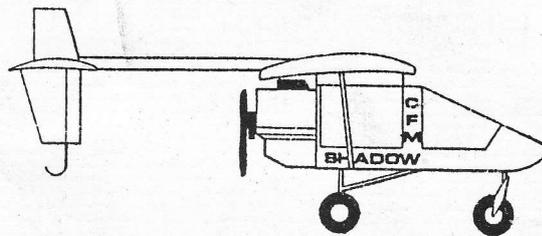
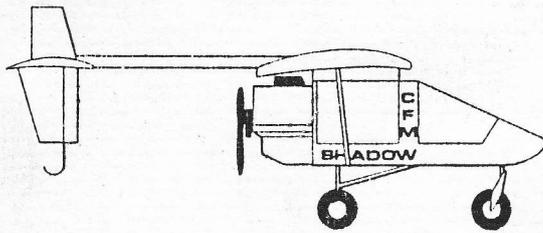


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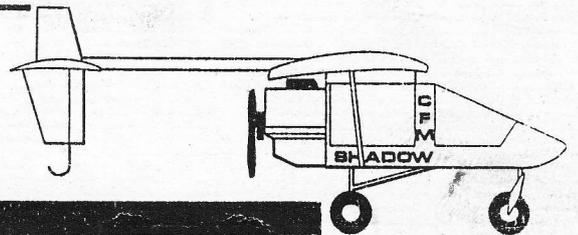
SHADOW

SERIES B & BD

DESIGNED by DAVID G. COOK



PILOTS NOTES



'SERIES' KEY

SERIES B - SINGLE CONTROL AIRCRAFT

SERIES B-D - DUAL CONTROL AIRCRAFT

P I L O T ' S N O T E S

D O C U M E N T R E F E R E N C E

PN - SH/B

LIST OF EFFECTIVE PAGES

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2. Total number of pages in this publication is 22 consisting of the following:

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SECTION 1

DESCRIPTION

NOTE: Unless otherwise stated, all AIRSPEEDS quoted are "INDICATED".

1.1 INTRODUCTION

The "SHADOW" Microlight Aircraft is a high wing monoplane with conventional three-axis control, three position flaps and differential brakes on the main wheels.

1.2 DIMENSIONS

| | |
|------------------|---------------------|
| Length - Overall | 21' |
| Height | 8' 2" (Top of Fins) |
| Wing Span | 32'11" |
| Dihedral | 0° |
| Wing Area | 162' Ft.Sq. |
| Tailplane Area | 14.5' Ft.Sq. |
| Elevator Area | 9.2' Ft.Sq. |
| Rudder Area | 5.5' Ft.Sq. |
| Fin Area | 1.5' x 2 Ft.Sq. |
| Aileron Area | 8.2' x 2 Ft.Sq. |
| Flap Area | 5.4' x 2 Ft.Sq. |
| Aspect Ratio | 6.4 : 1 |
| Wheel Track | 5' 6" |
| Wheel Base | 6' |
| Wing Incidence | 3.5° |

1.3 ENGINE

The Shadow is fitted with the ROTAX 447 (436.6cc) 2-stroke twin cylinder engine with single BING carburettor and a modified exhaust system.

Engine Controls:

