

## MICROLIGHT AIRWORTHINESS APPROVAL NOTE

MAAN NO:1877

ISSUE 2

DATE: 20 JUNE 2005

TITLE: Microlight Airworthiness Approval Note 1877, Shadow D, DD and D-SS aircraft, resolution of pitch circuit resonance (elevator flutter) concerns.

STAGE: Approval.

### 1. INTRODUCTION

The CFM Shadow D, DD and D-SS are Type Approved microlight types described in Microlight TADS BM55.

During the flight testing of a prototype Shadow ED aircraft, G-THAI under authority of MAAN 1824 it was found that the aircraft suffered from a divergent resonance of the pitch control circuit; this was considered unacceptable and also non-compliant with BCAR S181. The sole currently flying example of the Shadow D-SS, G-MZLP was subsequently tested and shown to display similar characteristics.

Following on from this, the BMAA conducted sample testing of two Shadow DD aircraft and four Shadow CD aircraft. Based upon this, the following conclusions were reached:-

- (1) Shadow CD aircraft (and thus by read-across, the B, BD and C aircraft) do not show any significant tendency towards pitch circuit resonance.
- (2) Shadow D-SS and DD aircraft (and thus by read-across D aircraft) do show a tendency towards pitch circuit resonance, which can become divergent. Where this becomes divergent it is unacceptable, in other cases, it is still a cause for concern.

It was therefore decided that action was required to minimise the risk of a flutter related accident in a D, DD or D-SS Shadow.

Issue 1 of this MAAN released Service Bulletin MAAN 1877/1 issue 1 which required a mandatory test flight before further flight, immediate grounding of any aircraft which showed divergent elevator flutter, and in any case grounding of all aircraft in this series from 20 June 2005 unless a permanent solution to the problem of elevator flutter could be found.

A modification has been developed which eliminates this tendency towards elevator flutter successfully; it does so by introducing an elevator friction damper. This MAAN approves this modification, and authorises issue of a mandatory service bulletin No. MAAN 1877/2 issue 1 associated with that modification.

## 2. BASIS FOR APPROVAL

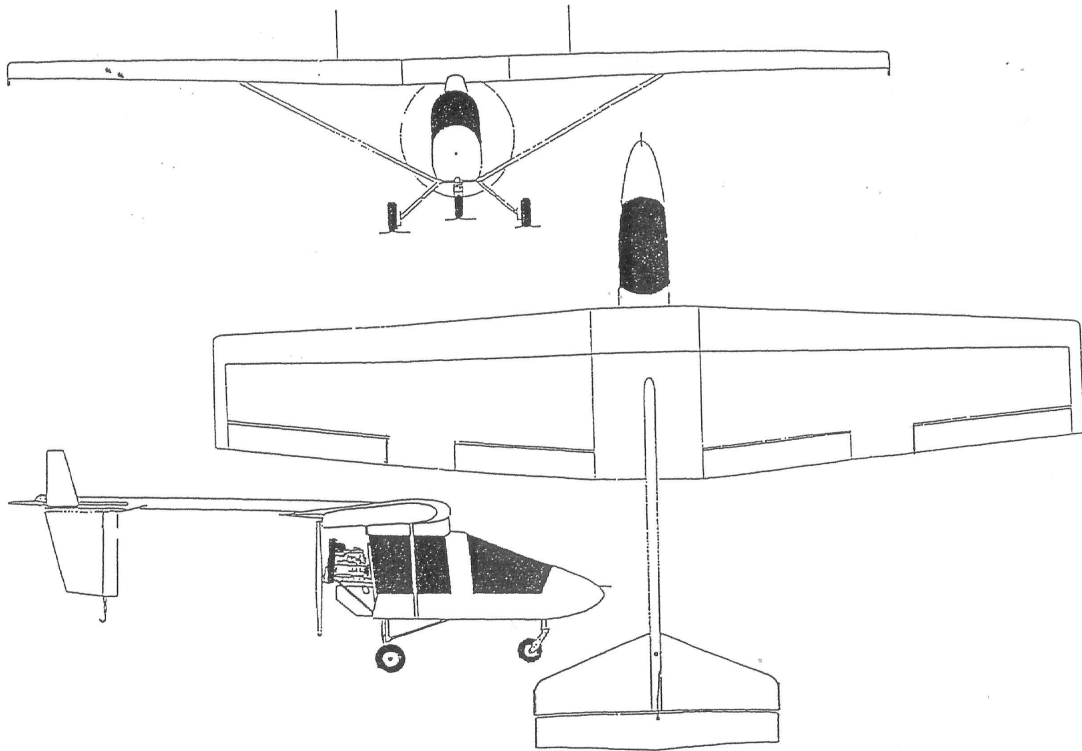
The basis for approval is as shown in TADS BM55 in its latest issue.

