ACCIDENT

Aircraft Type and Registration:	Aerola Alatus-M, G-CFDT
No & Type of Engines:	1 Corsair M25Y piston engine
Year of Manufacture:	2008
Date & Time (UTC):	11 June 2010 at 1400 hrs
Location:	Davidstow Airfield, Cornwall
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Propeller separated, damage to right wing and fuselage/ engine
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	72 years
Commander's Flying Experience:	n/k hours (of which 2 were on type) Last 90 days - n/k hours Last 28 days - n/k hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

When reducing engine power after a powered takeoff the pilot experienced high levels of vibration followed by a loud bang, which was caused by the separation of the pylon mounted propeller from the motor glider. The pilot completed an uneventful glide approach and landing. The cause of the propeller loss was the failure of the aluminium propeller shaft. The shaft may have failed during one of two events where movement of the engine pylon structure was sufficient to allow the propeller to strike the engine bay doors whilst it was under power.

History of the flight

After what appeared to be a normal powered takeoff and initial climb to 1,000 ft, the pilot began to reduce the engine power, at which point there was a significant increase in vibration, followed by a loud bang and a rapid increase in engine rpm. After switching off the engine the pilot observed that the propeller had separated from the glider and that the right wing panel had sustained damage. The pilot completed an uneventful glide approach and landing.

Description of the aircraft

The Aerola Alatus-M is a deregulated self-launching motor glider. A propeller is mounted at the top of a hinged pylon located immediately behind the cockpit.

The propeller is attached to the pylon via a pulley and bearing assembly secured to the pylon by an aluminium shaft and a 10 mm diameter steel nut and bolt. A multiple vee belt connects the propeller pulley to a crankshaft pulley on the single cylinder engine, which is mounted at the base of the pylon.

In gliding flight the pylon lies horizontally within the fuselage and is covered by a pair of hinged doors, which are held in the closed position be a rubber bungee. To use the engine for powered flight, an electrical actuator rotates the pylon and propeller assembly into the vertical position, pushing open the engine bay doors in the process, after which the engine can be started.

The engine is controlled through a throttle lever on the left side of the cockpit. After stopping the engine, the pylon can be retracted. This requires the propeller to be in the vertical position, and is accomplished by opening the decompressor valve, which allows the propeller to windmill freely, then extending the propeller lock. The controls for both the decompressor valve and the propeller lock are located on the right side of the cockpit; the propeller lock actuation control is mounted immediately behind the decompressor valve control to prevent inadvertent extension of the propeller lock while the engine is operating.

The propeller lock consists of an aluminium alloy bar pivoted about a point on the pylon structure. When extended, the propeller lock lies in the arc of the propeller, stopping the propeller blades in the vertical position. A rubber cap on the end of the bar prevents damage to the propeller. In the stowed position the lock lies against the pylon structure in a near vertical position. It is spring-loaded to the stowed position.

Previous operational history

Prior to being purchased by the current owner, G-CFDT had been involved in an accident where the propeller had struck the engine bay doors, whilst under power, which damaged the propeller and the bay doors. The manufacturer attributed this event to the limited clearance between the engine bay doors and the propeller, coupled with movement of the pylon in flight. The previous owner had the propeller repaired and, in order to prevent a reoccurrence, 'cut back' the engine bay doors to provide sufficient clearance for the propeller. After completing approximately six flying hours (since new) and replacement of the propeller, the glider was sold.

After purchasing G-CFDT, the current owner had the doors returned to their original profile; on the subsequent powered takeoff the propeller blades struck the engine bay doors. The propeller was repaired and rebalanced and the engine bay doors re-profiled to provide increased clearance for the propeller. The glider completed approximately two additional flying hours before the separation of the propeller on the accident flight.

Examination

The propeller and associated pulley were not recovered but the remains of the shank of the 10 mm mounting bolt, together with its nut were found within the propeller mounting structure. The propeller shaft had failed at the point where it was fitted to the mounting structure. The propeller lock had also been deformed and the rubber end cap was missing. Examination of the bolt shank confirmed that the fracture surface was characteristic of having failed in bending overload; there was no evidence of crack propagation in fatigue.

The fracture surface of the propeller shaft was covered in a thin layer of oily dirt. After cleaning, the fracture surface was found to show characteristics of a failure in bending. The fracture surface had been subject to mechanical wear, which made some of the features indistinct, but no evidence of crack propagation in fatigue was found. Some scoring of the inner diameter of the shaft was also identified. The deformation of the propeller lock was consistent with it having been struck by the rotating propeller, see Figure 1.

Figure 1
Damaged propeller lock

Paint had been transferred from the propeller onto the lock. The pattern of paint transfer indicated that the propeller lock had not been in the fully deployed position when it was struck by the propeller and that after the initial impact the lock had been moved into the fully deployed position before being deformed against the pylon structure.

Analysis

The damage and paint transfer on the propeller lock indicated that it was in a partially extended position when it was struck by the rotating propeller. The position of the throttle and propeller lock control on opposite sides of the cockpit are such that when operating the throttle the pilot would be unable to operate either the decompressor valve or the propeller lock without first releasing the control column. It is therefore possible that the extension of the propeller lock into the arc of the propeller may have been caused by the vibration experienced immediately before the loss of the propeller.

The condition of the fracture surface of the propeller shaft indicated that it had failed some time prior to the release of the propeller, possibly prior to the change of ownership. Given the operational history of the glider it is probable that the propeller shaft failed as a result of one of the two previous propeller strike events. Failure of the shaft would have increased the likelihood of the propeller moving 'out of plane' when rotating, but was not obvious enough to allow easy identification of the shaft's condition. It is possible that, during the incident flight, the increased movement of the propeller caused it to strike the glider's structure when the pilot reduced the engine power during the climb. The subsequent vibration resulted in the movement of the propeller lock which was then struck by the propeller and resulted in the failure of the propeller-retaining bolt and the separation of the propeller assembly.

Safety action taken

As a result of this incident, and reports of a previous propeller shaft failure on another Alatus-M, the manufacturer has produced a new shaft made of stainless steel which will be fitted to all new gliders. The manufacturer will recommend that owners replace the aluminium shaft currently fitted with the stainless steel shaft.

In order to increase the clearance between the engine bay doors and the propeller, the manufacturer has redesigned the engine bay doors fitted to new-build gliders. The manufacturer will recommend that current owners 'cut back' the engine bay doors fitted to their gliders to provide increased clearance.