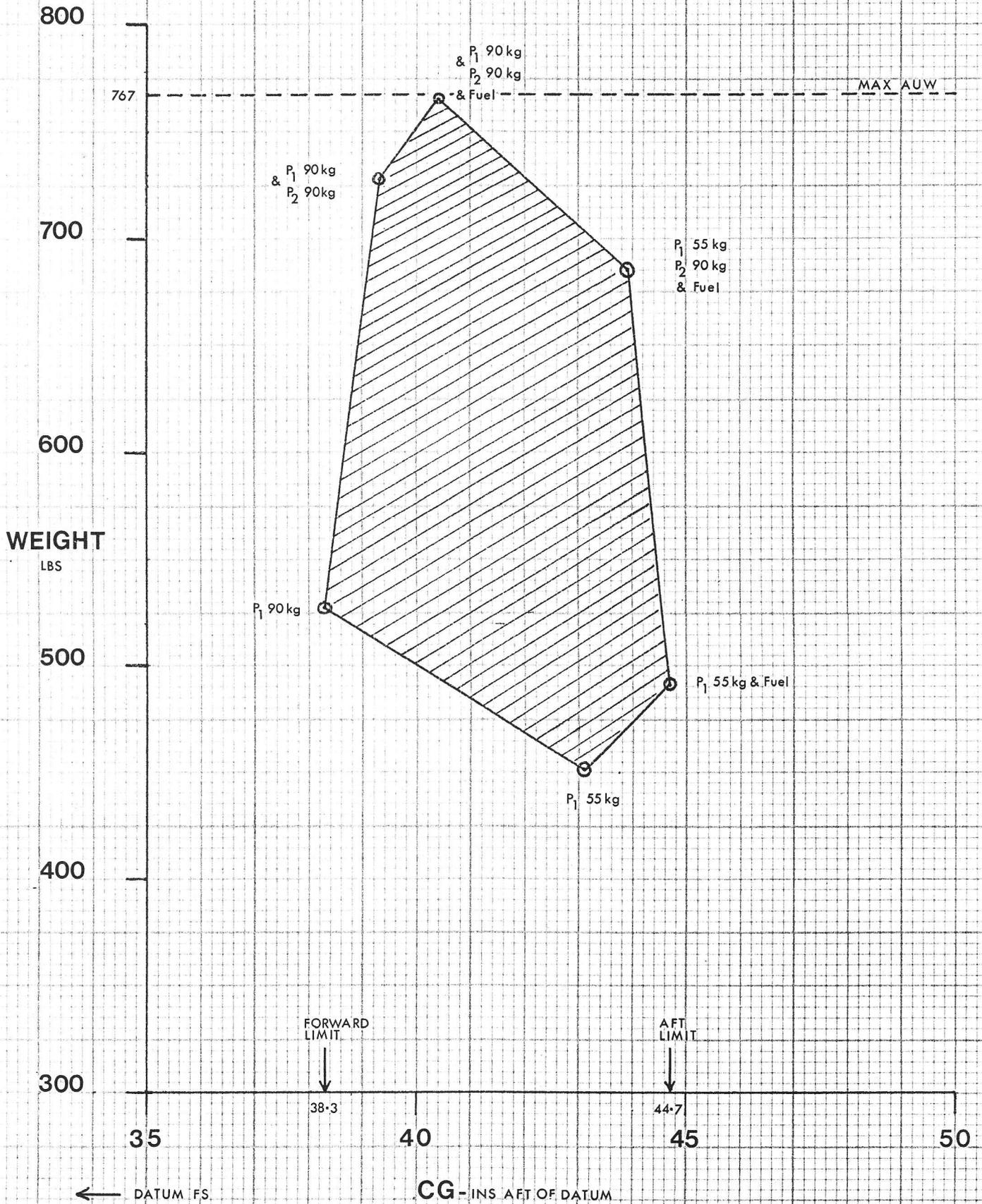
Throttle lever is mounted in the front cockpit on the port console. Push forward to increase RPM. For SERIES B-D the lever is in the same place in the rear cockpit.

Ignition Switch on starboard console ahead of control stick. Switch functions forward for ON.

Choke lever situated on port side of cockpit wall just in front of the throttle lever - up for RICH.

Starting of the engine is by rope recoil system. The handle is positioned next to the Pilot's shoulder - starboard side. Fuel Valve - for emergency use only. It is recommended that this is left in the down (ON) position - situated behind the throttle lever. Pull up for (OFF).

SECTION 1 (1:4 cont.)



SHADOW

SERIES-B α B D

WEIGHT & CG ENVELOPE

PN-SH/B 1-3

23rd February, 1987

SECTION 1 (Continued)

1.8 ELECTRICAL SYSTEM

There is a rectified electrical power supply on standard series aircraft which powers the fuel gauge only - this is 12 volt DC.

