

# ***TRACER***



## ***By Canterbury Sailplanes***

Thank you for buying the Tracer. This is a super new model designed for 3D electric flight – its light weight makes it very agile and great fun to fly. We hope you enjoy building and flying it!

The Tracer is designed around the GWS 350 geared motor (GW/EPS-350C with B, C or D gear box) 10x5 prop and a 2 or 3 cell Lithium Polymer (Li-pol) battery. With this low cost combination it flies brilliantly and is capable of all the usual aerobatics, plus a range of 3D maneuvers. 3 Cells provides vertical flight performance with a slight weight penalty – be aware though that the 11Volts of a 3 cell will over power the GWS motor, provided you keep the power set at 50% or less most of the time, the extra power of the 3 cell pack will still be there for short bursts if you need it.

Alternatively you can fit a brushless out runner type motor – reducing the weight and increasing the power for an even hotter model!

Keeping the weight as light as possible is the key to 3D aerobatics – the Tracer with the GWS motor and light weight radio gear with a 3 cell Li-pol battery should weigh **350 to 380gms**.

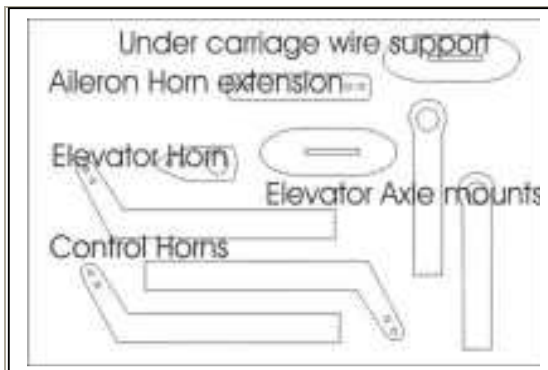
Choose light radio equipment, some examples are;

- 2 or 3 cell Li-pol 850mah packs are ideal for lightness, but the Tracer still flies really well with the heavier 1250mah pack. You should get around 15min of flying from a 1250mah pack, depending on how you use the throttle. Make sure the batteries have a good ‘C’ rating. This is an indication of how fast they can be charged and discharged. More than 5C is essential.
- 3 Servos; GWS Mini or Hitec HS55
- Receivers GWS R-4PII (4.4gm), Hitec HFS-05MS (9gm) or Feather (7.8gm)
- Electronic Speed controller (ESC); just about any 15-20Amp ESC will work ok, our own ESC is perfect for this model, whether you use Nicads or Lipo batteries. Be aware that the motor cut off voltage of an ESC designed for solely for Nicads will be set to cut the motor at around 4Volts – too low for Li-pols. Again experience has shown that if you stop flying when the motor performance starts to reduce (as the battery flattens) and recharge the battery you shouldn't have any problems. Note also that a special speed controller is required for a brushless motor.
- We recommend using Z bends for all the linkages to keep the weight down. For convenience you may also like to consider using adjustable linkages such as Dubro EZ Connectors, pictured here.



You will need the following to complete the model;

- **Cyanoacrylate (CA)** Both thin and medium and CA kicker.
- **Spray on contact adhesive.** Ados F2 or 3M Spray 77.
- **Sharp knife** – the ‘snap off’ type knives are best.
- **Strapping tape**
- **Fine screw drivers** for servo screws
- **Pliers**, for bending and cutting wire
- **Felt tip marker pen**
- **1.5mm drill bit (just to clear the holes for pushrod wires)**
- **100mm of self adhesive Velcro**



### Parts List

|                            |       |                     |                   |
|----------------------------|-------|---------------------|-------------------|
| Wing                       | 1     | Rudder              | 1                 |
| Wing tips                  | 2     | Elevators           | 2                 |
| Fuselage                   | 2pcs  | Control Pushrods    | 2 long<br>2 short |
| Plastic tube               | 1     | Wheels              | 2                 |
| Beads                      | 5     |                     |                   |
| Laser cut plastic parts    | 1 set | Carbon - fibre spar | 1                 |
| Undercarriage wire         | 1     | GWS Motor mount     | 1                 |
| 6mm Carbon elevator joiner | 1     | Bearing tube        | 1                 |



### Wing Construction

- Remove the two loose pieces of EPP inside the wing.
  - Lay the wing upside down on a flat surface and have some weights (about 1 kg) ready to lay along the wing while the glue sets.
  - Open the wing enough to put a coating of Gorilla glue along the main and rear spars.
- Tip:** Use one of the bits you removed to 'chock' the wing open, while you apply the glue.



