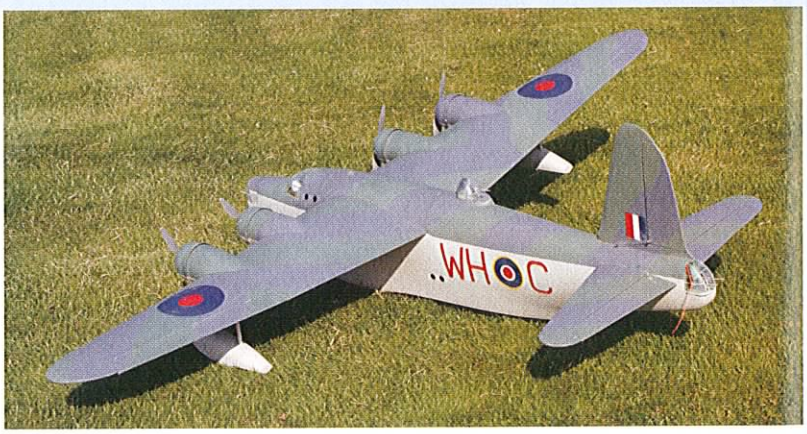
Short Sunderland

TONY NIJHUIS PRESENTS THE FLYING PORCUPINE IN ALL ITS FOUR ENGINE, MULTI MACHINE GUN GLORY

With over 800W / lb available there's certainly no shortage of power, which eases the burden on the builder regarding airframe weight.

Now it may have been noted by the more astute readers out there that I do have a liking for multi-engine scale aircraft. The category is heavily laden with bombers of all types and shapes so there's no shortage of subjects to choose from, yet, oddly, the planform of most four-engine bombers is pretty similar. Mind you, there has to be something sufficiently different about a subject to excite me enough to want to dust off my designer's hat and get a prototype in the air.

So, having already designed a 72" (1829mm) wingspan Boeing B-17 and prior to that the very successful 72" Lancaster, the next subject really had to be a deviation of sorts, but still in keeping with that four-engine bomber feel. To be honest I really didn't need an excuse to design and build the Sunderland flying boat, as



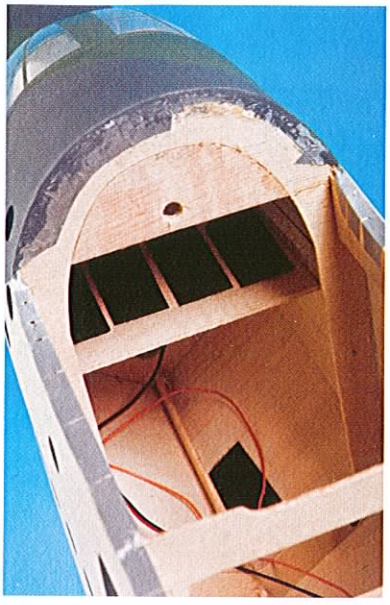
I'd always planned to do so - it was just a case of when!

CATALYST

Given that I designed the model with the intention of flying it off water, I must confess, I haven't yet done so. Not such a problem as it's a fact that the vast majority won't have access to water and, moreover, the model will happily take off from a grass strip without the need for wheels, skids or a dolly! Trust me, I've tried it! Anyway, given that my earlier Lancaster was so

Vacuum formed nacelles, cockpit and turret mouldings are all available from the RCM&E plans service.

Actually, there's room enough in the cockpit for a good amount of detail if you're dexterous.



You can't build this one in your lap - use a jig to form that free-flowing fuselage! Note the Velcro pads for the four Li-Po packs.

> ***...given that I designed the model with the intention of flying it off water, I must confess, I haven't yet done so.***

successful, I decided to employ many of the same attributes in the Sunderland and, thus, speed the whole design process:

- At 72" both the Sunderland and Lancaster are a comfortable size for most club flyers to transport.
- Electric powered and designed on a cheap and simple set-up, they give modellers the confidence to dabble with a multi-engine subject.
- They're both very popular. Probably two of the most evocative multi-engine aircraft of W.W.II!