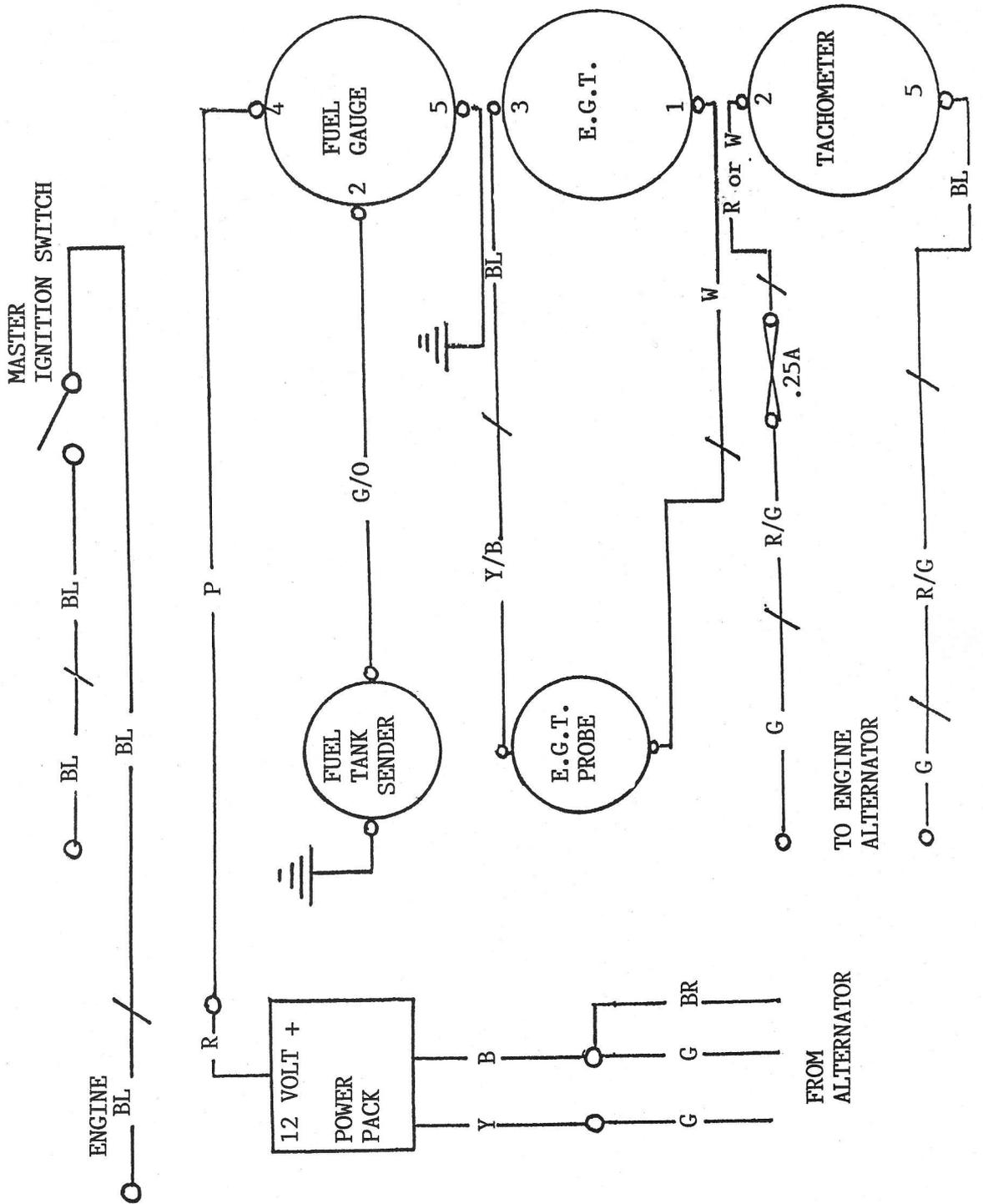
Ignition. Switching the ignition to 'OFF' shorts out the HT coils.

Tachometer. Wires taken straight from the alternator pass through a fuse (0.25 amp) to supply the tachometer instrument.

EGT and CHT temperature gauges require no outside power source.

