EoN Olympia 460 Glider, BGA No 1154 , 13 July 1996

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Aircraft Type and Registration:	EoN Olympia 460 Glider, BGA No 1154
No & Type of Engines:	None
Year of Manufacture:	1962
Date & Time (UTC):	13 July 1996 at 1410 hrs
Location:	Sleighford Airfield, Nr Stafford
Type of Flight:	Private
Persons on Board:	Crew - 1
	Passengers - N/A
Injuries:	Crew - 1 (fatal)
	Passengers - N/A
Nature of Damage:	Aircraft destroyed
Commander's Licence:	Bronze C certificate
Commander's Age:	-
Commander's Flying Experience:	Total - Approximately 50 hours over 4 years
Information Source:	Field investigation conducted by the BGA with AAIB technical support

Introduction

The Olympia 460 is a 15 metre wing span Standard Classsingle seat sailplane (Figure 1) built by Elliot's of NewburyLtd (EoN), and which entered production in 1960. It is essentiallyof wood construction except for the inboard sections of the wingmain spars, where aluminium alloy is used in conjunction withwood, and steel wing attachment fittings. The example involvedin this accident was manufactured in 1962, since when it had flownfor a total time of approximately 2,480 hours, 1,980 flights. In common with almost all sailplanes, it was designed in sucha way that the wing, tail surface and control connections werereadily detachable or foldable for storage and transport in apurpose-built trailer.

Article 8(2)(a) of the Air Navigation Order provides that thenormal requirement for an aircraft to have a Certificate of Airworthiness(CoA) does not apply to a glider used for private flying. Nearlyall gliding activity in the UK takes place under the auspicesof the British Gliding

Association (BGA), who regulate the sport,and who require all gliders operating from BGA affiliated sitesto possess a valid BGA CoA. (This glider, however, was unusualin that it was originally granted a CoA by the CAA when firstmanufactured, this example being registered G-ARUB). Itwas last inspected for the most recent CoA renewal in July 1995,and this was achieved on the 28th of that month.

History of the flight

This glider was owned by a syndicate of three people and, on theday of the accident, had been rigged and flown once by the samepilot prior to the accident flight. For the next flight, theglider was again to be launched by the winch method. This involvedattaching the glider, at the downwind end of the launch run, toa steel cable, the opposite end of which is reeled in by a powerwinch controlled by a driver. The steel cable is not actuallyconnected directly to the glider but joined to a 'weak link',designed to limit the maximum load applied to the structure toa safe value, which in turn is attached to a small parachute andshock rope, the end of which terminates in two interlinked steelrings. One of these rings is inserted into the hook/release mechanismin the glider just prior to launch.

The preparations for this launch, and conversations with the pilotby witnesses at the launch point, were reported as being normal. After the slack in the cable had been taken up, the 'all out'signal was given following which the glider was seen to quicklybecome airborne and adopt the climb attitude. Several witnessesformed the opinion that this launch was faster and less steepthan normal, the launches already being considered, by severalwitnesses, as being fast that day. One witness reported the presenceof a strong wind gradient, the surface wind being 5/10 kt. Ata height variously estimated by witnesses of between 600 and 700feet the glider was seen to 'speed- up' and its climb angle reduce. At about this time, and whilst still in a nose high attitudeand connected to the cable, several relatively rapid oscillationsin pitch occurred. One witness estimated these to be as muchas 15°, with the wings being seen to 'flex' correspondinglyan abnormal amount. At about this point, the airbrakes were seento briefly deploy. Almost immediately, they deployed again, thistime co-incident with the right wing failing in an upwards andrearwards direction, pivoting about its root end and releasinga cloud of debris. The right wing, still attached to the fuselage,was also seen to pivot upwards and, at about this time, the cableparachute was seen inflated with the cable disconnected from theglider. The wreckage fell to the ground, the break-up occurringat a height too low to allow the pilot to escape by parachute.

Wreckage examination

Following an initial on-site investigation by investigators fromthe BGA, where serious doubts about the pre-accident integrityof the wing spar roots arose, the wreckage along with the weaklink assembly from the winch cable was transported to AAIB Farnboroughfor detailed examination.

Spar description

The wing of the Olympia 460 series glider is almost entirely aglued wooden structure, with a conventional main spar, consistingof upper and lower wooden spar booms and a thin plywood shearweb. Towards the root end of the wing, the tension and compressionloads, respectively, in the lower and upper booms are transferredinto aluminium alloy strap assemblies bonded to their front andrear faces. At this location, the strap assemblies carry mostof these loads, the wooden core of the spar boom acting to stabilisethe straps enabling the upper ones, in particular, to maximisetheir ability to carry compressive loads. These strap assembliescomprised four straps at the root end of the spar, reducing innumber with increasing distance along the wing from the centrelinejoint. The alloy straps were bonded to each other by a Reduxprocess but, to facilitate the gluing of these assemblies to thewooden section of the spar booms, a veneer of mahogany was bondedto their appropriate faces. The bonding agent (phenol formaldehyde)is considered to be waterproof and good for use at low and ambienttemperatures. A diagram of the configuration of the wing, andits main spar root end construction, is shown in Figure 2.

