The Dart

by
Canterbury Sailplanes

Thank-you for purchasing the Dart, we're confident that you'll *really* enjoy flying this model. Developed from our very successful Arrow, the Dart is designed as a light weight slope soarer. The Dart flies very smoothly, with it's minimal drag and light weight, the Dart slope soars on the lightest breeze. It's very agile and fully aerobatic too - beginners to expert fliers will love flying the Dart!

GENERAL NOTES

- The Dart has a lot in common with the Arrow, they both have the servos positioned in the fuselage. This keeps all the radio gear together and increases the survivability in a crash as well as improving the roll rate by removing the servo weight from the wings. Refer to the plan at the rear of these instructions for the recommended radio installation layout.

- The kit box contains all the model parts. To complete the Dart ready to fly, you'll need the following items:
  - 2-channel radio control set with two mini or micro servos,
  - Elevon mixer (if you don't have mixing capability on your radio set),
  - 270mha or similar sized battery pack,
  - Spray-on contact adhesive (3M Spray 77 or Ados F2),
  - Sharp knife and some basic tools.

- Most Hardware stores or Automotive accessory outlets have 3M Spray 77 adhesive or Ados F2. The spray on adhesive really helps the tape to bond to the EPP so do try to get some.

- Gorilla Glue is included in the kit, this is a great all purpose adhesive. Using it is a little different from most glue as it foams while curing. Note the following points;

  - Read the instructions on the packet.
  - Use a **minimal** amount as the glue foams and expands when curing. Wipe off any excess before it sets, with a damp cloth.
  - You'll get a better finish by taping over the spars as soon as you glue them in, producing a smoother finish once the glue has cured.
  - When gluing the fin and wings in place, the expanding glue may push the sides apart – to prevent this, clamp or tape the parts together while the glue cures.
  - Any excess can be sanded or cut off.
  - It works well on tape – such as gluing the wings on.

- The kit includes coloured Polypropylene tape and strapping tape, (fibreglass reinforced) make sure you use the correct tape as specified in the instructions. There are 50 meters of coloured tape and 24M of strapping tape. Other Colours of tape are available - Blue, Black, Green, Red & Yellow, contact your local model shop or Canterbury Sailplanes if you require extra colours for your Dart.

- It's also worthwhile investing in a Lost Model Alarm, if you land/crash in trees, bushes or long grass, your model may be hard or even impossible to find. With a lost model alarm you can locate your model much easier. The alarm will sound for up to 2 days. Our LMA also sounds off as the battery pack in the model runs down, so you can gauge how long you can safely fly your model. Ask your model shop or check out our website for details.
(Note: LMA's aren't compatible with PCM radio gear)

- Another useful item is a servo extension lead so you can easily 'switch' the model on/off and charge the batteries in the model without having to remove them.

- The Dart fuselage has a cut-out to take a 270mha flat battery pack. You can use similar sized battery packs, but you may have to alter the battery recess to suit your chosen battery pack.

- When applying tape, take care not to apply it under tension, as this will cause the wings to bend and twist.

- When applying the spray adhesive to the model; spray onto the model and leave it a minute or two, waiting until the glue on the surface is "aggressively" tacky, before laying the tape onto the glued surface. Once it's on however, it's difficult to remove - so take care. Only a light mist of spray adhesive is required, you should expect to use about ½ - $^{3}/_{4}$ of the can building the Dart.

SOME EXPLAINATIONS:

- The bottom of the wing is the *flatter* of the upper and lower surfaces.
- The spar slots are the grooves cut in the top surface of the wings.
- The spars are the two 3.5mm diameter fibreglass rods in the kit.
- ELEVON is the name for the control surfaces on a flying wing, derived from a mix of the words Elevator & Aileron.

BEFORE YOU BEGIN ASSEMBLY

1) Check that all the parts as per the parts list page are packed in the box. You will note that the parts list page also has pictures of some items to help you identify them. This will help you later when reading the assembly instructions.

2) Other tools that you will need include:
   1. Electric or hand drill with 1.5 mm drill bit
   2. Small ruler or tape measure
   3. Sharp knife, scalpel or modelling knife
   4. Scissors to cut tape
   5. Marker (a ballpoint pen will do)
   6. Small phillips head screwdriver (for the servo's)
   7. Small screwdriver (for the control horn screws)
   8. Needle nose pliers (or strong tweezers)
   9. Soldering iron for melting out foam(not needed but can be helpful)

3) It's also a good idea while you're getting these items ready; to make sure you have enough batteries for both your Transmitter and for the radio gear to be installed in the Arrow. If you have rechargeable batteries, ensure they're charged as you'll need them to be ready prior to fitting the servos into the Arrow.

