LAA TYPE ACCEPTANCE DATA SHEET
TADS 324
SUPERMARINE SPITFIRE MK26

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| Issue 2 | | | |
| Revision A | Format change. New UK agent contact details. | Dated 30/9/10 | JV |
| Revision B | Note on carburettor settings modified. | Dated 24/11/10 | JV |
| Revision C | Updated contact details for Matthew Russell, amended mod number for 'Jabiru Engine Fuel System' in section 3.2, minor editorial changes. | Dated 16/12/13 | JV |
| Revision D | Additional items in section 3.5. | Dated 3/9/14 | FD |
| Revision E | Addition of Safety Spot articles and optional review mirror. | Dated 24/4/20 | MR |
| Revision F | Addition of warnings re undercarriage leg weld failures and tailwheel steering in section 3.4 | Dated 16/12/21 | FD |

This TADS is intended as a summary of available information about the type and should be used during the build, operation and permit revalidation phases to help owners and inspectors. Although it is hoped that this document is as complete as possible, other sources may contain more up to date information, e.g. the manufacturer's website.

Section 1 contains general information about the type.
Section 2 contains information about the type that is **MANDATORY** and must be complied with.
Section 3 contains advisory information that owners and inspectors should review to help them maintain the aircraft in an airworthy condition. If due consideration and circumstances suggest that compliance with the requirements in this section can safely be deferred, is not required or not applicable, then this is a permitted judgement call. This section also provides a useful repository for advisory information gathered through defect reports and experience.

## Section 1 - Introduction

### 1.1 UK contact

Mike Rae, 73 Carlogie Road, Carnoustie, Angus, DD7 6EX

Tel: 01241 859412 or 07709 754401
Email: the.raes@talktalk.net
Website: www.supermarineaircraft.com

For Matthew Russell Ltd drawings contact Matthew Russell Ltd on 01944 759242.

### 1.2 Description

The Spitfire Mk26 is a conventionally configured low-wing cantilever monoplane which is a reduced scale replica of the famous wartime fighter. The aircraft is manufactured in the form of a kit for construction by amateurs. The kit is manufactured by Supermarine Aircraft Pty of Queensland, Australia. The aircraft is of conventional riveted aluminium alloy construction. The wing is of full cantilever type and consists of a fixed centre section, which incorporates the outwards-retracting main undercarriage, and quickly-removable outboard panels. The wing is of single spar construction, the spar booms being of extruded square section aluminium tube. The wing is aluminium skinned overall. The fuselage is a riveted semi-monocoque structure with angle section aluminium alloy longerons. The tail surfaces are of conventional aluminium skinned construction, and incorporate aerodynamic balanced control surfaces. The control surfaces are operated by a conventional system of stranded steel cables, pushrods and bellcranks. The large plain flaps are electrically operated and their position is infinitely variable between stops. A single fuel tank is mounted in the forward fuselage turtledeck between the firewall and the instrument panel.

A conventional steerable tailwheel type undercarriage is fitted, the two main undercarriage units being independently retractable using electric motors and manual up and down locks operated via Teleflex type cables. Emergency lowering can be achieved using a combination of gravity and spring assistance, the connection to the electric rams being released by withdrawing the connection pin using an emergency pull-cable arrangement. Main undercarriage suspension is provided by simple telescopic spring legs, the steerable tailwheel suspension by a conventional cantilever leaf spring arrangement.

The cockpit includes a 'jump seat' immediately behind, and in close proximity to, the pilot. Both pilot and passenger are provided with four-point harnesses. As on the early model original Spitfires, a fixed windscreen and rearwards-sliding canopy are fitted, the rearmost part of the canopy being fixed. The jump seat is located behind the sliding canopy and access to the jump seat is therefore not available once the pilot is in place.

The Spitfire Mk26 has been cleared by the LAA with the flat eight Jabiru 5100A engine. The Isuzu V6 engine option is presently under consideration by the LAA. The MTV-18 electrically operated constant speed propeller has been cleared with the Jabiru 5100A engine. Fixed pitch Jabiru wood propellers may also be used, although note that the only propeller(s) approved for an individual aircraft are those listed on the individual aircraft's Operating Limitations document or in the PTL/1 (Propeller Type List) for the type.

