

MICROLIGHT AIRWORTHINESS APPROVAL NOTE

MAAN NO: 1773

ISSUE 1

DATE: 26 August 2005

TITLE: Microlight Airworthiness Approval Note 1773, Cook replacement undercarriage for CFM Shadow aircraft (all microlight variants).

APP: All Microlight CFM Shadow Aircraft.

STAGE: Approval.

1. INTRODUCTION

The CFM Shadow is a microlight aircraft, which exists in a number of variants described in Microlight TADS BM6, BM19, BM40, BM41 and BM55. Most variants of the aircraft administered by the BMAA are type approved, although some C series variants hold amateur built permits to fly, as it is intended will a single "E-series" Shadow which is currently under investigation under project number BMAA/HB/239.

This MAAN refers primarily to a modification proposed by D G Cook of Hillcrest, Aldringham, Leiston, Suffolk IP16 4QL. This modification replaces the main gear with a unit of new design and manufacture as a direct replacement.

In addition, this MAAN re-states a mandatory periodic inspection for all such aircraft, to be included within the maintenance manual, of the nosegear assembly following concerns of some nosegear failures having occurred due to incorrect adjustment of the nosegear bungee. This was first introduced in MAAN 1762 and is repeated here for completeness.

In addition, this MAAN re-states a modification to the TADS for each variant of the Shadow increasing the maximum permitted empty weight. This was first introduced in MAAN 1762.

These modifications are in response to a grounding of the Shadow type by UK CAA following an analysis of the existing undercarriage design and history by the authority which concluded that the existing maingear in particular was unsafe and should not be permitted to continue flying.

2. BASIS FOR APPROVAL

The basis for approval is BCAR Section S issue 3 with the exception that propeller ground clearances are not shown to comply, but the design is accepted on the basis of no decrease in propeller clearance and no increase in undercarriage displacement with load compared to the existing undercarriage (which has no history of propeller strikes whilst the undercarriage remained intact).

3. DESCRIPTION

The CFM Shadow is a tandem pusher 2-seat microlight aeroplane, a description of the design of which may be found in its operators manual.

The “Cook” undercarriage consists of an aluminium alloy main member, to which the axles are bolted, braced by a steel rod. The ends of the rods have rubber springs attached, contained within aluminium cylinders, for load transmission. New tyres are also used.

4. TECHNICAL INVESTIGATION

The main gear has been shown fully to comply with BCAR Section S issue 3 with respect to all requirements that affect the integrity of the undercarriage and its attachments for aircraft weights up to and including 408kg (MTOW) with a wing area equivalent to that of any currently approved Shadow variant, including the PFA Streak Shadow. This analysis, and test reports, is held in the BMAA project file associated with this MAAN.

It has been shown that the new main undercarriage is as stiff as the previous with larger radius tyres and extremely similar (vertical) geometry; it therefore offers no increase in risk of propeller strike. This aspect is therefore approved on the basis of “no worse than before” combined with no history of propeller strikes, rather than absolute compliance with the standard.

The nose gear has no history of failure when correctly adjusted, and therefore has not been replaced. Analysis carried out by the Popular Flying Association (PFA) and accepted by the BMAA has shown that a correctly adjusted nose gear is not subject to failure in normal operating conditions. PFA have reported this analysis in *MOD/206/002*, which is the basis for Appendix A of this MAAN.

Data has been supplied by Rotax for the 503 and 582 engines which allows an increase in maximum permitted empty weight for all C and D variant Shadows based upon a reduction in Maximum Continuous RPM from the current (single tier) limit to 6000, whilst leaving

maximum take-off power unchanged. This is read across also to the Rotax 447 fitted to the B series Shadow. Specifically:

D series (582) Fuel consumption at MCP is reduced from 25 litres/hr to 21 litres per hour, permitting an increase in maximum permitted empty weigh of 2.9kg (nominally 3kg), from 196kg to 199kg.

C series (503) Fuel consumption at MCP is reduced from 21 litres/hr to 19 litres/hr, permitting an increase in maximum permitted empty weight of 1.5kg, from 187kg to 188.5kg.

B series (447) Fuel consumption at MCP is reduced from 21 litres/hr to 19 litres/hr, permitting an increase in maximum permitted empty weight of 1.5kg, from 187kg to 188.5kg.

The weight increase due to the installation of this undercarriage is 3.2kg; this will not necessarily permit the undercarriage to be fitted to all currently legal aircraft.

