American General AG-5B, G-NODY

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Aircraft Type and Registration:	American General AG-5B, G-NODY
No & Type of Engines:	1 Lycoming O-360-A4K piston engine
Year of Manufacture:	1991
Date & Time (UTC):	12 September 2000 at 2154 hrs
Location:	Coventry Airport
Type of Flight:	Training
Persons on Board:	Crew - 2 - Passengers - 2
Injuries:	Crew - None - Passengers - None
Nature of Damage:	Landing gear wheel detachment
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	57 years
Commander's Flying Experience:	5,766 hours (of which 2,200 were on type) Last 90 days - 157 hours Last 28 days - 29 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and metallurgical examination by the Civil Aviation Authority

History of Flight

Following a successful landing by the student, the instructor took control of the aircraft to taxi to the southern taxiway for a crew change. However, during a left turn the left hand main landing gear wheel separated from the landing gear leg and the aircraft came to a halt. The engine was shut down and the aircraft was later removed from the taxiway.

Inspection found that the left wheel's axle had failed and subsequent examination of other GA-5B aircraft in the operator's fleet revealed a number of other axles which exhibited corrosion in the area of this failure.

Metallurgical examination of the axles

A metallurgical examination of the left axle failure was carried out by the Civil Aviation Authority. The preliminary conclusions of this examination indicated that the material between the counter-bores of the two upper bolt holes, used to attach the brake assembly, had been lost due to an exfoliation type corrosion. The remnant material had formed relatively sharp peaks between the

counter-bores. The material loss in this region appeared to have initiated small cracks which had extended into the body of the axle. It was considered that these cracks had propagated by a fatigue mechanism. Although these fatigue cracks were small, a high load event appeared to have initiated two monotonic cracks from either side of the remnant material peak. These two cracks had then merged and arrested, leaving approximately half of the axle cross-section to carry the associated loads. Multiple fatigue cracks had then initiated at the crack arrest front and had propagated, reducing further the load carrying cross-section of the axle. Another load event had then triggered the final fracture of the axle.

Corrosion of a general nature was evident on both axle assemblies from G-NODY, in the region directly alongside the forging flash line. There was also evidence of exfoliation type corrosion in the region of the two counter-bores in the right axle. Examination of the microstructure of that axle showed a coarse-grained recrystallized structure at the surface of the axle. However, within the body of the axle the microstructure was satisfactory, with a fully recrystallized small grain size structure. It was considered that the coarse grained structure of the surface and the grainflow around the flash line had rendered the axle susceptible to corrosion in this region. In the area of the counter-bores, the corrosion had induced exfoliation of the material. The grain structure on either side of the flash line was considered to have contributed directly to the failure of the left axle.

It was also considered that the coarse recrystallized grain structure had formed in the surface of the axles due to incorrect process control during the associated forging operations and/or subsequent heat treatment of these components.

Safety Action

The Civil Aviation Authority has requested the aircraft manufacturer to provide information on any previous corrosion problems of this type and of any proposed action to address this problem.