The Spitfire Mk 26 is an SEP Aeroplane (colloquially known as 'Group A'), not a microlight.

The type is not currently cleared by the LAA for aerobatics or spinning.

## Section 2 – Mandatory information for owners, operators and inspectors

At all times, responsibility for the maintenance and airworthiness of an aircraft rests with the owner. Condition No 3 of a Permit to Fly requires that: *"the aircraft shall be maintained in an airworthy condition".*

### 2.1 <u>Fast Build Kit 51% Compliance</u>

The LAA has accepted the content of the fast build kit. Note that it is essential that the major assemblies (wings, fuselage, etc) are supplied in component form requiring assembly by the builder, so that the inspector is able to inspect the individual components and 'open' assemblies and so that the builder is tasked with assembling these major assemblies as part of the 51% rule 'major portion' requirements.

### 2.2 <u>Build Manual</u>

A build manual is provided by Supermarine Aircraft.

Early build manuals were less detailed than the present version. The following clarification drawings are accepted by the LAA, and may be helpful especially for those with the early kits/manuals.

| | | |
|---|---|---|
| Fuel System Layout – Firewall | Matthew Russell Ltd | 6.9.04 |
| Carb Plenum Location | Matthew Russell Ltd | 6.9.04 |
| Fuel System Fuel Cock | Matthew Russell Ltd | 7.9.04 |
| Air intake / plenum | Matthew Russell Ltd | 21.12.03 |
| Cowl Flap Controls | Matthew Russell Ltd | 13.9.04 |
| Cowl Flap Control | Matthew Russell Ltd | 25.8.05 |
| Oil cooler inst (rect sump engines) | Matthew Russell Ltd | 27.6.05 |
| Oil cooler installation | Matthew Russell Ltd | 10.12.05 |
| Engine Cowls | Matthew Russell Ltd | 10.5.05 |
| Tank Mounting Brackets | Matthew Russell Ltd | 16.1.04 |

2.3 Build Inspections

Build inspection schedule 48.
Inspector approval codes A-A or A-M or K. Inspector signing off final inspection also requires 'first flight' endorsement.

2.4 Flight Manual

Pilot's Notes are available from Supermarine Aircraft.

2.5 Mandatory Permit Directives

Nil applicable specifically to this aircraft type.

Also check the LAA website for MPDs that are non-type specific (TL2.22).

2.6 LAA Required Modifications (including LAA issued AILs, SBs, etc)

The following mandatory requirements apply:

| | | |
|---|---|---|
| 1 | Stall handling | Aircraft must have acceptable stall warning and stall characteristics, to be assessed on an individual aircraft basis. Addition of wing leading edge stall strips (as shown Matthew Russell Ltd drawing) gave satisfactory results on G-CCZP but were ineffective on G-CCGH, which uses an artificial stall warner. |
| 2 | Fuel pressure gauge | A fuel pressure gauge must be fitted. Normal practise for aircraft with mechanical and electric boost pump, to allow pilot to check operation of both pumps before flight and to indicate any fuel system defects. |
| 3 | Retractable undercarriage | Conventional red (travelling) and green (gear down) undercarriage position lights must be fitted on the instrument panel. These may be activated by the existing gear microswitches. Lights to be located above gear retraction switches. LAA mod 11422 and Matthew Russell Ltd drawing |

| | | |
|---|---|---|
| | | refers.<br>Both port and starboard undercarriage retraction switches to be grouped together on starboard side of instrument panel for ease of operation. This location places all the undercarriage controls in one group.<br>Alignment marks to be added to the cockpit sidewall adjacent to the gear latch levers to show position of levers corresponding with fully home position of gear latches. |
| 4 | Pilot's shoulder harness | Shoulder straps to be fitted with linking strap behind pilot's shoulders to prevent straps sliding off pilot's shoulders. Matthew Russell Ltd drawing refers. |

2.7 Additional engine operating limitations to be placarded or shown by instrument markings

Notes:

- Refer to the engine manufacturer's latest documentation for the definitive parameter values and recommended instruments.
- Where an instrument is not fitted, the limit need not be displayed.

