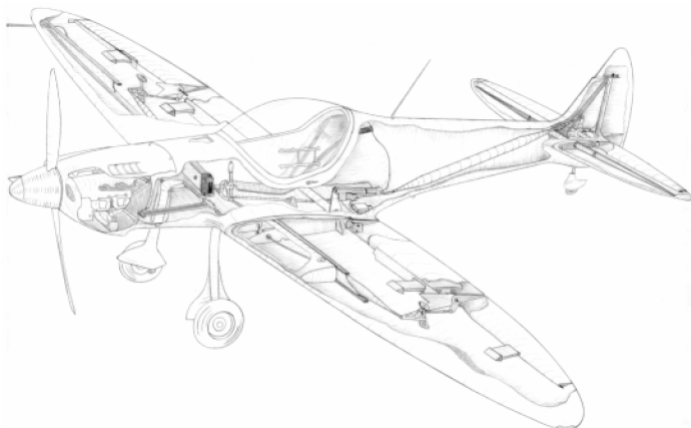


Flight Manual of the Light Aircraft *Twister*



G-TWST

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1.2 Description of the Twister

The **Twister** is a single seat aircraft that is made of honeycomb composites, reinforced with carbon and glass fibres. The wing spars are made from carbon fibre.

The **Twister** is an aerobatic low wing aeroplane with conventional tail, retractable landing gear and flap system. It is possible to put in a ballistic recovery system which is connected with the safety cockpit and the plane. The engine is a Jabiru 2200 four stroke engine.

Technical Data

Wingspan:	7.5 m	
Length:	6.18 m	
Wing area:	8.718 m ²	
Max. take-off weight: (MTOW)	420kg	
Max wing loading:	47 kg/m ²	
Elevator span:	2.8 m	
Elevator area:	1.65 m ²	
Crew:	1	
Engine:	Jabiru 2200, 60KW	
Propeller:	2 blade GT or Sensenich wooden prop	

2. Operating Limits

2.1 Strength

The **Twister** is designed for the following safe load factor:

+6 / - 4g with 420kg take-off weight .Max Zero Fuel Wt 350 KG

at a manoeuvre speed of 98 kts. It is not permitted to exceed this load factor; it is especially to be avoided to do any manoeuvres at speeds above 98 kts.

Airspeeds above 119 kts are to be avoided in heavy turbulence, e.g. in wave rotors, cumulonimbus clouds, and when flying over mountain ridges!

2.2 Airspeed Limitations

Airspeeds based on sea level conditions		kts
Minimum speed with flaps 30°:	V _{Sf}	36
Minimum speed without flaps:	V _S	44
Manoeuvre speed:	V _A	98
Cruising speed:	V _C	118
Maximum speed:	V _{NE}	165
Maximum speed with flaps 30°:	V _{FE}	65

2.3 Weights

Zerofuel weight: 350 kg
 Additional load: 70 kg

2.4 Operating Figures and Limitations of Engine

Performance:

Maximum output: 59 KW
Output at 2600 min⁻¹: 45 KW

Speed per minute (R.P.M.)

Maximum r.p.m.: 3300 min⁻¹
Maximum r.p.m. continuous: 2800 min⁻¹

2.5 Figures for Fuel and Oil

Fuel:

Mogas: unleaded min. 95 octane

Avgas: 100LL

**Aero Oil W Multigrade 15W-50
or oil which is equivalent**

2.6 Engine Monitoring Devices

For monitoring the engine the following instruments should be fitted: r.p.m. meter, oil temperature gage, oil pressure gage, and a cylinder head temperature indicator.

RPM meter:

Normal area 800-3300 RPM.

Oil temperature:

Normal area 15-118°C

Cylinder head temperature:

Normal area 150°C
Short term 175°C

Battery voltage:

Should not exceed 14,5 volts

If any of these operating limitations are exceeded, the engine has to be throttled to run at a lower r.p.m.