Although, compared to the Lancaster, the Sunderland is a somewhat forgotten hero, it played a huge part in maritime patrol as a rescue and anti-submarine craft. On 21 September 1939, two Sunderlands rescued the entire 34-man crew of a torpedoed merchant vessel from the North Sea. On numerous other occasions the Sunderland performed the unassisted killing of U-boats, using 250 lb depth charges winched out from the fuselage and dropped from under the wings.

Of course, a key incentive when building quite complicated models is the availability of CNC-cut formers and ribs, plus vac-formed canopies, domes, blisters and turrets. The Lancaster was one of the first *RCM&E* plans to have CNC-cut parts made available, and this was only possible because the plan was designed using Computer Aided Design.

So, if the formula worked for the Lancaster and the B-17, I reckoned it should work equally as well for the Sunderland. But then, you'll be the judge of that!

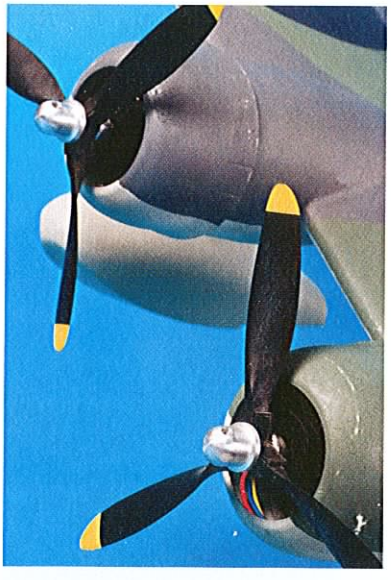
GONE BRUSHLESS

The power available from a brushless set-up is now immense. The suggested powertrain is courtesy of BRC Hobbies, who can provide a 200W motor and controller for around £30 mark. Just over £100 sorts the motor set-up, then; I seem to remember paying this amount for the brushed set-up in both the Lancaster and B-17, which gave only 600W total! So, if you compare the price 'per Watt' that's now available to us, we are, at last, in a situation where brushless works out cheaper than comparable conventional brushed power... Hurrah!

As we're fully aware, battery technology has come on in leaps and bounds, and Li-Po cells are creeping ever-closer to the price of equivalent NiMH cells, but with a huge weight saving. This, once again, reinforces the lesser concerns of trying to save on airframe weight. However, keeping the tail end of the model as light as possible is still one of the most important points to remember when building from a plan, so always select the best quality wood for this part of your model.

