

 **robbe**

Montage- und Bedienungsanleitung

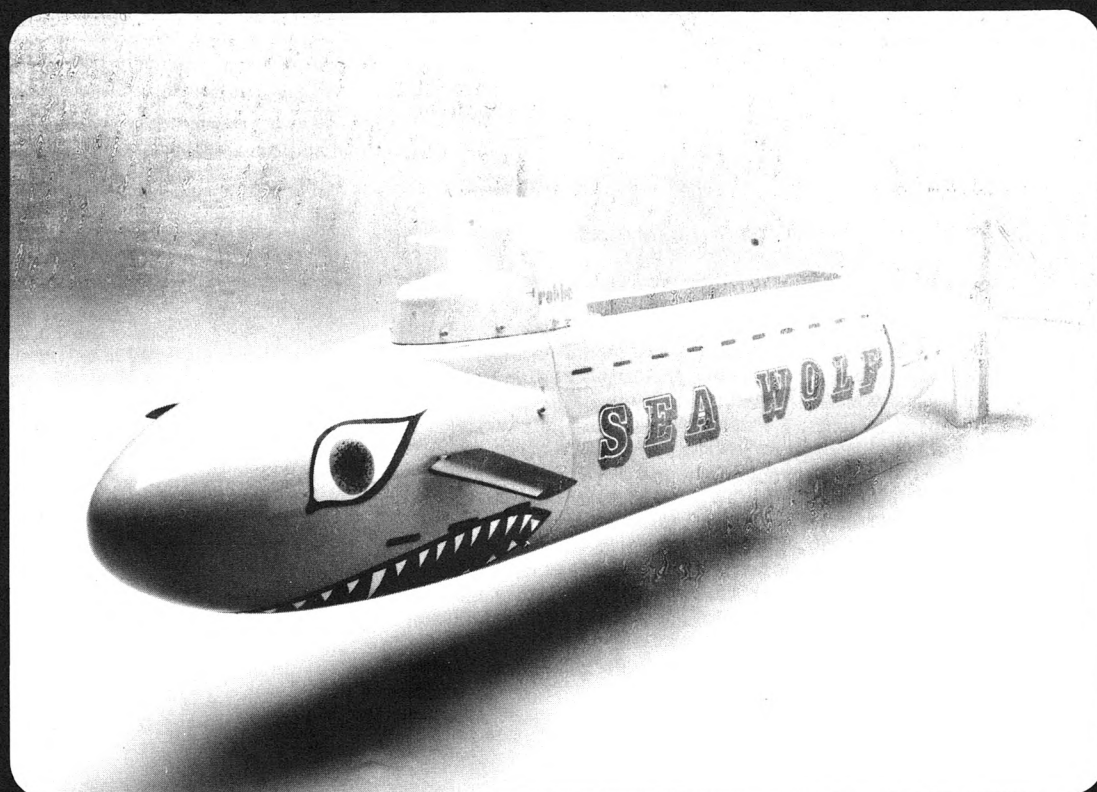
Notice de montage et d' utilisation

Assembly and Operating instructions

Montage - en gebruiksaanwijzing

Sea-Wolf

No. 1014



Part No.	Description	Material	Size in mm	No. off	Notes
Stage 1					
1.1	Electric motor / pinion	---	Ready made	1	Not included
1.2	Suppressor condensor	---	100 nF	2	Not included
1.3	Suppressor condensor	---	47 nF	1	Not included
1.4	Insulating sleeve	Plastic	Ready made	4	Not included
1.5	Motor power lead	Cu./Pl.	Ready made	1	Not included
1.6	Battery lead / socket	Cu./Pl.	Ready made	1	Not included
1.7	AMP Faston socket	---	Ready made	2	Not included
1.8	Rear buoyancy hull cap	ABS	Ready made	1	Inj. moulded
1.9	Stern tube / gear housing	Br./Pl.	Ready made	1	
1.10	Lubricating nipple holder	Brass	Ready made	1	
1.11	Lubricating nipple	Steel	Ready made	1	
1.12	Propeller shaft / gear	Steel/Pl.	Ready made	1	
1.13	Housing cover	Plastic	Ready made	1	Inj. moulded
1.14	Socket-head screw	Steel	M3 x 10	2	
Stage 2					
2.1	Nut	Steel	M3	1	
2.2	Threaded rod	Steel	M3 x 80	1	
2.3	Insert plate	ABS	3, die-cut	1	
2.4	Rear bulkhead	ABS	3, die-cut	1	
2.5	Front bulkhead	ABS	3, die-cut	1	
2.6	Profiled rail	ABS	Overlength	2	T-section
2.7	Front gusset	ABS	3, die-cut	2	
2.8	Rear gusset	ABS	3, die-cut	2	
2.9	Spacer plate	ABS	2, die-cut	2	
2.10	Support	ABS	2, die-cut	1	
2.11	Motor mounting plate	ABS	3, die-cut	2	
2.12	Washer	Brass	2.6 I.D.	2	
2.13	Self-tapping screw	Steel	2.2 x 4.5	2	
2.14	Switch bulkhead	ABS	3, die-cut	1	
2.15	Guide tube for depth vane pushrod	Plastic	2.2 x 3.2	1	Overlength
2.16	Guide tube for rudder pushrod	Plastic	2.2 x 3.2	1	Overlength
Stage 3					
3.1	Profiled rail	ABS	320 long	1	T-section
3.2	Buoyancy hull	ABS	345 long	1	
