THRUSTER TST

PILOT'S AND OPERATOR'S HANDBOOK

Part No: TAPL 02

INCLUDING PILOT'S NOTES

THIS HANDBOOK FORMS A PART OF AIRCRAFT TYPE: THRUSTER TST MK 1

SERIAL NUMBER 867-TST-021

G-MTKA

Thruster Aircraft (U.K.) Limited
Unit 3B, Highfield Road Industrial Estate
Camelford
Cornwall (U.K.)
PL32 9RA

Telephone 0840 213322

THRUSTER TST

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THRUSTER T.S.T.

THRUSTER T.S.T. MK 1 PILOT'S OPERATOR'S HANDBOOK AND AIRCRAFT FLIGHT MANUAL

PREFACE

The understanding of the information contained in this manual is essential for the safe operation of the Thruster T.S.T. Mk 1. The manual describes the operating LIMITATIONS WHICH MUST BE OBSERVED, the correct methods of rigging and de-rigging, check procedures and maintenance routines.

The Table of Contents (next page) indicates the location of information contained in the manual.

The manual will be revised as necessary and such new information will be provided to registered owners of each aircraft. Any questions regarding this manual or the information contained herein should be addressed to:

THRUSTER AIRCRAFT (UK) LIMITED.
3B HIGHFIELD ROAD INDUSTRIAL ESTATE
CAMELFORD
CORNWALL PL32 9RA
(UK)

Telephone Camelford (0840) 213322

THRUSTER T.S.T.

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SECTION 4 ROUTINE PROCEDURES AND CHECKS

4.1 Pre-flight Check List
4.2 Engine Start Procedure
4.3 Pre-Take Off Checks.

SECTION 1 DESCRIPTION

1.1 Introduction

The Thruster T.S.T. is a high wing monoplane, providing side-by-side seating for two occupants. It has conventional three-axis control, with dual rudder pedals and throttle controls and a single centrally mounted control stick for ailerons and elevator. A simple engine is mounted overhead in a tractor position. Landing gear is arranged with two main wheels and steerable tail wheel.

1.2 Dimensions & Areas

Wing Span	31 ' 6"	(9.6m)
Length	18 '	(5.5m)
Height	6 ' 6"	(2.0m)
Wing area	161.5 ft^2	($15m^2$) + AEROFOIL STRUTS
Stabilizer area	11 ft^2	
Elevator area	12.5 ft^2	
Fin area	7 ft^2	
Rudder area	7 ft^2	

1.3 Weight

Aircraft empty weight	331 lb	(150 kg)
Maximum take-off weight	788 lb	~~(358 kg)~~ 380KG

1.4 Power Unit and Propeller

The power unit for the Thruster T.S.T. Mk 1 is a Rotax R503 2V FA SS. This comprises a twin carburettor air-cooled two cylinder two-stroke engine of 60 hp (SAE) together with a reduction gearbox of 2.58:1 and a standard Rotax exhaust and silencer.

The Propeller is a ~~Catto 64 x 42 (62" diameter x 42 pitch)~~ BROLGA 68" dia x 10° PITCH and is manufactured from laminated wood.

1.5 Load Limitations and Operating C.G.

NOTE: See also Section 2, Limitations.

WARNING The load limitations must be observed to ensure operation within the approved safe limits of the aircraft centre of gravity.

Cockpit loads:

Maximum cockpit load:	180 kg (397 lb)
Minimum cockpit load:	55 kg (120 lb)

NOTE A solo pilot must weigh (including clothing at least 120 lb (55 kg).

Subject to these limitations, the aircraft will be loaded within its centre of gravity (c.g.) limits.

1.6 Centre of Gravity (c.g.)

The centre of gravity is given in inches aft of a specific reference datum (inches AOD).

C.G. Datum	Leading edge of wing
C.G. rigging attitude	Main fuselage tube at horizontal
Empty weight c.g.	16 " to 18" AOD,

OPERATIONAL WARNING See warning in 1.5 above.

1.5 Load Limitations and Operating C.G.

NOTE: See also Section 2, Limitations.

