SHORT SEALAND 480
BY IVAN PETTIGREW
CONSTRUCTION NOTES

The original model of the Sealand was designed to be an exercise in efficiency, using two Magnetic Mayhem motors in parallel, running off a nine cell battery pack. To achieve max efficiency, the motors were running at little over 50% of their maximum power. The model proved to be extremely popular. However in mid 2005 the supply of Magnetic Mayhems dried up and a search was made for a suitable replacement. Meanwhile a scaled down Catalina, the MiniCat, had been built and flown very successfully on GWS Speed 400 motors with 3.4:1 reduction and 9x6 APC slow flyer props. So this new model of the Sealand was designed as a scaled down version of the larger Sealand with the intention of using the same GWS Speed 400 geared drive as used in the MiniCat. The prototype model of the new Sealand 480 actually flew at first with these GWS geared motors. It flew adequately. Some would say it was scale like, which means that it was certainly not overpowered by model standards. Then a suggestion came to me from the UK that I try the Jamara Pro 480 HS BB motors. It seems that in Europe these Speed 480 motors are very popular. They are often referred to in N. America as “long can Speed 400.” With the Jamara motors the new Sealand 480 was transformed into a powerhouse and keeps up with its big brother in fine style.

The length of the Sealand 480 is 91% of the original model being down to 53 inches from 58 ½ in. However, the wing span is only half an inch shorter, but the wing area is considerably less. This is because the aspect ratio of the wing has been increased, meaning that there is quite a reduction in average chord. The higher aspect ratio of this 480 model actually conforms more to that of the full scale Sealand . This change is an attempt to increase the effective length of the moment arm and seems to have worked. The Sealand 480 is easier to land than the original model, and handles windy conditions and rough water very well for a model of its size.

FUSELAGE

The fuselage is a simple framed up box with bulkheads added to the top and bottom. First build the two sides of the fuselage over the plan (shaded sticks), and join together. Take note that the sides slope inwards slightly towards the top, the width of the fuselage at the top being less than at the bottom. The sides of the fuselage aft of bulkheads #8 are in two sections. The upper sections come together at the tail, while the lower ones come together at the point of the second step.

Except where otherwise stated on the plan, fuselage bulkheads are 3/32” balsa and sheeting is 1/16” Add bulkheads and sheeting to the curved upper surface of the fuselage. The lower semi circular bulkheads from 10B to the tail should then be added to the bottom of the upper section of the fuselage and sheeted from 10B to 12B. While the shape of the outer skin on the section of the hull from station 9 to 11 is the most challenging part of the fuselage construction, it is not as difficult as it might seem. My problem is not in doing it, but in explaining it in words that make it easy to follow. The sides of the fuselage are just sheeted from the bottom up to a point an inch or two above the water line. This sheeting is straightforward from the nose back to bulkhead 9 and this part should be done first. Next cut a piece of 1/16" balsa 8 ½" x 3 inches. This goes on the lower side of the fuselage from station 9 to the end of the second step including the fillet at the point of the second step. The top edge curls out to glue against the sheeting that was earlier applied between 10B and 12B. This is easier than it sounds, especially if the 3" wide strip is dampened where it curls outward at the top. Most modelers attempting a project like this have built a low wing scale model like a Spitfire that has a gusset and fairing where the trailing edge meets the fuselage. One way to visualize this is to lay the fuselage on its side, and think of the 1/8" gusset at the end of the secondary step as being the gusset where the trailing edge of a Spitfire meets the fuselage.

The bottom surface of the hull is next covered. The section to the rear of the main step is straightforward after attaching the thin triangular bulkheads and keel strip. The area forward of the main step is covered in stages, starting from the outside. The outer strips are glued to the crosspieces of the fuselage as if the hull was going to have a flat bottom. Then the triangular formers 1B to 7B are glued in place. Next the 1/8" x 3/16" keel is glued in place. Now cover the remaining "V" shaped part of the hull with 3/32" balsa or 1/32" ply. The concave shape of the hull that is thus formed really helps in reducing spray and getting the model on the step promptly. This model will take off easily with about 75% power. Use of reduced power during take off adds much to realism by lengthening the take off run.