- Remove your 'chock' and make sure both spars are aligned when the wing comes together.
- To keep the rear joint tidy, tape it to prevent the glue from foaming out.
- Put a weight along the top of the wing above the EPP spars and the trailing edge. Leave overnight to cure.

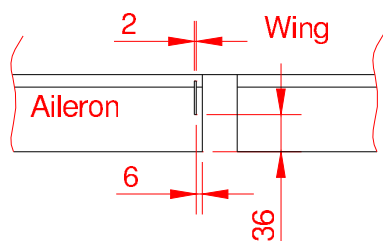


When the glue has cured:

- Using a sharp knife and a straight edge, make an 8mm deep cut along the small indent on the underside of the wing.
- Slot the carbon spar into the cut, ensure it's fully in and glue in position with thin CA.
- Glue the wing tips on with CA or Gorilla glue.

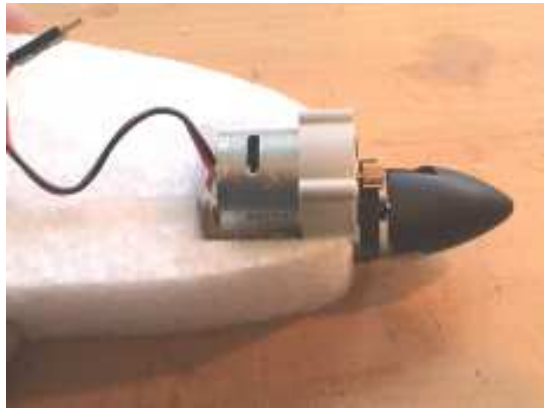


- Turn the wing right side up and mark the centre of the wing on the leading and trailing edges.
- Put a mark 15mm either side of your centre marks and draw a line from the leading edge to the trailing edge.
- Now draw another line on the aileron section of the wing only, 2-3mm outside the lines you've just drawn.
- Cut the ailerons along the line you've just drawn and through the hinge, to remove the centre piece.



- Make a double cut, 2mm apart and 6mm deep in the under side of the aileron, 6mm from the inner end. Carefully pick out the bits in the middle to make a slot for the horn.
- Remove two control horns from the sheet of polycarbonate parts. Cut 32mm off the plain end of the horns, see the plan for details.
- Buff the surface of the horn with sand paper where it will be glued.

- Slide the horn into the EPP and secure by wicking thin CA into the slot from both sides. Make sure you keep the end the pushrod connects to, *aligned* with the hinge line. (Refer to the plan)



#### **Fuselage construction.**

- Check and adjust the fit of the rudder/elevator servos in the fuselage (rear) cut-outs and the aileron servo under the wing in its own cut-out. (Refer to the plan for correct orientation)
- The cut-outs in the fuselage are big enough to suit the Hitec HS-55 servo's – without lugs. If you want to keep the lugs on, just cut slots to suit.
- Fit the longest double ended servo arm you have, on the aileron servo. (It needs to be at least 25mm between the outer most holes) If you don't have a large enough servo arm, screw the extension (plastic part) to the largest servo arm you do have.
- Don't glue your servos in just yet!
- Now you have to decide on your motor mount etc and cut the nose to suit. The kit comes with a wooden mount for the GWS 350 geared motor.
- If you use the GWS motor, the wooden mount should be installed in the bottom fuselage section – flush with and parallel to the join line. The original Tracer had the motor fitted horizontally as shown in the photo. This helps offset the weight of the battery pack on the opposite side. (Refer to the plan for cut-out details)