REFERENCE DRG. NO. S105

ROTAX
447

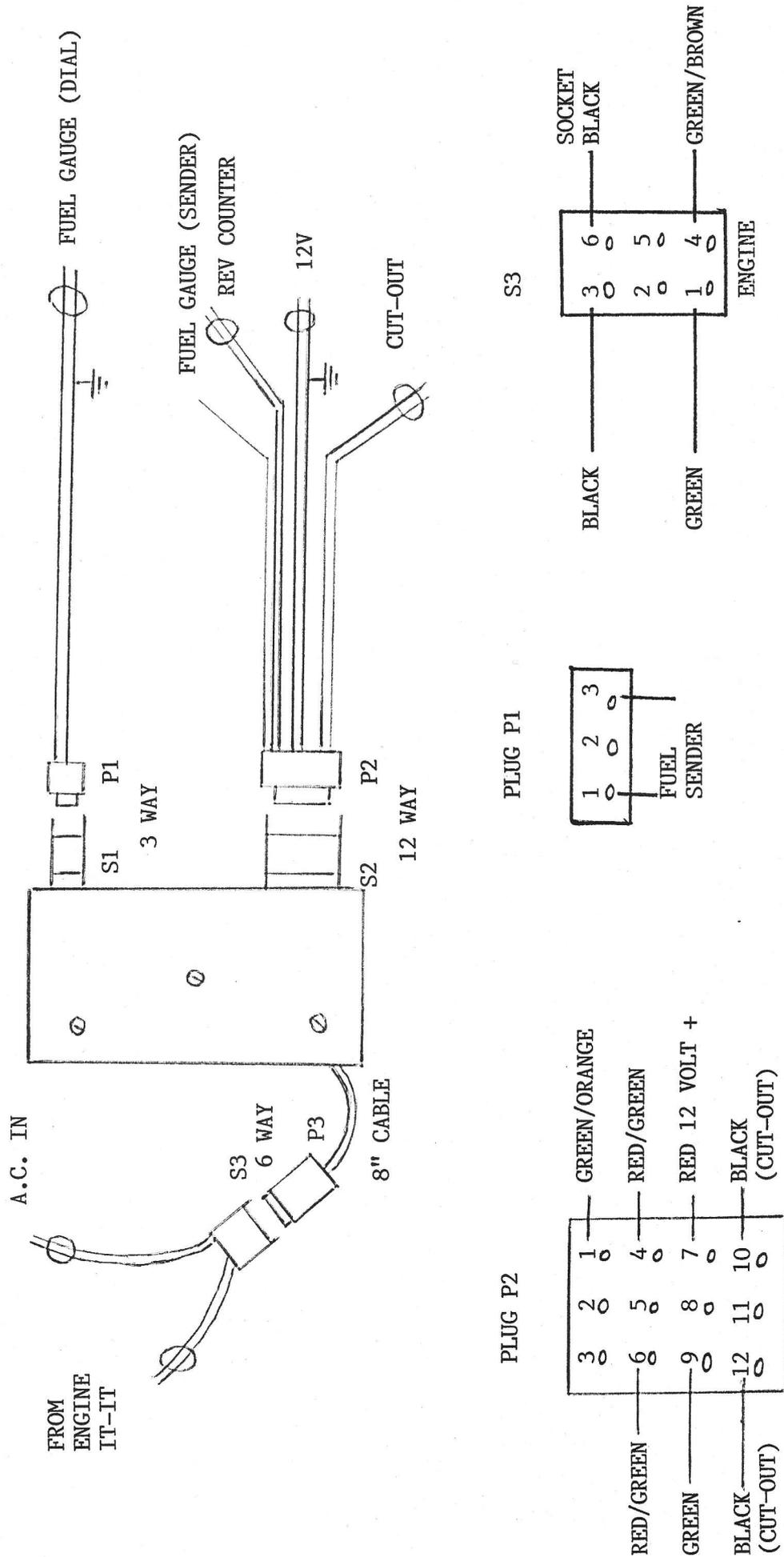


| KEY | |
|--------|----|
| BROWN | BR |
| BLACK | BL |
| BLUE | B |
| GREEN | G |
| ORANGE | O |
| PINK | P |
| RED | R |
| WHITE | W |
| YELLOW | Y |

**ELECTRICAL
SCHEMATIC**

WIRING OF PLUG CONNECTIONS
FROM RECTIFIER BOX TO LOOM AND ENGINE

SCHEMATIC DIAGRAM



SECTION 1 (Continued)

1.10 AIRCRAFT CONTROLS

Pitch Control - by conventional full width elevator. Stick forward ELEVATOR - DOWN - PITCH DOWN. Stick back ELEVATOR - UP - PITCH UP. Range + 20° - 16°

Roll Control - by differential ailerons. Stick left, ROLL LEFT (port aileron UP starboard aileron DOWN), stick right, ROLL RIGHT (port aileron DOWN starboard aileron UP). Range + 20° - 10°.

Yaw Control - by dorsal rudder. Left rudder pedal - rudder left YAW left. Right rudder pedal - rudder right YAW right. Range + 25° + 25°.

Flap Control - to 3 positions. Range 0°, 15°, 30°.

Ground steering is effected through a fully castoring nosewheel and the use of differential, cable operated drum brakes on the main wheels.

Dual Controls - Controls for the throttle, rudder, elevator and ailerons are provided in the rear cockpit on SERIES B-D aircraft. There are no brakes or flap select lever in this configuration. The rudder pedals have been inset into a small well that has been added to the floor of the aircraft.

1.11 GENERAL EQUIPMENT

Three/four point attachment full harnesses are fitted in both cockpits.

1.12 INSTRUMENTS

Any instruments that malfunction should be replaced. The only maintenance required is to ensure that the pitot system to the air speed indicator(s) and altimeter is free from obstruction and that all electrical connections are secure. If it is necessary to clear the pitot tube and line disconnect and blow it through - DO NOT blow down the pitot head with it connected. The air speed indicator(s) and altimeter are statically vented inside the cockpit.

The altimeter and air speed indicator(s) as fitted by the Factory are ex RAF type reconditioned instruments which are 'non-released' items. The front cockpit air speed indicator is certified to be within a 5% error and where a second instrument is fitted in the rear cockpit (as in the SERIES B-D) there is further certification that these two must be within a 2% error of each other. If outside fuel limits, correction cards will be supplied and fitted where clearly visible to both occupants.

