Aircraft Type and Registration:	Robin DR400/180 Regent, G-FTIL
No & Type of Engines:	1 Lycoming O-360-A3A piston engine
Year of Manufacture:	1988
Date & Time (UTC):	26 September 2003 at 1510 hrs
Location:	Little Staughton Airfield near Bedford, Bedfordshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Nose landing gear and propeller damaged. Engine shock loaded
Commander's Licence:	Private Pilot's Licence
Commander's Age:	44 years
Commander's Flying Experience:	102 hours (of which 16 were on type) Last 90 days - 13 hours Last 28 days - 4 hours
Information Source:	AAIB Field investigation

History of flight

The aircraft was being flown to Little Staughton Airfield for some pre-arranged scheduled maintenance. The weather at Little Staughton was CAVOK with a surface wind from 250° at 10 kt. Shortly after a normal landing on Runway 25 the aircraft veered violently to the left and the nose landing gear (NLG) collapsed. The propeller contacted the ground, the engine stopped and the aircraft slid approximately 20 metres before coming to rest 5 metres from the edge of the runway.

Background information

The Robin DR400 has a fixed tricycle landing gear with a steerable nose wheel. The NLG is somewhat unconventional in that the oleo is offset to one side of the steering pivot axis. Two support plates located on the upper half of the oleo outer cylinder attach the nose leg to the steering pivot mechanism (see Figure 1). The upper support plate is braced by a diagonal tube, which is welded at its lower end to the side of the outer cylinder, the vertical landing gear loads being reacted as compression in this tube and tension in the upper support plate. The steering input rod is connected to the upper support plate. Both the upper and lower support plates are normally attached to the outer cylinder by circumferential fillet welds around the lower side only of each support plate.

There is a history of in-service problems of cracking in the circumferential weld of the lower support plate and of cracking in the strap section in the area under the nose wheel lock. To address these problems, the aircraft manufacturer, Avions Pierre Robin (now Apex Aviation), issued Service Bulletin (SB) No 101 in 1983, which is classified as mandatory and requires a repetitive dye penetrant inspection of the lower support plate and the weld. The latest revision of SB 101, Revision 3, does not permit any weld repairs to be carried out and, if cracks are found which are in excess of the allowable limits quoted in the SB, the NLG must be returned to the manufacturer for repair. In March 1982 the Bureau Veritas, France issued Airworthiness Directive (AD) No 83 206(A)R3 which mandated the manufacturer's SB 101. There is no requirement in SB 101 or the AD to inspect the upper support plate or its weld.

Engineering examination

The initial examination of the nose landing gear indicated that a possible fatigue failure may have occurred in the region of the upper support plate. The nose landing gear was submitted for a detailed metallurgical examination. This examination confirmed that a fatigue failure had occurred in the narrow strap section of the upper support plate (see Figure 1) which had been the result of normal in-service loads and circumferential separation of the fillet weld between the upper support plate and the outer cylinder. The weld was found to be of very poor quality. The cross-sectional dimensions of the weld were inadequate around the complete circumference for the type of joint and there was gross gas porosity in the area of the separation. Further examination revealed gross gas porosity throughout the complete circumference of the weld. The examination also revealed that the weld had been made using a Gas Tungsten Arc Welding method (more commonly known as the Tungsten Inert Gas (TIG) method) and that it was the original manufacturing weld.

G-FTIL's nose landing gear history

In February 1993 the aircraft had a landing accident (AAIB Bulletin 4/93) during which the nose landing gear was damaged. The aircraft repair organisation replaced the NLG with a new item supplied by the manufacturer's UK agent. This replacement NLG which was manufactured in 1978 had completed approximately 2,700 landings prior to its failure.

Previous accident to a DR400 aircraft G-BJUD

In November 2001 the nose landing gear of a DR400 aircraft, G-BJUD, collapsed on landing (AAIB Bulletin 8/2002). The investigation established that fatigue cracking had occurred in the narrow strap sections of the upper support plate which progressed to the extent that the weld was no longer capable of maintaining structural integrity under normal in-service loads and failed in tensile overload causing the NLG to collapse. It was noted that the upper support plate had been welded both top and bottom to the oleo outer cylinder, the top weld being unapproved and added sometime after manufacture by an unknown person. The bottom weld, made when the NLG was manufactured, was found to have poor penetration into the parent material and excessive gas porosity. The NLG was manufactured in 1986.

Welding requirements

At the time that the NLGs for G-FTIL and G-BJUD were manufactured it is understood that the aircraft manufacturer was using a military standard for welding called 'Norme Air 0191' and individual welders were qualified under section 'L'institut de soudure' of this military standard. There is no procedure within the French civil aviation regulations which stipulates this military standard. The European standards for welding practices and procedures in aerospace are currently being developed and written but already in existence are Euro Norms (EN's), that are not aerospace specific, but which give general guidelines for practices and procedures that should be incorporated into national requirements. In France the EN's are incorporated into the Association Frangaise de Normalisation (AFNOR) standards.

