TLAC
THE LIGHT AIRCRAFT COMPANY

Detailed below is a copy of the original Sales Broc hure as provided by Russ Light at the launch of the Sherwood Ranger, it contains great information, interesting press releases and aircraft details.

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Little Snoring Airfield, Little Snoring, Fakenham, Norfolk. NR21 0JL
tel: 01328 822020 **e mail:** sales@g-tlac.com **web:** www.g-tlac.com
The Light Aircraft Company Limited registed in England No: 332 4556
Paul R Hendry-Smith Managing Director | Ivor Smith Director | Beryl J Smith Director

Introduction

Thank you for purchasing this information package. I have tried to include all the information, which you might require to enable you to decide if this is the aeroplane for you.

The majority of the information has been supplied in a "Question & Answer" form, these being the most commonly asked questions.

If you require further information, please do not hesitate to contact T.C.D. Ltd.

Russ Light.

About T.C.D. Ltd.

T.C.D Ltd. was formed in 1988 by Russ Light, who is now the Managing Director and Chief Design Engineer, to design and build the prototype Sherwood Ranger and subsequently manufacture the aircraft for sale in kit form.

The company is based here at Larkfield in North Nottinghamshire, and it owns its own fully equipped 5000 sq. ft. workshop with C.N.C. engineering facilities and expertise to produce all airframe components in house.
A drawing office utilising Computer Aided Design and Finite Element Analyses systems is under the same roof and the site also includes a 300 yd. grass landing strip.
Please note that visiting is strictly P.P.R.

General Description

Unique methods of construction

The "Sherwood Ranger" series are tandem two seat open cockpit biplanes of tailwheel configuration. The unique methods of construction allow the aircraft to be produced in various configurations, from microlight to aerobatic light aircraft, all similar in appearance.

Wings can be folded

One of their main features is that the wings can be folded by removing four securing pins. No disconnection of flying control circuits is necessary, and the overall folded width is such that they can be transported by road on a simple trailer. One person can accomplish the rigging operation, from trailer to pre-flight check in less than three minutes.

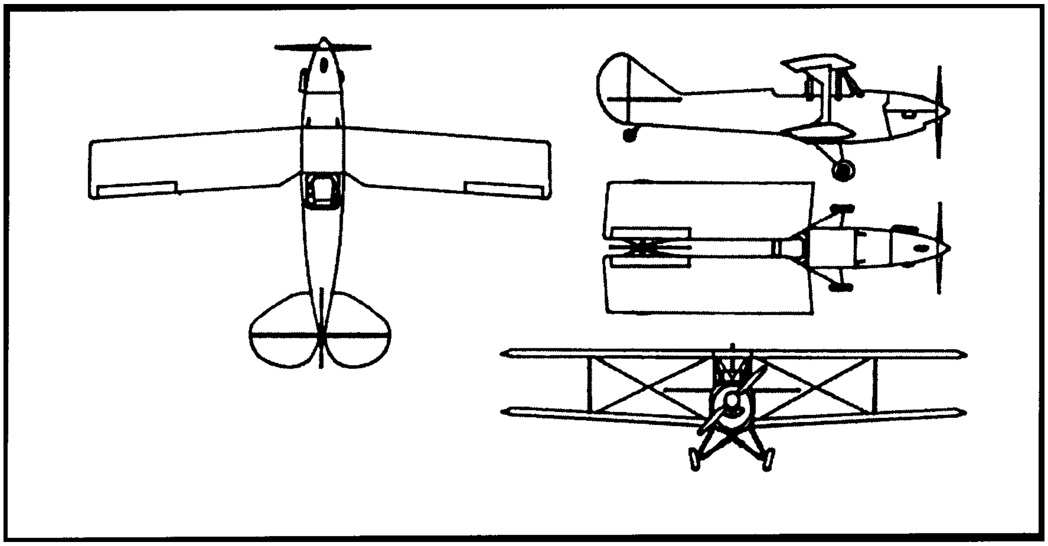
Conventional three axis dual flying controls are fitted with differential frise ailerons on all wings, steering during taxiing being effected by differential braking of the main wheels and fully castoring tailwheel. Solo flying is carried out from the rear seat.

The aircraft are powered by a fully enclosed engine driving a two or three blade propeller through a reduction gearbox.

Designed and manufactured in England

All aircraft are designed and manufactured in England by TIGER CUB DEVELOPMENTS LTD and supplied only as pre-fabricated airframe kits.

Features



Single or Two Place	Designed to meet British and European Airworthiness
"Biplane":	Requirements.
Folding Wings:	From trailer to fully rigged in less than 3 minutes.
Four Ailerons:	Differential frize ailerons on each wing for maximum roll Rate
Differential Brakes:	Differential brakes for precise powerful steering during take off and landing.
Dual Controls:	Full dual flying, engine controls and brakes.
Kit Construction:	Available in stage kits. Approximate building time 600 hours.
Fuel Tanks:	Top wing mounted fuel tanks. Provision for long-range tanks in lower wings.
Engine:	Designed for modern lightweight engines 60-80 HP.
Licence Requirement:	-LW- series aircraft can be flown on PPL D (Microlight)

Designed & Manufactured in England
by
TIGER CUB DEVELOPMENTS LTD.

Constructional Details

Wings

Wing design is identical for all four wings. They are of single aluminium tube main spar construction, with aluminium tube drag strut. The spar takes both bending and torsional loads. Ribs are birch plywood with lightening holes and bonded "U" section spruce top and bottom caps.

One riblet extending from L.E. to main spar is fitted between each main rib. Ribs are secured to the main spar using chopped strand mat (C.S.M.) fibreglass and polyester resin, backed up by safety rivets in critical positions. Leading edges are half round aluminium section with spruce trailing edge and wing tips, with optional sheeted edges and fibreglass wingtips.

A single fabricated aluminium "I" type interplane strut is fitted each side and interplane bracing is steel cable tensioned by turnbuckles, terminating onto fittings at the wing root ends. These fittings transfer loads into the fuselage by means of steel pins, which are withdrawn for wing folding. Two flying wires and two landing wires are fitted per side. The main spar walls are reinforced at the interplane strut positions, a single bolt passing through the spar to terminate strut and bracing.

Drag struts are joined to the main spars by inter locking with ribs and securing with C.S.M. polyester resin and safety rivets, the root end carrying the hinge fitting about which the wings fold.

Wings are covered using heat shrink fabric attached to the structure with cement. A variety of finishing schemes are available.

Ailerons

Ailerons are constructed and covered in a similar manner to the wings, with plywood ribs attached to an aluminum torque tube spar using C.S.M. polyester resin and safety rivets. The leading edges are covered in thin sheet plywood. Aluminum sheet hinges are fitted to the centre and each end rib. Similar hinges are fitted to the corresponding wing ribs. Operating horns are also fastened to each inboard end rib.