TAIL SECTIONS
These are of conventional construction. The only challenging part is in the mounting of the stabilizer. Notice that the spar (post) for the fin goes right down to the bottom of the fuselage. In constructing the fin, there are two ribs, F2. The lower one acts like a platform for the stabilizer to sit on, and the upper F2 further secures it. Do not glue the upper F2 in place when building the fin, or it will not be possible to slide the stab through the slot. Glue the upper F2 in place only after the stab has been attached to the lower F2. Sheet covering is added to the side of the fin between the top of the fuselage and the stabilizer mount with grain running vertical to add strength to the stab mount. Assembling the stab and elevator is not possible if they are joined together with hinges before assembly. The stab and elevator must be individually slid in between ribs F2 and F3, then joined together and glued in place on the lower F2. When this is done, the upper F2 can be inserted. Some builders may prefer to build the elevators in two sections and join them with a piece of "U" shaped wire. That enables them to be assembled after the stab is glued in place.

WING CONSTRUCTION

The wing is built in one piece. The basic airfoil is a Selig 7055, but outboard of the aileron break it uses a NACA leading edge cuff to reduce tip stall tendencies. A full depth 3/32” sheet balsa spar is continuous throughout the wing The ribs are cut where they meet the main spar, and are butted to the front and rear surfaces of the spar. The top surface of the wing spar should be a straight line from tip to tip. Cut the main spar from 3/32” sheet balsa and splice the pieces together over the plan. Notice that the only dihedral is that of the upward sweep on the lower edge of the outer section. This is due to the taper of the outboard section of the wing. Now glue the 1/8” x 3/16” hardwood strips to the front surface of the spar as indicated. These strips should be bass or spruce.

The wing ribs are cut from 1/16” balsa. Each rib is then cut in two at the point where it joins the spar. Assemble just the rectangular (non tapered) section of the wing first. Pin the spar on its edge over the plan. It is easiest to start by gluing the rear part of each rib in place first, then attaching the trailing edge. Next glue the front part of each rib in place and then the first inner strip of 3/16” x 1/8” balsa which forms part of the leading edge. The outer strip of 3/16” sheet that completes the leading edge is not added until the sheeting has been applied to the top and bottom surfaces of the wing from the leading edge back to the main spar. When the rectangular section of the wing has been assembled, one end is propped up a little so that the lower edge of the outboard section of the spar at the other end is flat on the work bench. That section of the wing (the tapered part) is now built in the same manner as the rectangular part, making provision of course for the aileron. The wing may first be built as if there were not ailerons, then by cutting the ribs where there is a dotted line between the secondary spars, the aileron section can be removed and completed. When one outer wing panel is completed, the procedure is repeated to build the tapered outboard section at the other end

Sheeting is now applied to the lower surface of the wing from the leading edge to the main spar. It should be done in two stages, first just from the wing root to the leading edge break. Now the wiring may be installed for the motors. Before covering the top of the wing, be sure to install the hardwood piece between the main spar and leading edge where the wing floats are attached. It will be noted at this point that the wing is still not torsionally strong, meaning that it can easily be twisted. After the sheeting is applied to the upper surface of the wing it will be very rigid and difficult to twist. Hence it is very important, when applying the sheeting to the upper surface, to weight that section of the wing down on a surface that is perfectly flat. There should be no washout from the wing root to the start of the aileron, so weight the wing down flat while sheeting is applied to this area. From the aileron break to the tip there should be 3/16” washout. Weight this section to give the proper washout and apply the upper sheeting. The remaining strip of 3/16” sheet balsa that forms the leading edge is now glued to the one in place and contoured to shape. Finally sheeting is added aft of the spar to the top and bottom of centre section, leaving the lower section open where the aileron servo fits.

Note the position of the aileron horn. It is mounted well back in order to give aileron differential. This is important, especially in a flying boat.

The wing floats are built up and covered with 1/16” sheet balsa. Construction is fairly basic, especially for anyone who has built a set of floats.

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The engine nacelles are built by first gluing the hardwood motor mounts in place, securing them firmly to the bottom surface of the wing as far back as the main spar. Next the nacelle bulkheads are glued in place. The nacelles are planked with 1/16” sheet balsa. Notice that bulkhead N-1 is ¼” thick. The forward end of the planking on the nacelles should just come to the mid point of N-1. The remaining half of N-1 forms the mount for the motor cowlings which slip into place over the forward half of this bulkhead.