Spar examination

On examination at Farnborough it became apparent that the rightwing had suffered a failure of the main spar in the section thatextends from the closing rib of the wing to the centreline joint. The upper and lower centreline joints had remained intact and,although the left wing had been severely damaged by impact withthe ground, it could be seen that this wing had not suffered anymajor in-flight failure. The upper boom of the right wing sparhad suffered a compression buckling type of failure, which hadresulted in severance of the top spar boom due to the consequentformation of small radius bends, as shown in Figure 3. A tensilefailure, with some torsion evident, of the lower spar boom hadoccurred at two locations, one either side of the lift pin fitting,these locations being indicated in Figure 2. It was also readilyapparent that, over a distance of approximately 20 inchesoutboard from the centreline joints, failures of the bonding betweenthe innermost face of all eight alloy strap assemblies and theirmahogany veneers had occurred due to corrosion of the aluminium,with copious quantities of oxide released during dis-assemblyindicating that this had occurred over a long period of time (Figure4). Corrosion was present on the outermost faces of the alloystrap assemblies, where the wing closing rib structures had beenbonded. Detailed metallurgical examination of these areas alsorevealed that intercrystalline corrosion had affected severalof the straps associated with the lower spar boom at the outboardfailure location, resulting in the (equivalent) loss of 1.5 ofthe 8 straps, *ie* approximately a 20% reduction of its tensileload carrying ability (Figure 5). It was also established thatsmall areas of corrosion were present in the surface of at leastone alloy strap at an interface between two of the straps, althoughthe metal to metal and metal to wood bonding, and the generalpre-accident condition of the wing structure and its glue joints,away from the heavily corroded areas, was very good.

It was apparent on both wing spar root sections, inboard of theclosing ribs, that there was no coating of paint over most ofthe web aft face, the face that naturally faces upward with thewings stored in their customary leading edge down attitude inthe trailer. Some areas of the upper and lower spar booms andthe naturally exposed outer surfaces of the alloy straps werealso without any paint covering in this region and some minorcorrosion was present. Small isolated areas of paint were present,however, giving the appearance that a paint covering had at sometime been removed. There was also an indication of a 'tide mark',most likely caused by water, on the aft face of the left wingspar web some 10 inches outboard of the closing rib, with themajority of the web surface inboard of this position to the centrelinejoint being discoloured (Figure 6). Similar discolouration waspresent over the same area of the left wing. The basic conditionof the wood in these areas, however, seemed unaffected by moisture. (Information, gathered by the BGA, indicated that it was notunknown for snow to be blown into this trailer during the winter,a time of year when most gliders are infrequently used).

Weak link examination

The weak link used on the cable to launch this glider on the accidentflight was recovered by the BGA and given to the AAIB to examine. This link was of the 'Tost' type, which employs a flat shapedstrip of steel, calibrated by a centrally drilled hole so thatfailure occurs in tension at a pre-determined load; in this case500 kg, colour coded white and stamped with the number 5, thecorrect value for this glider. In order to minimise the numberof 'nuisance' failures it is common practise to use two linksin parallel, as was the case here, but with one having an elongatedhole in one end, such that it cannot transmit any load until afterits partner has failed. It was readily established, however,that both links used on this occasion were identical, with onlythe slight elongation due to normal usage of their attachmentholes being evident. The general condition of both links suggestedthat they had been in service for some time, and when pull testedthe assembly failed at 987 kg. A new, sample, link from the samesource was also tested and failed at 523 kg, (Figure 7).

Thus on the accident flight (and presumably on previous launcheswith other gliders) it would have been possible for excessiveloads to have been induced in the airframe from this cable. Inview of the fact that the corrosion had developed over a longperiod of time, during which the glider had been launched andflown without incident, and that the aircraft had been launchedby winch earlier on the same day in similar conditions by thesame pilot, it is considered probable that excessive loads wereinduced on this occasion. This, in turn, exploited the degradedstrength of the wing spar, resulting in the upper spar boom collapsein the right wing.

There are reported to be some 34 Olympia 460 series gliders inthe UK, and an unknown number abroad. As a result of this accident,the BGA have recommended that none of these are flown until allhave been examined and a suitable inspection technique and/orrepair scheme is developed to assure continued airworthiness. Initial indications are that corrosion exists on several othergliders examined, at least one being of a severe nature, thisbeing found only after removal of the apparently intact coveringof paint. Gliders which employed a similar method of constructionare also to be examined, although the problem highlighted in thisreport could apply to any aircraft with this type of bonded metalto wood construction.