CEA DR360, G-AZIJ

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Aircraft Type and Registration:	CEA DR360, G-AZIJ
No & Type of Engines:	1 Lycoming O-320-D2A piston engine
Year of Manufacture:	1971
Date & Time (UTC):	9 May 1997 at 1445 hrs
Location:	Near Guernsey Airport, Channel Islands
Type of Flight:	Private
Persons on Board:	Crew - 1 - Passengers - 1
Injuries:	Crew - None - Passengers - None
Nature of Damage:	Fabric detached from underside of right tailplane
Commander's Licence:	Airline Transport Pilot's Licence with FI Rating
Commander's Age:	50 years
Commander's Flying Experience:	5,500 hours (of which 250 were on type)
	Last 90 days - 100 hours
	Last 28 days - 30 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and Inspection by the AAIB

The aircraft was on a flight from Quimper to Guernsey at 1,000feet in good flight conditions with no turbulence and about 10miles from Guernsey when the occupants heard a "bang"from the rear of the aircraft. The aircraft immediately yawedto the right and the right wing dropped. The pilot regained controlbut could feel vibration through the control column. He slowedthe aircraft to 80 kt and advised Guernsey ATC that he had a potentialcontrol problem. The occupants could see no damage on the wingbut could not see the rear of the aircraft. A successful landingwas made after gentle manoeuvring an uneventful approach.

When the aircraft was examined after landing it was found thatalmost all of the fabric covering the underside of the right tailplanewas missing. The tailplane was removed and sent to a repair agencyon mainland UK where it was examined by the AAIB, the remainingcovering being removed for closer examination.

The front (spanwise) edge of the missing section had formed abutt-joint with the edge of the fabric which remained. This remainingfabric covered the top surface and was wrapped around the leadingedge and along the underside to a distance of 5" and aroundthe trailing edge, overlapping the missing underside coveringwhere it was glued to the trailing edge structure. The departingfabric had ripped rearwards leaving remnants of the undersidecovering at the root and tip. The butt-joint had been very closefitting. The edge of the remaining fabric was a cut edge (ie notthe manufactured edge at the side of a roll) as could be seenfrom the free edges of the filaments and the occasional smallstep in the cutting line. At either end of the butt-joint, wherethe fabric wrapped around the tip and the root, the missing sectionhad been slightly overlapped by the remaining fabric. No reinforcingtape had been used to cover the butt-joint or any of the otherfabric joints. There was no rib-stitching or tape reinforcementalong the rib glue lines.

The stabilator had been recovered in June 1994 with Ceconite 101.All of the contact surfaces had been coated with three coats of20% thinned Super Seam adhesive. In the technique described bythe fitter, while the final coat was still wet or tacky, the fabricwould have been applied and rubbed with a finger or cloth wettedwith thinned (30 to 35%) Super Seam until the "wetted"appearance of the fabric showed that adhesive had penetrated andfilled the weave. The fabric was primed with three coats of Rand-O-Proofthe first of which was mixed with 20% thinned Super Seam and apolyurethane paint was used for the final colour coats (white).After a short period in service defects in the paintwork becameevident and it was agreed with the owner that this would be rectifiedat the annual inspection in February 1996. When he started thiswork the fitter found that he was able to prise the paint offthe surface and all of it was removed in this way. He cleanedthe surface with a thinner soaked cloth and repainted with a polyurethanepaint.

The factors which were considered relevant to the detachment ofthe under side fabric were the presence of the butt-joint withoutoverlap or tape reinforcement on the leading edge underside inthe area of maximum aerodynamic suction and also the integrityof the adhesion of the fabric to the structure. Procedures forcovering Robin aircraft with polyester fabrics are described inService Bulletin (SB) No 43 Revision 1 and a manufacturer's proceduresmanual is available for the Ceconite material.