Fuselage

The load carrying structure of the fuselage is constructed from aluminium tube and is designed around a strong cockpit cage incorporating substantial aluminium fittings to which wings, undercarriage, front and rear fuselage structures are attached.

A Warren truss arrangement is used for the rear fuselage sides whilst a Howe truss is more convenient for the top, bottom and front sides. Bolts, rivets and aluminium plates or machined fittings are used for all joints. Some are also reinforced with structural adhesive.

The cockpit and upper front fuselage fairing consists of a single fire resistant fibreglass moulding. Rear turtle decking and side curvature is achieved by means of plywood formers and spruce stringers.

Firewall and foot support trays are formed from sheet aluminium, as is the exhaust duct, which runs below and between the front rudder pedals.

Two seat support rails made of aluminium tube, run between front and rear cockpit and are attached to primary cockpit bracing structure, which also carries the control stick assembly. Plywood seat bases and backs are attached to the seat support rails.

The complete fuselage is covered with heat shrink fabric and cemented to the structure.

Fin, Rudder, Elevator

Fin, Rudder, Elevator and Tailplane are all of similar and Tailplane construction, utilizing aluminium tubes for leading edges, trailing edges and ribs. All joints are assembled using aluminium gusset plates and rivets. Assemblies comprising machined aluminium top hat collars and operating horns are attached to the inboard ends of the elevator leading edge tube.

A similar arrangement is fitted to the base of the rudder such that movement of the control surfaces is obtained by transmission of torque through the leading edge.
The fin is built integral with the rear fuselage whilst the tailplane leading and trailing edge locates on stub tubes attached to the fuselage.
Each control surface is mounted on three machined aluminium hinges, which are bolted to the respective spars.
All surfaces are covered with heat shrink fabric cemented to the structure. Additional security is provided by lacing the fabric to Rudder and Elevator Ribs.

Undercarriage

The undercarriage is of conventional "Piper Cub" style, utilizing bungee rubber rings for suspension. All leg and bracing members are aluminium tube with machined fittings at rotating joints. Axles are T45 tube located in machined aluminium blocks attached to legs.
Main wheels consist of a cast aluminium centre housing two sealed ball bearing, with split spun aluminium hubs fitted with 600-6 commercial tyres and tubes. Drum or disc brakes, cable or hydraulically operated by the rudder pedals, give differential braking for steering purposes.
The tailwheel is fully castoring and consists of a rubber bungee sprung trailing arm, to which is attached an 8" pneumatic tyred, plastic centred

wheel fitted with roller bearings. The assembly is free to rotate on a steel tube, which slides into the fin sternpost.

Engine Installation

The engine mounting structure is either welded steel tube, or fabricated from aluminium tube, channel and plate, bolted and riveted, depending on model, and is attached to the four front longerons through bolts and "U" brackets. Sufficient space is available between engine and firewall to enable an electric or pull start to be fitted. The exhaust outlet discharges through a cut out in the bottom centre of the firewall into an aluminium duct, which extends rearward as far as the main spar.

Split, fully enclosed engine cowlings are moulded from fire resistant fibreglass. The cooling air intake is moulded into the lower half, which is attached to the fuselage with machine screws into captive nuts. The upper cowl is attached using quick release fasteners for easy access. Carburettor air is obtained from inside the cowl.

An aluminium spinner and backplate is fitted.

Controls (Rudder)

Rudder pedals are welded T45 Tube with Nylatron bearings attached to the floor pan with aluminium angle brackets. 3mm steel cable is used to connect front and rear pedals, and from rear pedals direct to the rudder horn. Fairleads are used where the cables leave the rear fuselage. Being an open circuit system, cables are tensioned by springs attached between front pedals and bulkhead, whilst length is adjusted by turnbuckles located near the rudder horn.

Controls (Elevator)

A dual stick control column assembly, interconnected by push rod and torque tube is attached to the central cockpit structure. A further push rod connects the rear stick to a bellcrank assembly mounted on the seat support structure. Cables, tensioned by turnbuckles transport movement from the bellcrank directly to the aileron horn.

Controls (Ailerons)

An aileron operating horn is attached at the rear end of the stick interconnecting torque tube. This points downwards and is positioned slightly behind the lower wing folding hinges. A closed circuit cable system transmits movement directly from the horn to bellcranks mounted in each lower wing, arranged to differentially operate each lower aileron through rod-end bearings and push rods. Upper and lower ailerons are connected by rod-end bearings and push rods.

No disconnection of the operating cables is necessary during folding.

Cable tension and aileron rigging is effected by turnbuckles, one in each operating cable and one in the balance cable.

First Flight

G-MWND "LW series fitted with Rotax 532"

"I don't ever remember
being so nervous and tense
in my life."

Having spent several years designing and building the prototype "Sherwood Ranger", I had foolishly allowed my P.P.L. to lapse, thus when the great day finally arrived, it was necessary to call upon the services of my good friend Alan Wade, an aerobatic display pilot.

Being a man of few words, (he never uses 10 words where one and facial features will do), I knew that after spending most of his life making a Pitts S2 do things that all the laws of aerodynamics, gravity and physical capabilities say are impossible, the most I was going to get was an impassive, but frank and honest appraisal of the aeroplane.

One bright winters day, I had finally managed to catch Alan on one of his few days leave, and we all set off to the local airfield at Sturgate, myself, Alan and an entourage of friends, all who had contributed in some ways to the project.

After carrying out the mandatory engine runs and mentally and physically checking the aeroplane through from design conception to tailwheel tyre pressure, I could no longer find any excuse to delay the proceedings further, and duly handed the aeroplane over to Alan.

After a couple of short hops up and down the runway, I sensed that the event I had envisaged so many times over the previous years, was about to take place. I don't ever remember being so nervous and tense in my life.

Sure enough, we heard the sound of the engine on full throttle and in just a few short yards, the aeroplane was air borne and streaking sky wards. Levelling off at about 1000ft, Alan carried out a few shallow turns, followed by a wide circuit, and came in to land. Three wheels kissed the tarmac together for an absolutely perfect landing.
By now, my heart rate was beginning to return to something near normal and resisting the temptation to fire a barrage of questions at Alan, I waited until he'd switched off the engine and as nonchalantly as possible asked, "How did it go?" "It was fine". said Alan, It's a bit too turbulent at 1000 ft to check things out properly. I'll put a parachute on and climb to 5000 ft and try a few stalls."

After landing from the next 30 minute flight, I was just as anxious to hear what he had to say. As soon as the engine had stopped I again strolled over to the aircraft and helped him unstrap.