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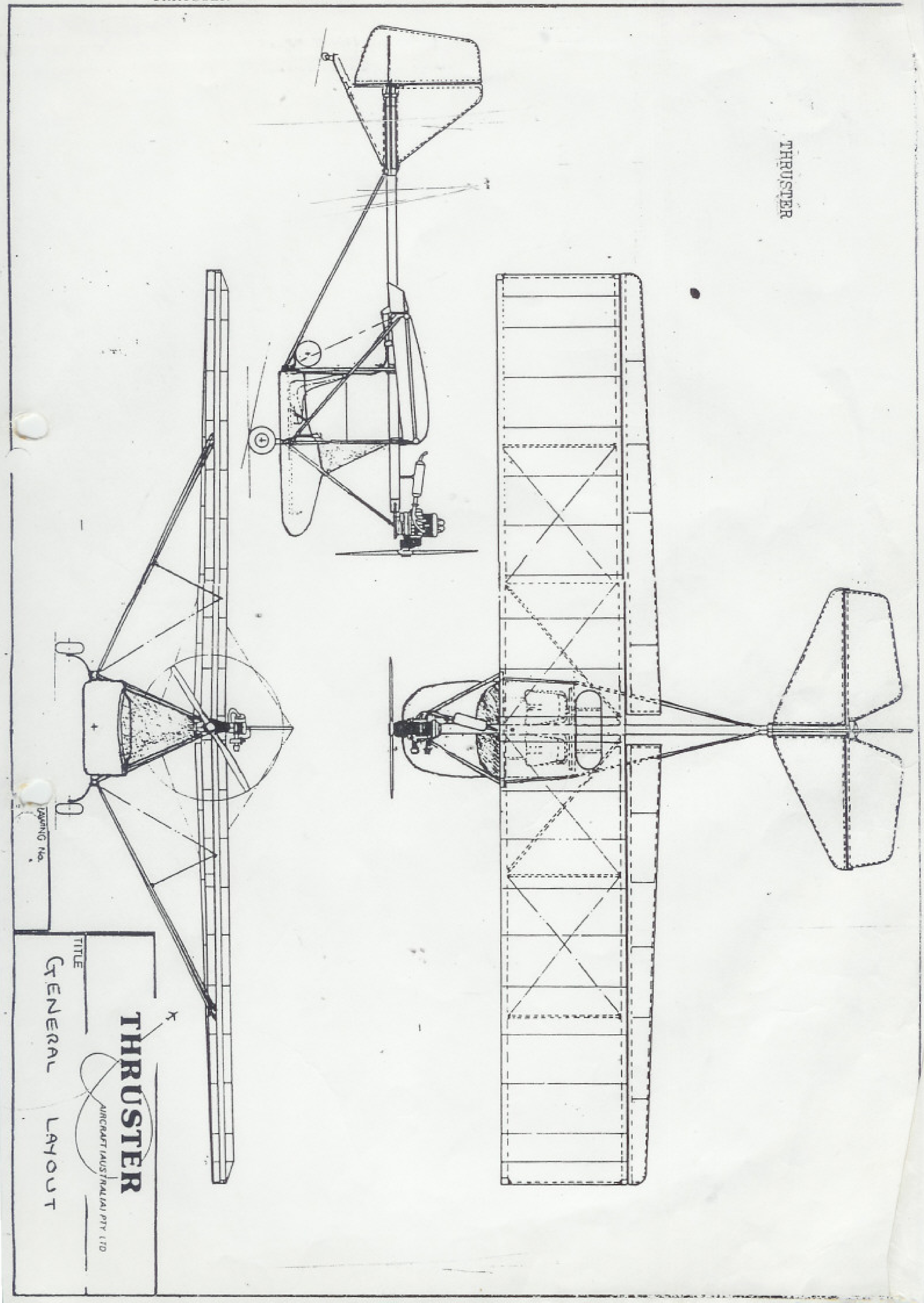
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THRUSTER
AIRCRAFT (AUSTRALIA) PTY LTD

SECTION 2 LIMITATIONS

2.1 Load and C.G. Limits
2.2 ~~Flying Limits~~
2.3 Engine Limits

SECTION 2 LIMITATIONS

2.1 Load and c.g. Limits

Maximum take-off weight:		~~788 lb (358 kg)~~ 380 kg.
Cockpit load:		
	Maximum:	180 kg (397 lb)
	Minimum	Not less than 120 lb (55 kg)

NOTE: Observation of these limits ensures correct operational c.g. and allows for zero to full fuel.

2.2 Flying Limitations

WARNING: At speeds above V_A control movements must be limited to one third of full deflection.

V_{NE}, Never exceed speed:	80 knots (92 mph)
V_A, Manoeuvring speed:	70 knots (80 mph)

AEROBATICS PROHIBITED

SPINNING PROHIBITED

Banking restricted to 60 ° with respect to natural horizon.