SECTION 2

LIMITATIONS

2.1 ENGINE LIMITS

Min. R.P.M. = 2,000
Max. R.P.M. = 6,000
Max. Cont. R.P.M. = 6,000
Max. E.G.T. = 1,350°F
Max. C.H.T. = 480°F

AIR TEMPERATURE CORRECTIONS

These indicators are calibrated at 70°F std and read the difference between the thermocouple prod or ring and pin terminals (air temperature) on cable.

For air temperature below 70° the correct reading would be the meter reading minus the number of degrees air temperature is below 70°. For air temperature above 70° add that amount to the meter readings.

2.2 FLYING LIMITATIONS - Control movements are to be restricted to 1/3 deflection at speeds in excess of VA.

Never exceed = 108 MPH (VNE) - 94 kts

Flap extend: Max. speed (VFE) = 15° = 65 MPH - 57 kts
30° = 60 MPH - 52 kts

Design manoeuvre speed = 76 MPH (VA) - 66 kts

Ceiling = 10,000 ft (without oxygen)

AEROBATICS PROHIBITED - Max. positive loading = +4G
Max. negative loading = -2G

SPINNING PROHIBITED

Operation - VFR daylight only.

2.3 DUAL CONTROLS

* DO NOT ATTEMPT TO FLY THE AIRCRAFT SOLO FROM THE REAR COCKPIT

SECTION 3

HANDLING

3.1 PILOT'S EXTERNAL CHECK LIST

| | |
|------------------|--|
| Cockpit | Switches off Canopy hinges and latches secure |
| Fuel | Check quantity Tank cap secure Vent line unobstructed Check CURTIS drain valve for any water - aircraft level |
| Engine/Propeller | All bolts secure Propeller bolts secure Propeller condition for erosion Exhaust system secure - springs present and wire locked |
| Main Gear | Tyre wear and inflation Brake cable attachments secure Check 'witness marks' |
| Nose Gear | Free swivelling |
| Wings | Structure undamaged Aileron and flap hinges secure Aileron and flap linkages secure Attachment pins and safety pins installed correctly Wing structure secure |
| Fuselage/Tail | All bolts secure Assembly bolts/pins - check safety pins Elevator hinges secure Rudder and elevator brackets secure Check for movement on control surfaces |
| Control System | Control stick free and secure Check pushrods and pins Rudder pedals secure |

3.2 PILOT'S INTERNAL CHECK LIST

BEFORE TAKE-OFF - CHECK AUV WITHIN LIMITS

| | |
|---|-----------------------------------|
| Pilot position correct | Controls - full and free movement |
| Flap position UP | Instrument check |
| Fuel valve on/check quantity | Altimeter set |
| Canopies locked - front and rear | |
| Seat belts secure - both cockpits. | |
| For Dual Controls - check all free and footwell for loose articles. | |

3.3 ENGINE HANDLING

Starting the engine may be accomplished by recoil-starter or by hand-propping. Always have another person to help you with starting. The helper should hold down the aircraft on its nose gear and chock the wheel. Do not 'blip' the throttle when engine is running as this subjects the reduction drive to excessive strain.

3.4 ENGINE STARTING

COLD START

Check Fuel on
Prime the engine with the primer bulb
Ignition switch OFF
Throttle open to 10%
Full choke applied
Pull engine through several blades
Pull engine to compression stroke
Ignition switch ON
Pull starter cable smoothly

HOT START

Leave throttle at closed or 10%
Check Fuel on
Apply choke if no reading on C.H.T. gauge
Pull engine to compression stroke
Ignition ON
Pull starter cable smoothly
After start close choke and allow to idle and warm
up for at least two minutes. R.P.M. = 3,000

RE-START IN FLIGHT

The engine can be started in flight provided it is warm but you are advised not to switch it off in flight. The engine cools rapidly (1-2 mins) and once cold it may not be possible to re-start it. Depending on Pilot strength, the starter cable can be managed with either hand, but it may be necessary to use both hands!

Set throttle to closed or 10%
Check Fuel on
Apply choke only if cold
Pull engine to compression stroke
Ignition 'ON'
Pull starter cable smoothly

3.5 TAXI-ING

If you have a passenger, strap him/her in before starting. Apply the brakes as soon as boarded. R.P.M. may be increased to 3,000 to clear engine whilst seat belts and canopy are secured.