DESIGN MATTERS

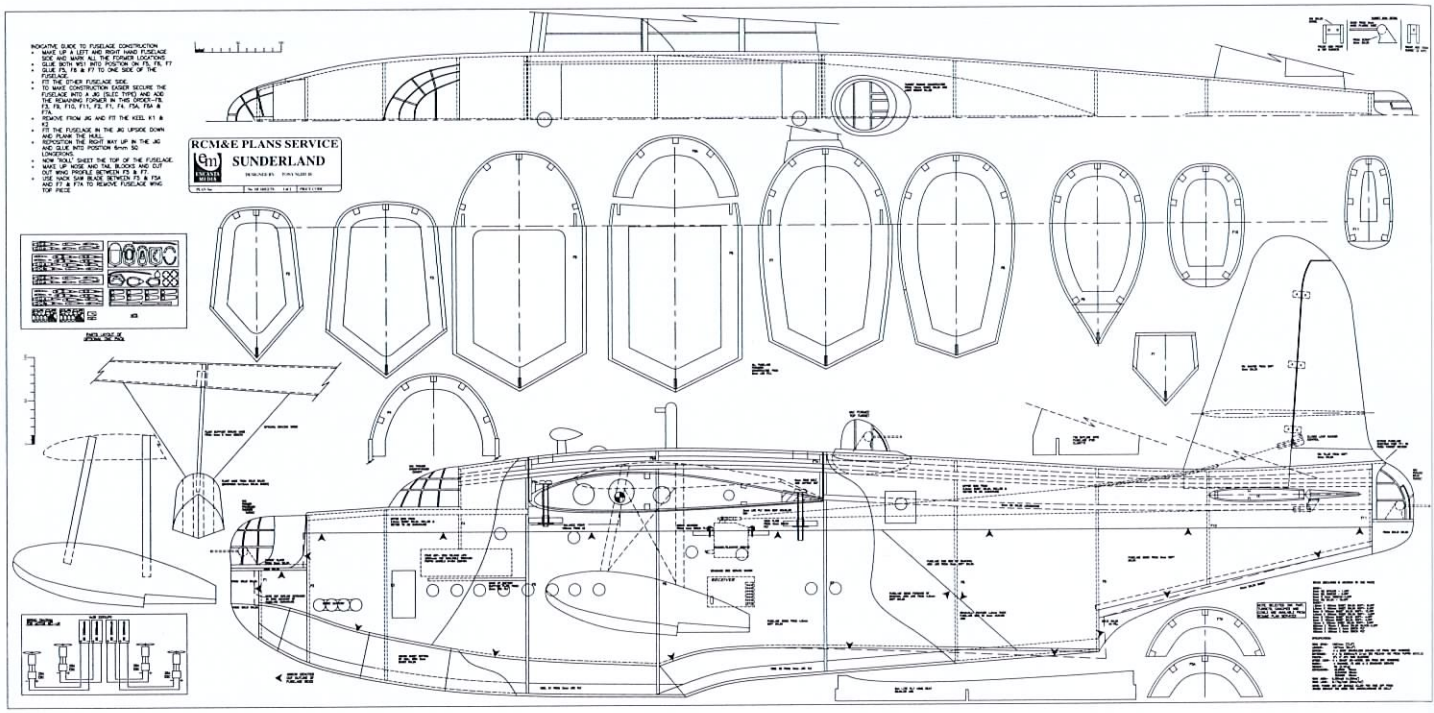
What, you may ask, are the basics behind the design? Well, as with most



The major departure with the Sunderland's design compared to my existing multi-engine models is in the use of brushless motors.

Don't be afraid to use a razor plane in the quest for those smooth fuselage curves.

The Sunderland operates beautifully from a grass strip, without the need for an undercarriage or a dolly!



Just look at that plan! Tempting eh?

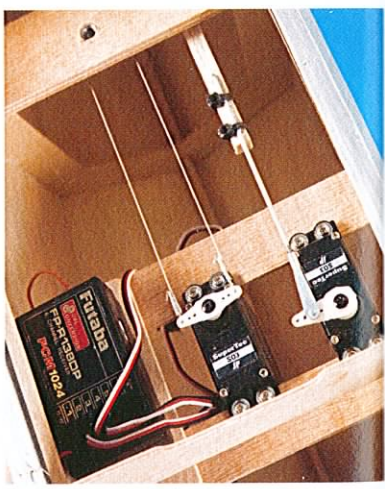
There's nothing complicated about the control surface hook-up. A closed loop rudder system and conventional elevator pushrod do the trick nicely.

of my recent models that are of a scale nature, the basic outline has been digitally scanned from copies of original 3-view drawings. The result is a perfect scale outline, which I think you'll agree from the accompanying photos, looks the business.

For the wing and tail design I used the Compufoil-3D program to produce a full set of lofted wing and tail ribs. However, I must admit to cheating here and using the B-17 wing planform and ribs, seeing as there was very little difference between the two apart from the wing tip. The tailplane was also modified from the B-17 plan. Mind you, most of this time saving was lost in 'head scratching' when it came to designing the fuselage. Trying to think of a simple way of reproducing it without compromising the Sunderland's scale appearance wasn't easy. There could be no compromise, that curvy fuselage had to look right and I hope you'll agree the result is very pleasing.

By the time the prototype was complete, covered, finished and detailed to the level seen in the pictures, the final AUW including four 2200 3s Li-Po flight batteries came out at 8 lb (3.6kg); pretty respectable for a package capable of producing over 800W.