Daylight (VFR) operation only.

2.3 Engine Limits

The propeller and engine/reduction combination ensures that the engine will operate within its R.P.M. limits, provided Flying Limitations are observed.

To avoid overheating it is only necessary to ensure that full throttle is only used either when in climbing or level flight or for periods not exceeding 1 minute when on the ground.

For monitoring and servicing, the following information is provided (see also engine section):

Maximum R.P.M. 6350

SECTION 3 EMERGENCY PROCEDURES

3.1 General
3.2 Precautionary Landing with Power
3.3 Rought Engine or Power Loss
3.4 Total Engine Power Loss
3.5 Engine Fire in Flight.

SECTION 3 EMERGENCY PROCEDURES

3.1 General

Emergencies due to aircraft or engine malfunction are rare if proper pre-flight and maintenance practices are followed. However, if an emergency should arise the following paragraphs shpuld be applied as appropriate.

3.2 Precautionary Landing with ~~Engine Power~~.

Prior to attempting a precautionary landing, wherever possible make a preliminary pass over the intended landing site to inspect for obstructions and surface conditions. Note the preferred area for touchdown, making particular allowance for obstructions in the approach. Check HARNESS(ES) AND TRIM. Land in a tail low attitude, as far as possible into wind; this will minimise the possibility of damage in soft conditions.

3.3 Rough Engine or Loss of Power

If rough engine running or loss of power occurs, it is most likely to be caused by spark plug fouling. Operate the throttle first to fully open, then gently towards idle but do not allow engine to fail; repeat this about six times. If the problem persists land at the nearest available site.

3.4 Total Engine Power Loss

If the engine stops during flight, first establish optimum glide * at 40 knots minimum. Select a suitable landing site. Establish wind direction if possible. CHECK HARNESS(ES) and Trim. SET Ignition OFF and FUEL OFF. MAINTAIN optimum glide. Approach clear of obstructions and land in a tail-low attitude into wind.

MIN SINK 45 kt
BEST L/D 50 kt

*Pilots more experienced on heavier machines or machines with very low drag should NOTE WELL that it is important to lower the nose promptly if the engine fails; very light aircraft have very low intertia and therefore loose speed quickly. (Practice makes perfect).

SIDESLIP IF APPLICABLE

45kt

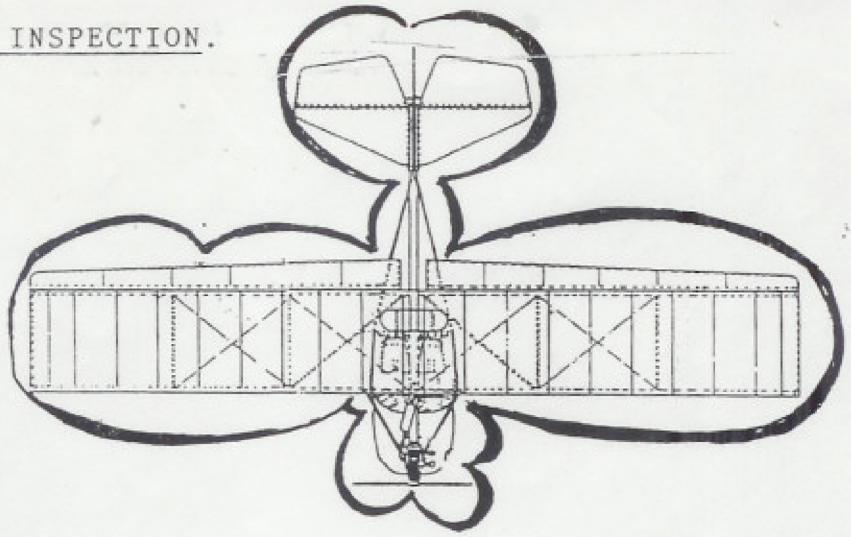
3.5 Engine Fire in Flight

In the event of an engine fire in flight, Set Fuel OFF. Keep throttle open until fuel is consumed. Set Ignition OFF. Establish optimum glide at 40 knots minimum. Select a suitable landing site. CHECK Harness(es) and Trim. Approach clear of obstructions and land in a tail-low attitude and into wind.

SECTION 4 ROUTINE PROCEDURES AND CHECKS

4.1	Pre-flight Check List
4.2	Engine Start Procedure
4.3	Pre-Take Off Checks.

PREFLIGHT INSPECTION.