"Well?" I said, "It's nice", he said, "just a couple of things, the ailerons are a bit light, exactly how I like them, but might be a problem for a novice, and the directional stability could do with improving.

"roll rate was excellent "

Further prompting revealed that the roll rate was excellent, better than a Stampe, with little adverse yaw, the stalls, power on and off were extremely docile and a dive to V.N.E. had proved uneventful.

It had been a very successful day and I was extremely pleased with the results and fired with enthusiasm to revalidate my P.P.L. without delay.

A couple of simple modifications soon improved the feel of the ailerons, and stronger rudder centring springs cured the problems with directional stability.

Apart from re-mounting the radiator to improve engine cooling, these were the only modifications carried out to the original aeroplane before submitting it for the certification flight test, carried out by the Civil Aviation Authority's test pilot, Bob Cole.

"It flies just as well as I thought it would. "

After a 50 minute flight test, Bob commented, "It flies just as well as I thought it would I can usually tell by looking at an aeroplane how it's going to handle. It's very pleasant to fly and easily meets the requirements of BCAR Sect "S", however it may require the addition of a stall warner to comply with JAR VLA. The only time I was aware of it's light weight was during take off and landing."

(Due to the low inertia, initial acceleration on the take-off run is very high, flying speed being reached in 3-4 seconds. Consequently, speed decays rapidly during the round out, ideal characteristics for short field operation).

Questions and Answers

This section of the brochure is presented in the form of answers to the most commonly asked questions.

What optional extras are available? (See price list).

The following optional extras are available and can be fitted to all aircraft; however, weight limitations or regulations may preclude their use on the "LW" series.

- Additional Fuel Tanks - Fibreglass fuel tanks can be fitted in all four wings, giving a total capacity of approximately 95 litres. In addition, an aluminium centre section fuel tank, with a capacity of 40 litres is available.

- Disc Brakes - The standard fitment consists of cable operated drum brakes, however, hydraulic disc brakes can be fitted.

- Fibreglass Wing Tips

- Sheeted Leading Edge

The standard wing on LW & ST aircraft uses riblets interspaced between the main ribs, to maintain the leading edge aerofoil shape. Sheeting this section with plywood increases the efficiency of the wing, but does increase the weight.

What engines can be used?

Engines of 50hp to 65hp can be used in the LW series and 65hp to 80hp in the ST and XP series aircraft.
At the time of writing specific details are only available for fitting the ROTAX range of two stroke engines. However, all possible help will be given to constructors who wish to fit alternatives. Bear in mind the following problems which may be encountered:-

- Cowlings may have to be modified.
- Engine cooling systems may have to be redesigned.
- Engine mounts will have to be modified.
- A heavier engine will affect the C of G. To counteract this it may be necessary to move the pilots seat further back or add tail ballast.

Note:- In certain circumstances, if your aircraft is the first to be fitted with a particular engine, we may be prepared to carry out the installation ourselves, free of charge

How long does the kit take to build?

The British Civil Airworthiness Authorities requires that a kit built aircraft takes at least 500 hours to construct. This has therefore been the target figure for kit construction time.

It is impossible to guarantee how long it will take to complete a particular aircraft, it will depend more on the individual builder than anything else. Some people work much faster than others-, some people can spend only a few hours a week; some people can work full time. It is more important to enjoy building and have an aircraft which reflects the amount of time spent on it's construction. If you build an aircraft that is quick to construct, but the end product disappoints you, then it's been a waste of time.

What jigs are required?

The wing assembly is the only area to require any form of jigging during airframe construction. This is simply a modified flat working surface marked and drilled according to the instructions supplied.

How is the aircraft purchased and supplied?

For U.K. customers only, the Sherwood Ranger is supplied in stage kits, so that it is possible to spread the purchase cost over a period of time. Refer to the latest price list for details.
Availability of kits will depend on stock levels at the time of ordering. Production of stage kits takes place in batches; it will therefore usually be possible to supply at least one stage kit from stock to enable construction to commence without delay. It is strongly recommended that the wing kit is purchased first. By the time construction is completed, the remaining stage kits will have been manufactured and placed in stock. These can be called off at any time up to 12 months after receipt of deposit at the price guaranteed at the order date.

An initial deposit of 5% of the complete kit price will be required with order, with the stage kit price being paid on collection. Please contact the factory for availability and delivery times.
Collection from the factory is preferred, otherwise shipping and crating charges will apply at cost.
Overseas customers buying from T.C.D.Ltd., must purchase the complete aircraft kit, with payment received in full before shipping. However, it may be possible to purchase stage kits where there is a local dealer.

What is supplied with the kit?

The complete Sherwood Ranger kit comprises of
all materials and components to enable the airframe to be constructed.
The majority of components are supplied pre-drilled and cut to shape.
Fibreglass components are pre-moulded and require final trimming to size.
The following items are not supplied with the kit:

- Engine and ancillary components.
- Propeller.
- Engine and flight instruments.
- Finishing materials, i.e. dope and paint.
- Upholstery.

All the above items can be purchased from T.C.D.Ltd., or any other source.

How much space is required to build the aircraft?

The largest sub-asst' is a wing. This is approximately 3.7m by Im. However, the front and rear fuselage assemblies, fastened together without engine, total approximately 4.5m in length.
The minimum workshop size required for building and covering would therefore be 4.5m by 3m. Initial rigging will require considerable space, and is best carried out either outside or in a hanger. Clearance dimensions of the completed aircraft, wings folded, are width 2.4m, height 2.35m and length 6.25m.

How much space is required to store the aircraft?

Doorway dimensions of a building will usually be the limiting factor which determines the suitability of an undercover storage facility. With the wings folded, the aircraft is manoeuvrable off the trailer and the minimum access dimensions are width 2.5m and height 2.35m, an internal overall length of 6.25m being required.
With the aircraft on a correctly designed trailer, the fin adds another .15m to the overall height. However, it is possible to manoeuvre during entry such that additional height is only required inside the building.
What skills are required to build the aircraft?

There are no particularly difficult skills required to build the Sherwood Ranger from a kit. It is really more an attitude of mind and confidence rather than skill and experience. If you can read and comprehend the simple instructions supplied with the kit and use basic hand tools, building should present few problems, but the following operations are typical of those required.

Note:- Full instructions are provided for all operations

Measure and mark distances in mm. (Since 99% of all holes are pre-drilled, very little measuring is required).

Drill holes in plate or tube using electric pistol drill (some pre-drilled holes are pilot holes i.e., they require to be drilled through with a larger drill size).

Cut aluminium plate using tin snips or bandsaw. In general plates are supplied cut to shape but some plates and brackets require the corners rounding off to finish the component.