Taxi-ing on runways. This may be increased to 20 M.P.H. On grass or rough surfaces do not taxi above 10 M.P.H. - steering below 10 M.P.H. is accomplished through differential braking but the rudder should be applied as well. The propeller blast will assist the rudder to turn at all taxi-ing speeds, thus saving brake wear. The nose gear will free swivel enabling very tight turns but always be sure that the gear is straight ahead before full power is applied. Point aircraft into wind whenever stationary.

When taxi-ing with the canopy open ensure that hands are clear in case the canopy slams shut.

Do not taxi through any puddles or surface water - it can damage the propeller.

SECTION 3 (Continued)

3.6 TAKE-OFF - only use prepared or semi-prepared runways.

Complete the pre-take off checks. Double check canopies are shut and seat belts tight. Be sure the nose wheel is straight - taxi forward a few feet. Be advised that the Shadow accelerates fast and that the take-off run is considerably further than most other microlights - see SECTION 6.

NORMAL - Brakes off - do not hold brakes on with full power - you will drag the locked wheels down the runway. Apply power smoothly; the rudder will be effective as soon as engine accelerates. Rotate nose wheel at 40 M.P.H. and hold clear until you accelerate to 55 M.P.H. As you pass through 55 M.P.H. rotate and you will be flying.

Full throttle recommended 100% for two minutes only.

ROUGH FIELDS - Very rough fields are not recommended due to heavy undercarriage loads. Fields that are semi-prepared are acceptable. Get the nose wheel off as soon as possible, use 15° flap and rotate at 40-45 M.P.H.

CROSSWIND - Normal take-off procedure with bias aileron towards wind direction. Aircraft will respond very much as usual and is minimally affected (LIMITATION 20 M.P.H. at 90°).

3.7 CLIMBING

For the best rate of climb maintain 60 M.P.H. - the best angle of climb is attained at 50 M.P.H. on full power. For good visibility a climb speed of 65-70 M.P.H. is used. Maximum rate of climb at AUW is 700 ft per minute.

3.8 GENERAL FLYING

Cruise - Maximum continuous recommended cruise power setting is 6,000 RPM giving a high cruise speed of 75 M.P.H. Cruising at 5,000 RPM is a good compromise for fuel economy and should show an airspeed of between 65-70 M.P.H. In rough air reduce to 60 M.P.H.

Pilot Position - The excellent visibility featured on the Shadow allows both tall and short pilots an uninterrupted view ahead, above and to the sides. Short pilots should use a cushion behind them so that their feet are firmly situated upon the rudder pedals which are not adjustable.

Wind Limitations - It is recommended that you do not fly in winds gusting to or over 25 M.P.H. - beware ground handling in these conditions.

Do not attempt to take-off or land with a crosswind of more than 20 M.P.H. at 90°.

Canopies - Do not attempt to open any canopy during flight.

3.9 RANGE AND ENDURANCE

Normal still air endurance with full fuel (5 GALLS) will not be less than 1 $\frac{3}{4}$ hours with 15 minutes reserve, but is entirely dependant upon AUW and cruise power setting. At economical cruise setting of 5,000 RPM fuel consumption is around 2 GALLS per hour.

SECTION 3 (Continued)

3.10 STALLING

There is no defined stall as generally accepted - with engine off or on idle a gentle 'mushing' descent starts around 38-40 M.P.H. Even with full power and a pitching angle of 60° there is no evident stall - above this angle a gentle 'nod' develops after which the aircraft regains it's original attitude. There is no difference to this effect with flaps in - either at 15° or 30° power on or off - however, the aircraft becomes more positive to roll control. At no time is buffetting of the controls felt nor will a wing drop.

3.11 TURNING

There is no tendency to side slip and sink rates are comparable to those experienced in level flight. No buffetting of the controls occurs. With power on it is possible to turn steeply without any trace of 'mushing' descent - remember that banking is limited to 60°.

3.12 SPINNING

The Shadow cannot be made to SPIN. These manoeuvres are prohibited in the United Kingdom.

3.13 SIDE SLIPPING

This manoeuvre is to be avoided as it places unnecessary stress on the forward wing attachment points.

3.14 AEROBATICS

These manoeuvres are prohibited in the United Kingdom. This aircraft is stressed at + 4G and - 2G at maximum AUW and is therefore non-aerobatic.

3.15 CHECKS BEFORE LANDING

Reduce speed to not more than 60 M.P.H.
Check that resistance is felt at brake pedals
Flaps as required
Harness tight and locked - Canopy secure

3.16 APPROACH AND LANDING

Into Wind - Descent may be made with the engine on idle. Rates of up to 1,500 ft/min can be reached without exceeding 65/70 M.P.H. The best circuit speed is 60 M.P.H. when the flaps may be extended to 15° down. Maintain this speed for approach. You will seldom need to use 30° of flap in normal conditions. Be sure that extra speed is not built up because the Shadow has a very long extended glide compared with other microlights and you may use much more runway than intended! Make a flare at 2-4 ft above the runway and hold off the mainwheels until below 40 M.P.H. the nose wheel may be held off until below 20 M.P.H. with full visibility to the pilot. Under heavy braking apply up elevator to ease the nose wheel loads.