3.3	Front buoyancy hull cap	ABS	Ready made	1	Inj. moulded
3.4	Self-locking nut	Steel	M3	1	
Stage 4					
4.1	Battery holder	ABS	2, die-cut	4	
4.2	Drive battery	---	Ready made	1	Not included
4.3	Switch actuating rod	Brass	1.5	1	Overlength
4.4	Switch	---	Ready made	1	Not included
4.5	Collet	Brass	2.2 x 7 x 5	1	
4.6	Grubscrew	Steel	M3 x 3	1	
4.7	Flexible boot for 4.3	Rubber	Ready made	1	
4.8	Guide tube holder	ABS	3, die-cut	2	
4.9	Grubscrew	Steel	M3 x 6	1	
4.10	Collet	Brass	4.2 x 7 x 5	1	
4.11	Depth vane pushrod	Brass	1.5 x 420	1	
4.12	Rudder pushrod	Brass	1.5 x 495	1	
4.13	Depth vane servo	---	Ready made	1	Not included
4.14	Rudder servo	---	Ready made	1	Not included
4.15	Double-sided foam tape	Plastic	1.6 x 19 x 50	8	
4.16	Receiver	---	Ready made	1	Not included
4.17	Motor controller	---	Ready made	1	Not included
4.18	Flexible boot for pushrods 4.11 / 4.12	Rubber	Ready made	2	
4.19	O-ring	Rubber	85 O.D.	1	
Stage 5					
5.1	Fixed control surface	Plastic	Ready made	4	Inj. moulded
5.2	Centre section	Plastic	Ready made	1	Inj. moulded
5.3	Rear bottom hull section	ABS	1.5	1	Vac. moulded
5.4	Self-tapping screw	Steel	2.2 x 6.5	3	
5.5	Locknut	Brass	M4	1	
5.6	Propeller	Plastic	50 O.D.	1	Three-bladed
5.7	Depth vane	Plastic	Ready made	1	Inj. moulded
5.8	Rudder	Plastic	Ready made	1	Inj. moulded

5.9	Tubular rivet	Brass	Ready made	4	
5.10	Self-tapping screw	Steel	2.2 x 11	4	
5.11	Rudder horn	Plastic	Ready made	2	Inj. moulded
5.12	Depth vane pushrod	Brass	1.5 x 220	1	
5.13	Rudder pushrod	Brass	1.5 x 220	1	
5.14	Guide tube	Plastic	2.2 x 3.2 x 100	3	
5.15	Collet	Brass	3.2 x 7 x 5	2	
5.16	Grubscrew	Steel	M3 x 3	2	
5.17	Switch pushrod	Brass	1.5	1	Overlength
5.18	Collet	Brass	3.2 x 7 x 5	1	
5.19	Grubscrew	Steel	M3 x 3	1	