Now here's the clincher. Assuming 400W will fly the model, this would equate to approximately 9A current draw per motor. Using one 2200mAh



Li-Po battery pack per motor, it doesn't take much to work out the probable duration will be around 15 minutes!

Nicknamed the 'Flying Porcupine' by the German forces during W.W.II, the Sunderland wasn't an easy victim, on one occasion surviving an attack by eight JU-88s and shooting down three of them in the process.

FUSELAGE

The first items to make are the fuselage sides, from the 'arrowed' outline on the plan. You'll note that the fuselage front and rear are made from 4.5mm and 3mm balsa sheet respectively. The reason for this is that there's quite a curve towards the rear, and 3mm sheet balsa is easier to bend than 4.5mm through the compound shapes required later on in the build.

Assuming you've bought the CNC pack, which includes all the formers and ribs required, mark the positions of all the formers onto the fuselage sides, noting that those of F8 and F9

Many of the principals used in the design of my previous multi-engine bombers have been used, and the results are very satisfying.

will have to lean forward slightly due to the curvature of the fuselage. If you don't quite understand this statement, it will become clear as you fit F8 and 9 and pull the sheet in at the bottom of these formers. Glue into position both parts marked WS1 onto formers F5, F6 and F7. Now glue the grouped formers onto one of the fuselage sides, checking alignment as you proceed. When happy, fit the other fuselage side. At this point I would suggest you use a fuselage jig to secure the fuselage structure and begin to add the remaining formers in this order; F8, F3, F9, F10, F11, F2, F1, F4, F5A, F6A and F7A. Remember to leave a small gap between F5 and F5A and between F7 and F7A, to allow a hacksaw blade to pass between.

Now remove the fuselage from the jig, invert it and clamp it back in position. Fit the keel pieces K1 and K2. If not already done, curve the fuselage sides in at the bottom so all formers are in contact, and then glue up. You may need to wet the side to aid bending, but you'll find the change from 4.5mm to 3mm balsa helps no end with the bending process. Now trim the bottom edge of the fuselage sides to an angle that matches the formers and begin to cross-sheet the hull, from F6 forward. Working in sequence, cross-sheet using 100mm wide sheet on one side, then the other, progressing toward the nose. When complete, work from former F6 back towards the rear of the fuselage. When you get to F9, the 3mm sheeting is replaced by 9mm sheeting, placed longitudinally, all the way to F11. At F9 the hull steps up. To smooth the transfer from one height to the other, cut a wedge shape piece from block balsa and glue this into position.

Remove the fuselage from the jig and apply the top sheeting using $^{3}/_{32}$" balsa. Make sure you use soft wood and, where necessary (especially at the rear), wet the wood outer surface to aid the bending. Okay, make up the nose and tail blocks from solid balsa and glue them into position. Sand the whole fuselage smooth and use a razor plane where necessary - especially on the nose and tail blocks - to achieve a smooth, flowing curve. Make sure you plane the step transition in the fuselage sides from front to rear.

Make up the front and rear turret fairing to the outline shown on the plan and then begin to remove the cut-away section that will allow the wings to be mounted. With a pen, mark the wing profile on both sides of the fuselage and make a cut just inside the lower profile between F5A and F7A. Doing this allows you to remove the cut-away section without having to guess exactly where the wing seat is. Using a hacksaw, cut between F5 and F5A followed by F7 and F7A, until the section becomes detached. When removed, the fuselage side can be trimmed flush with the wing seat WS1.

Fitting the wing mounting plates concludes the fuselage build, and is also the point where I leave you until next month. If you get this far by then, you'll be doing very well indeed! Next time, then, we'll finish her off and get her airborne, which for the prototype was not without incident!