1. COCKPIT

   (a) All switches- OFF — BRS SECURE (IF APPLICABLE)
   (b) Instrument panel- SECURE.
   (c) Fuel filter and primer- CLEAN and BULB FULL.
   (d) Control Movement- FULL AND FREE,OPERATING IN CORRECT SENSE
   (e) Throttle control- SECURE,FULL AND FREE MOVEMENT.

2. ENGINE.

   (a)Engine installation- SECURE,NO OIL LEAKS.
   (b) Carburettors- SECURE.
   (c) Spark plugs and leads-SECURE.
   (d) Fuel pump- SECURE.
   (e) Fuel lines- SECURE AND UNOBSTRUCTED.
   (f) Electrical system- SECURE.
   (g) Gearbox- SECURE.AND NO OIL LEAKS.
   (h) Gearbox breather- SECURE AND UNOBSTRUCTED.
   (i) Exhaust- SECURE AND NO LEAKS.
   (j) Air filters- SECURE AND CLEAN.
   (k) Cowl- SECURE AND UNOBSTRACTED.

3. PROPELLER.

   (a) Blades- CHECK FOR NICKS/CRACKS
   (b) Hub- SECURE.
   (c) Propeller bolts-SECURE.

4. POD.

   (a) Pod-SECURE AND CONDITION.
   (b) Windscreen- SECURE,CONDITION AND CLEAN.
   (C) Pitot tube- SECURE AND UNOBSTRUCTED.
   (d) Static vent- SECURE AND UNOBSTRUCTED.

PREFLIGHT INSPECTION CONT.

5. RIGHT LANDING GEAR.

(a) Tyre and Wheel- CONDITION,SECURITY AND PRESSURE.
(b) Leg and Axle- CONDITION AND SECURITY.
(c) Flying strut attachment- CONDITION AND SECURITY.

6. RIGHT WING.

(a) Leading edge- CONDITION DENTS AND SECURITY.
(b) Flying strut- CONDITION AND SECURITY.
(c) Wing skins- CONDITION.

7. RIGHT AILERON.

(a)Hinges and control horn- CONDITION AND SECURITY.
(b) Aileron skins- CONDITION.
(c) Control rods- CONDITION AND SECURITY.
(d) Aileron- FULL AND FREE MOVEMENT.

8. FUSELAGE.

(a) Fuel tank and vent- CONDITION AND SECURITY.
(b) Fuel contents- SUFFICIENT FOR FLIGHT.
(c) Fuel sump- CHECK FOR WATER.
(d) Fuel lines- SECURITY AND OBSTRUCTION.
(e) Control cables- CONDITION AND FULLAND FREE MOVEMENT.
(f) Pulleys- CONDITION AND CABLE SECURITY.
(g) Fairleads- CONDITION AND SECURITY.
(h) Structure- CONDITION AND SECURITY.
(i) Seat belts and attachments- CONDITION AND SECURITY.

9. TAILPLANE AND ELEVATOR.

(a) Tailplane- CONDITION AND SECURITY.
(b) Bracing wires- CONDITION,TENSION AND SECURITY.
(c) Elevator- CONDITION,SECURITY,FULL AND FREE MOVEMENT.
(d) Elevator control- CONDITION AND SECURITY.

10.FIN,RUDDER AND TAILWHEEL.

(a) Fin- CONDITION AND SECURITY.
(b) Rudder- CONDITION,SECURITY,FULL AND FREE MOVEMENT.
(c) Rudder control cables- SECURITY AND CONDITION.
(d) Tail wheel- CONDITION AND SECURITY.
(e) Tail wheel assembly- CONDITION AND SECURITY.
(f) Tail wheel spring- CONDITION AND SECURITY.
(g) Stearing linking bungie- CONDITION AND SECURITY.

PREFLIGHT INSPECTION CONT.

11.LEFT AILERON.
- (a) Hinges and control horn- CONDITION AND SECURITY.
- (b) Aileron skins- CONDITION.
- (c) Control rods- CONDITION AND SECURITY.
- (d) Aileron- FULL AND FREE MOVEMENT.

12.LEFT WING.
- (a) Leading edge-CONDITION,DENTS AND SECURITY.
- (b) Flying strut- CONDITION AND SECURITY.
- (c) Wing skins- CONDITION

13.LEFT LANDING GEAR.