Stage 6

6.1	Top rear hull section	ABS	1.5	1	Vac. moulded
6.2	Locating plate	ABS	1.5	4	Vac. moulded
6.3	Locating plate	ABS	1.5	4	Vac. moulded
6.4	Doubler	ABS	1.5	4	Vac. moulded
6.5	Self-tapping screw	Steel	2.2 x 6.5	1	
6.6	Self-tapping screw	Steel	2.2 x 6.5	4	
6.7	Self-tapping screw	Steel	2.2 x 6.5	2	
6.8	Top centre hull section	ABS	1.5	1	Vac. moulded
6.9	Bottom centre hull section	ABS	1.5	1	Vac. moulded
6.10	Top front hull section	ABS	1.5	1	Vac. moulded
6.11	Bottom front hull section	ABS	1.5	1	Vac. moulded
6.12	Locating plate	ABS	1.5	6	Vac. moulded
6.13	Joint strip	Plastic	Ready made	2	Transfer
6.14	Self-tapping screw	Steel	2.2 x 6.5	4	

Stage 7

7.1	Conning tower	ABS	1.5	1	Vac. moulded
7.2-7.4	Conning tower bulkheads	ABS	2, die-cut	2 each	
7.5	Front depth vane	Pl./Br.	Ready made	2	Inj. moulded
7.6	Tubular rivet	Brass	4 x 4 x 0.4	2	
7.7	Tiller	Plastic	Ready made	1	Inj. moulded
7.8	Collet	Brass	4 x 7 x 5	1	
7.9	Grubscrew	Steel	M3 x 6	1	
7.10	Front pushrod	Brass	1.5	1	Overlength
7.11	Connecting sleeve	Brass	3.2 x 4	1	Cut to size
7.12	Collet	Brass	4 x 7 x 5	2	
7.13	Grubscrew	Steel	M3 x 6	2	

Stage 8

8.1	Conning tower bulkhead	ABS	3, die-cut	1	
8.2	Conning tower bulkhead	ABS	3, die-cut	1	
8.3	Rivet nut	Brass	M2	2	
"HS"	Jig screw	Brass	M2 x 35	1	
8.4	Screw	Brass	M2 x 20	2	
8.5	Nut	Brass	M2	2	
8.6	Doubler	ABS	3, die-cut	2	
8.7	Vertical plate	ABS	3, die-cut	2	
8.8	Collet	Brass	4 x 7 x 5	1	
8.9	Grubscrew	Steel	M3 x 3	1	
8.10	Radar mast	Brass tube	4	1	Overlength
8.11	Solder tag	Brass	Ready made	2	
8.12	Sleeve	Aluminium	Ready made	1	Machined
8.13	S-hook	Brass	Ready made	1	
8.14	Screw	Brass	M3 x 10	2	
8.15	Tubular rivet	Brass	4 x 4 x 0.4	2	
8.16	Pushrod	Brass	1.5	1	Overlength
8.17	Self-tapping screw	Steel	2.2 x 6.5	4	
8.18	Rivet nut	Brass	M2	1	
8.19	Ring bolt	Brass	M2	1	Ready made
8.20	S-hook	Brass	Ready made	1	
8.21	Spring	Steel	Ready made	1	
8.22	Collet	Brass	3 x 7 x 5	1	
8.23	Grubscrew	Steel	M3 x 3	1	
8.24	Radar screen	ABS	1.5	1	Vac. moulded
8.25	Collet	Brass	4 x 7 x 5	1	
8.26	Grubscrew	Steel	M3 x 3	1	
8.27	Wire hoop	Brass	1.5	1	As plan

Stage 9

9.1	Conning tower depth vane	ABS	2, die-cut	2	
9.2	Aerial	Steel wire	0.8 x 500	1	
9.3	Top plate	ABS	3, die-cut	1	
9.4	Valve, complete	Steel	Ready made	1	
9.5	Ballast, front	Lead	approx. 440 g	1	Not included
9.6	Ballast, rear	Lead	approx. 350 g	1	Not included

Specification

Overall length:	ca. 900 mm
Overall beam:	ca. 200 mm
Width of buoyancy hull:	ca. 100 mm
Overall height:	ca. 320 mm
Weight:	ca. 4100 g

Please see separate sheet for notes on adhesives, and details of essential items not included in the kit.

