Yak 50, G-BWJT

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Aircraft Type and Registration:	Yak 50, G-BWJT
No & Type of Engines:	1 V530TA-D35 piston engine
Year of Manufacture:	1981
Date & Time (UTC):	24 September 1996 at 1050 hrs
Location:	2nm southwest of Deenthorpe
Type of Flight:	Test Flight
Persons on Board:	Crew - 1 - Passengers - None
Injuries:	Crew - None - Passengers - N/A
Nature of Damage:	Elevator severely damaged
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	55 years
Commander's Flying Experience:	10,120 hours (of which 4 were on type)
	Last 90 days - 96 hours
	Last 28 days - 28 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and additional AAIB inquiries

The aircraft was on a flight test from Spanhoe for the initialissue of a UK Permit to Fly. A dive to Vne (the 'never exceedairspeed') was initiated from an altitude of 7,000 feet, 270 kph,with full throttle and 80% RPM. When approaching 420 kph (Vnebeing 430 kph), the control column gave a sudden jerk, which wasfollowed by a 'squeaking sound'. The pilot pulled the throttleback to idle and eased the aircraft out of the dive, reducingspeed to 140 kph. He noted that the elevator trim wheel movedwithout resistance, and thus concluded that the trim tab (locatedon the left elevator) had become detached.

The aircraft returned to the airfield but the pilot convertedan initial approach into a low go-around, as he assessed thatthe aircraft's handling was abnormal. However, the second approachand subsequent landings were uneventful. An inspection of theaircraft revealed that the trailing edge of the inboard half ofthe left elevator, including the trim tab, had detached alongwith most of the fabric and some of the ribs.

The Yak 50, together with the structurally similar Yak 52, havemetal airframes with the control surfaces covered in a lightweightcotton fabric. A leading importer of this type of aircraft wasconsulted following the incident and indicated that the failuremay have been due to deteriorated fabric strength. In their experience,the strength of the material is approximately 80 lb/inch whennew, reducing to about 45-70 lb/inch after 4 years. The fabrichas no protection against ultraviolet light, and is prone to rottingdue to water entrapment, which usually occurs at the join betweenthe trailing edge and the unsupported areas. Condensation canalso cause rot, which usually produces visible evidence in theform of 'mould spotting'. In addition, the lacing used to stitchthe fabric to the ribs is also prone to rotting, with the resultthat after 4 years, or so, the fabric is no longer held to thepanel. The company was aware of in-flight fabric failures havingoccurred on ailerons and elevators in the former Soviet Union. In these cases, fabric strength, as assessed by a portable tester,was in the range 45-60 lb/inch. Following the subject accident,the fabric strength of the control surfaces of a 'sister aircraft',which was imported with G-BWJT, which were thought to have beenre-covered at the same time, was measured and found to be 50 lb/inch. Despite this low value, the appearance of the fabric was good,with no mould spotting.

The importers had in their possession the remains of an elevator,from a UK registered aircraft, that had failed in an apparentlysimilar manner to that from G-BWJT. In this case, the failurewas thought to have originated from a fabric tear caused by asharp point on a piece of sheet alloy that had been used to repairan elevator rib. The tear had progressed to the point where airflowhad 'inflated' the fabric envelope, with the consequent destructionof the elevator. There was also an unsubstantiated report ofanother aircraft which had suffered in-flight 'ballooning' ofelevator fabric, which had caused control column oscillation. This was found to have been due to the detachment of a 'stick-on'patch that had been applied to a small puncture in the fabric,which had probably been caused by stone impact.

Unfortunately, the elevator from G-BWJT was not available in itsimmediately post-accident state, as the owner had stripped itwith a view to a repair. However, the maintenance organisationwas able to verify that there were no previously repaired areasthat could have given rise to a fabric tear. In addition, theytested the fabric from the intact right hand elevator using atensile test machine. A one inch wide sample failed at 52 lb.

Following the accident, the owner of G-BWJT has had the flyingcontrol surfaces covered with a heavier grade, polyester, fabricof a type commonly used on western aircraft . The aircraft importeralso now routinely uses the same material on all aircraft deliveredto the UK.

Inspection aspects

This accident has highlighted the difficulty of assessing thecondition of fabric covered components, and has illustrated howfabric strength can be degraded even though its visual conditionmight appear satisfactory. The subject is covered in some detailin CAP 562; Civil Aircraft Airworthiness Information and Procedures(CAAIP), Leaflet 2-8. Two methods of measuring fabric strengthare discussed; the laboratory-style tensile tests and the portabletester which was mentioned earlier. The latter consists of acone and spring-loaded plunger assembly within a housing. Whenthe cone is pressed against the fabric surface, the force of applicationis read off on a scale similar to that of a tyre pressure gauge. The scale is calibrated in lb/inch, and thus the readings obtainedare compatible with those obtained from a tensile test machine. Any hole resulting from using a portable tester would thus requirea patch to be applied. Leaflet 2-8 does not list strength requirementsfor various fabrics, but notes that such information is suppliedwith portable testers.

Safety Recommendation

The circumstances of this accident, together with the evidenceobtained from fabric tests, have raised questions over the strengthand durability of the fabric material, as applied in the formerSoviet Union, to the flying control surfaces of these high performanceaircraft . The following Safety Recommendation is therefore madeto the CAA:

96-77: In view of the questionable durability of the lightweightcotton fabric applied to the flying control surfaces of Yak 50and 52 aircraft in the country of manufacture, it is recommendedthat prior to the issue of a UK Permit to Fly, or Certificateof Airworthiness, the CAA require such aircraft to have theircontrol surfaces re- covered with a heavier grade material ofa type that is in common use in the UK.