The engine cowlings are built in place with the motors installed. If the motor / gearbox combination is held in place with a hose clamp as shown in the plan, it is important that it is over the sleeve of the gearbox. The gearbox sleeve is just a press fit on the motor, so it is not adequate to put the hose clamp just on the motor. Before starting the construction of the cowling, two short pieces of 3/16” square basswood are shaped and glued to the front surface of N-1, one at each side. These are for locating the #2 wood screws that hold the cowlings in place. Next the nose blocks are made, but the hole for the propeller shaft should at this point be made just large enough for the nose block to be a snug fit over the hub of the prop adaptor. Secure the motor and gearbox on the motor bearers, but temporarily slide them back about half and inch back from the final position.

The prop adaptor hub should be in the middle of the nose block and will hold it in place while the cowlings are built. With the nose block held in place this way, start making the cowls by cutting out both side panels. These are attached to the 3/16” square bass strips on N-1 with screws, and glued at the front to the nose block. Next apply the top and bottom parts of the cowling, gluing these to the nose block and adjacent side panel sections, but not of course to N-1. It helps in joining the adjacent sheets to run a piece of 1/8” square balsa along the join. When completed, take out the screws and remove the cowlings. Now the hole in the nose block for the propeller shaft can be enlarged to give adequate clearance and the motor slid forward to its correct position. Before covering the cowlings, small washers should be made from 1/64 ply and placed under the heads of the #2 screws that hold the cowlings in place.

CONTROL THROWS

Control travel for the elevators is 7/8” up and down. For the rudder it is 1 ½” each way. The ailerons should travel 1 3/8” up, and not more than 3/4” down. Importance must be given to this amount of differential in the ailerons, and it should be achieved if the control arm on the aileron servo is located as shown. At the start of the take off run in a flying boat, one of the tip floats will be in the water. It is necessary to lift this float out of the water using ailerons, or the model will want to turn in the direction of this float that is dragging in the water. Poor aileron design aggravates this problem in many models because of the adverse yaw that is inherent at larger angles of attack such as while getting on the step. Two things are done in the design of the Sealand to overcome this problem. Frise ailerons are used, and a substantial amount of differential is used in the aileron linkage. At the start of the take off run, while holding up elevator to get on the step, advance the throttle just a small amount at first until the wings are leveled with both tip floats out of the water. When this is under control, advance the throttle further and relax on the up elevator as the model accelerates on the step. With practice this becomes one smooth continuous movement. A very slight amount of up elevator may be necessary at the point of lift off, especially if operating off glassy water.

In multi motor electric models, there is an increased risk of problems with radio interference from motor brush noise and also the increased length of wiring used for the motors. While it is always recommended to put a Schotky diode across the terminals of each motor when they are wired in series, it is not so critical in this application where the motors are wired parallel. The normal capacitors should of course be used across the motor terminals, whether or not Schotky diodes are used. The wires carrying current to the motor should be kept touching each other, and twisted about one turn to the inch. The radio and servos should be kept as far as possible from the motors and motor wiring, but this is taken care of with the layout shown in the plans. Servo leads must be kept short. Do not use outboard servos for the ailerons. These would require long leads running along the wing parallel to the motor wiring, and they would be very prone to picking up interference. At the low airspeed of this model, one standard servo is ample to operate the ailerons.

COVERING AND FINISHING

Most of the airframe on the prototype is covered with low temperature film. It has been found over the years that film does not stand up to repeated use in water, so the hull and tip floats are best covered with light tissue (silkspan) applied with nitrate dope. This should be done before covering the upper part of the fuselage with film. The silkspan should be applied to the entire hull, and up to the top edge of the sheeting on the sides, this point being a few inches above the water line. Be sure to prime the hull and tip floats by applying two coats of clear nitrate dope before covering. When applying the tissue, first spray it lightly with water and rub it on to the surface while damp. Next brush a coat of dope on to the tissue. It will bleed through and cement itself to the primed surface below. After it has dried, apply at least one more coat of clear dope. The hull should be sanded after each coat of dope is applied, and when a smooth surface has been obtained, the colour should be applied. Krylon spray paint is known to be one of the lightest and most suitable for models of this type. When painting is completed, cover the remaining section of the fuselage. Allow about an inch overlap where the film joins the top edge of sheeting on the lower part of the fuselage sides. It should not be continued to a point below the water line.

