

## **APPROVAL OF PROTOTYPE MODIFICATIONS**

### **1. Introduction**

One of the privileges of operating under an LAA Permit to Fly is the freedom it grants the owner to design modifications and have them approved by LAA Engineering rather than the CAA.

Prototype mods are treated as one-off modifications applicable only to the aircraft referred to in the application. If the modification is simple and/or sufficiently repeatable, members may apply to incorporate an already-approved Prototype mod on subsequent aircraft as a Repeat mod (see TL 3.07).

A modification proposal form is used to enable Prototype mod applicants to record the relevant information and submit it for LAA Engineering assessment. A unique number is then assigned to the mod which is used for all future correspondence. The LAA's role in the process is firstly to understand the detail of what is proposed and secondly to verify that the airworthiness of the aircraft to which it is applied is not adversely affected. It is important therefore to ensure that any drawings and description are clear and understandable: remember the LAA Engineers do not have the aircraft in front of them. It is also important to think about how aspects of the airworthiness may be affected by the proposed change. This includes ensuring the strength reserves are maintained and that the performance and handling are not significantly degraded. Whatever the modification, it should be coherently presented and supported with justification from the applicant as to why he or she considers that the aircraft will still be as safe as it was before the modification was fitted. Full details of what is being fitted/modified, where and how must always be included.

We are well aware that many builders may have little experience of the paperwork side of aircraft design, this but this need not be a problem. Included is a list of individuals who are keen to carry out design work on LAA aircraft and who might be able to help with detailed draughting or stressing of your mod if required. Unfortunately, LAA Engineering is unable to create mod descriptions or substantiation on behalf of applicants. This would not only overwhelm LAA resources in a way which would be unfair to other members, but it would also compromise the LAA's regulatory responsibility to independently check design submissions.

You will need to discuss your ideas with your inspector before submitting the form. There is then usually a period of correspondence with LAA Engineering to establish if the mod is viable and clarify the definition and substantiation activities. It is important to wait until you obtain approval from LAA Engineering before permanently installing the mod to your aircraft. This will avoid costly re-working if we subsequently find the proposal unacceptable. The drawings and calculations submitted by you will form the basis by which your inspector can eventually sign off the workmanship and conformity of your mod.

It is also normal to expect modifications to have been approved by the original designer of the aircraft – most homebuilt designers are happy to look at other builders' suggestions and pass comment. Designers are naturally upset if they find examples of aeroplanes flying around bearing their names as designer but the aeroplane looks nothing like what they drew in the first place and they have had no input in the design of the modification.

### **2. Charges for Approval of Modifications**

Provision of services such as this where Engineering resources are deployed to support a specific LAA member are subject to additional fees, these are published on the website ([www.laa.uk.com](http://www.laa.uk.com)) and in each issue of *Light Aviation*. Due to the engineering input that is required to approve a Prototype mod, the fee to approve it is higher than if you wish to copy an existing mod as a Repeat mod. In the case of a Repeat mod, refer to TL 3.07.

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In order to keep the running costs of the Engineering department to a minimum, members are requested to submit complete and well-presented applications giving full details and justifications. Remember that the engineers will be approaching the problem 'cold' without necessarily having the level of detailed knowledge of the type that you might have.

In the case of an exceptionally complicated and involved Prototype mod that will involve an unusually high level of input from the Engineering department, the right is reserved to charge a higher fee than published: this will be negotiated individually with the owner as the need arises. An example might be where the Engineering department needs to commission an independent finite-element model of the area in question, which would cost the department significant amounts of money.

On the other hand, if the proposed modification is considered to offer an innovative safety or noise advantage that might benefit other aircraft in the fleet, LAA Engineering may consider waiving the application fee. An application to have the fee waived can be made in section 3 of form LAA/MOD 2. Examples of what might be considered appropriate are modifications that address known airworthiness issues, an innovative new method of carb ice prevention or a change that significantly reduces the exhaust noise. Examples of what wouldn't generally be considered appropriate are applications to fit strobe lights, landing lights or a different propeller (unless it's of a radical new design).