2.7 Minimum Equipment

- Airspeed indicator
- Altimeter
- r.p.m. guage
- Alternator warning light
- Oil temperature gage
- Cylinder head temperature gage
- Magnetic compass
- Variometer
- Retractable undercarriage control unit
- Fuel indicator
-

3. Emergency Procedures

3.1 Airspeeds in Emergency Situations

Engine failure after lift-off:	kts
Flaps retracted	65
Flaps extended	63
Best glide speed	65
Precautionary landing with engine power	63
Emergency landing with stopped engine	65
Flaps retracted	65
Flaps extended	63

3.2 Engine Malfunctions

During take-off run:

1. Close throttle
2. Slow aircraft using wheel brake
3. When aircraft stopped and in safe area
4. Ignition off
5. fuel off
6. Main switch off

Immediately after lift-off:

1. Airspeed 65 kts
2. Land straight ahead
3. If safe select landing flap.
4. Ignition off.
5. Fuel off.
6. Main switch off

In flight:

(Re-starting of failed engine)

1. Airspeed 71 kts
2. Select suitable landing area
3. Check fuel selector open
4. Check ignition on both

5. Check carb heat on if required
6. Try to restart engine.
7. If engine does not restart carry out emergency landing

3.3 Emergency Landing

Emergency landing with stopped engine

1. Airspeed 65 kts
2. Make Mayday radio call
3. Fuel selector valve closed
4. Ignition off
5. Lower the undercarriage (if landing area is uneven or soft, land with undercarriage retracted)
6. Flaps as necessary (30° is recommended)
7. Main switch off (when landing is absolutely certain)
8. When safely on the ground vacate aircraft and go to pub and have a drink!

Ditching

1. Radio Mayday giving position and intention on frequency 121,5 MHz, set transponder (if fitted) on 7700
2. Undercarriage retracted
3. Flaps 20° – 30°
4. Fly at 62knots and a low rate of descent
5. Touch down in level attitude and low sink rate if possible land along waves but if a strong headwind is encountered land into wind across waves.
6. Inflate life jacket (if available)

3.4 Fires

Engine Fire

1. Close fuel selector
2. Ignition off
3. Main switch off
4. Airspeed 108 kts (increaseing airspeed will blow fire out, when fire extinguised carry out Emergency Landing)

Electric fire inflight

1. Main switch off
2. Avionic switch off
3. All other switches (except ignition) off
4. Use fire extinguisher (if available)
5. When fire is out, turn main switch on
6. Identify and Isolate faulty circuit, but do not switch it on again
7. Avionics switch on
8. Ventilate cockpit

3.5 Icing-up

1. Return or change altitude to fly in temperatures in which icing up is less possible.
2. Select carburettor heating
3. Increase r.p.m., to keep ice formation on propeller blades to a minimum.
4. Plan landing at the nearest airfield. In case of rapid icing up make a field landing.
5. If there is icing of more than 5 mm on the wings, one has to assume a considerably higher stall speed.
6. Use flaps as necessary
7. Land, if necessary consider a side slip on approach to give better visability
9. Approach – depending on the severity of icing up – with a speed of 76 – 86 kts (Caution: the airspeed indicator may show a false reading!)

3.6 Undercarriage Malfunctions

Switch with security flap



Light: undercarriage retracted and locked

Flashes when r.p.m. is reduced or flaps lowered and undercarriage is up!
(Signal can be heard too)

Light: undercarriage down and locked

Landing? Lower undercarriage!

Undercarriage does not retract:

1. Check switch in 'Undercarriage retract' position?
2. Check circuit breaker
3. Check 'Undercarriage retracted' light
4. Otherwise put switch to 'lower undercarriage'
5. Check 'Undercarriage down' light
6. Land or continue flight at max. 108 kts

Undercarriage cannot be lowered:

1. Check switch 'Undercarriage down'
2. Check circuit breaker
3. Check 'Undercarriage down' light
4. Emergency lowering of the gear. Pull the red undercarriage lowering handle and the gear will lower as you pull. Be aware that you will require a large force to lower the gear and the handle will extend about 50 cms towards you this is normal.

(Important: switch has to be set to 'lower', in order to avoid an accidental re-retraction of undercarriage!)

Check that the gear extended light is illuminated.

