

AIB Bulletin

11/84

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Ref: EW/C872

Aircraft type and registration: Stephens Akro Series 2 G-OODO (light single engined fixed wing aircraft)

Year of Manufacture: 1982

Date and time (GMT): 12 May 1984 at about 1740 hrs

Location: Rendham, near Saxmundham, Suffolk

Type of flight: Private

Persons on board: Crew — 1 Passengers — Nil

Injuries: Crew — 1 (serious) Passengers — N/A

Nature of damage: Aircraft destroyed

Commander's Licence: Private Pilot's Licence

Commander's Age: 38 years

Commander's total flying experience: 1823 hours (of which about 370 hours were on type)

Information Source: AIB Field Investigation

The aircraft, an home-built derivative of the Stephens Akro aerobatic display aircraft, was on a private flight from White Waltham Aerodrome, Berkshire, to a landing strip at Parham, Suffolk. The pilot had made this flight on previous occasions, and it was his habit, before landing at Parham, to overfly a farmhouse at the nearby village of Rendham, in order to alert the residents of his impending arrival, so that a car would be sent to the landing strip to meet him. On this occasion it was his intention to spend the night locally, before flying on the following day to Barton Aerodrome, Manchester, where he was to perform an aerobatic display as part of the Manchester Air Show.

History of the flight

The aircraft took off from White Waltham Aerodrome at 1634 hrs, and was cleared by Air Traffic Control to fly under Visual Flight Rules (VFR) direct to destination. The weather at the time was fine throughout the entire route, with no significant low cloud and surface winds generally from the north-east at 20 kt with peak local gusts up to

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35 kt. Light, occasionally moderate, turbulence was reported at the lower levels. The pilot reports that when the aircraft reached the dis-used aerodrome to the south-west of Framlingham, he decided to carry out a practice of his aerobatic display routine, as he had not flown any aerobatics during the previous 6 days. This practice lasted for about 4 minutes, after which the aircraft continued the flight towards Rendham village.

As the aircraft approached the village the pilot initiated a descent down to a height of about 500 feet above ground level, and then flew past the farmhouse in a northerly direction, before turning south for a second run past the house and towards the private landing strip at Parham. As the aircraft passed the farmhouse for the second time, the pilot initiated a pull-up manoeuvre which, he estimates, subjected it to a force of about 5.5 times that of gravity (5.5g). When the climbing attitude increased through an angle of approximately 40 degrees above the horizontal, there was the sudden onset of the most severe vibration. The pilot immediately closed the throttle, suspecting a partial blade failure of the propeller. (He had experienced such a failure during a flight on a previous occasion early in the aircraft's development stage.) However, with the engine throttled back, the vibration level did not reduce and the pilot then carried out a quick visual inspection of the airframe, which revealed that the entire leading edge of the left wing forward of the main spar was missing. Ground eye-witnesses confirmed that, shortly after the pull-up manoeuvre was commenced a quantity of debris was observed to be falling from the aircraft.

As soon as the pilot realised the extent of the in-flight structural failure, he made a quick check of the aircraft's flight instruments. The airspeed indicator was registering zero; (the aircraft's pitot/static system was attached to the left wing-tip area); he also considered that the altimeter might be unreliable, and that with rapidly reducing airspeed, the height gain in the pull-up manoeuvre would have been insufficient to allow the safe abandonment of the aircraft by parachute. As the airspeed reduced further, it became apparent that any application of UP elevator (positive 'g') would cause the aircraft to roll violently to the left. The pilot managed to retain control for a brief period in a steep descending turn to the left. However, as the aircraft approached the ground and he attempted to raise the nose, the rate of roll increased and it struck the ground on its left wing-tip, in a slightly nose-up attitude and at a bank angle of ninety degrees. The aircraft then continued along the ground for a total distance of 25 metres, during which it decelerated as the left wing disintegrated from the tip to the root, before coming to rest inverted. There was no fire, and the pilot was released from the wreckage by onlookers and subsequently transferred to a local hospital. He had sustained multiple serious injuries.

Aircraft Information

The wing of G-OODO was built in France in 1980—81 to a modified Stephens Akro design; the modifications being intended to improve the wing strength. The structure consisted of a continuous solid spar from tip to tip, tapering from the root to the tip, and manufactured from laminated Douglas fir. The ribs fore and aft of the main spar were constructed around the perimeter with a 7 x 7 mm wooden fillet bonded to the ply surface. The leading edge was manufactured of spruce with Douglas fir backing members. The whole wing was skinned with 2.5 mm plywood, adjacent sheets of plywood being scarf jointed. The grain of the plywood ran at 45° to the main spar over the aft section of the wing, while it ran parallel/perpendicular to the main spar over the forward section. The plywood timber was gaboon mahogany and the resin used throughout the wing was phenol formaldehyde or resorcinol formaldehyde or some combination of the two.

The pilot/owner purchased the wing, and a fuselage, constructed in the USA to Akro drawings, to accommodate it. The aircraft first flew on the 11.5.1982 and at the time of the accident had accrued a total of approximately 380 hours, a large proportion of which were spent practicing or performing aerobatic programmes.

The permit to fly stated operating limitations of plus 6g and minus 3g but both the owner and designer/builder of the wing were confident that the aircraft was capable of supporting much higher loadings.

The aircraft was transported to Australia by sea in January and returned by air in March 1984. During both trips the wing was mounted vertically, leading edges downwards, and bolted to a supporting cradle by the mainspar/fuselage attachment bolts. In addition there were two 3 inch wide straps at approx two thirds span helping to stabilise and support the wings. After each journey the wing was closely inspected and no damage discovered.

Wreckage

All of the aircraft structure recovered remote from the main impact site, indicating airborne detachment, was material from forward of the spar of the port wing, accounting for the total leading edge. The remainder of the port wing, including the main spar, was destroyed during ground impact.

A detailed expert examination of the port wing reconstruction concluded that the resin distribution and performance were more than adequate, and that the timber materials were all suitable for their task and in good condition. A particularly close examination of the leading edge ribs was made as previous cases of failure were recorded. However, these earlier failures had occurred on wings with rectangular lightening holes in the ribs; G-OODO had circular lightening holes. It was not possible to identify any pre-crash failure on these ribs, all of which had suffered extensive impact damage.

An internal inspection of the starboard wing, using a boroscope through underwing drain holes, failed to expose any pre-crash damage.

The manoeuvre being flown at the time of the structural failure should not have exposed the wing to any loading in excess of that which it would have regularly encountered. Therefore, the pre-failure existence of some structural damage cannot be ruled out although, following the total destruction of the wing on ground impact, no such damage could be identified.