### 3. The Process for Approving a Modification Application

Essentially there are two stages to a mod application. The first step is to outline the basic proposal on an LAA/MOD 2 form. If it is agreed as feasible, you will be asked to provide a full description on an LAA/MOD 3 form. There usually follows an exchange of correspondence to clarify the details and recommend any changes. Once all issues have been resolved, a modification approval note will be granted which is retained with the aircraft records. The flowchart in Figure 1 (overleaf) illustrates the typical process.

If the modification is extremely straightforward and you are very confident that the Engineering department will have no comments, then both forms may be submitted together: this is at your own risk!

Note: once an aircraft has been modified, it may not be flown until it has been approved. In the case of a Prototype mod, this requires the Engineering department to either issue a PFRC to enable flight testing or a mod approval document. In both cases, an inspector needs to sign a PMR in the aircraft's logbook before flight, having checked the modification for conformity with the modification details, audit of work carried out and satisfactory form and function.

### 4. Checklist for Aircraft Modifiers

Owners should bear in mind that modified aeroplanes will inevitably take longer to have their Permit-to-Fly issued or reinstated, than aircraft which are 'standard', due to the fact that they need detailed study by LAA Engineering rather than simply a routine paperwork check. This may prove a major irritation when your aeroplane is ready to fly but you have to wait for weeks or months to be granted clearance to fly it. It must also be said that many times we have come across cases where, at the end of a long (and sometimes surprisingly expensive) process of getting a modification tested and accepted, the builder concludes that the aeroplane's designer knew best after all and he should have left the design as standard. Builders who do not have aircraft design experience should remember that aircraft designers do!

## **APPROVAL OF PROTOTYPE MODIFICATIONS**

Care should be taken when considering applying for a modification, to prevent falling into a number of common pitfalls. Here is a simple check-list to use before starting to seriously consider applying for a modification to your aircraft:

1. The major consideration, certainly before considering making major aerodynamic or structural changes, is whether you feel it is wise to second-guess the aircraft designer. For example the designer may not have added an inspection hole in the structure to look at a control idler for a very good reason. Would this hole interrupt a major structural component? Remember that very little of the aircraft structure is there for no reason.
2. Will the proposed modification take the aircraft over its gross-weight with the maximum number of occupants on-board, even with minimum fuel?
3. Will the modification take the aircraft outside of its centre-of gravity envelope in any sensible loading conditions? Degradation of an already critical centre-of-gravity range is obviously a bad idea.
4. Will the proposed modification hamper construction further along the line. You definitely want to avoid starting a chain of extensive modifications simply because of a minor modification in the first-place.
5. How easy will the modification be to analyse and/or test? The worse the basic design of a mod scheme, the more expensive will be the analysis to prove it adequate or not. If the design is bad, then the analysis cost will probably be wasted proving it so.