## 3. DESCRIPTION

The CFM Shadow is a series of microlight aeroplanes as illustrated below. The BMAA has airworthiness oversight of the B, C, BD, CD, D, DD and D-SS variants of this aircraft. In brief summary, the differences between these are:-

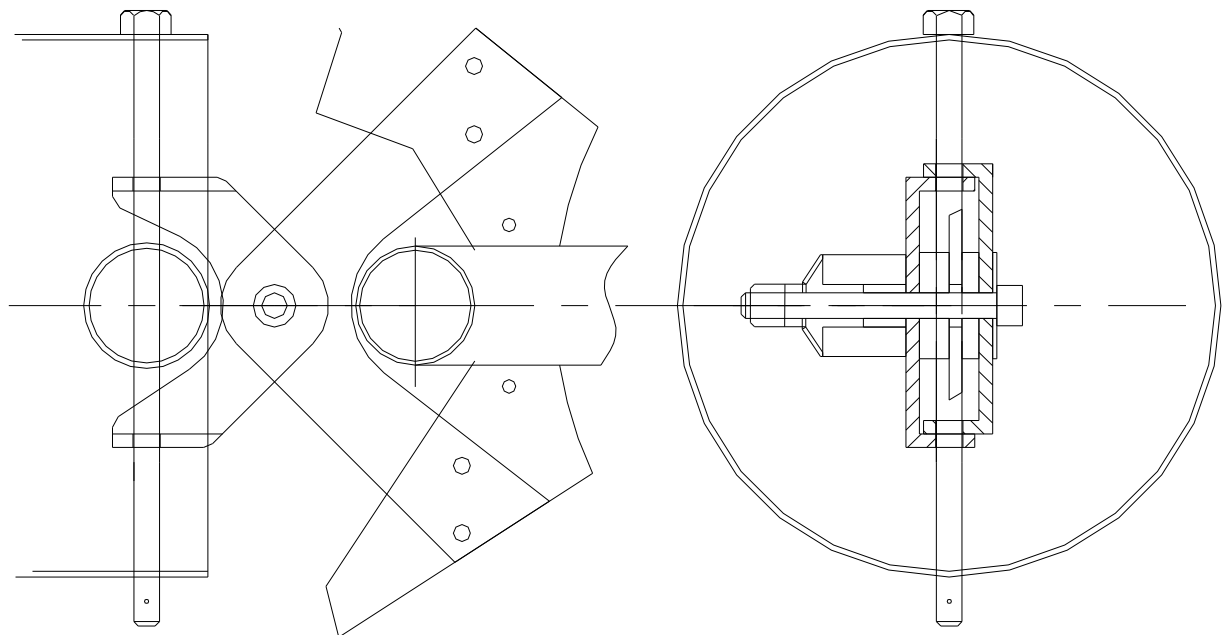
<u>Model</u>	<u>Engine</u>	<u>Wing</u>	<u>Struts</u>	<u>Other details</u>
B or BD	Fuji EC44PM, or Rotax 447	Original version	Round section	Narrowbody fuselage, MTOW 348kg or 374 kg
C or CD	Rotax 503 or 462	Original version	Aerofoil section	Narrowbody fuselage, MTOW 374kg
D or DD	Rotax 582	Stiffened compared to C	Aerofoil section	Widebody fuselage, MTOW 386kg
D-SS (Single seat)	Rotax 912	Similar to D	Aerofoil section	Widebody fuselage, MTOW 386 kg

(The “D” at the end of each name implies dual controls and is the most common variant of each model.)



Amateur build Shadow D and DD, Streak Shadow and Starstreak aircraft also exist under the supervision of the Popular Flying Association, but lie outside of the scope of this MAAN.

The device to be fitted to the aircraft consists of a series of greased nylon discs under compression, the tension on which may be adjusted, altering the rotating breakout+friction value. This is illustrated below:-



#### 4. TECHNICAL INVESTIGATION

During the flight testing of a prototype Shadow ED aircraft, G-THAI under authority of MAAN 1824 it was found that the aircraft suffered from a divergent resonance of the pitch control circuit; this was considered unacceptable and also non-compliant with BCAR S181. The sole currently flying example of the Shadow D-SS, G-MZLP, was subsequently tested and shown to display similar characteristics.

Following on from this, the BMAA conducted sample testing of two Shadow DD aircraft and four Shadow CD aircraft. Based upon this, the following conclusions were reached:-

- (1) Shadow CD aircraft (and thus by read-across, the B, BD and C aircraft) do not show any significant tendency towards pitch circuit resonance.
- (2) Shadow D-SS and DD aircraft (and thus by read-across D aircraft) do show a tendency towards pitch circuit resonance, which can become divergent. Where this becomes divergent it is unacceptable, in other cases, it is still a cause for concern.