- (a) Tyre and wheel- CONDITION,SECURITY AND PRESSURE.
- (b) Leg and axle- CONDITION AND SECURITY.
- (c) Flying strut attachment- CONDITION AND SECURITY.

4.2 ENGINE START PROCEDURE

4.2.1 DANGER Additional personnel must be made aware of danger areas as otherwise serious injury or death may result.

4.2.2 WARNING Before starting engine chock main gear or otherwise restrain aircraft during run up.

4.2.3 ENGINE STARTS CHECKS

1 Wheels - chocked

2 Throttle - set

3 Fuel - ON

4 Choke - ON (if needed)

4 Ignition - ON

5 Shout "CLEAR PROP"

6 Pull engine start cord firmly until engine fires

7 Close chokes and reset throttle

8 Allow engine to warm up (max 1 minute) before applying full power.

4.3 PRE-TAKE OFF CHECKS

Remember the convenient mnemonic CHIFTA

C Controls - full and free movement

H Harness - OWN and PASSENGER'S secure and adjusted

I Instruments - all reading correctly

F Fuel - ON and sufficient

T Trim - set for takeoff / TIME

A All clear - ensure circuit is clear in all directions.

5.0 **General Performance Data**

5.0.1 **Stall Speed**

Stall at Max take off weight	35 knots

5.0.2 **Cruise Speed**

80% ~~90%~~ Power	55 knots @ 11-12 LTR PER H one UP.
60% ~~70%~~ Power	45 knots

5.0.3 **Rate of Climb**

First minute climb from sea level, 600 ft/min

5.0.4 **Manoevring Speed**

V_A	70 knots

5.0.5 **Never Exceed Speed**

V_{NE}	80 knots

5.0.6 **Take Off Distance**

Take off to clear a 15 metre (50 feet) obstacle at full power.	100 metres

(See notes in sub-section 5.1 and 5.2)

SECTION 5 PERFORMANCE

5.0 General Performance Data
5.1 Take-off and Landing
5.2 Factors Which Affect Performance

5.0 General Performance Data

5.0.1 Stall Speed

Stall at Max take off weight	35 knots

5.0.2 Cruise Speed

90% Power	55 knots
70% Power	45 knots

5.0.3 Rate of Climb

First minute climb from sea level, 600 ft/min

5.0.4 Manoevring Speed

V_A	70 knots

5.0.5 Never Exceed Speed

V_{NE}	80 knots

5.0.6 Take Off Distance

Take off to clear a 15 metre (50 feet) obstacle at full power. 100 metres

(See notes in sub-section 5.1 and 5.2)

SECTION 5

5.0 AIRCRAFT PERFORMANCE

5.1.0 A. TAKE-OFF AND LANDING

The take -off and landing performance of an aircraft is influenced by the following variables:-

5.1 1. Density

Density is dependent on:

(a) Temperature:
With increase in temperature a given mass of air expands into a greater volume. Its density is therefore decreased.

(b) Humidity: Water vapour is less dense than air. Therefore, the greater the proportion of water vapour in an air mass, the lower density of the whole.

(c) Pressure: Under reduced pressure a mass of air will expand. Normal changes in ambient pressure at a given height above sea level are too small to be significant.

(d) Altitude: Pressure, and therefore density, decreases with increase in altitude.
Lower temperatures at greater altitudes may tend to counteract the reduction in density due to reduced pressure.

5.1 2. Wind velocity.

5.1 3. Surface slope.

5.1 4. Surface condition.

5.1 5. Aircraft weight.

5.1 6. Pilot technique.

We will now consider each of these factors separtely in relation to their ultimate effect on take-off and landing.

5.2 1. Density.

Reduction in density affects aircraft performance in ways:

(a) Engine power.
As the power out-put of an engine is approximately proportional to the air mass flow through the engine, power available will be reduced in conditions of reduced air density.

5.2 1. Density.
(b) IAS/TAS re~~lationship.~~

Air speed indicators are so calibrated that they will only indiacte ~~TAS in~~ conditions of ambient density corresponding to ICAN standard sea level which assumes a temperature of 15°C and a pressure of 1013.2mbs (Instrument and position errors may still be present).
When density is reduced any given IAS will correspond to a higher TAS.

On take-off, therefore, reduced density results in a longer ground run both because of the slower acceleration to unstick IAS with reduced power available and because, in order to reach the required un-stick IAS, the aircraft must be accelerated to a higher TAS.