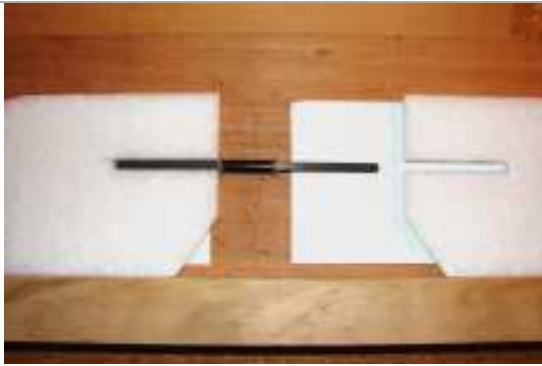
Trim around the mount until you can fit the GWS motor onto it easily, then glue in place with Gorilla glue.



**Tip:** Align the two elevator halves against a straight edge (in the photo I used a length of 50 x 25 wood).

#### **Tailplane construction.**

- Assemble the elevator joiner as shown in the plans (joiner + bearing tube + control horn + spacer) – BUT DON'T GLUE ANYTHING YET!
- Position the 2 elevator halves on a flat surface with a 34mm gap between each elevator and the trailing edges aligned/parallel with each other.
- Draw a line on the elevators parallel to the leading edge and 42mm back.
- Position the joiner just behind the line you've drawn and centralize it side to side. The control horn, bearing tube and spacer should just fit neatly between the elevators.
- Put a mark at each end and along the rear edge of the joiner.



**Tip:** Because the elevator control horn is higher on the top edge than the elevator itself, it's impossible to keep the two elevator halves **FLAT** while the glue cures. By packing each elevator half up on books or flat boards of equal thickness, spaced 40mm apart, you can keep the two elevator halves flat.

Tape over the slots in the elevators to keep the glue from foaming up and put a weight on each elevator half to ensure they're both sitting down on the packers underneath while the glue cures.

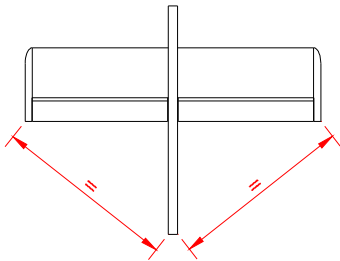
- Remove the joiner assembly and cut a 6mm wide slot in each elevator along your marks – dry fit the parts together after cutting the slots, to make sure everything fits together neatly.

- Lay one of the elevators on a flat surface with the slot you've just cut, on its **right hand end** (see photo) – this will be the right hand elevator.

- Dry fit the joiner into the 'right' elevator, with the bearing tube and spacer at the right hand end of the joiner, slide the control horn up to the 'right' elevator and CA it *onto the joiner*. Then slide the bearing tube and spacer back to the control horn and remove the joiner assembly from the elevator.

- Lay the 'left' elevator opposite the 'right' elevator, with about a 35mm gap between the two. Make sure both elevator halves are aligned correctly against your straight edge.

Now gorilla glue the joiner assembly into the two elevator halves – with the control horn on the **LEFT** of the bearing tube pointing **vertically up** (Refer to the plan for the correct orientation). Slide the two elevators towards each other until they *just* close up on the bearing tube.



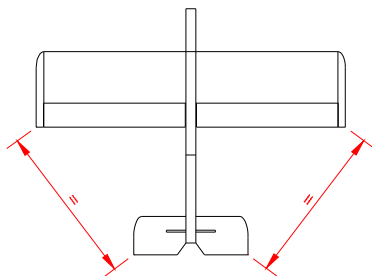
### Final Assembly.

Now is a good time to paint individual parts of your Tracer – like the bottom fuselage half on the model featured in these instructions.

- Take the bottom fuselage section and mark a spot on the side, approximately 45mm down from the wing leading edge. Drill a 1.5mm hole through the fuselage at that spot for the undercarriage wire.

- Lay the wing **upside down** on a flat surface and glue the bottom fuselage section onto it with Gorilla glue.

Note: Make sure the fuselage is vertical to the wing and measures the same distance from the rear corner of each wing tip to the tail end of the fuselage on both sides.



