

AIRCRAFT ACCIDENT REPORT No 6/94

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ACCIDENT TO PIPER PA-31-325 C/R NAVAJO, G-BMGH, 4 NM SOUTH OF KING'S LYNN, NORFOLK ON 7 JUNE 1993

SUMMARY

The accident occurred during a scheduled passenger flight from Birmingham to Norwich, with a pilot and seven passengers on board, when a propeller blade detached from the right engine propeller and passed through the aircraft's nose baggage bay before damaging the left engine propeller and stopping the left engine. As a result of the ensuing severe out-of-balance forces on the right engine it separated from the airframe almost immediately and the aircraft rolled to the right and entered a tight spiral dive, or spin. However, the commander managed to regain control of the aircraft and to carry out a successful forced landing. Both he and his seven passengers were uninjured, apart from one passenger who subsequently complained of neck pains.

The investigation identified the following causal factors:

- (i) Separation of the right engine, as a result of massive out-of-balance forces following fatigue failure of the right propeller hub and associated release of one blade, caused an immediate and critical loss of control which was only recovered and a successful forced landing accomplished by the exceptionally skilful handling of this commander.
- (ii) The grease nipple holes in such Hartzell HC-(03Y0)-0 type propeller hubs had not been masked prior to the shot peening process at manufacture and had therefore suffered deformation of the associated threads, which weakened their fatigue resistance.
- (iii) No detailed stress calculations from direct strain gauge testing had been undertaken, or had been required, on this propeller hub type at the time of its design and certification.
- (iv) Fatigue cracking that emanated from deformed grease nipple threads and which broke through to the outside surface of the propeller hub may not have been visible at the last maintenance inspection prior to the in-flight failure of the right propeller hub.

(v) Despite the occurrence of fatigue cracking from grease nipple holes on such propeller hubs in service which had caused the manufacturer to redesign this type of hub in 1983, some 10 years prior to this accident, and to issue three related Service Bulletins (SBs) in the period between October 1989 and September 1992 with the introduction of an optional eddy current inspection, in addition to visual inspection, the FAA had only issued one Airworthiness Directive (AD No. 89-22-05) requiring compliance with the initial SB 165. This had merely required periodic visual inspections and the FAA had not issued revised ADs to include eddy current inspections (as per SB 165A of 27 August 1992) or to emphasise the manufacturer's strong recommendation (SB 165B of 11 September 1992) for the replacement of such hubs with the improved post-1983 type of hub.

(vi) During the last visual inspection to FAA Airworthiness Directive No. 89-22-05, no cracking was observed on the propeller hub; the grease nipples had been removed from the hub to facilitate inspection. Such removal was not a requirement of this AD (which did not, however, warn against such removal) and may have tended to 'close up' any crack(s) present, reducing the chances of such visual detection.

(vii) The original hub design was certificated in the knowledge that the vibration stresses on the left-hand rotating propeller of this type were generally higher than those on the right-hand rotating propeller, but were deemed acceptable.

(viii) Operators and pilots of affected aircraft had not been made aware that the sudden initiation of unexplained vibration or grease leakage could indicate a potentially dangerous defect on such propeller hub assemblies although related Service Bulletins had warned aircraft engineers of such symptoms subsequent to 27 August 1992.

Four safety recommendations were made during the course of the investigation. These covered the need for airworthiness authorities and manufacturers to undertake additional measures to make pilots aware of important safety information contained in Airworthiness Directives (ADs) and Service Bulletins (SBs); for airworthiness authorities to update ADs with successive SBs, or at least make it clear that ADs refer to the latest issue of any associated SB; for the CAA and FAA to seriously consider issuing ADs to make manufacturers' strong recommendations to replace components mandatory; and that airworthiness authorities should require detailed stress analyses and direct strain gauge monitoring on all propeller hubs as part of the associated certification requirements. (Safety Recommendations 94-28, 94-29, 94-30, 94-31).