With Jabiru 5100 engine:

| | |
|---|---|
| Max CHT | 175°C |
| CHT warning range | 150-175°C |
| Normal CHT range | 100 –150°C |
| Minimum CHT | 80°C |
| | |
| Max oil temp | 118°C |
| Warning range oil temp | 100-118°C |
| Normal oil temp | 70-90°C |
| Minimum oil temp | 30°C |
| | |
| Oil pressure minimum | 50 kPa |
| Oil pressure normal | 225-500 kPa |
| Oil pressure warning 5 | 0-225 kPa |
| Maximum oil pressure | 500 kPa |

2.8 Control surface deflections

| | |
|---|---|
| *Ailerons (original)* | *Up: 14°*<br>*Down: 12°* |
| *Elevators* | *Up: 18°*<br>*Down: 15°* |
| *Elevator tab* | *Up: TBC*<br>*Down: TBC* |
| *Rudder* | *Left 30°*<br>*Right 30°* |
| *Flap* | *TBC* |

2.9 Operating Limitations and Placards

(Note that the wording on an individual aircraft's Operating Limitations document takes precedence, if different.)

1. Maximum number of occupants authorised to be carried: Two

2. The aircraft must be operated in compliance with the following operating limitations, which shall be displayed in the cockpit by means of placards or instrument markings:

   2.1 Aerobatic Limitations
   Aerobatic manoeuvres are prohibited.
   Intentional spinning is prohibited.

   2.2 Loading Limitations
   Maximum Total Weight Authorised: 720 kg
   CG Range: 550 mm to 700 mm aft of datum
   Datum Point is: front face of the firewall

   2.3 Engine Limitations
   Maximum Engine RPM: 2800 (with MT propeller, otherwise 3000 rpm)

   2.4 Airspeed Limitations
   Maximum Indicated Airspeed ($V_{NE}$): 193 knots IAS
   Maximum Indicated Airspeed Flaps Extended: 80 knots IAS
   Maximum Indicated Airspeed Undercarriage Extended: 110 knots IAS

   2.5 Other Limitations
   The aircraft shall be flown by day and under Visual Flight Rules only.
   Smoking in the aircraft is prohibited.

Additional Placards:

"Occupant Warning - This Aircraft has not been Certificated to an International Requirement"

A fireproof identification plate must be fitted to fuselage, engraved or stamped with aircraft's registration letters.

2.10 Maximum permitted empty weight

Not applicable.

**Section 3 – Advice to owners, operators and inspectors**

3.1 Maintenance Manual

The build manual includes basic maintenance details. In the absence of a detailed manufacturer's maintenance schedule, refer to LAMS. For engine and propeller refer to manufacturer's maintenance instructions.

3.2 Manufacturer's/Standard Options

The following options are accepted by LAA, having been cleared on G-CCZP:

| | | |
|---|---|---|
| Fuel Tank Fuel Quantity Gauge | Matthew Russell Ltd | 06.9.04 |
| Improved Control Column Stops | Matthew Russell Ltd | 20.7.04 |
| Dummy Radiator Covers | Matthew Russell Ltd | 16.8.04 |
| Alterations to Dipstick | Matthew Russell Ltd | 24.8.04 |
| Cabin Heat Layout | Matthew Russell Ltd | 22.8.04 |
| Alterations to Lower Plenum Cover | Matthew Russell Ltd | 24.8.04 |
| Front Cowl Support Beam | Matthew Russell Ltd | 10.8.04 |
| Rudder pedals plates | Matthew Russell Ltd | 16.8.04 |
| End Plates Centre Section (early kits) | Matthew Russell Ltd | 16.8.04 |
| Flap position indicator | Matthew Russell Ltd | 17.3.04 (LAA mod 11421) |
| Tail infill foam pieces kit | Matthew Russell Ltd | 10.8.04 |
| Spark Plug Access | Matthew Russell Ltd | 16.8.04 |
| MT prop pick-up block mounting | Matthew Russell Ltd | 14.7.04 |
| Dummy cannons | Matthew Russell Ltd | 16.7.04 |
| U/c Lever Lock and Springs | Matthew Russell Ltd | 10.7.05 |
| Wing Leading Edge Stall Strips | Matthew Russell Ltd | 16.8.05 |
| Jabiru Engine Fuel System | Matthew Russell Ltd | 5.8.04 (LAA mod 11423) |
| Adjustable Seat Back | Matthew Russell Ltd | 20.10.05 |
| Stick mounted PTT button | Matthew Russell Ltd | |
| Stiffener Bkt U/C Motor Mounts | Matthew Russell Ltd | 10.6.05 |
| Pitch pivot bracket stiffening | Matthew Russell Ltd | |
| Battery box build / location | Matthew Russell Ltd | 24.8.05 |
| U/c Position Lights | Matthew Russell Ltd | 18.3.05 (LAA mod 11422) |

Note – neither the V6 engine nor the wing fuel tanks have been accepted by LAA at this time.