Draw-file or finish the edges of plates and brackets.

Bandsaw out pre-marked plywood components. (Most plywood components, including ribs are supplied pre-cut to shape).

Pop-rivet assemblies together.

Assemble structure using nuts and bolts.

Spray paint aluminium components using small spray gun or air brush. (Goggles provided).

Bond wooden components together using two part adhesive.

Fasten components together using fibreglass matting and resin. (Full instructions and equipment provided).

Attach fabric to aircraft, heat shrink and dope.

Spray paint finish. (Recommend this operation is carried out by a professional).

Is it easy to tow the aircraft on a trailer?

The trailer design supplied by T.C.D. Ltd., is a basic two wheeled chassis style. The overall length is 6.7m and width 2.3m, with a gross weight including aircraft of less than 1000lbs. This allows an average family saloon to comfortably tow the aircraft at speeds of up to 50mph. A lightweight cover is available for towing in wet weather, but this tends to reduce towing speed by creating considerable drag.
The prototype aircraft has been trailered for several thousand miles with no problems whatsoever.
Note:- It is strongly recommended that the factory is consulted before trailers of a different design are used.

Have stress analyses been carried out?

The load bearing structure of the Sherwood Ranger has been analyzed using Computer Aided Finite Element Techniques. In addition, the airframe of the prototype aircraft was subjected to a proof-loading equivalent to +4g at a maximum A.U.W. Control systems and engine bearers were subjected to ultimate load conditions.

At what stage of completion are the components supplied?

Components are supplied as follows:-

- Tubes are cut to length and pre-drilled and formed.
- All plates thicker than .064mm are cut to shape, pre-drilled and pre-formed where necessary.
- Brackets pre-drilled and formed.
- Plates thinner than .064" are pre-drilled and marked out.
- Wing ribs stamped out to shape.
- Plywood components pre-formed or marked out.
- Spruce components machined to section require cutting to length.
- Machined items pre-drilled.
- Cables supplied to length with end fittings attached.
- Fibreglass moulded components require trimming and drilling.
- Welded components supplied ready welded.

What is the difference between the ST, LW and XP series?

There are three variations of the Sherwood Ranger, the ST (standard), the LW (lightweight) and XP (extra performance) series. All share the same basic aerodynamic shape and methods of construction, and can be built as a single or two seat aircraft.

The ST series is designed to comply with European requirements for light aircraft, JAR VLA. At present the Rotax 582, 618 or similar engines up to 80hp are the preferred engines for this aircraft, however a number of customer built aeroplanes are now being fitted with four stroke engines.
The LW series is designed around the requirements of BCAR Section S. Aircraft designed to this specification are commonly known as microlight aircraft in the U.K.

Similar in appearance to the ST series, there are slight differences in airframe material sizes in order to produce a minimum weight aeroplane, consequently the maximum A.U.W. is lower than the ST series.

Engines between 50 and 65hp, can be fitted, but depending on the country of operation, regulations governing the maximum AUW may dictate the amount of fuel which can be carried, or what optional extras can be fitted, when built as a two seater.

For instance, in the UK, when fitted with a Rotax 582 engine and built as a two seat aeroplane, it may not be possible to fit an electric starter motor and carry more than 25 litres of fuel without exceeding the weight limits applicable to micro-light aircraft.

(It is possible that the weight limit for microlight aircraft will be increased in the near future, in which case this limitation will not apply).
The XP series have a similar airframe to the ST series, but with a shorter wingspan, and are mainly for the constructor who wishes to modify the aircraft by fitting larger engines.

Is the Sherwood Ranger aerobatic?

The control surface dimensions were designed bearing in mind the requirements for aerobatic operation. The airframes of the LW and XP series are strong enough to meet aerobatic category requirements at reduced operating weights, i.e., single seat operation.

Certification of a Microlight aircraft for aerobatic operation is not legal in the U.K.

How does the performance compare to other aircraft in this weight category?

During the first 50 hours of flight-testing, the performance of the prototype aeroplane continued to improve as the engine gradually bedded in and developed more power.
Every few hours it was necessary to slightly coarsen the pitch of the ground adjustable propeller to prevent exceeding the maximum rpm during full throttle operation. This resulted in a significant increase in climb rate and cruise speed over the initial results obtained during the early stages of testing.
Typical performance figures shown on the rear cover of this manual have been based on these results.
Where a range of figures are shown they relate to minimum and maximum operating weights. More detailed information is shown in the appropriate pilots manual supplied with each aircraft.

Being the designer, I was naturally interested in comparing the Sherwood Ranger's performance with aircraft of similar weight and engine size, as no doubt will prospective builders. This was by no means easy, obtaining accurate data from manufacturers published information proved to be extremely difficult.

Naturally, manufacturers will supply data obtained under the most favourable conditions, however, some of the claims seem to be most unrealistic, a fact borne out by talking to operators of several small kit built aircraft. In many cases, their aircraft did not appear to perform anywhere near as well as the advertised data suggested, therefore when comparing figures for this class of aeroplane, it would be wise to consider the following points:-

- Treat all advertised data with suspicion. At best they will have been obtained under ideal conditions, on an aeroplane and engine in peak condition, by a pilot who can fly the aeroplane to it's limit.

- Ensure that relevant information applies to an aeroplane operating at maximum all up weight.

- Talk to a pilot who actually operates a particular aeroplane to obtain more realistic information.

For the reasons discussed in the next paragraph, treat even this with caution.
Comparing speeds quoted as Indicated Air Speed readings (IAS), is meaningless unless the position and instrument errors are known. It is easy to position the static source such that the airspeed indicator over reads by 20% in the cruise, and under reads by 20% at the stall. Figures are usually quoted as IAS unless otherwise stated. (The static source on the Sherwood Ranger is located such that the position error is negligible at all practical operating speeds).

Performance figures are invariably those obtained under International Standard Atmosphere (ISA) sea level conditions.

Climb performance in particular decreases significantly with height and increased temperature.
Take off and landing distance should include the distance to clear a 50ft. obstacle, not just the ground roll, and be obtained using the recommended climb or approach speeds at maximum all up weight.
(Figures shown on the rear cover for take off and landing distances were obtained in this configuration by an average pilot. These figures can be improved considerably by using short field techniques).
Although conventional Biplanes are usually less efficient than an equivalent monoplane, due mainly to interference effects between upper and lower mainplanes, the overall performance of the Sherwood Ranger is at least as good, if not better than most aeroplanes in this weight category, including monoplanes. Ian Barr, a very experienced pilot and instructor who has flown a large variety of modern lightweight aeroplanes, confirmed this fact. He commented, "This is certainly the nicest aeroplane I've flown, and far more efficient than I had expected."
Further improvements are possible by simple modifications to reduce drag. These will be in the form of small lightweight fairings fitted to various areas, and will be retrofittable to all aircraft.