Landing without a sure indication that undercarriage is locked down

1. Go through Undercarriage does not extend' checklist
2. Fly normal approach with full flaps
3. Landing: in a tail low attitude as gently as possible
4. Brake as little as possible
5. Taxi: slowly
6. Turn off engine and examine undercarriage

3.7 Spinning

In case of unintentional spinning, do the following procedure to stop spinning:

1. Pull throttle to idle.
2. Centralise controls.
3. Use full opposite rudder.
4. When rotation stops centralise rudder and gently ease out of dive back into wings level attitude.
- 5.

3.8 Canopy Jettison

Pull back on canopy opening and canopy jettison levers, push the canopy up and away to the right, when the canopy is clear undo harness and vacate aircraft in opposite direction to rotation!, When clear of aircraft pull parachute deploy handle and go to nearest pub and have a stiff drink!.

4. Normal Operating Procedures

4.1 Assembly (Rigging)

Wings:

Important:
Fitting is done by using only little amounts of force !!

- Remove seat from cockpit
- Set control column to neutral
- Insert the spar of the wing into the spar tunnel of the fuselage and push the wing into the fuselage except for the last approx. 8 cm
- Connect fuel, fuel indicator and pitot tube If not auto connecting.
- Set aileron and flaps to neutral position
- Push wing spar carefully into the fuselage
- Insert excenteric bolt from the cockpit into the spar tunnel (excenteric bolt has to be inserted completely)
- Move the lever of the excenteric bolts from the middle to the outside turning through 90° each (**For this use manual power only, no tools!**)
- Fit locking bolts to Aileron push rods and safety pin.
- Put seat back into place . **HAVING CHECKED FOR LOOSE ARTICLES.**
- Check function of aileron, fuel gage, fuel system and airspeed indicator

Elevator and tailplane:

- Set control stick to neutral
- Unlock locking cable and pull it to the back
- Push the elevator carefully onto the tube to the fuselage
- Push locking cables back in and lock them
- Check function and range of movement of elevator!

Rudder:

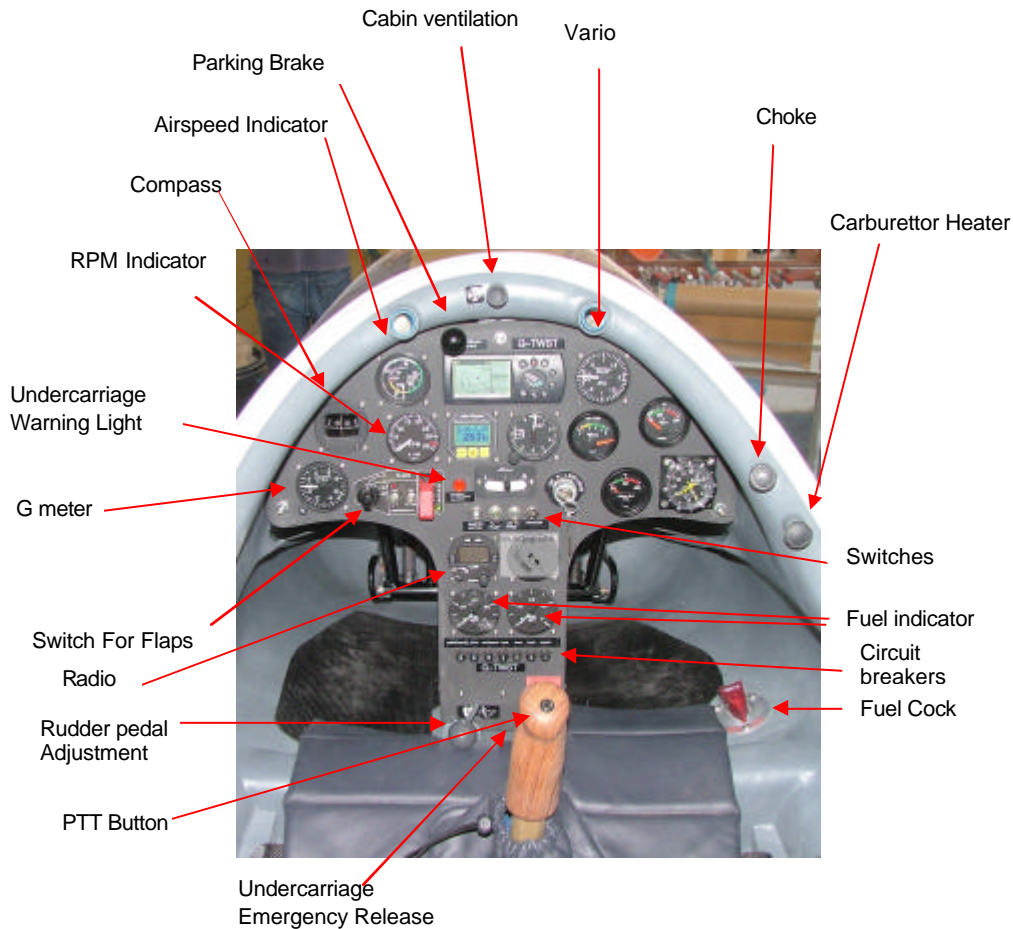
- The rudder is inserted onto the upper rudder bellcrank by aligning the two pins into the rudder holes from above