Additional options acceptable to LAA:

- Factory-supplied rear-view mirror (bolt heads to be inside the cockpit).

3.3 Manufacturer's Information (including Service Bulletins, Service Letters, etc)

In the absence of any over-riding LAA classification, inspections and modifications published by the manufacturer should be satisfied according to the recommendation of the manufacturer. It is the owner's responsibility to be aware of and supply such information to their Inspector.

Nil known.

3.4 Special Inspection Points

- The build manual is somewhat lacking in detail in some areas. For clarification, Matthew Russell Ltd has produced various drawings (see above) to describe how these areas were dealt with on G-CCZP, and have proved satisfactory. These drawings may be helpful to other builders; especially those with early edition build manuals which have less detail than the present version.
- Problems have been experienced with the quality of the kit supplied airframe parts, including seriously misplaced pre-drilled holes and varying wall thickness of

the wing spar cap extrusions. This has lead to some parts having to be scrapped. All kit components must therefore be very carefully checked on receipt.

- Problems were apparently experienced with an air leak at the intake manifold joints of the 5100A engine, needing the mating surfaces to be cleaned up and suitable sealant used.
- Check that wing leading edge profiles are smooth and symmetrical port and starboard, especially at the tip where the skins have significant double curvature.
- Substitution of stronger gear latch return springs. The original springs are not intended to be powerful enough to force the locking pins into the gear latch holes. The pilot has to push the pins in manually. Stronger springs have been fitted on G-CCZP, which are considered acceptable, however the designer does not recommend this as he is concerned this may cause wear problems in the long term. If stronger springs are used, the locking pins and related parts must be checked regularly for signs of wear developing.
- A standard oil cooler, fitted originally to G-CCZP, ruptured in flight causing substantial oil loss. It seems that the oil cooler must be of high pressure type. It is understood that high pressure oil coolers are now being supplied with the Jabiru engine installation kits.
- For Jabiru engine installations, following an incident that occurred on a first flight, the carburettor jetting/needles should be checked against the latest information available from the UK Jabiru agent. In addition, the CHT probe needs to be positioned in accordance with Jabiru recommendations. Fitment of an EGT gauge is strongly recommended.
- Following the accident that befell a UK registered Spitfire Mk 26 in August 2021, on landing, in which one undercarriage leg folded up, it appears that this may have been caused by an internal failure of the undercarriage leg. The internal failure resulted in the lower section of the leg twisting through more than 90 degrees compared to the upper leg so that the wheel was pointing sideways rather than 'fore and aft', leading to a violent and damaging ground loop. The aircraft concerned had suffered a previous heavy landing and the legs had been inspected subsequently for damage, but it seems likely that a weld hidden within the leg had cracked but this did not come to light until the joint broke free altogether during the subsequent accident flight. The shallow penetration of the weld on the leg concerned, when compared with the weld on another damaged Mk 26's leg may also have been a related factor. Unfortunately, due to the nature of the design of the undercarriage legs on the Mk 26, the weld concerned, which attaches the upper end of the splined shaft that holds the upper and lower sections of the leg in alignment, is not visible even with the undercarriage leg stripped to its component parts. It is therefore not possible to check it visually for either the appearance of the weld as manufactured or the presence of cracking in the weld in service. The later Mk 26B leg does not use this splined shaft – instead, the upper and lower sections of the legs are held in alignment by conventional external scissors. Supermarine advise that they can no longer supply parts for the Mk 26 undercarriage legs, as since relocating to the USA they are only supporting the later Mk 26B type. A group of owners of Mk 26s needing replacement legs have chosen to redesign the legs using external scissors like those on the 26B, to avoid the reliance on the spline arrangement, and are having them made in the UK. As part of the redesign they have also incorporated stronger chrome-moly tube to reduce the likelihood of the legs bending in heavy landings. It may be that in time, a different mod could be devised to add external scissors to existing standard Mk 26 legs, but as in the Mk 26B, this would also require small additional cut-outs in the wing to accommodate the scissors when the undercarriage is retracted. Due to the possibility of hidden damage being caused to the welded attachment of the internal splined shaft in a heavy landing, LAA advises great caution in returning to service a leg that has suffered a heavy