Please see the main Robbe catalogue for details of tools and aids to building.

How the Sea-Wolf works

When at rest the model floats on the surface in a stable attitude, with the top surface of the hull roughly at water level. Buoyancy is just sufficient to keep the model afloat. When run at low speed, the boat stays on the surface in this attitude.

If motor speed is raised, the model's forward speed increases, and the boat dives automatically. Slots in the hull allow water to flow in and out freely, so no pump is required. Water pressure increases with depth and speed until it is sufficient to rotate the pivoting radar screen towards the rear. This action activates the automatic diving system. The movement of the radar screen is transferred mechanically to the forward depth control vanes. The vanes are moved to a positive angle of attack, which causes the boat to rise to the surface. As soon as the radar screen is out of the water, the forward vanes return to their former position, and the model can be dived again. The duration of each dive varies according to the model's speed.

The boat can be controlled using either two or three channels. With two channels the model's diving characteristics depend on its speed and the automatic diving system. The optional function of controllable depth vanes opens up new possibilities to the more experienced operator:

The automatic diving system can be over-ridden while the model is under water, i.e. you can control diving depth directly.

If the depth vanes are pulled back, it becomes possible to run the boat at high speed on the surface, without the model diving.

Sequence of assembly

In general terms the numbering of the kit components corresponds to the sequence of assembly; the number before the point indicates the stage of construction, the number after the point the individual component. Please refer to the plan, the detail drawings, the building instructions and the parts list to ensure that you understand each stage.

Scrap material which has to be removed from the vacuum mouldings is marked by hatching-in, either in the drawings or on the part itself.

After cutting the vacuum-moulded parts to size, sand the cut edges smooth.

The identification drawing "O", which is bound into the centre of this booklet, will help you identify the die-cut parts. Number the die-cut parts as shown, but do not separate them until they are needed. Clean up the cut edges before installing them.

Directions, such as "right-hand", are as seen from the rear of the model, looking forward.

Painting

The plastic parts should be washed down with white spirit (not cellulose thinners) before painting. Avoid touching the cleaned surfaces with your fingers.

Before you apply the final colour finish, we recommend that you apply a good quality polyester filler paste to all joints, and rub down to a smooth

finish. The model can then be primed and given a colour paint finish.

If any part is to be painted more than one colour, then you will need to mask out the base coat with Sellotape or PVC tape (not paper masking tape) before applying the second colour. The tape must be removed as soon as the paint is touch-dry.

The only types of paint that we recommend for this model are high-quality synthetic enamel or acrylic paints.

You can copy the colour scheme shown in the kit box illustration if you wish.

Applying the transfers

Fill a medium-sized plastic bowl with luke-warm water (around 20 degrees C), and add a few generous squirts of liquid detergent. Moisten a sponge cloth in the solution, and wet the area of the model which is to be decorated. Peel off one of the transfers, moisten it in the bowl, place it on the model and move it into position. When you are satisfied, press it down with a cloth. Allow the water under the transfer to dry out, then press down once more with a soft dry cloth.

The kit box illustration gives a good idea of where to apply the transfers.

Radio control equipment

A Robbe 2-channel radio control system is sufficient to control the model. If you wish to control the depth vanes you will need a 4-channel set.

The receiver system is powered from the main drive battery, so you will need a motor controller rated at a minimum of 20 A continuous current, with integral receiver power supply.

We recommend that you use the RC system components shown on the plan. If you intend using a radio other than the recommended Robbe system, you can still follow the arrangement shown, but you will need to allow for minor differences in component size.