On with the construction!

1. Shape the wing tips.
   - Remove the wings from the surrounding EPP foam.
   - Mark out a radius of 100mm from the leading edge to the wing tip.
   - Cut along the line with a sharp knife and then sand an even radius (from the top to the underside of the wing) right around the wing tip, using a sanding block with 40 to 80 grit sandpaper.
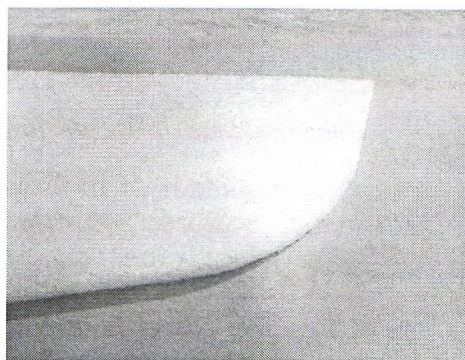
Tip: Don't discard the wing 'skins', these will come in handy later on as a bed to build and tape the wing on.

2. Select one of the balsa elevons and position it next to the trailing edge of one half of the wing. Make sure the leading edge of the elevon is vertical when sitting flat on your bench/work table.
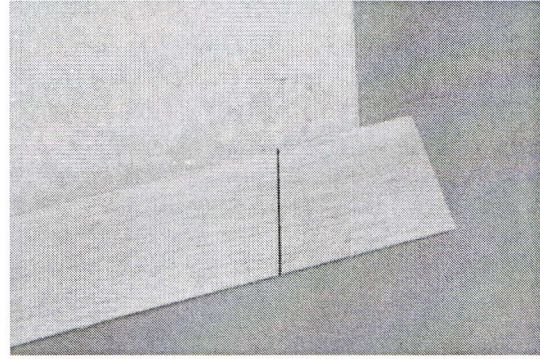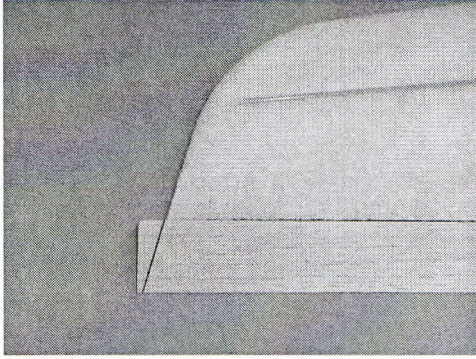

- Mark and cut the inner end of the elevon about 15mm (enough to clear the fuselage by at least a couple of mm) from the wing centre line.
- Lay a ruler along the tip; mark the elevon in line with the tip and trim off the outer end.
- Repeat for the other elevon.

3. Cover both elevons with coloured tape or coloured material of your choice.

Joining the wings.
- Cut the foam wing skins apart and use the two outer sections to go under the wings.
- Place the wings and matching skins, bottom down on your bench or table. Butt the two wing roots together to check the alignment. Due to the varying thickness of the EPP blocks, it's possible to get a height mismatch, if this is the case, place paper or cardboard under the low wing and skin until both wings line up.
- Join the wing halves using Spray adhesive, apply a liberal amount to both surfaces, wait 5 minutes and push together. – *Be careful handling the wings until the spar is installed*
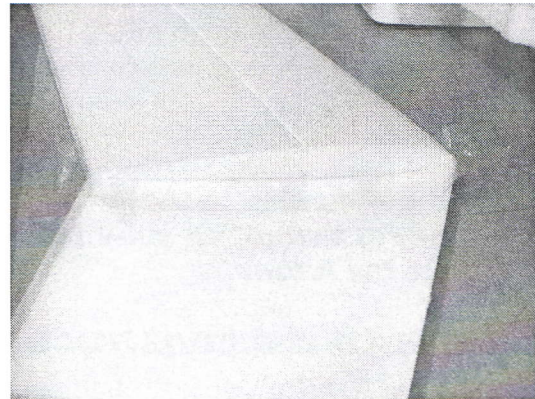
4. Join the fibreglass rods to make the spar.
- Insert a fibreglass rod fully into the alloy joiner tube and glue with Gorilla glue or CA.
- Carefully crimp the alloy joiner onto the spars with pliers.