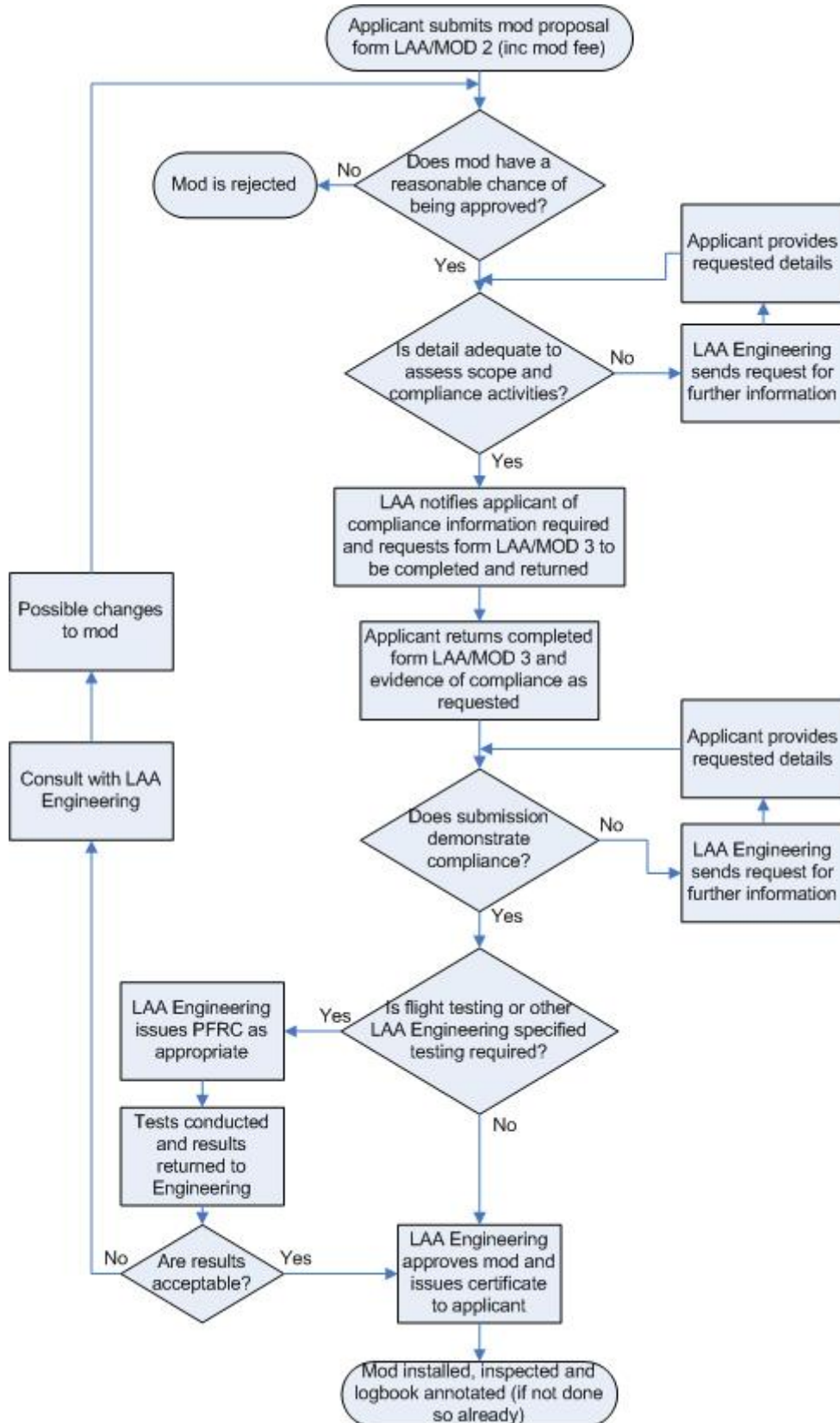
To substantiate a modification it is usual to have to show compliance with the requirements of an appropriate design code, e.g. BCAR Section S (microlights), CS-VLA (aeroplanes) and BCAR Section T (Gyroplanes), and with normal aviation practice for the aircraft category in question. Modifications should therefore be designed to meet these standards from the start. These design codes can be downloaded from the links from the LAA web site ([www.laa.uk.com](http://www.laa.uk.com)).

### **5. Example Modification Submission**


On the following pages is an example of form LAA/MOD 2. An LAA/MOD 2 is to be used to give notice of a proposed modification so that LAA Engineering can advise on the required minimum content of the Modification Application.

## APPROVAL OF PROTOTYPE MODIFICATIONS

Figure 1: Prototype mod process



## APPROVAL OF PROTOTYPE MODIFICATIONS

 Light Aircraft Association	<b>LAA/MOD 2 MODIFICATION INITIAL PROPOSAL Issue 2</b>	Mod No. (Office use only)
		£ 45.00 Fee Received Yes/No
		Page 1 of 4

This form is used to give notice of a proposed modification so that LAA Engineering can advise on the required minimum content of the Modification Application.