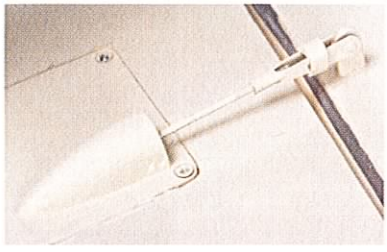
ORDER LIST

Item	Code	Price
Mouldings (canopy, turrets and nacelles)	CANRC2052	£20.00 + p&p
CNC wood selection	CNCRC2052	£64.95 + p&p
Sunderland plan	RC2052	£18.50 + p&p
Sunderland plan pack (CNC selection, plan and mouldings)	SETRC2052	£98.50 + p&p

Email: customer.services@myhobbystore.com or tel. 01689 899200

DATAFILE

Name:	Short Sunderland
Model type:	Multi-engine scale electric
Designed by:	Tony Nijhuis
Wingspan:	72" (1828mm)
Fuselage length:	54" (1377mm)
Wing area:	623 sq. in.
All-up weight:	8 lb (3.6kg)
Wing loading:	29 oz / sq. ft.
Functions (servos):	Alerons (2); elevator (1); rudder (1); throttle (0)
Powertrain used:	4 x BRC Hobbies A2409-12T motors, 4x Hi-model 25amp ESC, 4 x 8 x 4 APC props, 4 x 3s 2200mAh Li-Pos.



Small, cheap commercial covers are a neat finishing touch for the aileron servos.

Short Sunderland

TO THOSE WHO LONGED FOR AN AIRFIX SUNDERLAND AS A KID TONY NIJHUIS OFFERS ULTIMATE TEMPTATION

Having concluded last month's article by completing the fuselage, we'll push on now and build the wings, which are constructed as separate panels. Start by pinning the lower spar down over the plan and glue the ribs into position, noting that W5, 6, 9 and 10 are angled where they're in contact with the nacelle sides. Note also that W11 incorporates the wing float support slots. Fit the top spar, ply braces and rear top spar, and make up the inner l.e. and aileron t.e. using 6mm balsa sheet. Remove the wing panel from your building board and fit the lower rear spar. The remaining wing panel can now be built to the same level of fabrication.

Skin the top surfaces of both wing panels using sheets of 1.5mm x 100mm medium balsa, butt-glued together on a flat building board to generate a single sheet that covers the panel. Sand this sheet smooth and flat and then glue it onto the wing, starting at the l.e. and working back to the t.e. When dry, trim the excess skin flush with the wing. Next, install all the power and servo wiring. Remove the wing skin from the l.e. back towards the main spar in the nacelle area to allow the nacelle sides to fit against the ribs, and fit wood infills between W1 and W2 (as shown on the plan), to strengthen the wing bolt mounting points.

Time to sort the wing servo boxes, which you can either build yourself, or buy. In this respect the prototype uses J. Perkins mini wing servo boxes to very good effect. Okay, prepare the lower wing skin the same way as the top, glue in place using PVA, then add weights to make sure the skin sticks tight to the ribs. When dry, trim off any excess skin and remove the area where the nacelles fit. Make up the l.e. from 9mm sheet stock, glue it in place and shape to the correct profile as shown on the plan. Fabricate the wing tips using a laminate of 9 and 12mm balsa, glue in place and trim to shape.

She looks every inch a lumbering Sunderland in the air, especially when flown gracefully at half throttle.

I used my, now standard, method of finishing the model, i.e. covering with silver Solarfilm, then keying and painting.

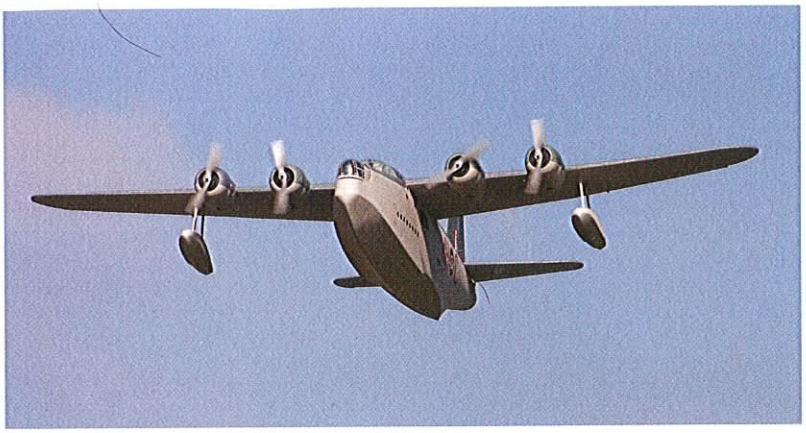
To make the ailerons, cut the bottom sheet to size, then fit the aileron l.e., trimming as required to sit at the angle shown on the plan; this angle can be checked by test-fitting one of the aileron ribs. Mark out and fit the ribs onto the bottom sheet, then trim the top edge of the aileron l.e. flush with the ribs. Finally, enclose the structure with the top sheeting, and trim to shape.