5. Lay the spar on the top of the wing, mark the location of the joiner tube in the centre of the wing and cut away a minimal amount of foam to allow it and the spar to sit in the slot in the wing.
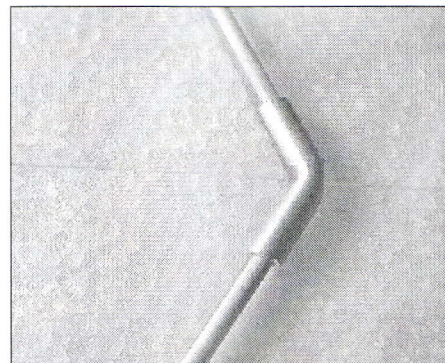
6. Glue the spar in place with Gorilla glue. (Put tape over the spar in the wing for a smooth finish) Lay the wing back in the wing seats or on a flat surface, ensuring it's level, then leave over night while the glue sets.

Tip: Place weights on top of the spar to keep it in position until the glue cures. A length of flat timber is ideal, or you could use books etc. The main thing is to keep the weight directly over the spar and avoid sharp edges pressing into the wing.

### Connect the Servos, Elevon mixer (if required), battery and receiver.

7. Select one servo arm for each servo. You need a straight arm about 15mm long for each servo. It'll be necessary to cut off any unused arms if there's more than one.
8. Use a 1.5mm diameter drill to enlarge the outer most hole in the servo arm.

Servo Arm
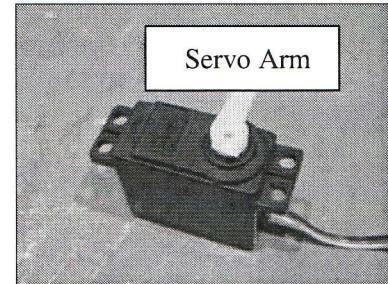
9. Position the 2 servos in the fuselage cut-outs above the wing. Note: You can install servos without the mounting lugs. Cut the lugs off with side cutters or a very fine saw, DON'T CUT THE LEADS!! If you don't wish to cut the lugs off, you don't have to, just cut slots for them in the fuselage to suit.

Tip: Make a small hole through the fuselage in the servo cut-outs to get the left servo lead across to the receiver. Trim the fuselage in front of the servo arm (as shown here) to allow the arm to move forward without hitting the fuselage.
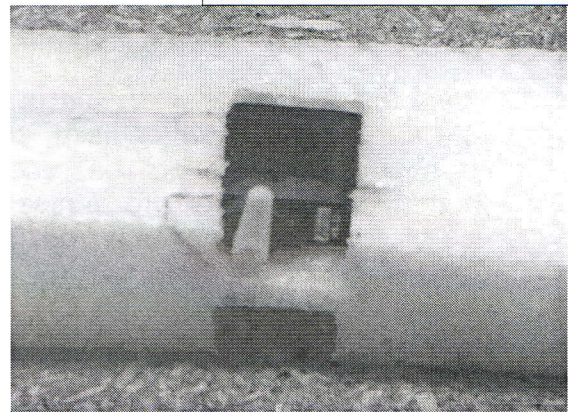
10. Ensure the servos have their arms at the bottom of the servo, pointing toward the wing tips and the servo leads *towards the front*. Check that the trims are in the central position on your transmitter and the servo arms are pointing out at right angles to the fuselage - adjust the position of the arms on the servo so both point out equally.

Tip: Make sure the servo (arm) is 2-3mm *above* the wing seat so the pushrod clears the wing when fully assembled. You may also have to trim the fuselage slightly around the servo arm to allow full movement.

- Check when you pull the elevator stick back (or towards the bottom of transmitter case) both servo arms should move toward the nose of the fuselage. Moving the stick towards the top of the transmitter should produce the opposite reaction. Moving the aileron stick left, should move the left servo arm towards the fuselage nose, the right servo arm towards the tail. Moving the aileron stick to the right should cause the opposite reaction. Refer to your Transmitter or mixer documentation for instructions on programming. When satisfied the servos are correctly set up, re-install the screw to keep the servo arm on.