landing but not been condemned due to having become visibly bent. Check very carefully that the mainwheels remain in alignment and that, with the aeroplane jacked up to take the weight off the wheels, the lower part of the leg cannot be manually twisted in relation to the upper leg. It may help to remove the mainwheels and slide a length of suitably sized thick wall steel tube, not more than half a metre long, over each axle in turn so that you can apply more leverage. Whether you detect any movement or not, if you suspect that the weld might have been cracked in a heavy landing, consult LAA Engineering before further flight.

- Problems have been reported with the steerable tailwheel unit either failing to 'break out' into the free castering mode at all, or breaking out prematurely during landing when full rudder is applied to keep straight, leading to loss of directional control and ground loops. The break-out point should be adjusted so that it does not occur while the rudder is within its normal operating range from stop to stop, but breaks out if the tailwheel is forced approximately 10 to 15 degrees past the full rudder travel angle ie when pushing the aeroplane around on the ground to go backwards into the hangar, or when pivoting the aeroplane around one wheel when slow taxiing, using full asymmetric brake. The tailwheel brake out angle can be adjusted by alterations to the slack in the steering springs, the gearing of the tailwheel steering or, better, by modification of the cam profile within the tailwheel steering unit.

Additional weight and balance information:

Levelling datum: top fuselage longeron
Moment arm of pilot: 1100 mm
Moment arm of passenger: 1600 mm
Moment arm of fuel: 400 mm
Moment arm of baggage: 1600 mm

3.5 Operational Issues

- The first two UK–built examples exhibited a significant wing drop at the stall and no pre-stall warning as first built. Both the wing drop and the lack of stall warning were corrected on G-CCZP by fitting wing leading edge stall strips. Variation between wing leading edge profiles on individual aircraft is likely to cause differences in stall characteristics between individual aircraft. Matthew Russell Ltd drawing (2 sheets) shows stall strip configuration accepted on G-CCZP.
- Aileron control friction – friction between ailerons and aileron seal strips makes ailerons stiff to operate which slightly degrades lateral control characteristics in flight. Ensure control stiffness is not excessive, dress seal strips to avoid excessive pressure on ailerons.
- If the tailwheel does not steer satisfactorily, tail wheel assembly may need adjusting on tail spring to give optimum trail angle on tailwheel.
- Check that the engine picks up and runs satisfactorily after a brief zero-g excursion.
- Adjustments may need to be made to the cowling and cooling ducts to optimise engine cooling. One builder did not appreciate the fact that it is essential to create an essentially airtight plenum system so that all the air entering the front intake is forced to pass down through in between the cylinder cooling fins, it is no good having the engine sitting inside the cowls with air just blowing over it and finding its own way out at the bottom. Without proper cooling arrangements the engine will self-destruct in minutes in flight. The message to the pilot is to carry out extensive ground runs and that the engine temperature gauges must be watched

like a hawk on the first flight, and be prepared to curtail the flight immediately if temperatures do not look as though they are going to stabilise within the permitted range.

