembly. The latter problem is usually due to worn bolts or bearings. Additionally, excessive movement in the draglink assembly is also believed to contribute to cracking or breaking of the nosegear trunnion's lower draglink bushing bosses.

In the early 1980s, after receiving reports of loose, cracked, or broken nose landing gear link and brace assemblies in the above airplanes, the Piper Aircraft Corporation issued Service Bulletin (SB) No. 678, "Nose Landing Gear Downlock Bushing Replacement" (PA-44-180) and SB No. 724A "Nose Landing Gear Inspection and Rigging" (PA-28R-201T and PA-28RT-201T) to correct these problems. To further resolve these problems, on July 29, 1986, Piper issued Service Letter No. 988, "Nose Landing Gear Modification" applicable to both PA-28R and PA-44 series airplanes. The stated purpose of the letter was as follows:

> Reports have been received of damaged and broken draglink attachment hardware, and nose landing gear downlock linkage broken, due to motorized towing, rough field operations, and lack of maintenance, resulting in inadvertent nose landing gear retractions.
>
> This Service Release announces the availability of a Nose Landing Gear Modification Kit which, when installed, will reduce the possibility of damage.

The modification kits consist essentially of a close tolerance bolt, four bearings, and other associated hardware to be installed on the draglink assembly. The close tolerance NAS464P4-27 bolt provided replaces the AN4-20 bolts used to connect the upper and lower draglinks. The detailed instructions and sketches provided with the kit indicate that the new bearings are to be installed in the upper drag link and reamed to close tolerance after assembly and that the lower drag link is to be machined. The instructions also provide for a check of the nosegear downlock hook to ensure that it rotates freely, as well as power-operated nosegear cycling and free-fall tests, while observing the downlock hook for correct functional operation.

In view of the above, the National Transportation Safety Board recommends that the Federal Aviation Administration:

> Issue an airworthiness directive applicable to Piper PA-28R (Arrow and Turbo Arrow) and PA-44 (Seminole and Turbo Seminole) series airplanes, requiring compliance with Piper Service Letter No. 988, "Nose Landing Gear Modification," at the next 100-hour or annual inspection, whichever occurs first. (Class II, Priority Action)(A-93-117)

Chairman VOGT, Vice Chairman COUGHLIN, and Members LAUBER, HART, and HAMMERSCHMIDT concurred in this recommendation.

By: Carl W. Vogt
Chairman