- Finally, the rudder is secured against slipping out at the top by two safety pins into the two Rudder bellcrank pins.
- Check function of rudder!

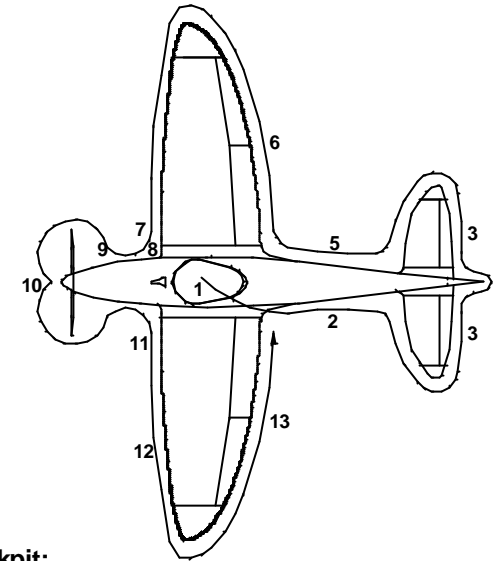
4.2 De-rigging

De-rigging is done in the opposite order of the rigging!

4.3 Cockpit Description:



4.4 Pre-Flight Walk Around Checks



1. Cockpit:

- Main switch on
- Check fuel
- Main switch off
- Fuel selector open
- Right and left Excentric Bolts secure
- Check paperwork uptodate
(Log Book – Flight Manual – Certificate of airworthiness- Registration – Noise certificate – Certification – Insurance – Personal Licence – Radio license)

2. Fuselage left side:

- Check for visible damage
- Static port clear

3. Elevator:

- Check for visible damage
- Elevator secure
- Elevator and elevator drive no excessive play

4. Rudder:

- Check for damage
- Rudder secure and no excessive play

5. Fuselage right side:

- Check for damage
- Static port clear

6. At right wing check:

- For visible damage
- Aileron and aileron drive for condition and play
- Flaps and flaps drive no for condition and play

7. Right undercarriage:

- Check gear legs for damage
- Brakes
- Tire pressure 2.5 bar (35psi)
- Creap mark
- Undercarriage retraction mechanism check screwdrive and leads

8. Drain fuel:

- **Check fuel for contamination and water**

9. Engine:

- Remove top cowling
- Check oil level and fuel pipes
- Check engine area for loose items, leakages and evidence of wear
- Drain gascolator and check for water and contamination

10. Propeller:

- Check for damage
- Check spinnercap and screws for damage and security

11. Cowling:

- Cooling areas open and clean
- Air intake for grass and debris

12. Left undercarriage:

- Check gear legs for damages
- Brakes
- Tire pressure 2.5 bar (35 psi)
- Creap mark
- - Undercarriage retraction mechanism check screwdrive and leads

13. Drain fuel:

- **Check fuel for contamination and water**

14. Covering

- Remove covering from pitot tube and check opening for dirt.