Set the servos to neutral using the radio control system before you start building (sticks and trim levers central).

Stage 0, the boatstand, parts 0.1 - 0.2

The first step is to assemble a strong boatstand so that your model is securely supported on the workbench. Transfer the shape of the end supports 0.1 to a suitable sheet of wood (they are shown full-size), and saw them out. Glue the end supports to the baseplate 0.2. Stick felt or foam plastic to the support surfaces of the completed boatstand, to avoid the model becoming damaged or scratched.

Stage 1, preparing the power system, parts 1.1 - 1.14

Please refer to the wiring diagram when working on the electrical circuits.

- Slide the soft iron mantle off the electric motor 1.1, as it is not needed for this model.
- The motor 1.1 must be suppressed first. Slip an insulating sleeve 1.4 onto the pins of one condenser 1.2 and solder one pin to one motor terminal and the other to the motor casing. Repeat the process with the other condenser 1.2 and the other motor terminal. You will need to file the casing clean before soldering.
- Fit insulating sleeves 1.4 onto both pins of the condenser 1.3, and solder it between the motor terminals to form a bridge.
- Solder the power leads 1.5 to the motor terminals.
- Make up the battery lead from the lead with socket 1.6, and the AMP Faston plugs 1.7.

- At this stage you should check the direction of rotation of the motor by means of the radio control system. To do this, connect up the motor controller and radio system, following the instructions supplied with the units. Connect the main drive battery. When connecting the lead to the battery, take care to maintain correct polarity.

- Move the transmitter stick in the direction of "forwards running". The motor pinion should now rotate to the right, i.e. clockwise. If the motor runs in the opposite direction, reverse the connections at the motor terminals by swapping the leads over.
- Drill the three 3.2 mm holes for the pushrods.
- Drill out the central (stepped) hole in the rear buoyancy hull cap 1.8 to 6.5 mm diameter right through.
- Push the stern tube 1.9 and gearbox housing through the buoyancy hull cap.
- File out the bottom end of the lubricating nipple holder 1.10 to a half-round shape, to match the curvature of the stern tube, and solder it to the tube, as shown on the plan.
- Drill a 3 mm hole into the stern tube, drilling through the holder. Blow out the drilling swarf.
- The lubricating nipple 1.11 can now be glued to the holder: apply Stabilit Express thinly all round the flange of the nipple, and push the parts together.
- Slide the propeller shaft 1.12 into the stern tube. Apply teflon grease to the gear to lubricate it.
- Fit the housing cover 1.13 into the gearbox housing. Insert the motor and tighten the screws 1.14.

Stage 2, insert for the motor / gearbox assembly and radio control system, parts 2.1 - 2.16