Crosswind - a recommended landing attitude is the low wing towards the wind method, grounding the upwind mainwheel first. The rudder remains very responsive to directional control.

SECTION 3 (Continued)

3.17 GOING ROUND AGAIN

Open throttle smoothly to full power.
Return flaps as required.
At lighter weights only 90% RPM need be used.

3.18 CHECKS AFTER LANDING

UNBOARDING CAUTION:- The Shadow unladen will adopt a parked posture on its main wheels and tail skid. When leaving the front cockpit be sure that the aircraft posture is gently attained. Neither pilot nor passenger should get out while the engine is still running.

3.19 STOPPING THE ENGINE

Only switch off when EGT has reached low readings.

3.20 ENGINE FAILURE IN FLIGHT

In the event of an engine-out be quick to determine your landing area. Shut off the fuel valve (UP). Make sure the actual approach faster than usual (70 mph) to be sure you reach your selected landing area. Use full flap (30°) to kill off any ground effect float-on when over your threshold. Hold off as long as possible with a high angle of attack and touch down slow and gently. Try always to land into the wind and on fields in the direction of cropping - not across. Emergency glide speed is 50 mph - there is a placard to this effect on the cockpit panel.

3.21 ACTION IN THE EVENT OF FIRE

Fire is normally caused through two sources in aircraft - electrical or fuel.

Fire on the ground - switch off electrical power and shut off fuel.

Fire in the air - switch off electrical power, shut off fuel and make emergency landing as soon as possible.

3.22 FLYING FROM REAR COCKPIT - DUAL CONTROLS

Controls for the throttle, rudder, elevator and ailerons are duplicated in the rear cockpit for SERIES B-D aircraft. There are no brakes, flap select lever, ignition switch or fuel cut off facility from this position.

The only instrument that is repeated is the Air Speed Indicator - this is certified to within a 2% error of the one in the front cockpit. Forward vision is somewhat restricted, but is excellent to the side. Practise will be required to get used to the slightly different attitude from the rear cockpit, but in all other respects the handling of the aircraft remains unaltered.

Instructing from the back - it is essential to ensure that the front pilot has the ability to ground handle the aircraft with the use of the differential brakes, can use the flap select lever correctly and is capable of operating both the ignition switch and the emergency fuel cut off valve.

DO NOT ATTEMPT TO FLY THE AIRCRAFT SOLO FROM THE REAR COCKPIT

SECTION 4

RIGGING AND DE-RIGGING

4.1 DESCRIPTIVE

The aircraft can be rigged with two persons. Detachable items are as follows:-

- a) Rudder and fin post
- b) Elevator
- c) Tailplane - Port/Starboard sides
- d) Port/Starboard outer wing panels

NOTE:- The main cockpit/boom structure will assume tail-down posture before and after rigging when the front cockpit is unloaded.

The tail boom must be supported whenever the rudder/fin post is not rigged. When fitted, the tail boom must be gently lowered onto the rudder tail-skid.

WARNING:- Failure to observe this basic requirement will result in damage.

4.2 RIGGING

- a) Assemble the aircraft on level ground.
- b) Insert rudder/fin post up into the rear of the boom. Align securing pin hole through boom with hole in rudder/fin post. Insert securing pin and safety clip, then add clevis pin to rudder horn with safety clip.
- c) Push port tailplane half into the cutout holes in the rear of the boom. Hold in position and gently ease starboard tailplane half into port half. Insert both forward and rear securing pins from the upper surface and secure with safety clips.
- d) Attach elevator with four clevis pins and add safety clips. Connect teleflex operating jaw to elevator horn with clevis pin and safety clip.
- e) With the wings supported by a person at each end, engage flap torque tube into wing rib. Push wing into position and add the two main wing pins. Connect wing strut with bolt, nut and safety clip.

NOTE:- Keep this wing supported whilst fitting other wing.

When both wings have been fitted add the safety clips to wing pins. Connect aileron push/pull tubes with clevis pins and safety clips. Secure zip fasteners on underside of wing panel. Connect flap push/pull rods with clevis pins and safety clips.