- *It's very important that the servo arms are both the same length, both are set at the same angle, and both move the same amount when you move the elevator stick on the transmitter. If you don't get this right the model could be difficult to trim and won't loop or roll straight.*

Refer to the plan on the back page for the next steps.

Fuselage shaping:
Shaping the fuselage is optional, but if you want to shape it, now is the best time. Use a sharp knife to remove the corners initially, then a sanding block with 40 to 80 grit sandpaper. Take your time, the end result should be a 15mm radius around the top and a smaller radius 5mm, around the bottom corners. **Note:** Don't remove any material from the wing seat.

11. The servos should be a neat fit in the fuselage – the cut-outs are sized for Hitec HS55 servos, but you may need to relieve or fill the cut-out with some EPP off-cuts to achieve a good fit around your servos. When you're satisfied with the fit, Gorilla glue the (EPP offcuts and) servos in place – alternatively, use double sided tape to hold them in. (Spray contact adhesive on the back of the cut out in the fuselage, before sticking the servo in place with tape).

12. Now install the receiver and battery in the cut-outs provided, depending on the size of the receiver used, the cut-out may also require relieving or off-cuts of EPP to wedge the receiver in neatly. **Don't** glue the receiver or battery in – but do try for a nice neat fit.
Tip: Cut small pieces of EPP from the wing skins to make covers for the battery and receiver cut-outs.

13. If you're using an electronic mixer, cut a hole for it just behind the receiver.

14. Make a shallow cut about 4-5mm deep from the battery and servos to the mixer and receiver, carefully push the wires into it.

15. Curl the aerial up on top of the receiver for now to keep it out of the way.

Taping
Wing.
Before taping the wing, you have to remove a small section from the leading edge at the wing centre – refer to the plan at the back of these instructions.

16. Spray the top of the wings with a light mist of Spray adhesive; this is best done outside or with newspaper on the floor to catch any over spray. (The kit box lid is ideal for this)

17. Refer to the taping plan. Using the strapping tape, first apply strips in the order shown to the top of the wing, take care not to stretch the tape as it goes on! When complete, turn the wing over and repeat on the bottom side.

18. Dry fit the fuselage to the wing at this stage, align it so that it's central to the fuselage and the distance from the nose to each wing tip (trailing edge) is equal on both sides. Draw a line on the wing, down both sides of the fuselage.

19. Cover the wings with coloured tape – but stop the tape just 3-5mm over the lines you've just drawn, as shown in the photo here. Apply the tape without stretching, in the same order as shown on the taping plan.

The wing top centre section shown here has the fuselage outline drawn on the wing and the typical amount of coloured tape over the line.

Fully tape the underside of the wing, overlapping the tape on each wing at the wing join by 50mm.
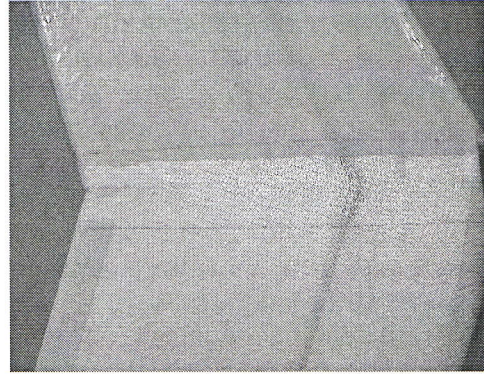
20. Hinge the Elevons to the trailing edge of the wing. Refer to the plan for details.

   • Apply the tape to the wing first, then holding the elevon against the wing trailing edge as shown in the plan, attach the tape to the elevon..

   • Fold the elevons onto the top of the wing and apply a layer of tape along the inside of the hinge line.

Note: Ensure that the leading edge of the elevon (now facing rearwards) and trailing edge of the wing stay aligned while applying the second strip of tape.

   • Check that the elevons travel freely up and down, if they bind up when moved up or down, you may have to retape the hinge.

Fuselage.

21. Put a small piece of white paper over the servos and receiver to prevent the tape from sticking to them and to keep the tape colour even. Spray contact adhesive on the fuselage then apply strips of the strapping tape along the sides of the fuselage from the nose back to the tail – covering the fin slot as well.

22. Tape from nose to tail along the top and bottom of the fuselage, segment the edges of the tape where it goes around complex curves. Stick the segments down, from the tail end first, working towards the nose.
    Do Not cover the wing seat!