- When the glue has cured, turn the wing and fuselage right side up and glue the elevator assembly (bearing tube) into the bottom section of fuselage. Make sure the elevator control horn is pointing **down**, the elevators are level with the wing and measure the same distance from tip to tip on both sides.

- Now glue the top section of fuselage on with Gorilla glue. Tape the joint for a smoother finish and put several wraps of tape around the fuselage along its length to keep the joint tight while the glue cures.

### Fitting the servos.

Before you do anything else:

- Make sure each servo has been set to its neutral position with the servo arm at right angles to the servo.
- Also make sure you put the elevator servo into the right hand side cut-out **upright**, as shown in the plan. Fit the rudder servo into the left hand side cut-out **upside down**.

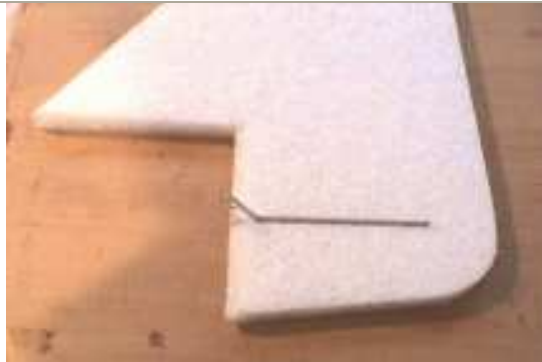
**Tip:** It's a good idea to install the servos with the wire leads towards the front of the model. (ie: Pointing towards the receiver!) You can make shallow cuts in the fuselage to tuck the wires into, which keeps them tidy and out of the way.

- Now you can install the aileron, rudder and elevator servos in place with glue, double sided tape or Velcro, but whatever you use - make sure that the servos are a snug fit in the cut-outs.



### Rudder construction.

- Prepare the rudder hinge by cutting the leading edge at 45 degrees – note the technique used in the photo and that it's the left hand side of the rudder being trimmed.



- Cut a 2mm wide slot in the rudder for the control horn, about 50mm down from top of the hinge edge.
- Remove a control horn from the sheet of plastic parts and buff the surface of the horn where it will be glued, with sand paper.
- Slide the horn into the rudder and secure by wicking thin CA into the slot from both sides. Note in the photo that the horn is protruding out on the same side as the beveled hinge edge.



- Draw a line down the end of the fuselage, approximately **20mm** in from the **left hand side**.
- Apply contact adhesive to the fuselage on the left hand side of the line only and on the **left hand** hinge edge of the rudder.
- Align the rudder to the line you've drawn and at right angles to the fuselage (full right rudder!). Make sure you have approximately 2mm of clearance off the top of the fuselage.
- Apply two short strips of tape above and below the control horn, onto the rudder and the end of the fuselage.



- Rotate the rudder across to the left, keep it vertical and apply contact adhesive to the right hand end of the fuselage and the right hand hinge edge of the rudder.
- Apply one strip of strapping tape onto the end of the fuselage and the rudder to complete the hinge.

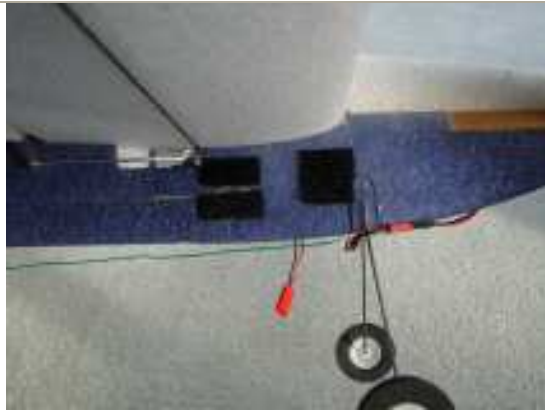
### **Rudder and elevator servo set-up.**

