# Europa, G-FLOX

**AAIB Bulletin No: 7/2000 Ref: EW/G99/10/04 Category: 1.3**

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| **Aircraft Type and Registration:** | Europa, G-FLOX |
| **No & Type of Engines:** | 1 Jabiru 2200A piston engine |
| **Year of Manufacture:** | 1998 |
| **Date & Time (UTC):** | 5 October 1999 at 1335 hrs |
| **Location:** | Redhill Aerodrome, Surrey |
| **Type of Flight:** | Private |
| **Persons on Board:** | Crew - 1 - Passengers - 1 |
| **Injuries:** | Crew - None - Passengers - None |
| **Nature of Damage:** | Damage to propeller and outrigger. Small split in fuselage shell |
| **Commander's Licence:** | Airline Transport Pilot's Licence |
| **Commander's Age:** | 43 years |
| **Commander's Flying Experience:** | 7,600 hours (of which 9 were on type)<br>Last 90 days - 192 hours<br>Last 28 days - 67 hours |
| **Information Source:** | Aircraft Accident Report Form submitted by the pilot and AAIB examination of propeller |

After a take off from Redhill, the pilot carried out a touch and go on Runway 08R; the grass surface was damp and the surface wind was light and variable. On climb out, at approximately 150 feet agl, the pilot felt heavy vibration from the engine and made a forced landing within the aerodrome boundary.

The propeller was a modified version of a two-bladed, wooden model normally supplied by the engine manufacturer for fitment to the Jabiru engine. It had been reworked by the manufacturer to optimise performance for the Europa/Jabiru 2200 combination. The manufacturer had produced a scheme for the alteration of blade pitch in which layers of fibreglass were added to the blades and then ground away to achieve the desired profile and pitch. This propeller, one of a number being trialed, differed from that scheme in a number of respects and was not representative of production propellers. Four layers of crossweave fibreglass had been laid on the front surface of each blade

and three on the back. A section of this fibreglass skin, comprising all four layers from the front surface of one blade, had detached in flight and was later found close to the upwind end of the runway, about 500 metres from where the aircraft came to rest. The detached skin had no abrasion or damage at its tip. This indicated that the propeller had not touched the runway during the go-around and some tip damage which was found on the rest of the propeller had evidently been sustained during the forced landing. The weave was aligned with the span and cord and there was no wrap around the leading or trailing edges. The core wooden propeller had a polyurethane leading edge insert in each blade for the outer two thirds of its span for erosion protection. On the lower surface this insert was stepped above the wooden blade material and the glass fibre was butted against it. On the front surface the polyurethane was faired to the wood and the glass fibre overlaid it being faired at its edge to the curvature of the aerofoil.

There were three areas of suspect bonding between the detached glass fibre skin and the wood. Close to the hub where the surface had a double, concave/convex, curvature there was some "puddling" of the resin and a lack of wetting of the glass fibres showing that the glass fibre mat had not been pressed sufficiently on to the wood during curing. However, the exposed surface of the resin showed some evidence of fracturing so it appeared that there had been some adhesion and this had probably been ruptured as a secondary effect of the skin detaching. Along most of the trailing edge there was resin adhering to the wood but, again, there was a lack of wetting of the glass fibres and this indicated that there had been a poor bond. Though the separation of the skin could have initiated at the trailing edge some tearing of the resin could be seen and this rupture was probably also secondary. The primary area of suspicion was near the leading edge over a section positioned between about 3 cm and 15 cm from the tip. Resin was present on the wood and had wetted the fibres but the exposed separated surfaces were very smooth showing that they had not bonded. Small voids in the resin could also be seen. This area was immediately behind the polyurethane leading edge insert. The faired edge of the fibre glass matting which had covered the polyurethane had detached with the skin and none remained on the polyurethane. It could not be assessed whether the exposed, faired edge of the glass fibre skin had played any part in the separation. Reportedly, good adhesion can be achieved between epoxy resin and polyurethane but the resin is stiffer than the polyurethane and the feathered edge of the glass fibre and resin skin in this location at the leading edge of the propeller would be vulnerable to disbonding from flexural and impact loads.

It was also noted that as the propeller was painted black, the heating effects in direct sunlight could lead to softening of the resin or to thermal expansion stresses developing between the glass fibre skin and the wooden core. This two-pack paint had been applied to provide rain protection in lieu of a wrap-around leading edge strip, which reduced propeller performance. The manufacturer reported that, after the accident, procedures were changed. On reworked propellers the polyurethane leading edge strip is removed and remoulded after blade re-profiling to cover the edge of the fibreglass. The use of black paint is discontinued; a clear finish allows bruising from stone impacts to be easily seen. The Popular Flying Association will be advising their inspectors to be particularly vigilant when inspecting propellers of this type.