Avions Robin SB 43 describes the rib-stitching of certain areasof the wing but states that, "There is no stringing (sic)on control surfaces." It does not prescribe fabric layoutbut advises a "fabric-fabric overlap of at least 70 mm (2.75")at the leading and trailing edges". The glueing process isgiven as a "Procedure used during manufacture" for use"on all unvarnished woods". The process is simply describedas 2 coats of 20% thinned adhesive on the wood followed by 2 coatsof 35% thinned adhesive on top of the attached fabric.

Ceconite 101 is the heavier of two grades described in the proceduremanual, being the equivalent in weight of cotton TSO C-15 (approximately4 oz per sq yd) but stronger and more durable. (The weave of thefabric is composed of interwoven bunches of polyester filaments;the filaments are not twisted into threads.) The glueing methodis described in the procedures manual as follows:-

"For maximium strength, care must be exercised to obtaingood bonds. First, apply 'Super Seam Cement' liberally to bothsurfaces. (Sufficient 'Super seam Cement' must be used to penetrateand completely encase each fibre.) Then, using you hands, jointhe surfaces as the cement becomes tacky. Finally, go over theoutside of the joint using thinned cement. - - -"

The objective is to achieve good adhesion of the cement on tothe structure with a thick coating which can be brought to penetratethe weave from below and encapsulate all the fibres. This

processis assisted by application of thinned adhesive from the outsidesurface of the fabric. If adhesive is applied predominantly fromthe outside it may penetrate the fabric but not make a good bondwith the wood or adhesive surface below. A distinct change inthe translucence of the fabric shows when the adhesive has penetratedthe weave.

On G-AZIJ the wooden surfaces left by the lost fabric were slightlyglazed, presumably by the remaining adhesive. There was no signof any of the wood itself having been lifted or removed as thefabric detached. The remaining fabric was removed to be examinedfor indications of the quality of the bond and the tailplane wasreleased for repair.

The fitter prepared a sample piece using his normal technique.This supported a 13.5 lbs load on the 1~feet square sample withoutfailing. A piece of fabric was then torn off and examined microscopicallytogether with a sample from G-AZIJ where the fabric had been stuckto a rib and a third sample which was obtained from another Robinaircraft. In all three cases the separation of the fabric fromthe structure occurred at the interface between the fabric andthe glue. No glue was left on the weave and a clear imprint ofthe weave was left in the glue surface on the wood. This appearsto be a logical place for the separation to occur as the gluedoes not adhere to the filaments but merely encapsulates themand its load bearing area here is at a minimum; reduced to theaggregate area of the individual fingers of glue which penetratethe weave. It is often said that it is an indication of a goodbond if wood is lifted with the fabric when it is peeled. Theremay be some variation of penetration of the glue between the filamentsas distinct from mere penetration of the weave which would affectthe strength of the adhesion of the fabric with the best adhesionproducing this effect. A number of other (crashed) aircraft wereexamined but none showed any lifting of the wood with the fabricexcept where the wood had been damaged. As a result of this investigation,therefore, and given the information available, it could not beshown that the adhesion of the fabric was a factor in the detachmentof the stabilator fabric additional to the exposed butt joint.

The fitter identified the work as his own but was at a loss tounderstand or explain why he had introduced a butt-joint intothe covering at that location and without any covering. (Goodpractice would have required a covering over the joint that wrappedaround the leading edge to terminate on the top surface.)

The covering and painting of the stabilator in 1994 was not recordedin the aircraft log book. However, the logbook entry describingthe other work carried out at that time did refer to worksheetsheld by the maintenance company and those contained a record ofthe recovering and repainting work. The Licensed Aircraft Engineer(LAE) who had signed the worksheets did not hold the rating (Category'B' Aeroplanes, Para. 5.1 of BCAR) which qualified him to certificatethe fabric covering of a complete aerofoil. The log book entry,which did not specifically list this work, had been signed byan LAE who was so qualified. The repainting of the stabilatorin 1996 was recorded on a "snag sheet" with a fitter'ssignature showing that it had been accomplished but without anycertification that it was fit for release to service. The correspondinglog book entry did not contain any reference to the repainting.