The forward and side view cross-sections of the aircraft are extremely similar and it is therefore judged that performance and handling of the aircraft will be unchanged.

Given that the undercarriage is now fully compliant with structural requirements it is also considered that previous CAA prohibition on fitment of the fibrelam “slipper” fuel tank may be removed. Therefore compliance with this MAAN cancels SB 1193.1 (Removal of slipper tanks).

5. FLIGHT TESTING

Flight testing, including extensive ground handling assessment and a large number of deliberate hard landings, on a variety of surfaces, has been carried out on a sample aircraft (Streak Shadow, G-MEOW) for the PFA. This testing is considered acceptable by the BMAA, and is held on the BMAA project file associated with this MAAN.

A check flight in accordance with flight test schedule BMAA/AW/011 has been carried out on a sample aircraft (Shadow CD, G-MJVF). This testing is considered satisfactory and the results are held on the BMAA project file associated with this MAAN.

6. MANUALS, PLACARDS AND INFORMATION

Appendix A to this MAAN is to be added as an Amendment to the Operators manual for all Shadow aircraft, including those to which another approved maingear is fitted.

Appendix B to this MAAN shows the worksheet for manufacture of this undercarriage. A copy of this worksheet must be completed for each undercarriage set, (including a signature by a BMAA inspector authorised for the purpose) and becomes the MANUFACTURE

CERTIFICATE OF CONFORMITY for the undercarriage. A copy of each certificate must be supplied to the BMAA by the manufacturer - along with clear indication to which aircraft registration the unit has been supplied. The original copy of this worksheet is to be supplied (once completed by the manufacturer) with the completed undercarriage and shall be retained with the aircraft logbook once the undercarriage is fitted.

Appendix C to this MAAN shows the worksheet for installation of this undercarriage. A copy of this worksheet, when completed, becomes the INSTALLATION CERTIFICATE OF CONFORMITY for the undercarriage; this is to have been supplied by the manufacturer (for completion by the installer) with the completed undercarriage and shall be retained with the aircraft logbook once the undercarriage is fitted. The inspector signing for the installation may not be the same person as has carried out the fitment of the undercarriage.

In all other respects the aeroplane must be placarded and maintained according to TADS BM6, BM19, BM40, BM41 and BM55 as applicable.

7. NOISE CERTIFICATION

Noise certification is not affected by this note.

8. RADIO

Any aircraft radio installation is not affected by this note.

9. INSPECTION

To TADS BM6, BM19, BM40, BM41, BM55 as applicable, this MAAN and the operators manual.

A new 50 hour/annual inspection action is introduced, as described at Appendix A to this MAAN.

10. WEIGHT AND BALANCE

The aircraft weight is increased by 3.2kg at 46.75" AoD; procedures for addressing this are included at the end of Appendix C to this MAAN.

11. SIGNIFICANT FEATURES AND LIMITATIONS

The main gear is replaced with a new item of similar appearance to the original main gear, but of more substantial construction.

A new inspection action is introduced; see Appendix A.

12. CERTIFICATION

12.1 I certify that a CFM Shadow B, BD, C, CD, or DD aircraft that complies with this MAAN has an undercarriage that is acceptable and fully compliant with the certification basis, and therefore may continue to fly under, and have revalidated, a Microlight permit to fly.

Prepared by:

Authorised by:

C J Van Ingen
[Under the supervision of JAF Viner]
British Microlight Aircraft Association

J A F Viner
Deputy Chief Technical Officer
British Microlight Aircraft Association

Initial Distribution:

D Cook
N Townsend

BMAA: All registered owners of B, BD, C, CD and DD Shadows.
MAAN File 1773
NCR File 19

CAA: Light Aircraft Certification Section (Gatwick)
Applications and Certifications Section (Gatwick)

Appendix A - Addendum to Section 16.2 of Shadow Maintenance Manual

(To be applied at 50 hour and annual checks).