NACELLES

The nacelles are fairly time-consuming, but at least you don't have to make the cowls (assuming you've bought the vac-formed goodie pack!) The main nacelle sides and formers lock together fairly quickly so it shouldn't take too long to see each nacelle structure appear ready for skinning. Now then, sheeting the forward section of the nacelles is fairly straightforward, as it simply involves rolling a piece of firm 1.5mm balsa around the equal-size formers N1 and N2 (check that there's sufficient slack in the power cables to pull through N1). The middle section is designed to have a small amount of curve built in, constructed using 12mm strips of soft 2.5mm balsa, planked between the middle formers. Finally, the rear section of the nacelle is made from solid balsa, roughly shaped before being glued onto the wing skin. Shape and lightly sand the nacelles to a smooth, flowing curve.

In order to mount the motors on the firewall I made up a liteply

Wing floats are made from laminated balsa, cut and sanded to shape.



The power on tap from the four brushless outrunners is in no doubt and will come in handy when I eventually try her off water.

cage-type motor mount, although if preferred you could use a proprietary item which, I believe, BRC Hobbies sell. Note that the motors on the right-hand wing each require a minimum of 1° right side-thrust.

The wing panels can now be joined, using a good quality white or epoxy glue. To add additional strength to the joint, use a 2" open weave bandage or glass cloth, secured with epoxy or PVA glue. The wing can now be offered up the fuselage. Trim the l.e. and t.e. at the root so that the panel fits snugly, then mark and drill two 6mm holes through the wing and ply wing mounting plates, for the wing bolts. Remove the wing and open out the holes in the mounting plate to accept captive nuts. Refit, and secure. The wing cut-away section can now be trimmed to the top wing profile and when happy with the fit, can be glued in position. Incidentally, to release the wing you'll need to make two 12mm holes directly above the wing bolts, for screwdriver access.

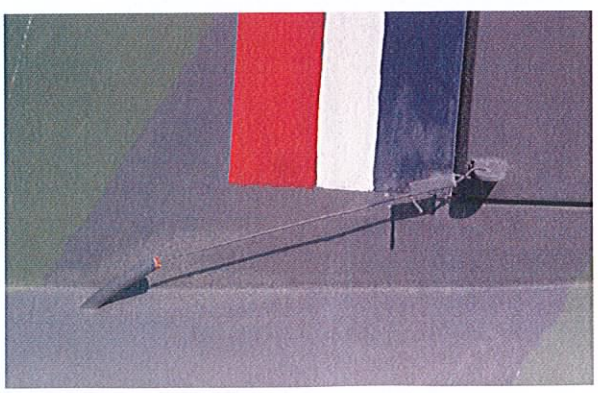
TAIL & FIN

The tailplane is a built-up affair, constructed over the plan. Oh, and as it's a fully symmetrical section it doesn't matter which way the ribs are fitted. Constructing the tailplane flat on the building board allows dihedral to be included (on the underside) when the tailplane is removed and turned down-side up... if you get my drift. Anyway, cut and pin the t.e. and spar to the plan, then fit ribs T2 - T7, the inner l.e. and the enclosing spar. Remove the structure from your building board. The positive dihedral should be noticeable, but mark to distinguish which is top and bottom, to avoid confusion. When the structure is complete, the tailplane can be sheeted top and bottom using 1.5mm balsa. With this, the leading edge is then applied and the tips cut to size and fitted. Shape the l.e. and tips to shape. The elevator is made around a central 3mm balsa core, edge-fixed to a 6mm balsa sheet l.e. Riblets are applied top and bottom to give an 'open framework' scale appearance. As for the fin, this is from 9mm balsa sheet, shaped to the profile shown on the plan.