### 1. AIRCRAFT DETAILS

Registration	Type	Serial Number
<b>G - BMOD</b>	<i>Batplane mk3</i>	<i>LAA-456-54321</i>

### 2. APPLICANT DETAILS (Note: Applicant must be a 'Full plus' member)

Owner's Name	<i>Bruce Wayne</i>	Membership No.	<i>043561</i>
Name and address of person to be contacted regarding this modification :			
<i>Bruce Wayne</i>			
<i>Hightop Castle</i>			
<i>Dunbarb Lane</i>			
<i>Gethin City</i>			
Daytime Telephone Number: <i>01623 568245</i> e-mail: <i>bat.mar@supernet.com</i>			


### 3. MODIFICATION DETAILS

Title: <i>Increase main wheel size to 600x6</i>
Purpose: <i>Improve rough field capability</i>
I wish to apply for a Mod fee waiver on the basis that this modification is intended to develop a new innovation in relation to either - a) safety or b) noise reduction (please delete as applicable). <b>YES / NO</b>
Brief description of proposed modification: (30 words max) <i>The existing 500x5 main wheels are to be replaced with larger 600x6 wheels sourced from standard aircraft hardware. This involves removing and replacing the stub axles with new design parts.</i>
Does this mod appear on any similar aircraft? <i>Yes</i> If Yes, which one? <i>G-RDLR</i> Describe variations to previous mod. <i>Batplane mk2 has a similar mod, but it was not necessary to change the stub axles.</i>

### 4. PREDICTED WEIGHT AND BALANCE EFFECT

	Weight (lb/kg)	CG (in/mm)	Moment
Existing	<i>340 kg</i>	<i>1550 mm AoD</i>	<i>527,000 kgmm</i>
Weight Change	<i>+3.5 kg</i>	<i>1778 mm AoD</i>	<i>6,223 kgmm</i>
Post Mod	<i>343.5 kg</i>	<i>1552 mm AoD</i>	<i>533,223 kgmm</i>

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		Page 2 of 4


### 5. DESIGN CONSIDERATIONS

Will the proposed modification affect any of the following? If 'yes', then submit proposals, on the sheet provided, for how you will demonstrate that the modified aircraft is nevertheless airworthy. Normally this involves showing compliance with applicable paragraphs of the design requirements, e.g. CS-VLA, BCAR Section T or Section S.

\* In the case of additional equipment being installed, equipment qualification, proof of functionality, integrity of mountings and its operating environment must also be considered.

The integrity of the airframe	<del>YES</del>	NO
The flying control system	<del>YES</del>	NO
The occupant restraint system	<del>YES</del>	NO
Aircraft crashworthiness	<del>YES</del>	NO
Any part of the undercarriage installation	YES	<del>NO</del>
Any part of the engine installation (including reduction drive)	<del>YES</del>	NO
The fuel or oil system	<del>YES</del>	NO
The engine control system	<del>YES</del>	NO
The propeller and its installation	<del>YES</del>	NO
The flight handling qualities	<del>YES</del>	NO
Aircraft performance	YES	<del>NO</del>
Aerodynamics	<del>YES</del>	NO
Ground handling qualities	YES	<del>NO</del>
Aircraft noise levels	<del>YES</del>	NO
The electrical system	<del>YES</del>	NO
The radio installation	<del>YES</del>	NO
Instrumentation	<del>YES</del>	NO
Additional equipment*	<del>YES</del>	NO
Pilot's Operating Handbook	<del>YES</del>	NO
Maintenance Manual	<del>YES</del>	NO

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	<b>LAA/MOD 2 MODIFICATION INITIAL PROPOSAL Issue 2</b>	Mod No. (Office use only)
		£ 45.00 Fee Received Yes/No
		Page 3 of 4


Proposals for how modification details will be present with modification application. e.g. text, drawings, photographs, etc.

*Drawings of new stab axle details*  
*Spec sheets for new wheels and tyres*  
*Photograph of general arrangement*

For each of the affected areas identified in section 5, describe your proposals for how the airworthiness of the modified aircraft will be demonstrated. e.g. compliance with a recognised design code, normal aviation practice, safety comparison with existing design, service experience in other countries.

*New wheels and tyres are standard aircraft hardware and have previously been approved on aircraft with much higher gross weights (e.g. Superplane mk2, MTOW of 900kg).*  
*Stab axle strength will be demonstrated by static load test in accordance with the prescribed loads in BCAR Section S.*

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		Page 4 of 4

### 6. DESIGN SUPPORT

In many cases you will be required to obtain a declaration of "no technical objection" from the Designer of your aircraft regarding the modification that you intend to install.