- Cut 4 pieces of plastic tube approximately 25mm long, slide two pieces each, onto the long pushrod wires -this will later act as a guide.
- Slip the pre z-bent end of a long pushrod wire into the elevator servo arm from the top (drill the hole out to 1.5mm if required).
- Lay the other end of the pushrod wire over the outer most hole in the elevator control horn – **WITH THE ELEVATORS SET LEVEL** (ie: Aligned with the fuselage joint).
- Put a mark on the pushrod approximately 7mm past the hole(s) in the control arm.
- Put a 90 degree bend in the pushrod on your mark – make sure it's at right angles and pointing **away** from the fuselage! Now put two 30<sup>0</sup> bends into the wire, 25mm apart – refer to the plan, just in front of the 90 degree bend. These bends will provide some adjustment for length if required later. Lay the pushrod over the control horn again and adjust the 30<sup>0</sup> bends until the end of the wire is lining up with the hole(s) on the control horn.
- Cut the excess wire off approximately 6-8 mm away from the 90 degree bend.
- Rotate the elevators to clear the control horn from the pushrod wire. Align the end of the pushrod with the outer hole on the control horn and push the pushrod **into** the side of the fuselage, rotate the elevators back until the control horn is over the end of the pushrod. Align the end of the pushrod with the hole in the control horn and release it so it locates into the hole.
- Make the Rudder pushrod in the same manner as the elevator pushrod. When you've got the rudder pushrod to the correct length and located in the control horn, slide a bead over the end of the wire and CA it in place – take care not to glue it to the control horn!
- CA the plastic guides to the fuselage approximately 100mm apart, between the servo and control surface - refer to the plan.

### **Aileron servo set-up.**

Make sure the servo arm is square to the fuselage and the aileron trailing edges are in line with the fuselage joint!

- Use the two short pushrods for the ailerons, bend them 25mm back from the z-bend (refer to the plan for the approximate shape). Fit them into the aileron servo arm and mark the pushrods where they line up with the hole(s) in the control horns. Cut the wires approximately 10mm past the marks and form a 90<sup>0</sup> bend at that end – **away from the fuselage**.
- Move each aileron away from the pushrod and spring the end of the pushrod into the control horn the same way you did for the elevator control horn/pushrod.
- Trim the EPP around the aileron servo arm if required, to allow for full rotation of the arm.



- Bend the undercarriage wire, using the plan on the back page as a guide – Leave one end unbent until after the next step!
- Feed the U/C wire through the 1.5mm hole you drilled in the fuselage earlier then do the final bend.
- CA the under carriage wire in place.
- Trim approximately 8mm off the 'bottom' of the plastic support pieces before fitting them over the wire and gluing to the fuselage with medium CA.
- Slide a bead onto each end of the undercarriage wire up to the first bend and CA in place.
- Fit the wheels then slide on the remaining beads. Secure with a drop of CA on the outside end of the wire - KEEP it clear of the wheel!



#### **Fitting the GWS 350 motor.**

- Fit the motor onto the motor mount. Trim the fuselage to clear the motor until you get it fully onto the mount.
- Drill a hole through the motor mount and into the wood, and then screw a small screw to hold the motor in place. A servo mounting screw is ideal for this.
- We recommend you use a prop saver to increase the life of the prop. The prop sits on it, and is held in place with rubber bands.



#### **Fitting the receiver etc.**

- Connect up the receiver, servos and ESC.
- Attach the receiver and ESC to the fuselage with double sided tape or strips of Velcro. Keep the ESC as far as possible away from the receiver (Not like I have it in this photo! Refer to the plan) Attach the battery also with strips of Velcro – keep the strips on the fuselage longer than what you need so you can move the battery around to balance the model. For a 3cell (1250HP) Lipo pack, initially locate the battery so the front edge of the battery is **20mm in front** of the wing.

#### **Balancing the Tracer.**

There is a range of Center of gravity positions to consider depending on the type of flying you intend.

For aerobatics and general fun flying balance the Tracer on the spar or up to 5mm *in front* of the spar. For hovering and 3D aerobatics, move the C of G back 10mm at a time until you find the balance that suits your flying style best.

Adjust the balance by moving the battery forward or back until the model balances level.

### Control movements

Elevator – 25mm up/down

Ailerons – 35mm up/down

Rudder – as much as you can get!

Note: The dimensions listed above are measured at the trailing edge of the control surface.

### Tracer undercarriage wire plan

