No: 5/90 **Ref: EW/C1151** **Category: 1c**

Aircraft Type and Registration:	Piper PA25-150 Pawnee, G-ATFR
No & Type of Engines:	1 Avco Lycoming O-320-A2B piston engine
Year of Manufacture:	1960
Date and Time (UTC):	18 March 1990 at 1615 hrs
Location:	RAF Wattisham, Suffolk
Type of Flight:	Private (glider towing)
Persons on Board:	Crew - 1 Passengers - N/A
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to tailplane, landing gear and left flap
Commander's Licence:	Private Pilot's Licence
Commander's Age:	35 years
Commander's Total Flying Experience:	1300 hours (of which approximately 1200 were glider-towing, and approximately 50 on type)
Information Source:	AAIB Field Investigation

The pilot had just towed a glider to 3000 feet from the airfield at Whatfield, which is situated at the southern edge of the RAF Wattisham Military Air Traffic Zone (MATZ). The glider released normally and the tug turned right and began to descend. As is customary, this manoeuvre was not particularly dramatic since the transition from high power/low speed climbing flight to high speed/low power descending flight is carried out slowly to minimise shock cooling of the engine cylinders. Whilst the pilot was looking around for the glider, there was a loud 'bang'. The airframe shook and he became aware that the elevator controls had become somewhat ineffective. As he was assessing the extent of pitch control that remained, and only a few seconds later, there was a second bang and the nose of the aircraft pitched violently upwards. This prompted the pilot to push the stick as far forward as he was able and to apply full power, which returned the aircraft to an attitude which was still nose high, but not excessive. After recovering from a further oscillation in pitch, induced by trial movements of the elevator and throttle, the pilot realised that he was descending with full power, at about 90 to 95 MPH IAS, and that the rudder pedals had adopted almost full left rudder positions. Upon glancing over his right shoulder, he became aware that the tailplane on that side appeared to have pivoted upwards about its rear spar and had wedged vertically, perpendicular to the airflow.

The pilot decided to attempt an emergency landing at RAF Wattisham (which was closed operationally but had gliding in progress) but, not having an RT headset in the aircraft, was unable to transmit an

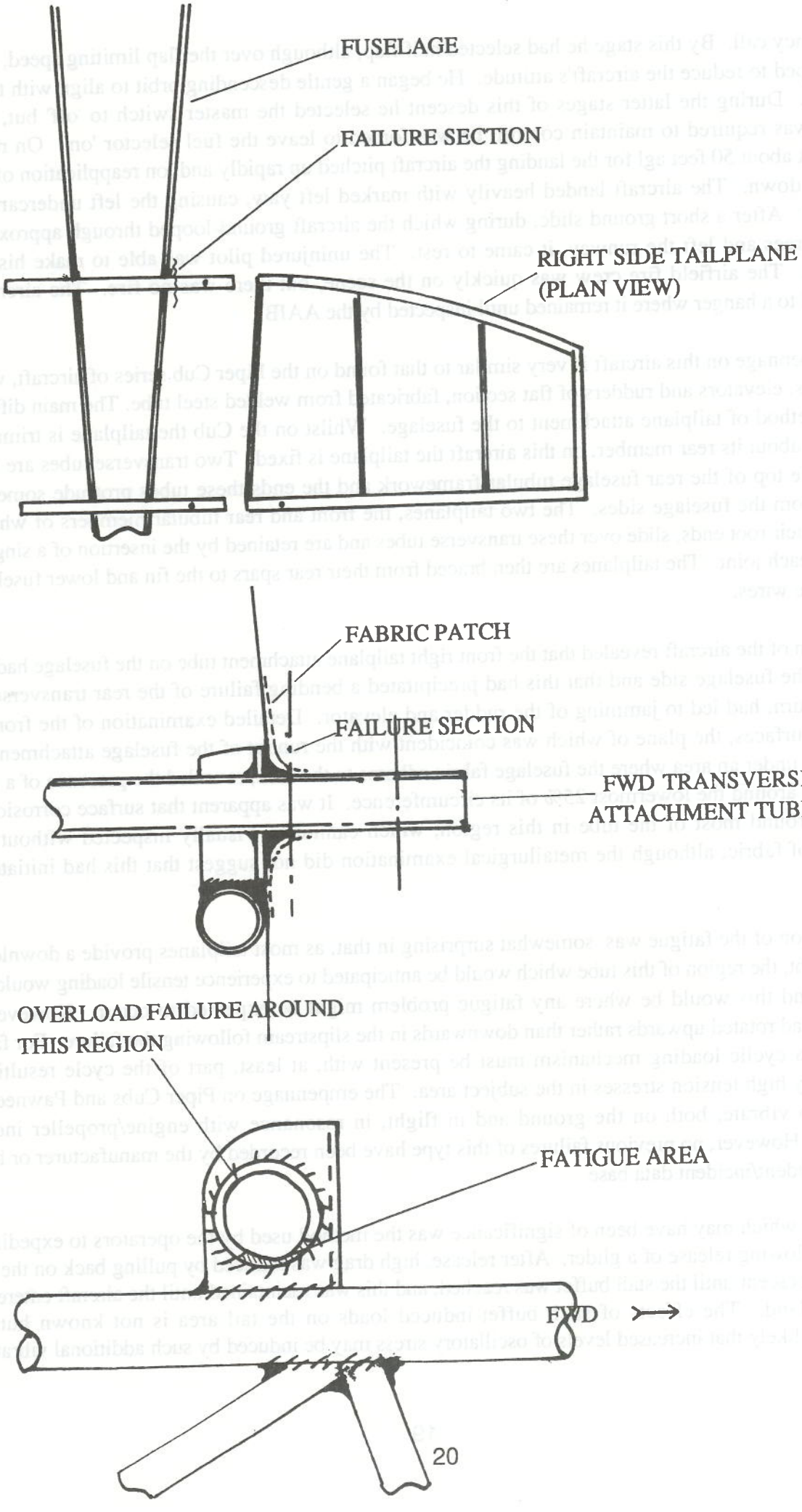
emergency call. By this stage he had selected half flap, although over the flap limiting speed, and this had helped to reduce the aircraft's attitude. He began a gentle descending orbit to align with the main runway. During the latter stages of this descent he selected the master switch to 'off' but, as high power was required to maintain control, he was forced to leave the fuel selector 'on'. On reducing power at about 50 feet agl for the landing the aircraft pitched up rapidly and, on reapplication of power, pitched down. The aircraft landed heavily with marked left yaw, causing the left undercarriage to collapse. After a short ground slide, during which the aircraft ground-looped through approximately 180 degrees and left the runway, it came to rest. The uninjured pilot was able to make his escape unaided. The airfield fire crew was quickly on the scene, but there was no fire. The aircraft was removed to a hanger where it remained until inspected by the AAIB.