- Screw the nut 2.1 onto the threaded rod 2.2.
- Drill and file out the transverse slot for the nut 2.1 in the insert plate 2.3, starting at the marked points. When the slot is finished, file out the lengthwise slot for the threaded rod. Cover the slots on one side with adhesive tape.
- Place the insert plate 2.3 on a flat table, with the slots for the nut and the threaded rod projecting over the edge.
- Screw the nut in or out on the threaded rod until it matches the position of the transverse slot. Place the threaded rod in the insert. Apply Stabilit Express to the slots to glue the assembly 2.1 / 2.2 in place.
- Cut the openings for the battery and the gearbox housing.
- Cut a hole in the bulkhead 2.4 to take the motor lead 1.5.
- Place the insert plate 2.3 on a flat surface.
- Position the two bulkheads 2.4 and 2.5 on the plate 2.3 as shown on the plan, check that they are upright, and fix them in place with instant glue.
- Push the full-length T-section rails 2.6 through the bulkheads and fix them in place with instant glue. Allow a drop of instant glue to run along the joints to fix the rails to the plate and the bulkheads.
- Cut away excess rail length at front and rear, following the shape of the insert plate. Sand the rails to the correct angle to match the inside shape of the buoyancy hull caps.
- Glue the front and rear gussets 2.7 and 2.8 in place, as shown on the plan. The gussets must rest against the rails.
- Glue the two spacer plates 2.9 to the insert plate, flush with the inside edge of the rear slot for the stern tube.
- Glue the stern tube support 2.10 on the plates 2.9.
- Glue the mounting plates 2.11 in place, butting up against parts 2.9 / 2.10.
- Place the motor / gearbox assembly in the aperture in the insert plate from underneath. Sand back the mounting plates 2.11 if necessary.
- Drill 1.5 mm holes through the horizontal webs of the gearbox housing and the plates 2.11, to take the self-tapping screws 2.13.
- Remove the motor assembly and drill out the holes in the gearbox housing to 2.5 mm diameter.
- Install the motor assembly, fixing it in place with the washers 2.12 and the self-tapping screws 2.13.
- Push up the rear buoyancy hull cap 1.8 against the insert plate, but do not glue it yet. The insert plate must fit into the inside slots in the buoyancy hull cap.
- Cut and file out the rectangular aperture and screw holes in the switch bulkhead 2.14 for the radio system switch. Trim the switch bulkhead to fit, and glue it to the stern tube support 2.10 only, using instant glue.
- Cut a rectangular slot, about 3 mm wide and 5 mm long, in the front end of the depth vane guide tube 2.15 - detail drawing "Z".
- Cut the guide tubes 2.15 and 2.16 to length, roughen them up at the joint positions, and push them through the side holes in the buoyancy hull cap. Pull the buoyancy hull cap back, and fix the guide tubes in place with instant glue.

Stage 3, assembling the buoyancy hull, parts 3.1 - 3.4

- Cut the T-section rail 3.1 to a length of exactly 320 mm.
- The rail has to be glued in the buoyancy hull, ending 13 mm short of the front rim of the hull. Mark this 13 mm dimension on the inside at the front.
- Place the rail 3.1 in the buoyancy hull 3.2, lining it up with the 13 mm mark.
- Fix the buoyancy hull on the workbench so that it cannot roll. Place a steel ruler against the rail 3.1, to help you to align the rail perfectly straight. It must run parallel to the hull centreline, and should be perfectly straight.
- Fix the rail in place with a drop of instant glue at front and rear. With the steel ruler resting against the opposite side of the rail, allow a drop of instant glue to run along the joint. Take care not to glue the ruler in place!
- Slide the insert plate into the buoyancy hull, and check that it runs smoothly on the rail 3.1.
- Push the rear buoyancy hull cap back until it rests against the lubricating nipple, and slide the buoyancy hull along to meet the cap.
- Fit the front buoyancy hull cap 3.3 onto the threaded rod 2.2, and check that the insert plate engages in the slots in the cap.
- Lock the front cap in place with the self-locking nut 3.4. Do not tighten the nut firmly.
- Push the buoyancy hull forward against the front cap as far as it will go, and slide the rear cap forward to meet the hull. The two caps should seat snugly in the buoyancy hull, with no gaps.
- Draw an alignment line across the buoyancy hull and the forward hull cap. This determines the final position of the parts, and avoids any danger of gluing them together in the wrong position.
- Undo the nut 3.4, and pull off the buoyancy hull forward, together with the forward buoyancy hull cap.
- Fit the rear buoyancy hull cap against the insert plate again, checking that it engages squarely in the slots.
- The insert and the switch bulkhead should now be glued to the rear buoyancy hull cap, using Stabilit Express. **As soon as you have applied the resin, fit the buoyancy hull and forward buoyancy hull cap, and align all the components carefully.**
- Prop up the model vertically until the glue has set hard, e.g. with the stern tube in an empty bottle. This will prevent the resin running off the joint.
- Remove the whole of the front section.
- Apply a second coating of Stabilit Express to the joint at the rear buoyancy hull cap on the inside. Glue the guide tubes 2.15 and 2.16 to the cap at the same time.
- Apply Stabilit Express to the outside of the stern tube at the buoyancy hull cap.
- The buoyancy hull should now be glued to the front cap. Apply transparent adhesive tape all round the forward cap and the front rim of the buoyancy hull.
- Apply a generous coat of silicone sealant to the inside flange of the forward buoyancy hull cap 3.3 and the front part of the buoyancy hull. Line up the alignment marks, and fit the cap on the buoyancy hull. Press the parts together until there is no visible gap. Check that the alignment marks are still in line.
- Allow the silicone to dry out completely; you can check this by feeling the excess material which is squeezed out. The joint must be open to the air on both sides while the sealant is setting. When the silicone has cured, **remove the strips of tape and the excess sealant.**