15. At left wing check:

- For visable damage
- Aileron and aileron drive for condition and play
- Flaps and flaps drive for condition and play

4.5 Checklist before Engine Start

1. **Fuses?**
2. **Pedals** adjusted ?
3. **Fuel cock** selected to both?
4. **Rudders** moving freely ?
5. **Altimeter** set ?
6. **Seatbelts** fastened ?
7. **Canopy** closed and locked ?
8. **Throttle closed**
9. **Avionics off**

4.6 Checklist „Starting Engine“

1. **Mainswitch on**
2. **Call “Clear prop”**
3. **Open choke**
4. **Parking Brake set**
5. **Ignition on**
6. **Engine Start** - Set throttle to **1200 RPM**
7. **Avionics on**

4.7 Checklist before Taxi

1. **Warming at 1500RPM**
To an oil temperature of **15°C (59°F)**
2. **Flaps up**
3. **Check fuel quantity**
4. **Radio listen out for other traffic**

4.8 Checklist at Engine Run-up Point

1. **Brakes holding**
2. **Elevator** fully back
3. **Throttle** 2000 RPM
4. **Magnetto check left off and no significant drop or rough running**
5. **Magnetto check right off and no significant drop or rough running**
6. **Magnet checks** both on
7. **RPM** idle 800 RPM
8. **Flaps 10°**
9. **Trim system** in central and slightly forward position

4.9 Take-off and Climb

1. Line-up aircraft for take-off
2. Speedily increase to full throttle while monitoring RPM. It must be above 2400 RPM !
3. Start rolling with neutral elevator and keep direction with the rudder.
4. At approx 45 kts the aircraft will lift off by itself in a level attitude
5. Climb out at approx. 65 kts.
Watch cylinderhead temperature (max. 175°C).
6. Retract undercarriage below 76 kts.
7. If no steeper climb angle is required, the climb speed may be increased.

4.10. Cruise

1. Set cruising RPM according to the flight manual

4.11 Turn off Engine during Flight

1. Leave engine to cool for approx. 30 sec. at idle setting

2. Ignition off

After switching off the main battery switch, the radio, the undercarriage retraction and the flaps cannot be used!

4.12 Starting Engine during Flight

1. Fuel selector switch both
2. Main switch on
3. Ignition on
4. Avionics switch off
5. If necessary, operate starter while propeller stationary

4.13 Approach for Landing

1. Throttle as necessary
2. Set flaps at a max. speed of 76 kts
3. Lower undercarriage at a max. speed of 76 kts. Check for green light
4. Approach speed of 65 kts

4.14 After Landing

Retract flaps?

4.15 Turn off Engine after Flight

1. Avionics off
2. Leave engine running for approx. 30 sec.
3. Ignition off
4. Main switch off
- 5.

4.16 After the Flight

1. Clean aircraft
2. Fill in log book

5. Flight Performance

5.1 The Take-off Run

Short distance take-off run on a grass runway over a 15m obstacle at sea level in 20°C is 300m.

The maximum cross wind 90° to the runway direction is 20 knots

5.2 Range/Fuel Consumption

- At a speed of 108 kts the consumption is 12 litres/h with a variable pitch prop and 15 litres with the wooden GT Prop.

- The tank takes 80 litres, of which 8 litres are not usable due to safety reasons.

- The range at 108 kts is 1000 km or 600 miles.

6. Centre of Gravity (C of G) and Load Planning

6.1 Weigh Report

6.2 Calculation Model to determine C of G

Calculation to determine the centre of gravity and the maximum take-off weight.

Part	Mass kg	Lever Arm mm	Mass x Lever Arm kg x mm
Aircraft empty	See weigh report	See weigh report	
Pilot		750	
Tank (1l = 0,75kg)		250	
Luggage		1500	
Undercarriage retracted			4800

Sum:

The sum of masses may not exceed 420 kg!

The centre of gravity of the loaded aircraft is calculated as follows:

$$X_{\text{Flight}} = \text{Sum (Mass x Lever Arm)} / (\text{Sum}_{\text{Mass}})$$

Minimum loading of 73kg on the pilot seat!!