It was therefore decided that:-

- (1) Whilst no airworthiness action is to be taken in respect of Shadow B, BD, C and CD aircraft, airworthiness monitoring of the type is to be enhanced. This is outside of the province of this MAAN and only mentioned here for completeness.
- (2) All Shadow D, DD and D-SS aircraft were to be flown by a BMAA or CAA Test Pilot before further flight.
- (3) Any Shadow D, DD or D-SS shown to suffer from pitch circuit resonance were not to be flown until a BMAA or CAA approved modification had been made to the aircraft rectifying this.
- (4) All Shadow D, DD and D-SS aircraft were, in any case, to be modified by fitment of suitable modification, approved by BMAA or CAA, no later than Monday 20 June 2005, otherwise the aircraft were not to be flown.

This MAAN approves and mandates this modification, and an associated Service Bulletin No. MAAN 1877(1) issue 2 which is at Appendix A to this MAAN. The modification is a development from one designed for a PFA administered Streak Shadow, G-MYTY which was found after initial flight testing in 1995 to suffer from severe and divergent elevator flutter similar to that which has been found by BMAA on E and D series aircraft.

The modification is described in Section 3 above, and fitting and adjustment instructions are given in Appendix A to this MAAN.

#### 5. FLIGHT TESTING

Development and then approval flight testing of this modification has been carried out by a BMAA Test Pilot familiar with the type; in all but the most severe and deliberate excitation, elevator flutter did not occur. Longitudinal handling was degraded, in that the trim speed band was increased, but it remained within the requirements of the approval basis for the aircraft, and

was also considered acceptable.

Flight test results were reviewed separately by the BMAA technical office, CAA Flight Test Dept. and by Prof. George Done who is a flutter specialist. All considered that in this finally tested configuration the modification was satisfactory.

## 6. MANUALS, PLACARDS AND INFORMATION

BMAA SB MAAN 1877/2 issue 1 (which is at Appendix A to this MAAN) is to be retained with the logbook for all affected aircraft. In addition, the Shadow C and CD Service Manual (no separate manual exists for the D series aircraft) is to be amended at page 6-16 as shown by the SB, where that manual is used for a D, DD or D-SS Shadow.

In all other respects the aeroplane must be placarded and maintained according to TADS BM55 in its latest issue.

## 7. NOISE CERTIFICATION

Noise certification is unaffected.

## 8. RADIO

Any aircraft radio installation is not affected by this note.

## 9. INSPECTION

In accordance with procedures agreed between the BMAA and Broom Engineering (originally detailed in MAAN 1872), each mod kit is to be supplied with an installation drawing and parts list, which is to be checked and signed by a BMAA inspector (in category B); that document is then to be retained aircraft with documentation, acting as a certificate of conformity for the part. Broom Engineering will also separately supply a copy of each such document to the BMAA, identifying the aircraft for which it was supplied.

Subsequent inspection is to be to TADS BM55, this MAAN and the Service Bulletin at Appendix A to this MAAN.

## 10. WEIGHT AND BALANCE

The aircraft weight and balance is modified by the addition of 0.12 kg at 143 inches aft of datum; this will move the CG aft by about 0.05", and is not sufficiently significant to require preparation of a new W&CG report.

## 11. SIGNIFICANT FEATURES AND LIMITATIONS

A pitch damping mechanism is introduced, fitted at the elevator control horn (rear of the aircraft boom tube, above the fixed horizontal stabiliser).


## 12. CERTIFICATION

BMAA Major modification No. 1877 is approved, consisting of an elevator pitch damper for fitment to CFM Shadow D, DD and D-SS aircraft.

All CFM Shadow D, DD and D-SS aircraft must comply with the Service Bulletin at Appendix A before the first flight following 20 June 2005.

It is recommended that UK CAA issues a Mandatory Permit Directive (MPD) supporting the Service Bulletin at Appendix to this MAAN.

It is recommended that UK CAA passes details of this MAAN to all foreign authorities believed to have Shadow series aircraft on their national register.

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### Initial Distribution:

- CAA Aircraft Projects Dept (Gatwick), 2 copies: *FAO Mr A Love, Mr N Williams*
- CAA Flight Test Dept (Gatwick),: *FAO Mr C Taylor*
- MAAN File 1877
- Shadow Flight Centre, Old Sarum.
- Chief Engineer, PFA (*Mr. Francis Donaldson*)
- Chairman, AOPA (*Prof. George Done*)
- Broom Development Engineering, *FAO: Mr M Broom*

(Appendix A only):

- All registered owners of type approved Shadow D, DD and D-SS aircraft.