EMERGENCY FLOTATION

With an electric powered model, because of the weight of the batteries and motors, there is not enough flotation to keep the plane on the surface of the water in the event of a crash, or the hull being punctured. Hence it is recommended that blocks of foam board be placed in the fuselage, or even some of the wing bays. The small air sacks that are often used as packing are another option. When asked why the model of the Sealand is so light, I point out the little air bags and say that they are filled with helium. In the case of several multi motor flying boats that I have flown for several years now, I have fortunately never had to put these flotation devices to the test. But in earlier years I lost a flying boat with a single pylon motor following a crash due to radio failure. When I got to the crash scene, all that was floating was the wing and tail section that had torn loose. The weight of the battery and motor had taken the rest to the bottom of the lake. Had it been a multi motor flying boat, the wing would have probably gone down as well because of the weight of the motors. Flotation is like insurance. You will only need it if you don't have it. This model was not intended to be a pattern plane, but it is surprisingly aerobatic. With tapered wings, it has an excellent roll rate. It handles loops, rolls and Cuban eights with ease. Be sure to secure the battery well before trying inverted flight or eight point rolls.

Enjoy building and flying your Sealand 480
Ivan Pettigrew

SUMMARY - Short Sealand 480

September 2005. Scale 1/10 Span 74 ½ ins, Wing area 695 sq.ins. Airfoil, Selig 7055 with LE cuff on outboard sections. Length 53 ins. Weight with eight CP-1700 SCR nicads, 61 ounces. Wing loading 12.6 oz/sq.ft. Motors are two Jamara Pro 480 HS BB with MP Jet 4.1:1 ratio gearboxes driving 10x7 APC electric props. Motors are wired parallel, static current, 23 amps from the battery, 11.5 amps to each motor. Static thrust is 30 ounces at 5,900 RPM. Plug in wheels are optional for flying from land. Very aerobatic.

For further details on flying boats, read the page about "Flying Boat Design' on www.ivansplan.com

More About Motors:

There may be some confusion about the Speed 480 motors, since Graupner also have a series of Speed 480 motors. They are quite a bit more expensive than the Jamara 480 (long can S-400) motors, but the Graupner series have a different configuration and thicker shaft. They are no doubt very good motors, but I don't know about a gearbox that would drive props in the size used on this model. In a model like this, scale size props give great efficiency, and the use of smaller props would not be as efficient. When it comes to a gearbox, the Jamara Pro 480 uses the MP Jet Speed-400 gearbox. Yes, this motor takes a Speed 400 gearbox because it has the same can diameter and shaft size as a Speed 400 motor. In the prototype Sealand 480, MP Jet Speed-400 gearboxes of 4.1:1

ratio were used and APC 10x7 electric props were found to give the desired performance on eight cells. On nine cells the model is really lively. On CP-1700 SCR nicads the model is light and responsive and the flights of adequate length. The model was tested for endurance on an eight cell 3,000 mAh NiMH pack and flew for 32 minutes. If using Li-Polys, check that the transmitter is fully charged!

Static thrust from the Permax motor with nine cells turning an 11x7 prop at 5,100 RPM is about the same as with the Jamara on eight cells turning a 10x7 prop at 5,900 RPM. But simple mathematics, multiplying the RPM/1,000 by propeller pitch will show that the approximate pitch speed in the air is quite a bit higher with the Jamara motors.

Another possibility is to use the Permax 480 7.2 volt motor with a 3.0:1 ratio gearbox and 10x7 APC electric prop. MP-Jet offer the same sealed gearbox in this ratio, but there are some simple offset gearboxes available at a lower price such as the T400 3:1 ratio ball bearing gearbox available from Tower Hobbies for $14.99. One advantage to this gearbox is that the pinion is held on with a grub screw which I find more satisfactory than the loose fitting pinion of the MP-Jet gearbox which is held in place with gap filling loctite.

The suggestions given are for APC electric props which have been found to be the most efficient on electric models of this kind. Please note that APC also make a series of "slo flyer" props. Do not substitute a 10x7 APC "slo flyer" prop for the 10x7 APC electric prop. The slo flyer prop has a much wider blade and puts a lot more load on the motor. It would be alright if the gear ratio was increased, but the pitch speed would be much lower.

Update, 2015. Most electric models are now powered by outrunner brushless motors. Adequate power for the Sealand 480 is a pair of Park 400 or 450 motors, or equivalent.. With brushless motors, each motor requires its own ESC, but these can both be run parallel from one battery. Recommended for this set up would be one 3S-2600 mAh Li-Po, or slightly larger for extra long flights. If the speed controls are fitted with BEC, be sure to disable the BEC in one of the speed controls as per instructions; cutting the red wire.

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