X_{Flight} must be between 365mm (nose heavy) and 450mm (tailheavy)!

7. Checks und Maintenance

7.1 Control surface Deflections

	Distance from axis of rotation	Upwards deflection	Downwards deflection
Aileron	335	100 +/-10	90 +/-10
Rudder	400	190 +/-15 L	190 +/-15 R
Elevator	180	80 +/-7	60 +/-7
Flaps	365	-	180 +/-14

7.2 Maximum play of Control surfaces

Aileron:	+/- 5mm
Elevator:	+/- 3mm
Flaps:	+/- 6mm

7.3 Maintenance

Caution: No synthetic bearings may be greased! The plastic bushes can be replaced as necessary.

Repairs are to be discussed with the dealer or manufacturer!

After **1000 flying hours** the aircraft has to be checked by the manufacturer.

Common wrench torque of bolt connections

(Bolts slightly greased)

M5	5	Nm
M6	9	Nm
M8	23	Nm
M10	46	Nm

Building part propeller

Part	Interval Hour	25	50	100	300	Action
Spinner cap			x			Check bolts, tighten if necessary
Variable pitch prop			x			Take off spinner cap, check for damage, room of movement and dirt. Check propeller blades for damage.

Building group Engine

Part	Interval Hour	25	50	100	300	Action
Engine						See maintenance manual Engine.
Engine area, cables, pipes		x				Check for brittleness and wear of the pipes replace as necessary
Oil level		x				If low, check for cause, replenish as necessary
Engine attachment			x			Check vibration rubber, screw connections and steel tubes for damage
Fuel lines and couplings		x				Check pipe connections for leakages and brittleness, replace if necessary. Grease sealing rings of couplings lightly with vaseline
Fuel filter				x		Replace
Fuel tank			x			Check for leakages
Tank ventilation		x				Examine tank ventilation for contamination.
Silencer		x				Check silencer mounted firmly. Examine exhaust pipes and silencer for holes.

Building group Wings

Part	Interval Hour	25	50	100	300	Action
Wing spar					x	Check pressure points for wear and dirt. Check excenteric bolts and plastic tubes for damage.
Wing					x	Remove aileron and flap, Check aileron-bell crank and spar for damage (white breaks)
Elevator					x	Check attachment and tube for damage

Building group Controls

Part	Interval Hour	25	50	100	300	Action
Rudder					x	Remove rudder: Check all parts for damage
Rudder				x		Check springs and cable eye stiffener
Flap connection				x		Check if bolts are firmly attached to the rudder, replace plastic bushes if necessary
Push rods aileron and Elevator				x		Check for tears and damage
Rudder hinges				x		Check for play in the rudder actuators, see 7.1.
Flaps drive				x		Check bellcranks and drive for damage
Trim				x		Check springs and drive

Building group Undercarriage

Part	Interval Hour	25	50	100	300	Action
Retractable Undercarriage			x			Check undercarriage legs for damage and tear, the mechanics for dirt, check for grease on tubes and the spindledrive, check for damage and functioning. Grease lightly with vaseline if necessary.

Emergency lowering of undercarriage			x		Jack up the aircraft, retract undercarriage with electrics. Lower undercarriage using emergency lowering. It must be possible for the mechanism to be driven to the rear position. The acme thread spindle has to turn centrally when in operation. Afterwards the cable has to be re-attached in the normal position with a <u>thin</u> safety wire.
Brakes		x			Check effectiveness, air the brakes if necessary, renew the brake shoes or brake discs. Check the level of the brake fluid container, Brake fluid (MIL-H-5606) .
Tires	x				Check wear, replace if necessary. Check tire pressure 2 to 2,5 bar.
Tailwheel	x				Check wheel, tube, and dampers for wear. The tire pressure must be 3 bar

Other Checks

Part	Interval Hour	25	50	100	300	Action
Pitot-tube and Static Port				x		Check tube and tube couplings for contamination and leakages
Canopy Lock				x		Check firm locking, if necessary grease and check the hinges.
Wiring loom				x		Check wire insulation for damage. Check couplings for tightness and corrosion.

The Fuel system