Actions required:

1. Place the aircraft on level ground, and drain all fuel.
2. With a person of average weight (between 77 Kg and 90 Kg) occupying the front cockpit, and rear seat empty, check visually that the nosewheel suspension is on the stop i.e. there is no deflection of the noseleg suspension from the fully extended position.
3. Check visually that when an additional weight of 10-20 Kg is applied to the top of the nosecone, in the vicinity of the top of the instrument panel, the nosewheel suspension comes just off the stop.
4. If the noseleg is off the stop at stage 2 above, or does not come off the stop at stage 3 above then the noseleg bungee is incorrectly installed or has deteriorated in condition, and must be replaced in accordance with the CFM instructions, setting the pre-tension so as to satisfy the criteria of stage 2 and 3 above.
5. Inspect the noseleg in the vicinity of the noseleg suspension stop cable. If there is evidence of wear of the noseleg through contact with the cable, more than 5 thousands of an inch deep, then the noseleg must be replaced, checking on completion that the bungee pre-tension has been set such that the criteria of stages 2 and 3 above are complied with.
6. Inspect the bungee for signs of fraying, or rotting of the outer braid, or necking/failure of the internal rubber cords. If any of these conditions exist then the bungee must be replaced in accordance with the CFM instructions and complying with the criteria of stages 2 and 3 above.
7. Refill fuel tank as required, to avoid condensation forming in fuel tanks.

Appendix B – Manufacturing worksheet and Certificate of Conformity

Undercarriage Serial No. _____

Undercarriage assembler _____

Work date: _____

Supplied to aircraft: G-_____

A. Pre-assembly inspection/Parts checklist

Notes:

1. Check all items against drawings for presence, dimensions and surface treatment and record below.
2. Identify Certificates of Conformity for materials and record below.

Item	Item Description	Part No	Qty	Condition	Inspected (state condition e.g. satisfactory)	Material C of C ref. No
1	AN3-12A Bolts	-	8	Cad. Plate		
2	AN3-13A Bolts	-	4	Cad. Plate		
3	AN3-15A Bolt	-	2	Cad. Plate		
4	AN4-13 Bolt	-	2	Cad. Plate		
5	AN4-13A Bolt	-	2	Cad. Plate		
6	AN4-17A Bolts	-	4	Cad. Plate		
7	10-32 UNF Nyloc Nut	-	14	Cad. Plate		
8	¼-28 UNF Nyloc Nut	-	6	Cad. Plate		
9	¼-28 UNF Plain Nut	-	4	Cad. Plate		
10	¼-28UNF Castellated Nut	-	2	Cad. Plate		
11	Split Pin St St	-	4	Self Colour		N/a
12	3/16" Plain Washer	-	6	Cad. Plate		
13	¼" Plain Washer	-	10	Cad. Plate		
14	5/16" Plain Washer	-	2	Cad. Plate		
15	M8x75 Socket Head Cap Screw, Grade 12.9	-	2	Bright Zinc Plate (BZP)		
16	M8 Nyloc Nut	-	2	BZP		
17	Main u/c leg	573	1	Powder coat		
19	Drag Strut Plate RH	578-A	2	Paint		
20	Drag Strut Plate LH	578-A	2	Paint		
21	Axles	572-A	2	Paint		
23	Stand-Off	584	2	Paint		
24	Clevis - Female	577	2	Paint		
25	Clevis - Male	576	2	Paint		
26	Cylinder	575	2	Paint		
27	End Plate	580	2	Paint		
28	Rubber Bushes	581	4	N/a		N/a
29	Spacer	582	2	Paint		
30	Tie Rod	583	1	Paint		
31	Trelleborg Tyres	-	2	N/a		N/a

B. Assembly

1. Assemble items checked in section A above in accordance with drawing A101-A. This worksheet is void without a copy of drawing A101-A attached.

Undercarriage assembler's declaration:

The undercarriage, with the following serial number and detailed in drawing A101-A, has been assembled in accordance with drawing A101-A, this worksheet and MAAN 1773.

Signed:..... Date:

C. Quality Control Procedure

1. Ensure table in part A is complete.
2. File Certificates of Conformity for all materials, for future reference.
3. Sign undercarriage assembler's declaration in B above.
4. Submit assembled undercarriage and this paperwork to BMAA inspector for inspection/signing off.

D. BMAA Inspection

This section is to be completed by BMAA inspector.

Item	Activity	Initial
1	Documentation check (Sections A & B completed by u/c builder)	
2	Visual check of u/c assembly against drawing A101-A	

The work recorded above has been completed to my satisfaction and in that respect the undercarriage is considered fit for attachment to the aircraft.