APPENDIX A Sample Instructions

2.2.16 AILERON HINGE ATTACHMENT

1. Bond the inner and outer hinges onto the inside faces of ribs R6 and R10 respectively using adhesive F241. Position the hinges such that when fitted, the aileron is in alignment with the wing ribs and a

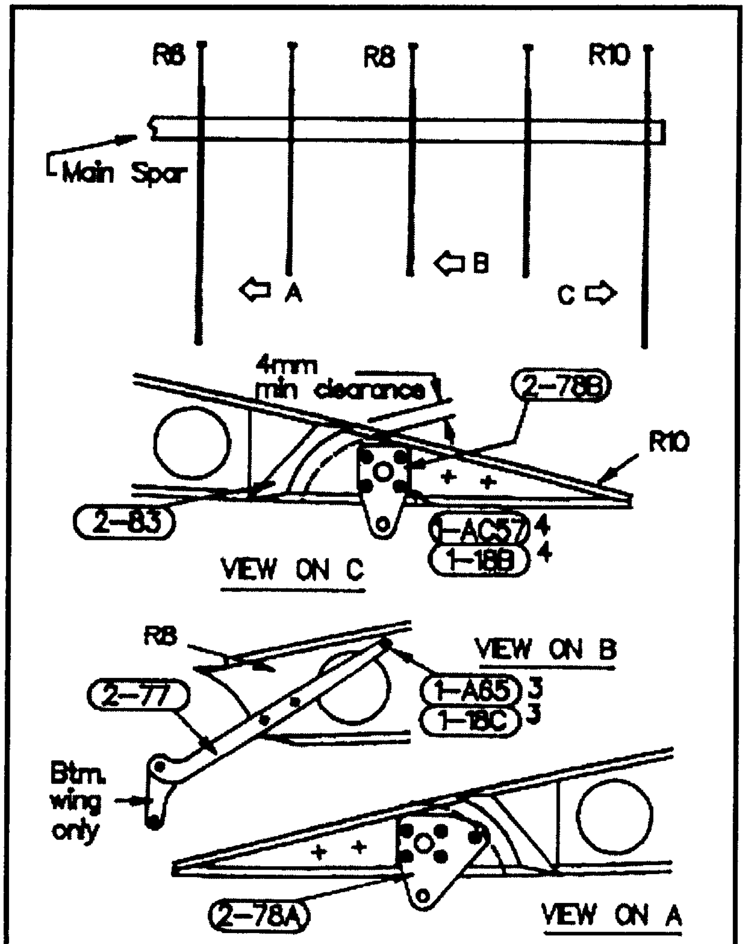


Fig.2.26(a) WING AILERON HINGE POSITIONS (R.H. SHOWN)

clearance of approximately 4mm.is maintained between the aileron cut-out web and the aileron leading edge sheet.

Fig 2-26(a) view C shows a typical situation. Rebate the lower rib capping strip just deep enough to allow the hinge to sit flush to the spacer web, item 2-85.

After the adhesive has fully cured, drill the spacer and rib webs 4.1 mm. and fit csk. rivets, see fig.2-26(a), views A and C.

THE *Sherwood Ranger*

by Russ Light

The Sherwood Ranger series of aircraft are tandem two seat open cockpit biplanes of tailwheel configuration. The unique methods of construction allow the aircraft to be produced in a variety of configurations, from microlight to aerobatic light aircraft, all of similar appearance. Russ Light, who designed the Sherwood Ranger and built the prototype aeroplane, describes the philosophy behind his design.

When aircraft constructors are asked, "Why did you decide to build an aeroplane", the standard reply is, "because it seemed like a good idea at the time".

Whilst to a large extent this is true of my decision to design and build the Sherwood Ranger, the main reason was that despite being involved in the design and manufacture of several light and microlight aircraft in the past, none of them completely met my own personal requirements.

The design of an aeroplane is a compromise at every stage, with many conflicting requirements. It is therefore necessary to decide on .a priority list of specifications.

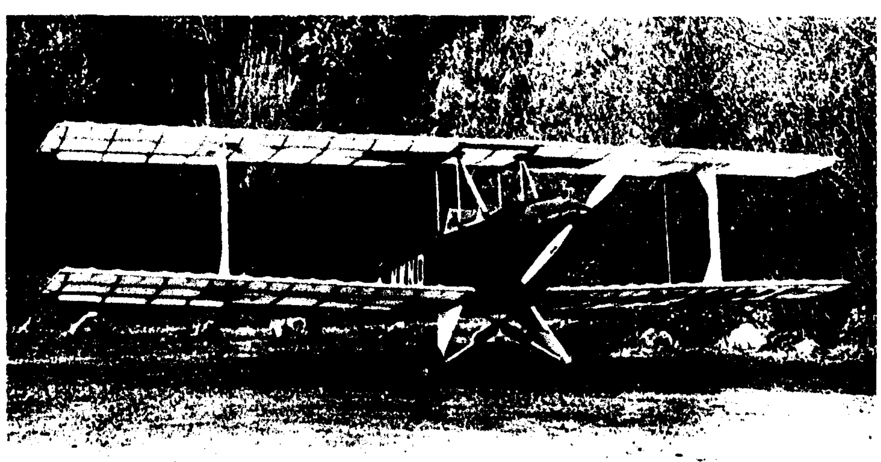
Size and weight

Having flown a large variety of single and multi-engined aeroplanes over the past 25 years the only thing that has ever marred the sheer thrill and enjoyment of this fantastically rewarding pastime, has been the drain on my pocket. I suspect that the majority of pilots who fly for pleasure have the same problem. For safety's sake, it is essential that pilots remain current but that can be an expensive business when the hire charges for a two seat production aircraft can cost around L80 per hour. Private ownership of this type of aircraft would not significantly reduce the operating costs either, the majority of the expense being attributed to maintenance, hangarage, insurance and landing charges.

The first important requirement therefore was that the aircraft should be inexpensive to operate. In general, the lighter the aircraft the lower the operating costs, and I decided that the basic aeroplane must be light enough to meet British Civil Airworthiness Requirement Section S, or what is commonly known as a Microlight Aircraft. Since I intended to produce an aeroplane which, if successful, could be manufactured for sale in kit form, it was also important that the basic airframe could be easily uprated to accommodate larger engines and possibly aerobatic capabilities.

One or Two seats

Although I suspect that the majority of private pilots spend most of their time flying alone, a two-seater aircraft is a much more practical proposition, if for no other reason than to check-out prospective pilots. An analysis showed that the costs involved in building a two



seater were not much higher than for one seat only.