- Carburettor needles and jets. Jabiru changed the carb needle/jet combination some years ago to a leaner configuration, with a view to improving fuel economy, but then found this caused problems with overheating / piston seizure etc so issued a mandatory bulletin calling for the needle/jets to be changed again to provide richer mixture again. It's important to ensure you have the correct needles and jets as currently specified. It would in any case be a good idea to check the plug colours /appearance before and after the first flight to make sure that mixture strengths are OK, not just to rely on CHTs and EGTs.
- VP prop. It's important to bear in mind that the Jabiru engine was designed with a lightweight fixed pitch prop in mind, not a constant speed unit. The ability with a constant speed prop to run the engine at high throttle settings but with the RPM held down to low figures (e.g. 2500-2600) may not suit the mixture characteristics of the Bing carburettors as set up, and may cause the engine to tend to run lean and more likely to seize. The MT prop is not allowed to be used at more than 2800 RPM, so there's a tendency to over-prop the engine anyway. The main message is for the pilot NOT to combine high throttle settings with RPMs held below 2800, the Jabiru engine is designed to run at high power at 3000 RPM not 2600 and Jabiru warn strongly against 'strangling' it in this way.
- CHT gauges. One builder didn't appreciate the importance of where the CHT gauge thermocouples were placed on the cylinder heads, or that this placement would affect what the readings were and therefore what the 'red line' should be.
- As the mixture strength and cooling effect may differ between cylinders it's important to be able to monitor all eight CHT's not just what is assumed to be the hottest pair – it may be one of the others that's hottest.
- Brakes. Several owners have had problems with spongy brakes; some have fitted uprated master cylinders and brake lines in the hope of improving things. A recent finding is that because of the way the brake pedals and master cylinders are mounted, any springiness in the rudder circuit translates into sponginess in the brakes. The rudder circuit on some examples has become spongy because of the rudder horn starting to move inside the rudder in response to the pilot pressing hard on both brakes together – effectively this pulls the rudder forwards and bends the rudder spar in the vicinity of the bottom hinge. An LAA mod to avoid this issue is just being drawn up, after successful implementation on one of the Enstone Spitfires. For now it is important to be aware of this issue and keep an eye on the rudder for signs of problems developing at the bottom if over-stressed by high brake forces being applied. It's also been found that the rudder pedal 'leg length' adjustment makes a surprising difference to the seeming effectiveness of the brakes – much more difference than you'd anticipate.
- One builder didn't check the security of the propeller retaining nuts before flight, probably because he assumed it had already been done – the (very expensive constant speed) prop came off in flight and was never found. Luckily a safe and skilful propeller-less forced landing was made back onto the airfield. This is quite a complex aircraft and needs a disciplined approach to the final checks and sign-offs, flagging anything that's 'still to do'.
- One pilot hadn't fully prepared himself mentally for how to operate the unique retractable gear, or how the emergency system worked, consequently when he had to use it in an emergency, he got it wrong, which contributed to the brand-new aircraft being wrecked. With the Mk 26 u/c it really is important to let the new pilot practise the operation of the undercarriage beforehand with the aircraft on jacks, until it's operation is second nature so he can still manage it when under pressure, understands what the lights and tell-tale rods mean etc. This also allows a final check on proper adjustment, alignment etc.

- One pilot didn't appreciate the speed with the tail comes up if forward stick is used too heavy-handedly to raise the tail early in the take-off run, and dinged the propeller. Once the tail starts to rise you have to be prepared to check the pitching-down positively by centralising the stick.
- Two pilots lost directional control on take-off and crashed before getting properly airborne at all. The Spitfire is not a difficult taildragger but certainly won't tolerate mishandling. Any in-practise Jodel pilot who is also used to a Tiger Moth's lack of forward view in the 3-point attitude should have no problem in taking off or landing it.
- One Spitfire's new replacement Jabiru engine was damaged on first starting up because the oil cooler had not been replaced or purged clean of debris left from when the first engine was 'making metal' as it was beating itself to pieces internally. The oil cooler released its debris into the brand-new engine.
- See section 3.4 above regarding tailwheel steering breakout issues and the possibility of main undercarriage leg internal failures after heavy landings.

The following *Safety Spot* articles are relevant to Spitfire Mk. 26 aircraft:

*Light Aviation Nov 2016 Undercarriage Retraction Issues*

The retractable undercarriage system has a failsafe system which allows a 'jammed' retract to extend if a failure occurred. The failsafe system employed a pin which failed. Article discusses rectification of design.

*Light Aviation Sep 2015 Spitfire Mk26 undercarriage failure*

Undercarriage failure due to tension in retract linkages. Emergency release pin failed to operate correctly thus a forced landing was performed.

*Light Aviation May 2014 Structure failure at lower rudder hinge*

Under routine inspection it was found that the rudder spar had suffered deformation due to the tail wheel steering arm being wrenched back.

*Light Aviation Aug 2008 Spitfire Mk 26 Propeller departing aircraft*

Aircraft suffered an inflight departure of the propeller during the aircrafts maiden flight. Discussion of the propeller flanges and common faults.

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Please report any errors or omissions to LAA Engineering: engineering@laa.uk.com