Tip: As you apply the strapping tape, make some small cuts through the tape to allow the aerial and battery leads to come through. Pull the wires fully through the tape when you apply it to the fuselage.

23. Cover the fuselage with coloured tape – start on the sides and work up towards the top of the fuselage, cover the fin slot as well. Take your time, segmenting the edges to go around complex curves, avoid wrinkles as much as possible. (Small wrinkles can be 'ironed' out later on with an iron or covering iron). *Don't apply the tape to the bottom of the fuselage just yet!*

24. Cut small holes in the tape for the servo arms to exit and for the battery lead to plug into the receiver. (Most fliers choose not to use a switch, preferring to plug the battery lead into a servo extension lead outside the covering, the

other end of which is plugged into the receiver). Trim the covering away from the sides of the fuselage around the wing seat.

25. Cut away the tape covering the fin groove along the top of the fuselage, then glue the fin in with Gorilla glue. Make sure you keep it vertical and at 90 degrees to the wing seat and remember to wipe off any excess glue before it sets. Tape the fin in place while the glue cures to keep it in position.

26. Bend the Elevon Pushrods to the shape shown in the plan. Each section of the length adjustment kink is approximately 12mm.
Note: Make sure you have each pushrod orientated properly *before you bend it*, you need to make one right hand pushrod and one lefthand pushrod.

27. Place a control horn on each elevon about 3mm out from the inner ends. Mark and drill the 1.5mm holes required for the mounting screws – *but don't fit the control horns just yet*.

Joining the wing to the fuselage.
- Lightly sand the glossy surface off the strapping tape in the centre section of the wing, between the two lines you drew on the wing earlier. Take care not to sand right through the tape!

- Apply Gorilla glue to the wing seat on the fuselage.

- Place the fuselage onto the wing, align it with the marks you made previously in step 18, taking care to keep the wing central. Put some weight on top of the fuselage, making sure the fuselage is held vertical, while the glue cures.

28. When the glue has cured on the wing/fuselage joint, apply a length of strapping tape from 50mm in front of the wing to 50mm behind the wing. For additional strength (optional); cut 4 strips of strapping tape 20mm wide by 100mm long and apply them diagonally across the wing and onto the fuselage sides at the wing leading and trailing edges. (ie: From the left wing across to the right hand side of the fuselage)

29. Cover the bottom of the fuselage with coloured tape, from tail to nose, including the wing.

30. Fit the elevon pushrods into the servo arms (from the top). Feed the other end of the pushrods through the fourth hole up on the control horns. Then mount the control horns onto the elevons. Cut the excess length of screw off after you've tightened them.

31. Switch on your radio gear and make sure the trims are in the central position. Measure the elevon position at the wing tip by placing a ruler under the wing and elevon. The elevon should be 3mm high at the trailing edge. Tweak the pushrod adjustment kink until you get a 3mm gap under the elevon trailing edge and ensure both elevons are set at the same angle.

Final balancing and control set up.

32. First balance the model laterally. Suspend the model between your fingertips placed at the nose and tail of the fuselage. If one wing is heavier than the other, add a small amount of weight to the lighter wing tip until it balances.

33. Mark the Centre of gravity **140mm** back from the leading edge at the centre of the wing, next to the fuselage. Now balance the model on your fingertips placed at this point. It may be necessary to add weight (lead is best) to the nose or tail to balance, fit this into a small hole in the underside of the fuselage and tape over.
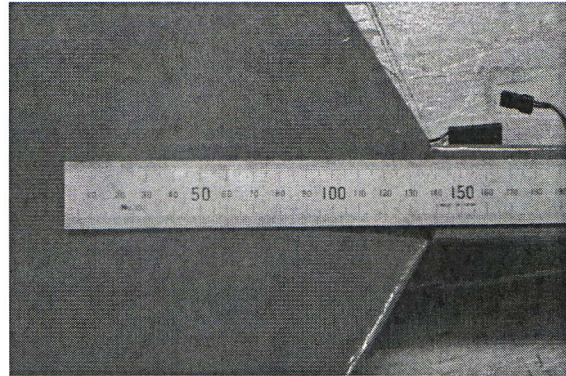
34. Set up the elevons so that the when you move the aileron stick on the transmitter to the left (applying roll control) the left elevon moves 12mm up and the right elevon moves 12mm down. Move the aileron stick to the right for the opposite effect. When you move the elevator stick on the transmitter up and down (Pitch control) both elevons move 8mm up and down. (Measured at the trailing edge).
Note for beginners, go for 6mm up/down movement on elevator and 10mm on aileron.
Experts fliers can use up to 20mm of movement either side for a really wild flying Dart!