To fit the tail feathers, grab the fuselage and mark / cut out the slots for the tailplane and fin. Trim the tailplane slot so the surface sits parallel with the wings when fitted, but don't glue it in just yet. Okay, glue the fin in place, ensuring that all is square, then install the outer tubes for the rudder's closed loop system, using the open tailplane slot to facilitate access. Once the cable outers are installed the tailplane can be fitted and glued into position, remembering to first add the elevator torque rod. Those nasty elevator fairings that fit against the fuselage can now be cut out, fitted and shaped.

A closed loop rudder system seemed the best way to approach this control surface.

The little blister dome behind the cockpit is optional and can easily be moulded on the workbench. Failing that, take a look round the supermarket for a plastic bottle or some packaging that offers the same shape.



WING FLOATS

The wing floats are made from laminates of 12mm sheet balsa. Draw the basic float profile onto the laminate blocks and cut to shape. The roughly-profiled floats now need to be shaped to form a 'boat hull' profile; in plan view, the rear of the float tapers slightly, whilst the nose of the float is rounded off. Drill a series of three 3mm holes to allow each obechi leg to recess into the float, then lay the assemblies to one side until the model's finished.

COVER & FINISH

I covered the prototype using silver Easycoat Solarfilm, and then keyed the surface with 800 grade wet 'n' dry ready for the paint to be applied. You don't have to go the same route, of course - tissue / nylon and dope or

lightweight glass cloth (17g / sq. m) and acrylic vanish or epoxy resin are perfectly acceptable alternatives.

When it comes to selecting a colour scheme, there are plenty to choose from although I eventually settled on a Coastal Command scheme, which I think does the model justice. These colours were simply brush painted using Humbrol enamels, as were the roundels, fin flashes and squadron markings.

Taking off on short grass (wet is even better) will present no problem.

The power, weight and wing loading will allow additional scale detail if you wish to go to town.

RADIO & POWER

Fitting out with radio is quite straightforward as all is generally contained within the wing section of the fuselage. To access the flight packs you'll need to remove the wing, as these fit just forward of the C of G.

The plan details specifications for the recommended motors and cells to be used, plus an indicative wiring diagram. In essence the setup is one battery pack per motor and ESC, which means that if one motor, ESC or battery pack fails, it won't affect the remaining three. Now, on the prototype I didn't take my own advice and decided to feed a pair of motors from single 2200mAh battery packs - Puffin Models RC Pelikan 16Cs. Excellent packs, these, but they need to be limited to 35A (16 x 2200). Unfortunately in my haste to get out there and fly, I didn't pay much attention to the combined effect of two motors drawing 40A+! Read on and you'll see what happened...

FIRST OUTING

As with all my prototypes, the first test flight took place with the model uncovered (although I did put a line of Solarfilm along the keel because I was determined to take off from grass). I was feeling pretty confident, so without further ado the Sunderland was lined up into wind and the throttle advanced. With around 800W of power at her disposal acceleration was swift, and within a couple of metres the wing levelled out and both floats were off the ground. With some up elevator applied she fair leaped into the air. With this I backed the throttles off to around $^2/_3$ and she continued to climb with gusto. Reaching cruising height, a few clicks of down trim had the model flying hands-free upon which some three minutes of leisurely circuit work followed. All seemed okay, apart from the fact that, occasionally, she'd wander off to the left, a trait that needed checking with rudder.

Having landed without a problem I added a little nose weight as the Sunderland seemed a little too pitch sensitive. Then, thinking I had at least two minutes of flying available from the batteries, I decided to have another go. Here, then, a clean take-off was followed by a gentle right turn into a downwind pass. At this point, and with no input from me, the model started a gentle left turn and began to fly away. Now, not being sure of what was causing this I reduced power, whereupon control was regained. Then, on powering up once more to gain height she yawed and flicked into the river that borders the Hastings flying strip. What a home-coming for a flying boat! Arriving at the river's edge, a rather soggy and forlorn airframe was sitting in a reed bed.

