ACCIDENT

Aircraft Type and Registration:	Extra EA 230, G-CBUA
No & Type of Engines:	1 Lycoming AEIO-360-A1E piston engine
Year of Manufacture:	1986
Date & Time (UTC):	10 October 2008 at 1330 hrs
Location:	White Waltham Airfield, Berkshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Right landing gear, wheel spat, aileron spade and propeller
Commander's Licence:	Private Pilot's Licence
Commander's Age:	44 years
Commander's Flying Experience:	698 hours (of which 128 were on type) Last 90 days - 26 hours Last 28 days - 4 hours
Information Source:	AAIB Field Investigation

Synopsis

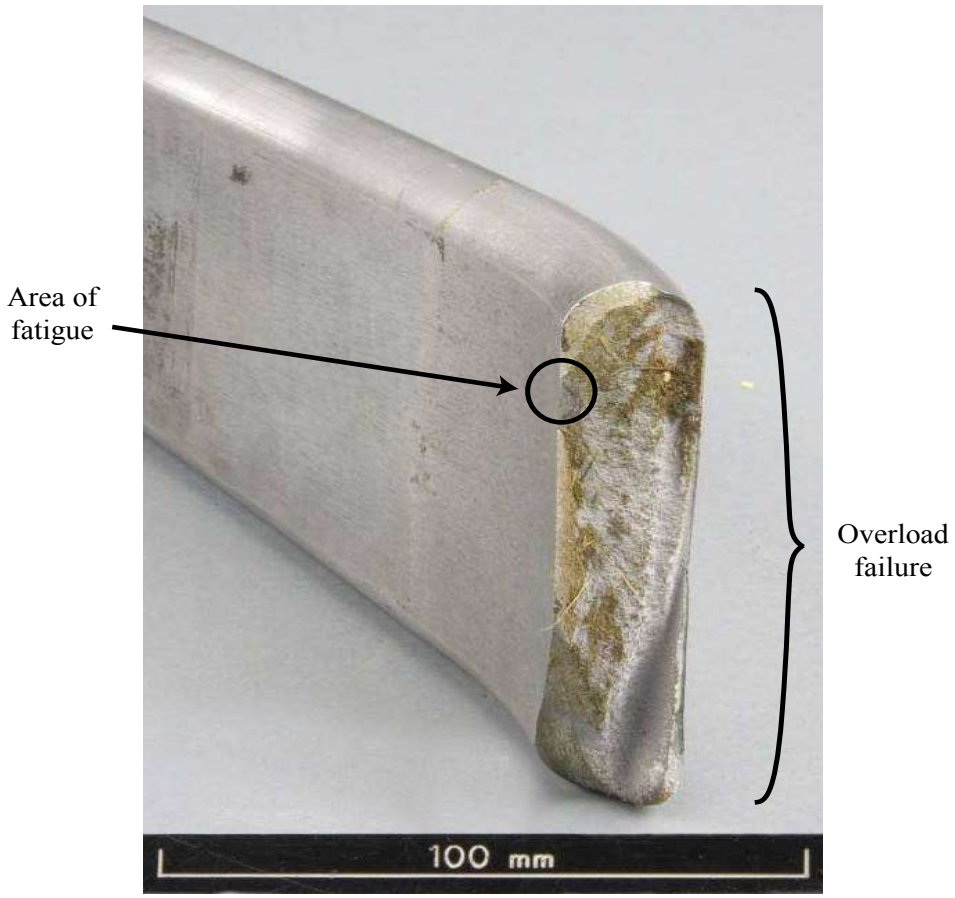
While taxiing to the holding point the right landing gear leg fractured, which resulted in the right wing tip contacting the ground and the aircraft pivoting to the right. Metallurgical examination of the failure of the right landing gear showed that the fracture was as the result of a fatigue crack that had initiated from a small corrosion pit.

History of the flight

The pilot carried out a daily inspection of the aircraft and found it to be fit for flight. After starting the engine he taxied the aircraft towards the holding point for Runway 21. The airfield, which was where the aircraft was based, has a grass surface and is, in areas, very undulating. The pilot taxied very slowly to minimise the bouncing and vertical loading on the aircraft. While passing the holding point for Runway 25 the upper right landing gear leg fractured, the right wing tip contacted the grass surface and the aircraft pivoted to the right by approximately 90°. During the pivot to the right the propeller contacted the ground, shattering the wooden blades.

Engineering examination

Initial examination of the failure surface of the aluminium landing gear indicated an area of fatigue (Figure 1).



Courtesy of QinetiQ

Figure 1

Landing gear leg, G-CBUA

Both halves of the landing gear were taken to the Materials and Failure Analysis Department at Qinetiq for detailed examination.

In summary, the QinetiQ examination revealed that the landing gear was manufactured from a single length of 2024 aluminium alloy 22.5 mm thick, which was then formed to the desired profile. It was found that the gear had fractured at the bend at the top of the right leg. It was concluded that the failure of the right main landing gear was caused by the growth of a fatigue crack which originated at a small corrosion pit on the inner surface of the bend radius at the top of the leg. There was evidence of a second similar crack originating from a small corrosion pit on the matching (unbroken) left leg of the landing gear. There was no evidence of protective measures having been taken to prevent corrosion pitting other than surface polishing, which had been carried out only to the lower part of the landing gears. There was no associated mechanical damage that would have influenced the failure.

Examination of the fracture surface in a scanning electron microscope (SEM) revealed coarse growth bands across the crack length and attempts to count them showed there to be between 45 and 50 visible. Contained within the major visible growth bands there appeared to be a number of less distinct bands and

individual fatigue striations. It is possible that each of the major growth bands visible on the fracture surface indicated a landing, whilst the minor bands found within these could be associated with bumps during taxiing over rough ground. Therefore it is possible that the crack may have been progressing for up to 50 landings before final fracture occurred.

The metallurgist further commented that there was no evidence to suggest that the material's mechanical properties contributed to this failure, but that the high copper content of 2024 alloy makes it susceptible to corrosion and the material commonly requires additional protection from environmental degradation. In this case there was no evidence found of an effective protection scheme applied to the undercarriage leg, which would have increased the likelihood of the formation of the corrosion pit which initiated the fatigue cracking. The metallurgist considered that the adoption of additional corrosion protection measures, such as inhibited paint coatings over anodising or conversion treatments on the landing gear, would reduce the occurrence of the fatigue-initiating corrosion pits. There is evidence[1] to suggest that there can be in-service fatigue failures originating from corrosion damage in components under sustained stresses acting in the longitudinal or short-transverse directions relative to the grain structure of the material.

Other information

At the time of the accident the aircraft had flown approximately 1,743 hours since manufacturer and 28 hours since an annual maintenance check.

The area where the failure occurred is covered by a composite fairing. There are no specific maintenance requirements to examine for cracking of the landing gear in that area and nor is there a manufacturer's requirement to apply corrosion protection measures to the main landing gear. As this aircraft design is not type-certificated, the following Safety Recommendation is made to the aircraft manufacturer:

Safety Recommendation 2009-104

It is recommended that EXTRA GmbH review the continued airworthiness of the main landing gear fitted to the Extra EA 230 aircraft, to ensure adequate protection measures to reduce the occurrence of corrosion pitting.

Footnote

[1] ASM Speciality Handbook, Aluminium and Aluminium Alloys 1996. Properties of Wrought Aluminium and Aluminium Alloys – corrosion behaviour.