Signed:..... Authorisation Ref:..... Date:
(inspector number)

Appendix C – Installation worksheet and Certificate of Conformity

Aircraft type: _____

Registration: _____

Owner/Operator: _____

Undercarriage fitter: _____

Work date: _____

Introduction

The undercarriage is supplied with the axles fitted and the tie rod assembly fitted and adjusted. It is therefore only necessary to fit the main gear to the fuselage, attach the drag struts, fit new tyres to the original wheels and re-fit the wheels to complete the job. None of the original fuselage attachments are altered.

This document must be read in conjunction with drawing A101-A.

Undercarriage manufacturer:

D G Cook
Hillcrest
Aldringham
Suffolk IP16 4QL Tel 01728 453209

Removal of Existing Undercarriage

1. Drain all fuel from fuel tanks
2. Remove Slipper tank – if fitted.
3. Place weight in front cockpit and chock nose-wheel.
4. Raise airframe by lifting main wheels until they are clear – ensure stability. It is recommended that the wings are removed. (Hint – alternatively build a timber stool that fits snugly under the fuselage behind the main gear and let the tyres down).
5. Disconnect brake cables from wheel connections.
6. Remove wheels.
7. Unbolt Drag Struts from U/C – at leg end only.
8. Unbolt U-bolts by removing nuts inside rear cockpit.
9. Remove U/C from airframe.

Installation of Aluminium Type Undercarriage

Note – Axle axis is biased forwards.

1. Attach U/C with 4 x AN4-17A bolts. Fit washers beneath nuts.
2. Attach # 578 Plates to Drag Strut with AN3-15A bolt.
3. Line up # 578 Plate on U/C leg & drill 2 x 3/16" dia holes through U/C leg using # 578 Plate as a guide. The drag struts should just touch the main gear. Note: do not "stretch" holes in drag struts. In the event of an unsatisfactory fit being possible (due to assembly tolerances during the construction) new drag struts should be fitted and drilled accurately to suit. Both drag struts should be the same distance up the leg.
4. Secure Drag Strut to U/C leg with 4 x AN3-13A bolts.
5. Repeat procedure for other U/C leg.
6. Position brake assembly to locate on its Stop bolt.
7. Install Aluminium Sleeve between brake & wheel.
8. Re-fit wheels using a new split pin through the castle nut.
9. Connect brake cables and adjust if necessary.

To Fit New Tyres

1. Deflate tyre and unbolt wheel halves.
2. Fit new Tyre & tube – avoid pinching tube between wheel halves.
3. Inflate to 24psi.
4. Fit wheels to U/C. Use new split pin through axle to secure.
5. Lower the airframe.

Complete installation by replacing Slipper Tank if fitted.

Checklist

Item	Detail	Builders check (initial)	Inspectors check (initial)
1.	Presence and tightness of AN4-17A bolts, Nuts and washers fixing main gear to fuselage.		
2.	Correct fitting of drag strut to main gear i.e. no oval holes in drag struts or main gear.		
3.	Brakes and cables correctly fitted and adjusted.		
4.	Trelleborg tyres fitted and pressurised to 24psi.		
5.	Wheel nut secured with new split pin.		
6.	M8 Cap screws attaching tie rod assembly to main gear tight (20 ft.lb torque)		
7.	Tie rod clearance present at ends of cylinder and tie rod not slack. (This is set before the u/c is delivered but can be checked by grasping tie rod and attempting to push and pull along its axis).		
8.	AN4 clevis bolts not over tightened and thereby pinching clevis joint. (This is set before the u/c is delivered but can be checked by applying light pressure to the centre of the tie rod and observing slight up or down movement of the cylinder).		
9.	Check all fuel lines, tank fittings, wiring etc as appropriate from dismantling		
10.	Inspectors independent overall check for condition alignment, good workmanship, fuel tank /fuel line refitting etc or any other factor related to the undercarriage work.		

Inspectors Declaration

The work recorded above has been completed to my satisfaction and I hereby certify that the aircraft has been modified in accordance with MAAN 1773 issue 1.

A new weight and balance sheet is to be prepared (form BMAA/AW/028) showing the addition of 3.2kg at 46.75" AoD, OR a new weighing may be carried out (recorded on the same form). Re-weighing is not mandatory unless the aircraft has not been reweighed within the last 5 years.

AIRCRAFT LOGBOOK HAS BEEN ANNOTATED ACCORDINGLY

Signed:..... Authorisation Ref:..... Date:
(inspector number)