So what had happened? Well, unfortunately, all but one of the speed controllers had burnt out. Fortunately, however, thanks to BRC Hobbies' fast delivery I only had to wait a day before replacements parts arrived, and with the wing reasonably intact was able to have it repaired

ORDER LIST

Item	Code	Price
Mouldings (canopy, turrets and nacelles)	CANRC2052	£20.00 + p&p
CNC wood selection (ribs, formers etc.)	CNCRC2052	£64.95 + p&p
Two sheet Sunderland plan	RC2052	£18.50 + p&p
Sunderland plan pack (CNC selection, plan and mouldings)	SETRC2052	£98.50 + p&p

Email: customer.services@myhobbystore.com or tel. 01689 899200

My pilot looks a little too modern but you'll find a better chap, I'm sure.

There's a fair number of colour schemes for the Sunderland, including civilian ones, however the Airfix box was my inspiration.

quite quickly. With this, I reconnected all the motors to the batteries used on that fateful day. On opening the throttle to maximum all seemed fine for the first 10 seconds or so, but then the outer left-hand motor started to hunt, before slowing down and quitting. Having stopped all the motors I then throttled up to half speed - no problem there, all the were running quite happily. However, on application of full throttle the 'hunt, slow and stop' situation manifested itself again. Still baffled, I re-charged the batteries and repeated the exercise; for the first few minutes all seemed fine, but then a motor began to hunt, slow down and stop. Finally, the penny dropped!

In my haste to fly I'd forgotten to check the current draw from the battery. Had I done so, I would have seen that the set-up was pulling over 50A per pack. On a 16C pack this would pull the voltage down tremendously and, as a result, the speed controllers would be at the point of initiating the low voltage cut-off - a facility that all Li-Po speed controllers have to protect the batteries. Of course, all controllers are set to much the same cut-off voltage, although one may react slightly quicker than another. The result is that as the cut-off voltage is reached, one controller will shut down first. Since, in the Sunderland, I had two motors and two controllers connected to one battery, when one motor cut, the battery effectively lost half its load and, consequently, the voltage increased. Sensing the refreshed voltage the remaining speed controller continued to run its motor for another few minutes. So, the rule here is to make sure you use a large enough capacity battery pack with a 'C' rating that's well within the likely maximum current draw. I'd suggest a 3700mAh 20C pack as the minimum starting point to feed a pair of motors, or alternatively, as suggested on the plan, use one pack per motor.

SECONDS OUT... ROUND 2!

After the Sunderland's first mishap, the second flight was approached with more than a little apprehension. Having test-run the model on the four Li-Po pack set-up, the earlier problems seemed to have been solved. By now I'd covered the model in Easycoat but wasn't willing to risk a full paint job!

Airborne again and with one battery pack per motor, the additional power was noticeable and she responded beautifully to the controls. Being a shoulder-wing design the Sunderland is directionally very stable, so much so that rudder needs to be used to get those turns smooth and flat.

After six minutes of gentle circuit flying it was time to land, a manoeuvre that you'll need to perform with enough power to keep the draggy airframe penetrating.

LANDLUBBER

That's that, then - one Sunderland signed, sealed and delivered for you to enjoy. If you want something that will definitely stand out at your club patch, this is the one!

DATAFILE

Name:	Short Sunderland
Model type:	Multi engine scale
Designed by:	Tony Nijhuis
Wingspan:	72" (1828mm)
Fuselage length:	54" (1377mm)
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All-up weight:	8 lb (3.6kg)
Wing loading:	29oz / sq. ft.
Functions (servos):	Ailerons (2); elevator (1); rudder (1); throttle (0)
Powertrain used:	4 x BRC Hobbies A2409-12T motors, 4 x Hi-model 25amp ESC, four 8 x 4" APC props, four 3s 2200mAh Li-Pos