Stage 4, installing the radio control system, parts 4.1 - 4.19

Note: if you intend fitting fixed depth vanes, the depth vane servo 4.13 is not needed. If you wish to install controllable depth vanes, the grub screw 4.9 and the collet 4.10 are not required.

All other components and procedures are the same for both versions. As a result, it is possible to operate the model initially with fixed depth vanes, then install controllable vanes once you have got used to the model.

- Sand back both edges of the 2mm thick die-cut battery holders 4.1 until they fit easily into the 1.5 mm slots in the battery 4.2.
- Push the four holders upward as far as they will go, and fix them in place with instant glue.
- Bend one end of the switch actuating rod 4.3 as shown on the plan view, and slip it through the inner hole in the rear buoyancy hull cap from the inside.
- Install the switch 4.4. It must be positioned so that it is "On" when pulled

back, i.e. when the pushrod is pulled. If the switch rod should get tangled in weed when the boat is running, this arrangement ensures that the radio system stays switched on.

- Mark and drill the transverse hole in the switch knob exactly as shown in the detail drawing "Y". Use a 1.5 mm drill first, then open up the hole to 2 mm diameter.
- Thread the pushrod 4.3 through the hole in the knob from the underside, bending the rod as necessary.
- Lock the pushrod in place with the collet 4.5 and grubscrew 4.6. Cut the pushrod to the length shown on the plan, and de-burr the cut end carefully.
- Add a little liquid detergent to a bowl of water, and moisten the inside of the flexible boot 4.7 with it.
- Fit the boot onto the pushrod 4.3, and slide it forward as far as the stub on the buoyancy hull cap 1.8. Set the boot to a total length of about 50 mm.
- Temporarily place the battery 4.2 in the aperture in the insert plate.
- Drill 3.2 mm holes in the holders 4.8 for the guide tubes 2.15 and 2.16, fit them onto the tubes from the front, and position them as shown in the plan view. The outside edge of the holders must not project beyond the edge of the insert plate. Glue the holders in this position.
- Fit the grubscrew 4.9 into the collet 4.10, and slip the collet onto the depth vane guide tube 2.15.
- Cut the depth vane pushrod 4.11 to a length of 420 mm, the rudder pushrod 4.12 to 495 mm. De-burr the cut ends carefully.
- Form a double bend in one end of the pushrods 4.11 and 4.12, and connect them to the output disc of the corresponding servos 4.13 and 4.14.
- Slip the depth vane pushrod 4.11 into the guide tube 2.15. Position the servo 4.13 as shown in the plan view, and fix it on the plate 2.3 with two strips of double-sided foam tape 4.15, with the pushrod running in a straight and unobstructed path towards the rear.
- With the depth vanes disconnected, adjust the pushrod 4.11 as shown in the plan view, and tighten the grubscrew 4.9 in the collet 4.10 - detail drawing "Z".
- Install the rudder pushrod 4.12 and servo 4.14 in the same way, fixing the servo in place with two further strips of double-sided foam tape 4.15.
- Fix the receiver 4.16 and the motor controller 4.17 in place with strips of double-sided tape 4.15.
- Connect up the radio control system and the battery, referring to the wiring diagram and the instructions supplied with the units. Keep the leads to the motor, controller and switch tidy by pressing them onto a further piece of double-sided tape stuck on top of the motor controller.
- Make sure that the charge socket is still accessible. Wrap the rest of the leads in insulating tape or spiral tubing, and deploy them neatly.
- Set the servos to neutral from the transmitter.