35. Lay the receiver aerial along the side of the fuselage and attach it to the top of the fin or the rear of the fuselage with a small piece of tape, let the excess length trail off. Don't double the aerial up as it can affect the range of your radio.

Designers comment;
I test flew the prototype Dart in 15 knots of wind and it went really well. At such a low weight, I was surprised at how quick it flew and how well it penetrated the breeze – even gusts over 15knots hardly made any difference to its forward speed. The Dart is a very versatile model, you'll find you can fly in as little as 5 knots of breeze up to 15 knots with little or no trim changes.
With the larger control throws it's a blast to fly in the stronger winds, very agile with a really quick roll rate. I hope you enjoy flying the Dart as much as I do, it's a great model.

Tip on launching your Dart: When I launch my Dart, I hold onto the rear fuselage with my index finger at the back (pointing up at the fin). I keep the nose of the Dart pointing down until I'm ready to launch then bring it up and throw – you can get 10m high launches doing it like this.

Cheers,
Carey Burr.

CONGRATULATIONS – Your model is now assembled – LET'S GO FLYING!!!

First a quick note on safety:

- Model Aircraft, even those made from EPP foam like the Arrow, can be dangerous if you hit someone, be careful, think about where you fly and the safety of yourself and those around you.
- Avoid flying sites close to full size airfields, roads, houses and power lines.
- Don't fly near Para-gliders, you can injure these people or worse, if you collide with them in flight. Wait until they land or fly somewhere else.

A few notes on flying for beginners

If you haven't flown before it is well worth getting some help. Ask at the local model shop or go to a local flying slope, most fliers will be very happy to help.

If you are a first time flier, before going to a slope, go to the local park and practice throwing and gliding the plane flat and level into the wind. This will get you used to the controls so that corrections become quick and automatic because on the slope you don't get time to think about which stick to push in which direction. Before flying, check the basic functions, i.e. up is up, down is down (stick forward), right is right and left is left. Check the radio range by following your radio manufacturers' instructions.
These initial flights will also be a good opportunity to trim your model for straight and level flight.

Once on the slope and you have mastered level flight try some turns. As you turn you will need to add a small amount of up elevator to keep the model level. Be very gentle on the controls, the model will not fly well if you use lots of Jab type control movements on the sticks. It's best to **always turn into the wind** as down wind turns can take up a lot of airspace; it can also be tricky to judge the correct airspeed.

Good soaring slopes are a little hard to find, however this makes an interesting challenge for this captivating sport. A good slope is characterised by the wind blowing straight up a slope that is steeper than 45 degrees. Tall sand dunes over about 6 Meters and hills higher than about 30 Meters should provide sufficient lift. You will often see birds soaring in these areas. *It's best to talk with local flyers* or see where others are flying to find the best sites for each wind direction and strength. You can also get first-hand tips on flying and trimming. Most foam planes will fly well in winds from 10 knots to 20 knots. Experts can fly outside this window.

Choose a place to fly that offers a landing site. With EPP models this is less important - just dodge rocks if you can. Long grass, tussock or bushes are fine. *Watch out for spectators!*

Thermals will also assist flying. Thermals are generated by sun the sun heating the land, warming air which then rises as it is lighter than surrounding air. This makes a sunny slope work better than a sheltered one. Before flying, ensure that your transmitter batteries are charged. Follow your radio manufacturer's instructions for proper safe radio operation.

Always make sure that no one is on your frequency before turning your radio transmitter on. Do this by asking any other flyers if they are on your particular radio channel (refer radio manufacturer instructions to determine the channel you are on).

When you choose a slope, have a good look around and imagine where you will fly, pinpoint areas such as trees and cliffs where you don't want to fly and decide where you will land and perform a final range check (refer radio manufacturer instructions).