Transportability

Another major requirement was that to save on hangarage and maintenance charges, it must be possible to quickly dismantle and transport for storage at home. From previous experience of similar aircraft, I came to the conclusion that anything that took longer than 5 minutes, single handed from trailer to pre-flight inspection would preclude the possibility of regularly flying for the odd half hour just when I felt like it. That magic period just before sunset when the wind invariably falls calm and the air becomes as smooth as -silk creates an irresistible urge in me to aviate.

By simply withdrawing four fixing pins the wings of the Sherwood Ranger can be folded backwards in seconds. This minimises space if it is desired to hanger the aircraft, or allows towing on a suitable trailer. Rigging, including removal from the trailer, can be accomplished by one person in less that three minutes. No flying controls are disturbed.

Engine size and type

Initial calculations indicated that an engine rated at 50hp would be the minimum size required to achieve acceptable performance. With the constraints on empty weight imposed by the microlight requirements, this dictated that a two stroke engine was the only practical proposition for the minimum weight basic aeroplane.

The power to weight ratio of a two stroke is considerably higher than a four stroke, plus the fact that the initial purchase price is invariably much lower. The main drawback seems to be their reputation for being less reliable, however the modern versions, which have been specifically designed for use in aircraft, are developing an excellent record.

Operational Requirements

If it is possible to keep the aeroplane at home, why go to the trouble and expense of transporting it to an airport and paying huge landing fees? It therefore seemed sensible that it should be possible to operate from short unprepared grass fields. Tailwheel aircraft, as well as being lighter and cheaper to construct than nosewheel configurations, are usually more suitable for this type of operation.

The Sherwood Ranger LW and ST series aircraft can be successfully operated from unprepared grass strips as short as 200 yards.

***Performance** Requirements*

The performance parameters which usually interest pilots most are rate of climb and cruise speed. When operating from areas which would not normally be recognised as suitable for use as an airfield, the ability both to clear obstacles by climbing steeply, and to quickly reach operating altitude, is essential for safe operation. With the low wing loading of the Sherwood Ranger, a perusal of other aircraft with similar power to weight ratios suggested that climb rate would not be a problem. The prototype LW series, fitted with a Rotax 532, 64hp engine, has a rate of climb between 900 and 1200fpm with a take off roll of 150 to 300ft, depending on AUW, runway surface and piloting technique.

Whilst as high a cruise speed as possible is desirable, it was not given the highest priority for the following reasons:-

1) I fly because I enjoy flying. If it takes an extra 15 minutes to get to my destination, as far as I'm concerned it's another 15 minutes of enjoyment, another 15 minutes experience and another 15 minutes in my logbook.
2) Unless an aeroplane can be flown in IMC, its use as a reliable and dependable means of long distance transport, especially in the UK, is very restricted. Since homebuilt aircraft are restricted to operating in VMC, the number of times when the full potential of a high speed long distance homebuilt can be realised is surprisingly few.

The prototype will cruise at speeds between 50mph and 85 mph depending on throttle setting.

Styling

The quest for producing minimum weight flying machines has resulted in some rather unorthodox looking creations taking to the skies. There is no doubt that weight, cost and kit build time can be saved by resorting to such configurations onfigurations as tailless or pod and boom fuselages. Whilst I have every admiration for these machines, I feel that an aeroplane must inspire and excite me sufficiently to justify spending thousands of pounds of hard earned cash and hundreds of hours of spare time on its construction.

Styling is also important for economic reasons. The latest futuristic machine will only be state of the art until the next futuristic machine appears, after which its value on the open market plummets. Another important decision, therefore, was that the aircraft must be a style which would not quickly date. The classic styling of the Sherwood Ranger guarantees admiring glances wherever it is seen.

Methods and materials of construction

The trend these days seems to be towards composite construction, using fibreglass or carbon fibres. Whilst these are excellent materials for aircraft construction, it is my opinion that the level of inspection and control of working practice which are essential to guarantee the integrity of this type of structure, is extremely difficult to achieve for both the homebuilder and the inspecting authorities. For this reason it was decided to use only reinforced plastic techniques on either non structural components such as cowlings and fairings, or structural components that could easily be loaded to ultimate design load.

With the type of fuselage and empennage structure envisaged, there are really only two viable alternative methods of construction, i.e. steel or aluminium tube.

For aeroplanes in this weight category, to utilise the full benefits of steel would mean using extremely thin walled tube. Such sections, apart from being difficult and expensive to obtain, are difficult to weld and prone to corrosion. A weight analysis showed that an aluminium tube fuselage, using bolted and riveted joints, could offer a weight saving of over 30% on a welded steel tube fuselage, using commonly available tube sizes. In addition it would be very easy to repair. Since there are four virtually identical wings, ease of construction is of prime importance. A tubular aluminium alloy spar was chosen to carry both bending and torsional loads. Pre-formed ribs *are* then slid onto the spar and bonded into position. Alloy ribs were considered, but the required gauge of material is so thin that it is extremely prone to handling damage. It was therefore decided to use birch plywood ribs with spruce caps.

As is common practice with this type of structure, heat-shrink polyester fabric was the obvious choice to complete the airframe.

Safety

Safety is another extremely important consideration in the design of any civil aeroplane. There are many aspects which affect the safe operation. By safe operation, I mean the likelihood of any person, - pilot, passenger or onlooker being injured through any direct or indirect cause associated with the aeroplane. The final major requirement was therefore that the aeroplane must be safe and easy to operate.

Some of the main points to consider are: structural integrity, handling characteristics, landing and take off speed, engine reliability / configuration, durability, performance, visibility and crash protection.

Why a Biplane ?

Bearing in mind all of these desirable requirements, and having spent many hours deliberating on the best compromise, I eventually decided that a biplane configuration would be best for the following reasons:-

1) Without resorting to the complexity of fitting flaps or slots, the relatively large wing area required for slow stalling speeds would require wing spans in the region of 35ft and wing chords of around 5ft for a monoplane. Wings of this size would be very difficult to remove or fold quickly and easily, whereas biplane wings of similar total area can simply be folded back, the overall width remaining within the legal limit for trailering.

2) The biplane wing configuration is lighter for a given strength than the monoplane wing, or put another way, for a given weight the aircraft can be made stronger.