Safety Recommendations

Safety Recommendation 2004-86

It is recommended to the manufacturer, Apex Aviation, that Service Bulletin 101 be re-issued to include the inspection of the Upper Support Plate in the same areas as those specified on the Lower Support Plate.

Safety Recommendation 2004-87

It is recommended that the Director Generale de L'Aviation Civile (DGAC), France as lead agency for the European Air Safety Agency (EASA), re-issue Airworthiness Directive No 83-206(A) to include the inspection of the Upper Support Plate in the same areas as those specified on the Lower Support Plate.

Safety Recommendation 2004-88

It is recommended that the Director Generale de L'Aviation Civile (DGAC), France assess the standard of welding made by Apex Aviation to ensure that it meets the European and French requirements and standards for the manufacture of aviation components.

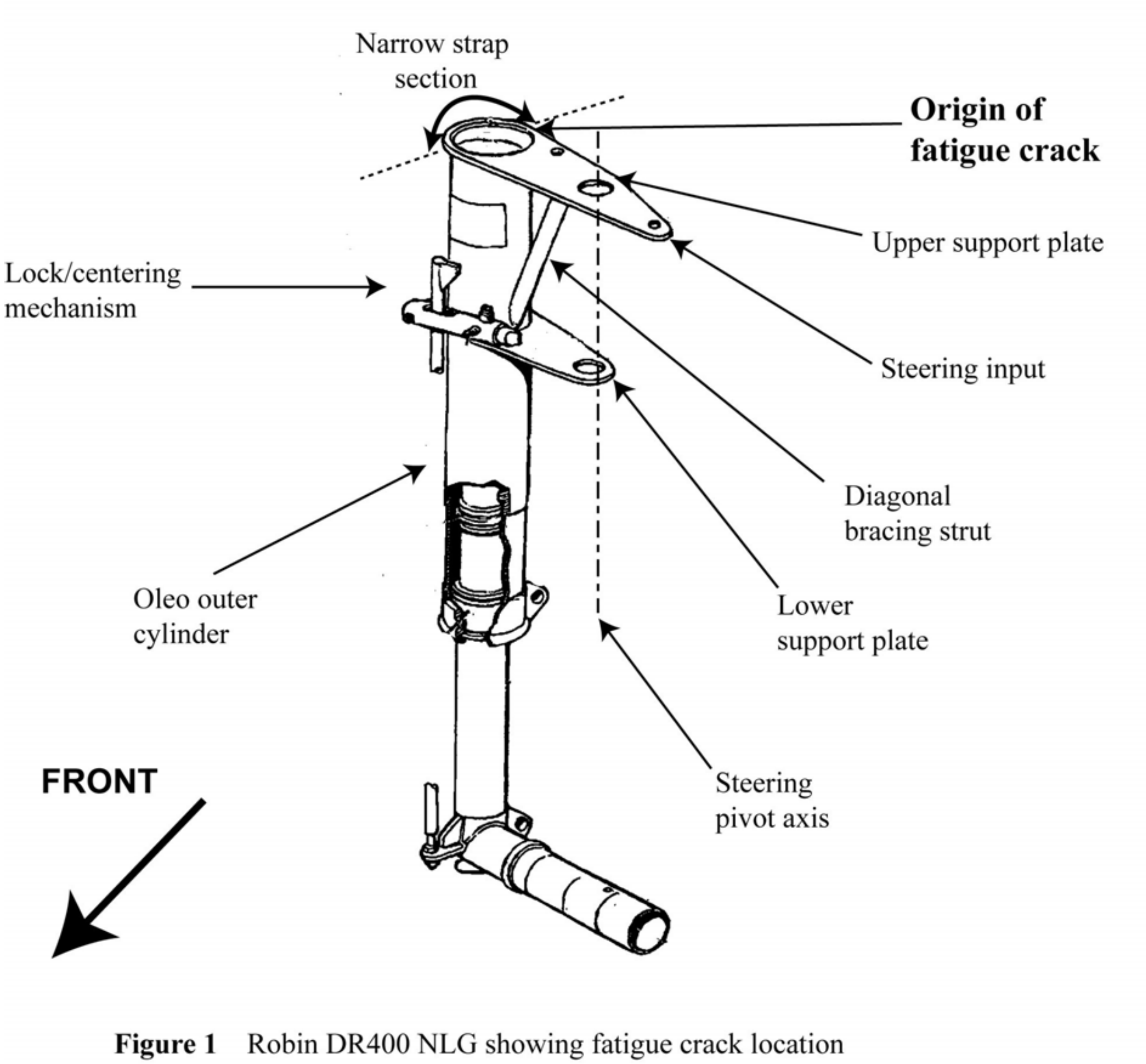

Figure 1 Robin DR400 NLG showing fatigue crack location

Adapted from a manufacturer's drawing