Always launch your model straight into the wind, with the wings level and a firm push out. Be ready to stop a steep initial climb by pushing the stick forward. Also be ready for a sudden turn to one side. Concentrate on keeping the model in front of you and heading away from the slope. If the model heads down and out from the slope, try pulling up a little. *If the model continues to sink, land it before you loose it!*

If the model climbs nicely but starts to go back over your head, push the elevator stick forward slightly (down elevator) to get speed up and hold it until you can fly it some metres in front of you. Once you are comfortable, try some zigzag turns, always turning into the wind. Remember to add up elevator when turning. Don't try fancy moves yet, just concentrating on getting your hours up. Practice, practice, practice.

Note the bad areas are below the horizon and down wind of you. This will put you out of the lift and into turbulence.

It can be quite cold on the slope so be prepared to dress warmly so you can enjoy the day.

SUMMARY OF SLOPE ETIQUETTE

You will always be welcomed at an established slope flying location by experienced flyers. The majority of flyers will almost always be prepared to stop what they are doing to help out and offer advice if you ask for it, so don't be shy.
Some informal rules have developed over time, which allows everyone to enjoy the slope. Some of these are listed below:-

Always check there are no other flyers are on the same frequency as you before turning anything on. *You can only establish this by asking around.*
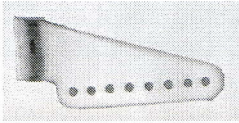
Avoid flying or landing where other flyers are standing. Pay particular attention if there are any spectators nearby, remember, foam models can hurt if they hit people.

Do not engage in combat with a composite or balsa model at any time. These are very expensive models and do not bounce like your new EPP model!

Challenge other EPP flyers before beginning combat so they know what's going on and can decline if they wish.

Avoid at all times any hang gliders or Para gliders. If you intend to share the same slope make sure you talk to these people before launching. You must give way at all times. *A foam model has the potential to damage parts of a hang glider or para glider resulting in serious injury or death.*

Parts list

Fuselage	1
Wings	1 Set
Balsa Elevons	2
Fin	1
Spars	2
Elevon Horns	2
Screws	4
Backing plates	2
Pushrods	2 (1 right hand, 1 left hand)
Alloy wing joiner	1
Strapping tape	1
Coloured Tape	1
Gorilla glue Adhesive	1
Instructions	1

Canterbury Sailplanes
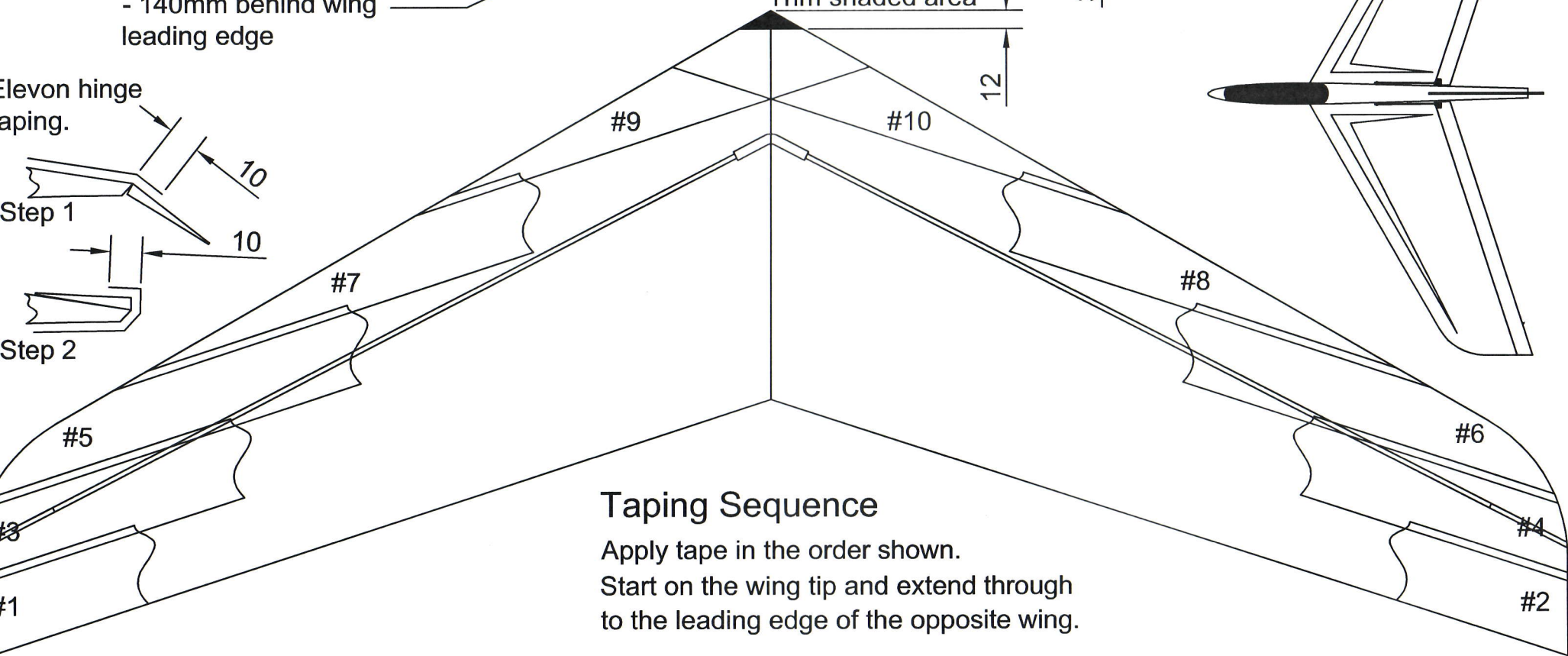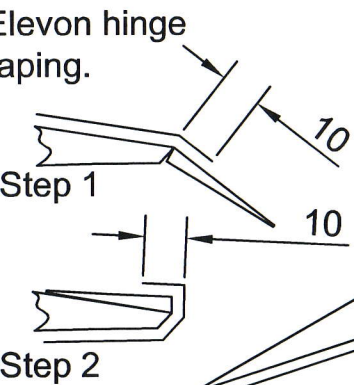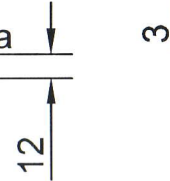**www.canterburysailplanes.co.nz**