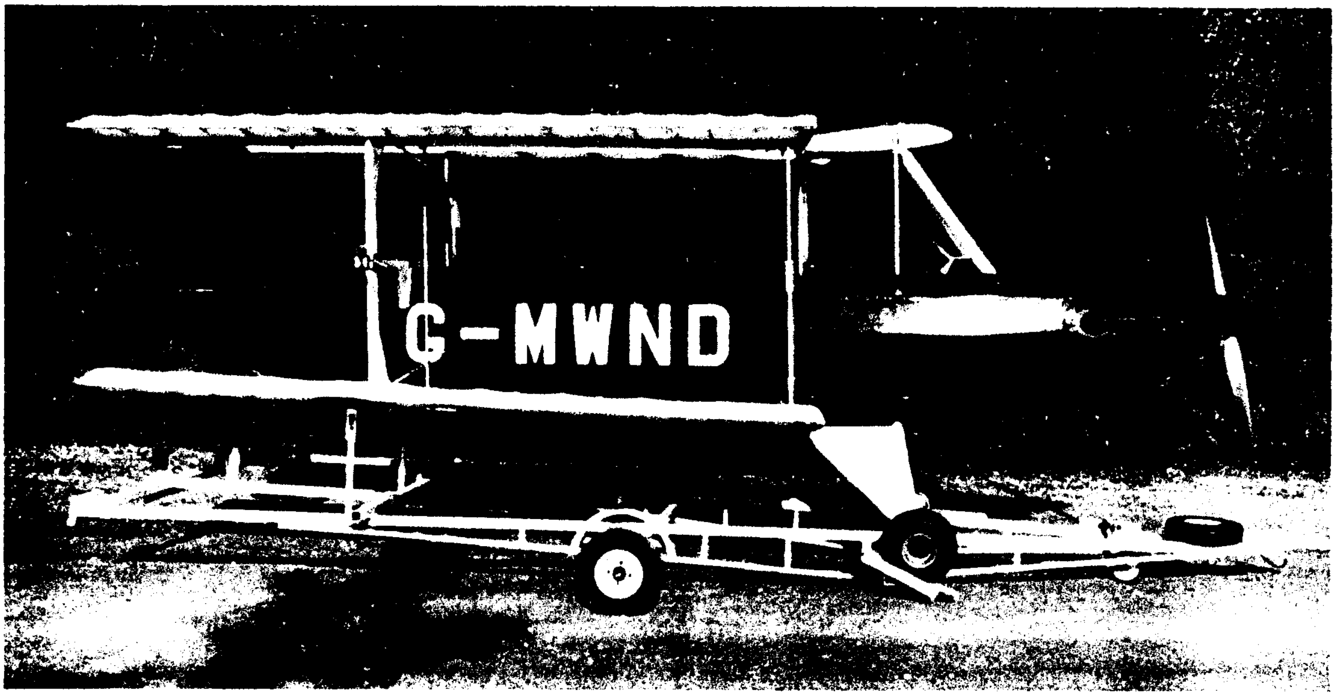
3) The cockpit is surrounded by structure. This greatly reduces the chances of injury during an emergency landing. The cockpit area of the Sherwood Ranger is designed to form an extremely strong cage type structure for maximum pilot and passenger protection.

4) The aesthetic appeal of the biplane is timeless. The design will not be out of date in 50 years time

docile. The lower wings generally stall slightly ahead of the upper wings, thus giving gentle stalling characteristics. All of the pilots who have flown the prototype aeroplane remark on its docile stalling and extremely pleasant handling characteristics. Bob Cole, the CAA's chief test pilot, commented after a 50 minute flight "It is an extremely pleasant and safe aeroplane to fly, with no obvious vices, it easily meets the CAA requirements. The only time you are aware of its light weight is during the landing."

Add to this the chance of the ultimate flying experience, piloting an open cockpit biplane on a summer's day over the English countryside, and I think you will agree, it's no contest.

For further details of the Sherwood Ranger range of aircraft kits contact Tiger Cub Developments Ltd., of Doncaster *(Tel. 01777 817975).*



The Sherwood Ranger LW

The Ranger is not just a 'pretty' biplane: it performs like a group W aeroplane, it's good fun to fly and it doesn't drain the wallet. Is it the microlight to dispel its classification prejudices? Miles McCallum reports

The big problem for anyone who flies purely for fun is the expense of getting into the air. Coughing up something like £80 an hour to whizz around in the wild blue with no particular place to go takes quite a lot of the gloss off, leaving many· pilots to question whether it's really worth it. Some shrug their shoulders, and laugh off an hour in the air as the 'L100 cup of coffee', and others simply· give up.

Buying your own aircraft — if it's a certified, factory built example — won't really make any difference to the ultimate operating costs; by the time you have forked out for tie down or hangarage, maintenance, recertification and fuel, the chances are that I[will have cost you more at the end of the year than ¡ust hiring one when you have the urge — or the means.

Going the homebuilt route is a way out... sometimes. The problem there, apart from a year or five stuck in a workshop (and not in the air) is that weight and performance hear a direct relationship to the ultimate cost. Simple: reduce the weight, accept lower performance standards, and things become more affordable. If you take the argument to its logical conclusions, we are talking a microlight. The trouble is, that generally means tighter weather criteria: you can't fly if the wind is up above 15 kt, and every gust or thermal gives you a good jolt. If you are into control and handling, the sort that puts a smile on your face, you're unlikely to end up with something that responds like a Europa, or a Slingsby, or even a Grumman. Flying something that feels like the stick is attached to the controls with frayed elastic with the'responses of a dead cat is no fun — so why bother?

People do, of course, on the basis that flying is at least flying, but for many the choice is either a 'proper' aeroplane, one that feels solid in a bit of weather — with all its attendant costs — or nothing. The reality of the situation, however, is that the dividing line between microlights and heavier aircraft is becoming increasingly blurred. You can still pigeonhole them purely on the basis of weight, speeds or whatever, but the truth of the matter is that modern microlights do perform and they can be good fun — especially if you consider feel and handling to be at the top of the requirements list. Ah well, another prejudice hires the dust!

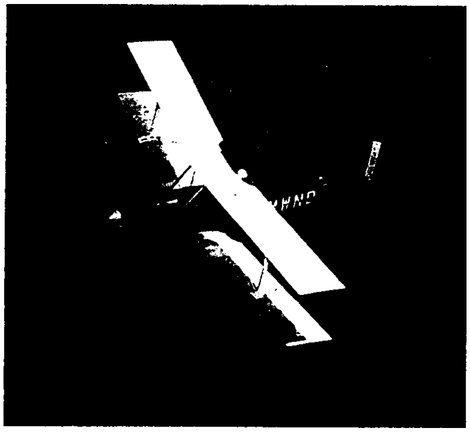
For more ideas and information on cutting the cost of your flying turn to page 24

The microlight for all pilots

Russ Light's Sherwood Ranger LW is an aeroplane that we have been watching for a Couple of years now, monitoring progress and waiting for a chance to evaluate it. I have to confess that the desire to fly it was partly based on the fact that it is a very pretty biplane with classic lines (I'm a sucker for anything with two wings) and partly because he promised that a heavier, faster, aerobatic version would follow. Never mind that — flying the LW microlight version is a knock out. This is a real pilot's aeroplane, and any theoretical disadvantages – rapid progress excepted – accruing from its classification lust didn't enter the frame.