The empennage on this aircraft is very similar to that found on the Piper Cub series of aircraft, with the tailplanes, elevators and rudders of flat section, fabricated from welded steel tube. The main difference is the method of tailplane attachment to the fuselage. Whilst on the Cub the tailplane is trimmed by pivoting about its rear member, on this aircraft the tailplane is fixed. Two transverse tubes are welded across the top of the rear fuselage tubular framework and the ends these tubes protrude some 3 to 4 inches from the fuselage sides. The two tailplanes, the front and rear tubular members of which are open at their root ends, slide over these transverse tubes and are retained by the insertion of a single bolt through each joint. The tailplanes are then braced from their rear spars to the fin and lower fuselage by adjustable wires.

Inspection of the aircraft revealed that the front right tailplane attachment tube on the fuselage had failed close to the fuselage side and that this had precipitated a bending failure of the rear transverse tube. This, in turn, had led to jamming of the rudder and elevator. Detailed examination of the front tube fracture surfaces, the plane of which was coincident with the runout of the fuselage attachment weld fillet, and under an area where the fuselage fabric adheres to the tube, revealed the presence of a region of fatigue around the lowermost 25% of its circumference. It was apparent that surface corrosion was present around most of the tube in this region, which cannot be visually inspected without some removal of fabric, although the metallurgical examination did not suggest that this had initiated the fatigue.

The location of the fatigue was somewhat surprising in that, as most tailplanes provide a download in stable flight, the region of this tube which would be anticipated to experience tensile loading would be at the top, and this would be where any fatigue problem might be expected to occur. However, the tailplane had rotated upwards rather than downwards in the slipstream following the failure. For fatigue to occur, a cyclic loading mechanism must be present with, at least, part of the cycle resulting in sufficiently high tension stresses in the subject area. The empennage on Piper Cubs and Pawnees can be seen to vibrate, both on the ground and in flight, in resonance with engine/propeller induced vibration. However, no previous failures of this type have been recorded by the manufacturer or by the CAA's accident/incident data base.

One factor which may have been of significance was the method used by the operators to expedite the descent following release of a glider. After release, high drag was induced by pulling back on the stick in a spiral descent until the stall buffet was reached, and this was maintained until the aircraft entered the circuit to land. The effects of such buffet-induced loads on the tail area is not known but it is considered likely that increased levels of oscillatory stress may be induced by such additional vibration.


FUSELAGE
FAILURE SECTION
RIGHT SIDE TAILPLANE
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FABRIC PATCH
FAILURE SECTION
FWD TRANSVERSE
ATTACHMENT TUBE
OVERLOAD FAILURE AROUND
THIS REGION
FATIGUE AREA
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