Has the designer agreed to co-operate with you over this modification? *Yes*

Do you have access to any other design capability? *No*

### 7. INSPECTION SUPPORT

In many cases your inspector will be required to supervise testing and confirm compliance with the requirements.

Has your inspector agreed to co-operate with you over this modification? *Yes*

I am prepared to act as supervising inspector for this mod:

Signed *R. Boywonder* Date *27 February 2009* Inspector No. *999*

### 8. FUNCTION AND FLIGHT TEST PROPOSALS

In many cases a modification will require in-depth function and flight testing and this often requires the involvement of a suitably qualified test pilot and may dictate the standard of the airfield chosen.

State your proposals for function and flight testing the modification.

*A ground handling test and standard flight test schedule is proposed to ensure no adverse effects. Several circuits will also be conducted to ensure no adverse effects on touchdown and take-off.*

### 9. PROPOSED FLIGHT TEST DETAILS

Test Pilot	Total hrs PIC	Hrs on type	Airfield
<i>T. Penguin</i>	Min 100 hrs PIC <i>750</i>	Min 10 hrs on type <i>30</i>	<i>Gottham Airport</i>

### 10. OWNER'S DECLARATION

I declare that the foregoing information is correct and I agree to abide by any conditions pertaining to this modification. I agree that this modification and all ideas contained within are the property of PFA (Ulair) Ltd and can be used in any way for the benefit of the LAA and its members. I have enclosed the appropriate fee.

Signed: *Bruce Wayne* Print: *B. WAYNE* Date: *28 February 2009*

If this mod is successful, are you willing to allow potential applicants wishing to fit the same mod to their aircraft to contact you? **YES / NO**  
 If so, which means of contact is acceptable to be published on the LAA's web site?  
 home phone ?, mobile phone ?, email ?, address ? [Tick whichever apply]

## **APPROVAL OF PROTOTYPE MODIFICATIONS**

### **6. Design Consultants**

The people listed below have offered to help LAA members with technical matters, either on a voluntary or consultancy basis. Their appearance on this list does not imply any recommendation by the LAA.

#### **6.1 Design / Stressing**

##### ***David Chamberlain Aerostructures***

Hunters Moon  
70A Bury Road, Shillington  
Hitchin, Herts SG5 3NZ  
Tel/Fax: 01462 711148

##### ***David Starkey***

Aeronautical Services Ltd  
Gulham Science Centre  
Abingdon, Oxon OX14 3DB  
Tel: 01235 465106, 01865 408360  
Fax: 01235 465098

##### ***Miss E Tusar***

2 Victoria Court  
Cunnery Road  
Church Stretton  
Shropshire SY6 6AF  
Tel: 01694 720194  
Fax: 01694 722751

##### ***Chris D Burleigh***

Pacombe Cottage  
Lode Hill  
Downton  
Wilts  
SP5 3PP  
Tel: 01725 511921

##### ***David W Kent***

56b High Street  
Dilton Marsh  
Westbury, Wilts BA13 4DY  
Tel/Fax: 01373 827745

##### ***Carl Tharme***

Innova Services  
114 Bucklers Mead Road  
Yeovil  
Somerset BA21 5RE  
Tel: 01935 20872

##### ***Ellis Round***

Cloddy Hall Farm  
Edgton  
Craven Arms  
Shropshire SY7 8HN  
Tel: 01588 680436 Mob 07980  
e-mail: ellis.round@btinternet.com

#### **6.2 Draughting**

##### ***Mr S Hazel***

6 Eaton Close  
Hatfield  
Huntingdon  
Herts PE18 7SR

##### ***Mr Ivan Smith***

2 Bramshall Road  
Uttoxeter  
Staffs ST14 7PG

#### **6.3 Certification of New Aircraft Projects for Commercial Production**

##### ***Dave Simpson***

7 The Green  
Tea Green  
Luton  
Beds LU2 8PS  
Tel 01438 768809  
Mob 07971 293295