

CFM Aircraft Ltd Streak Shadow SA-M, G-MGPH, 23 June 2002

AAIB Bulletin No: 2/2003 **Ref:** EW/G2002/06/28 **Category:** 1.4

Aircraft Type and Registration: CFM Aircraft Ltd Streak Shadow SA-M, G-MGPH

No & Type of Engines: 1 Rotax 582 piston engine

Year of Manufacture: 1997

Date & Time (UTC): 23 June 2002 at 1830 hrs

Location: 2.5 miles north of Spalding, Lincs

Type of Flight: Private

Persons on Board: Crew - 1 Passengers - 1

Injuries: Crew - None Passengers - None

Nature of Damage: Damage to nosewheel assembly

Commander's Licence: Private Pilots Licence (Microlights)

Commander's Age: 44 years

Commander's Flying Experience: 1,500 hours (of which 90 were on type)
Last 90 days - 38 hours
Last 28 days - 16 hours

Information Source: Aircraft Accident Report Form submitted by the pilot, further enquiries and metallurgical examination by the AAIB

The aircraft was cruising at approximately 2,000 feet agl when the engine rpm suddenly increased from the normal cruise power setting of 6,000 rpm. The pilot retarded the throttle, established a glide descent and soon became aware that the propeller had detached. The flying controls felt normal and a check of the aircraft showed that the propeller had not made contact with the structure. He selected a field for landing, trimmed the aircraft, lowered the flaps, shut down the engine and instructed the passenger to tighten his seat belt. The aircraft touched down gently, but as it came to rest the nosewheel rolled into a ditch and was damaged. Both occupants vacated the aircraft without injury.

Previous accidents

This aircraft also lost its propeller whilst in the cruise at 1,000 feet on 29 July 2001 (reported in AAIB Bulletin 4/2002). The pilot carried out a forced landing and both he and his passenger were uninjured. On 20 May 2002 a propeller detached from a similar aircraft belonging to the manufacturer. This event, which occurred during a demonstration flight, also resulted in a successful forced landing.

Metallurgical Examination

The propeller together with the head end of the bolts was not recovered. The detached threaded ends of the six propeller attachment bolts were removed from the gearbox flange and subjected to metallurgical examination. This showed that the bolt failures were due to simple bending fatigue. Five of the ends were of approximately the same length, the sixth was about two and a half thread pitches (3.3 mm) longer. The fracture face on this piece was corroded and it had been subsequently mechanically damaged. This could possibly have been the first bolt to fracture.

Hardness checks showed the bolt material exceeded the minimum strength requirements. However, the ends were not of the form expected on roll thread fasteners as they appeared to have been sawn and were relatively heavily corroded. It was not possible to confirm whether the bolt heads had been wired locked together in accordance with the manufacturers proposed modification.

The propeller and its installation

The three-bladed propeller installed on this aircraft is used in the pusher configuration. Each of the laminated wooden blades is mounted in a two-part plastic pitch block which allows the blade to be set at the desired pitch angle. The blades are then clamped between two aluminium hub plates to form the propeller assembly that is secured by six bolts to the gearbox flange.

At the time of the first accident, in July 2001, the design was for the propeller assembly to be attached by six M8 DIN 931 bolts which were screwed into threaded holes on the gearbox flange and torqued to 10 ft lbf. Locking was provided by stiff nuts installed on the threaded portion of the bolt protruding through the gearbox flange. The propeller separated from the gearbox flange due to the progressive failure in fatigue of a number of the propeller mounting bolts. The remaining bolts failed in overload, causing the sudden loss of the propeller. The most likely source of the problem was considered to be the incorrect torque tightening of the propeller mounting bolts, or loosening in service, allowing bending loads to be applied to the bolts.

This method of mounting the propeller is only used on factory-built Shadow aircraft such as GMGPH. With this method, it was recognised that it was possible to torque tighten the stiff nut to obtain the 10 ft lbf. torque value without the mounting bolt itself being correctly torqued, so that the propeller was not fully seated on the gearbox flange. To prevent the possibility of incorrect assembly, the aircraft manufacturer recommended drilling out the threads in the gearbox flange and installing oversize bolts that pass through the gearbox flange. The propeller would then be clamped to the gearbox flange by the action of torque tightening the stiff nuts. No incidents have subsequently been reported with this propeller attachment method.

Manufacturers action

The manufacturer issued Service Bulletin 16, dated 11 June 2002, concerning the procedure for fitting new bolts. It stated: ensure that all six bolts are evenly torqued to 12-14 ft lbs, and that the bolt is not thread-bound in the gearbox output flange. When refitting the Stiff-Nuts (8-10 ft lbs) ensure that the bolt in question is prevented from turning.

The aircraft manufacturer also proposed a modification to the method of propeller attachment using hexagon-head steel bolts screwed directly into the threaded gearbox flange. Positive locking was provided by wire-locking between the bolt heads. It was considered that this modification should ensure correct installation of the propeller and the wire-locking would provide a visual means of checking the security of the bolts. This method was used on G-MGPH following repair after the first accident. The aircraft had flown 8.5 hours with this propeller configuration when it detached.

CAA action

As a result of the accidents in July 2001 and May 2002 the CAA issued a Mandatory Permit Directive (MPD) 2002-004 R1 CFM dated 20 June 2002 that is reproduced below:

***Applicability:** CFM Shadow D, Shadow D-D and Steak Shadow aeroplanes fitted with a Rotax 582 engine and a Precision propeller, where the propeller mounting bolts are installed through threaded holes in the gearbox output flange. The MPD is not applicable to aeroplanes where the propeller mounting bolts pass through plain holes in the gearbox output flange.*

***Compliance:** Before further flight from the effective date of this MPD revision, determine the time in-service of the propeller hub mounting bolts. Bolts that have either exceeded 25 hours time in-service or for which time in-service is not known, must be replaced before further flight with new bolts in accordance with the manufacturers Service Bulletin No 16. New bolts must be replaced at intervals not exceeding 25 hours time in-service.*

Further Information

There are no other aircraft with this propeller attachment modification. The MPD remains applicable to aircraft where the propeller mounting bolts are installed through threaded holes in the gearbox output flange. Since this accident the manufacturer has ceased trading.