The majority of the kit is manufactured 'in house', obviating quality control problems, and follows Current very

The Amger displays till the features of a classic British 30's biplane fighter



light aircraft tube, wood and fabric practices. The fuselage is largely made from aluminium tubing riveted together with gusset plates or machined fittings. All the metalwork thicker than 0.064mm (0.016") is precut, drilled, and formed where necessary, the rest being drilled and marked out ready for cutting using tinsnips or a handsaw. Some critical areas are bonded as well, using a structural adhesive as a belt and braces backup. This is estimated to weigh 30% less than an equivalent steel tube fuselage. All cubes are precut and drilled with pilot holes so any damaged components can be easily replaced with off the shelf items. The tail surfaces are made in much the same way as the fuselage structure.

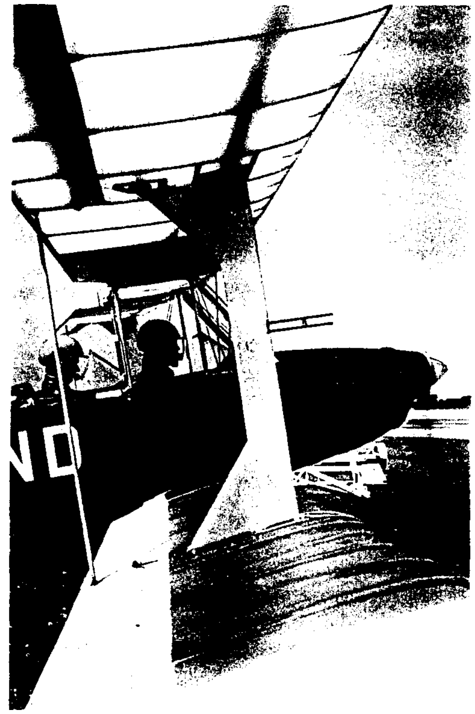
The first kitbuilder, Dan Nelson, reports that the entire fuselage framework can be assembled using clecos (temporary fasteners) in around six hours, and it is effectively self jigging. The pilot holes are drilled to size and either bolted or riveted using 'cherry' (aircraft quality) pop rivets. The turtlecleck and sides are fleshed out with ply formers and spruce stringers, and the cockpit top and cowling are fibreglass mouldings. The ply components are marked out ready for bandsawing, and the spruce is machined to section and needs cutting to length.

The wings require a purpose-built flat surface measuring 3.7 x *1* metres to construct them, but are in effect four identical units – as long as you build right and left sides. Don't laugh: quite a few builders have ended up with a 'spare' handed component in the past. An ali tube spar takes all the bending and torsional loads, and a diagonal ali tube takes care of drag loads. Prestarnped birch ply ribs Fitted with spruce U section capstrips are slid into place, and extra nose riblets fitted before bonding on the *V2* round ali leading edge. The trailing edge and wing tips are spruce, and the aft outboard corner of each panel is then lifted a specific amount to provide the washout demanded before all the ribs are bonded into position using chopped mat fibreglass and polyester resin. Critical areas –such as the drag strut fixing – are backed up with rivets for safety. Again, Dan reports that it's simple, strong and light.

The entire airframe is covered with heatshrink dacron fabric, bonding it to the structure, and only the elevators and rudder require ribstitching for security. Careful attention to keeping the weight as low as possible is a must: the prototype has only the minimum amount of dope applied to the wings in an effort to keep the weight within the legal maximum, although this may change in the course of time.

A time for building

The kit has been designed to be built in a little over the PFA minimum of 500 hours, hence various parts are not being prefabricated as much as they could be: even the rawest novice should have no problems with construction. The instructions are detailed, clear, simple and well illustrated. You could in theory build the Ranger using hand tools only, although Dan relates that some power tools made the ıob easier. The engine, prop, instrUnicimS. upholstery and finishing materials arc nut included in

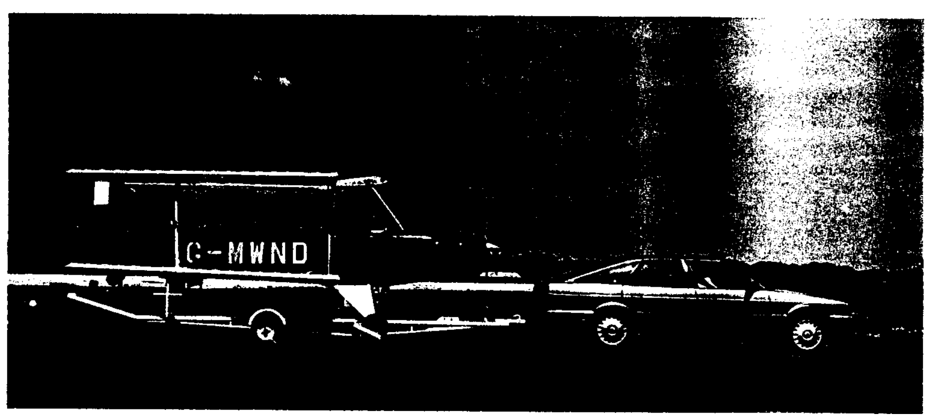


The 26 leer wingspan is rather elegant, truth a slight sweepback and very clean lines

THE SHERWOOD RANGER'S OWN TRANSPORT

Hangarage accounts for one of the largest chunks of fixed costs when you own an aircraft. You'll see various competitors extolling the advantages of keeping an aeroplane at home, proudly quoting 'only' 20 or 30 minutes rigging and derigging time. Pretty good, I suppose, compared to a Cessna, but that's enough to put most people off from using the option — indeed, all the pilot/owners I know who have such aeroplanes usually only derig them and tow them home for the winter or for repairs.

The Ranger has been designed with folding wings so it can be towed home on a trailer: no mean feat with a biplane. A dedicated trailer has been created specifically for the aeroplane, and the entire operation is simplicity itself, even without any helpers. The forward inboard ends of each pair of wings are held apart with a temporary brace, and the wings are swung into position, and locked in place with a pin through each forward root fitting. The brace is removed for flight... and that's it. Lift the tail off the trailer and wheel the aeroplane forward 20ft, and you are ready to go. The fuel and pitot/static lines remain coupled, as do the aileron cables, and the flying and landing wires require no adjustment.



The Sherwood Ranger can be unstrapped and rigged in about the same time it takes to read this panel