On landing, the higher touch-down TAS corresponding to the correct IAS will again result in a longer ground run.

On the climb-out, less power results in a lower rate of climb: Higher TAS results in a reduced angle of climb.

On the approach, higher TAS results in a flatter approach angle, and an increase in the distance covered during the flare out.

5.2 2. Wind Velocity.
A headwind on take-off reduces the ground run, since the aircraft has an effective airspeed equal to the headwind component before it starts to move, and must only be accelerated through the remaining airspeed range to unstick IAS. Similarly the ground run is reuced when landing into wind.

The lower ground speed corresponding to unstick and touch-down IAS is an important factor in reducing wear and tear on the aircraft when operating on rough airstrips.

On the climb-out, angle of climb is increased into wind and decreased down wind.

Where any appreciable wind-gradient is present - i.e. a rapid rise in wind strength with increasing height - rate of climb will also be increased into wind and decreased down wind, as a result of the aircraft's inertia.

On the approach, similar effects on rate and angle of climb will be experienced.

5.2 3. Surface Slope.
When taking off down hill the ground will be reduced owing to the increased acceleration imparted by gravity. On landing, an up hill slope will aid deceleration and reduce the ground roll Note that when the overall gradient of the strip exceeds 1:50 all take-off's must be made down hill.

5.2 4. Surface Condition.
Any surafce condition which will increase rolling friction will naturally increase take-off distances. The longer or wetter the grass, or the softer the ground, the greater the rolling friction. On landing, aircraft fitted with brakes

may have longer ground roll on grass than on sealed surfaces due to the increase in braking efficiency: aircraft without brakes will benefit by the increase in rolling friction on grass and stop in shorter distances than on sealed surfaces.

5.2 5. Weight.

As weight is increased, unstick speed is increased and acceleration decreased. These two effects combine to lengthen take-off run. Rate of climb will, of course, be reduced as too will angle of climb even if climb-out speed is kept the same as that used at a lower weight. If climb-out speed is increased slightly, as it should be in order to maintain a safe margin above the higher stalling spped, angle of climb will be still further reduced.

On landing, higher weights necessitate higher approach speeds to maintain a safe margin above the stall. As the momentum to be dissipated after touch-down depends on both speed and weight, it is apparent that, again two factors operate to lengthen landing roll when weight is high.

SECTION 6

NOT APPLICABLE.

SECTION 7 SYSTEMS DESCRIPTION

7.1	Engine; Rotax Operator's Manual
7.2	Fuel System
7.3	Electrical Systems
7.4	Airframe
7.5	Propeller
7.6	Harness
7.7	Landing Gear
7.8	Flight Controls and Control Surface Deflections.

7.0 SYSTEMS AND EQUIPMENT

7.1 ENGINE

The GEMINI is powered by a ROTAX, model R503 500CC. twin cylinder in-line two stroke engine. Rated at 58hp @ 6500 rpm. Max. continuous 3000-6500 rpm. Normal operating range 3000-6500 rpm.

7.2 FUEL SYSTEM

Pre mix 50:1 super two stroke oil and 90-96 octane is supplied from a 40 Lt. fuel tank via an in-line fuel strainer primer bulb and diaphragm fuel pump to two bing 54/36 carburetor.

7.3 ELECTRICAL SYSTEMS

The ROTAX R503 engine uses 2 x point/coil ignition. The engine also has an integral alternator (12v 75w) feeding a solid state rectifier/regulator (optional).

7.4 AIRFRAME

The GEMINI is manufactured from the highest quality materials, A.N. and MS AIRCRAFT QUALITY hardware is used throughout to ensure safe structural strength(+6-3) ultimate. Wing spars are constructed of 6061 T6 alloy and have been statically tested to 7g pos. 4g neg. without yield.

7.5 PROPELLER

The GEMINI uses a two bladed fixed pitch "CATTO" Eastern Maple wood propeller available in either cruise or climb types. Propeller R.P.M. reduction is via a 2.58:1 integrated gear box. A 64" x 42" propeller is fitted as standard.

7.6 SEAT HARNESS

A quality four point harness is fitted to ensure maximum pilot safety. Meets ANO 108-42 requirements.

7.7 LANDING GEAR

The GEMINI employs spring steel landing legs on the main gear and also on the steerable tail wheel.

7.8 FLIGHT CONTROLS

Full three axis controls via push/pull cables to full span ailerons, and cables via aircraft quality pulleys and nylon fair leads to rudder and elevator.