CHECK:- SECURING DEVICES IN ALL PLACES WITH SAFETY CLIPS ON THE FOLLOWING ITEMS:-

- 4 Main Wing Pins plus safety clips
- 2 Wing Strut bolts and nuts plus safety clips
- 2 Aileron Connect Pins plus safety clips
- 2 Flap Connect Pins plus safety clips
- 2 Tailplane Connect Pins plus safety clips
- 4 Elevator Pins plus safety clips
- 1 Rudder/Fin Post Pin plus safety clip
- 1 Elevator Horn clevis pin plus safety clip
- 1 Rudder Horn clevis pin plus safety clip

SECTION 4 (Continued)

4.3 DE-RIGGING

A special slide hammer, supplied with the aircraft tools, is required to de-rig.

- a) Wings:- Remove clevis pins and safety clips from aileron push/pull tubes and flap connect rods. Remove wing strut safety clips, nuts and bolts.

NOTE:- The wing is cantilever type and can support its own weight without the struts being connected when being de-rigged.

Insert slide hammer from top of wing and engage by rotating its shaft for two turns.

Support both wing tips and apply gentle pressure upwards.

Use slide hammer to remove wing pins.

Remove wing and repeat procedure for the other wing.

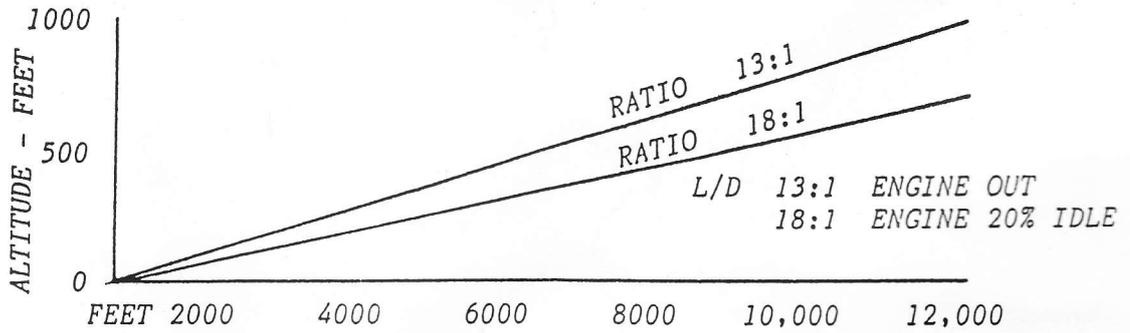
- b) Tailplane:- Remove safety clips and securing pins from boom, elevator and teleflex elevator horn. Separate tailplane halves.
- c) Rudder/Fin Post:- Remove safety pin and securing pin. Separate from boom.

NOTE:- It is recommended that all securing and clevis pins are placed back into their assembled position to prevent loss.

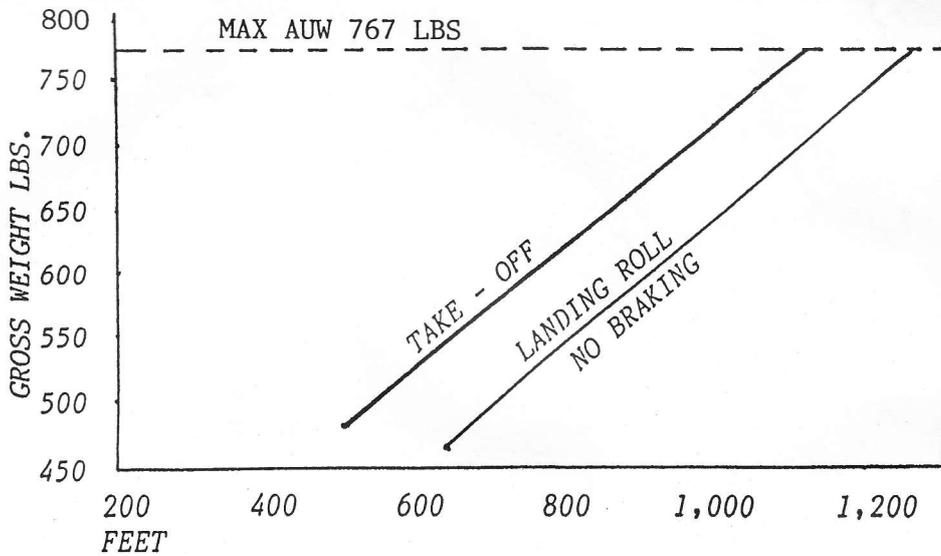
SECTION 6

GRAPHS

6. 1 HEIGHT LOST AGAINST DISTANCE COVERED



6. 2 GROUND DISTANCE TO CLEAR 50 FEET - ZERO WIND





APPROVED

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