Canterbury Sailplanes

Dart

Dart Specifications:
Wingspan - 1000mm
Length - 610mm
Finished weight - 350 to
400gms

Control throws:
Elevon =
12mm Up/Down
Elevator =
8mm Up/Down

Pushrod length
adjustment kink

Receiver
HFS-05MS

Battery
4.8v 270mah

Reflex

3
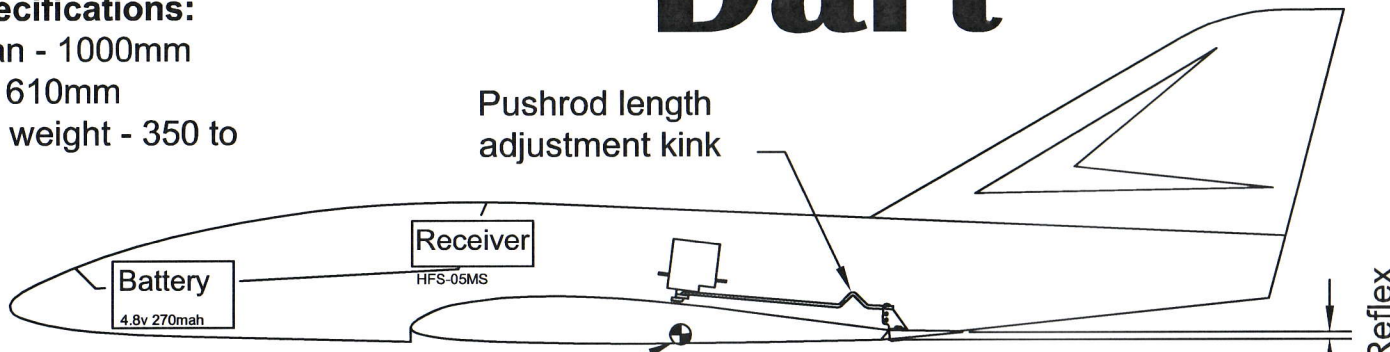
Balance approximately 135
- 140mm behind wing
leading edge

Trim shaded area

12

Elevon hinge
taping.

10

Step 1

10

Step 2

#9

#10

#7

#8

#5

#6

#3

#4

#1

#2

Taping Sequence

Apply tape in the order shown.
Start on the wing tip and extend through
to the leading edge of the opposite wing.

Canterbury Sailplanes help line ~ Carey@flycs.co.nz, Ph 0064 3 544 9216