- Fit the flexible boots 4.18 onto the pushrods 4.11 and 4.12 as described earlier, moistening them with water beforehand. Set each to a length of about 50 mm. Check that the servos are still at neutral. Apply instant glue to the boots 4.7 and 4.18 where they meet the pushrods and at the stubs on the buoyancy hull cap, to ensure a watertight seal at both ends.
- Remove the battery 4.2. Slip the O-ring 4.19 onto the rear buoyancy hull cap.
- Fit the buoyancy hull 3.2 and the forward cap 3.3. Screw the self-locking nut 3.4 into place and tighten it lightly. This will compress the O-ring 4.19 slightly.

Stage 5, the control system, parts 5.1 - 5.19

- Slide the four fixed control panels 5.1 into the slots in the centre section 5.2 from the rear.
- Apply a drop of instant glue to the slots at the front end of each fixed panel.
- De-burr the hole in the front of the centre section, using a drill bit.
- Fit the assembly 5.1 / 5.2 onto the stern tube; the bush must be visible at the rear.
- The next step is to align the fixed control panel assembly. You will need to place the model in the boatstand for this.
- Position the buoyancy hull 3.2 so that the right-hand and left-hand stubs on the forward cap are the same distance above the workbench: X right = X left - detail drawing "X".
- Rotate the fixed control panel assembly on the stern tube until the horizontal panels are also the same height above the workbench: Y right = Y left. As confirmation, check that the vertical fixed panels are truly vertical.

- Glue the centre section 5.2 to the stern tube **at the front end** only. Use Stabilit-Expreß. Do not run the risk of glue getting inside the stern tube.

Note regarding the next step: when drilling holes for the self-tapping screws, drill a 1.5 mm hole through both parts together first. The hole in the outer part is then opened up to 2.5 mm diameter to provide clearance. This process is not described in detail every time.

The slots for flooding the hull and letting water out again should be drilled out in stages, starting at 1.5 mm and ending at 3 mm.

- Drill and file out the bottom slots for water exit in the bottom rear hull section 5.3 at the marked points.
- Drill holes for the three slots in the rear hull section for the pushrod exits, and file them out to follow the run of the pushrods.
- Cut out part 5.3 as indicated, and trim it to fit snugly against the fixed control panel assembly. It should finish flush at the rear end. The slots and the rear opening are intentional. File out the lateral slots to the exact shape shown.
- Sand back the front rim of part 5.3 until it ends exactly flush with the flange of the rear buoyancy hull cap.
- Fix the rear hull section to the fixed control panel assembly by applying instant glue on the inside of the joint. Apply a fillet of Stabilit Express to reinforce the joint.
- Rotate the model in the stand, and set the rear hull section exactly horizontal.
- Drill a 1.5 mm hole exactly central through part 5.3 and into the flange of the buoyancy hull cap 1.8. **Take care not to drill into the cap itself. The same applies when you drill the remaining screw holes.** It is essential to keep to the 10 mm dimension, as shown on the plan.
- Fix part 5.3 to the buoyancy hull cap with one self-tapping screw 5.4.
- Drill the two side holes for the other self-tapping screws 5.4, and fit the screws.
- Screw the locknut 5.5 onto the propeller shaft, leaving 0.5 mm clearance between it and the stern tube bush.
- Cut down the hub of the propeller 5.6 as shown in the plan view, and clean up the cut face neatly. Screw the propeller onto the shaft, and lock it against the nut 5.5.
- Screw the depth vanes 5.7 and the rudder 5.8 to the fixed control panels, using the tubular rivets 5.9 and the self-tapping screws 5.10. Check that they move freely on their hinges.
- Cut off the lugs of the rudder horns 5.11, and sand the cut edges flat. Open up the inner hole of both horns to 1.5 mm diameter.
- Cut the two pushrods 5.12 and 5.13 to the length of 220 mm, form a double bend into one end of each, and connect them to the horns.
- Cut the three guide tubes 5.14 to the length of 100 mm.
- Slip two of the guide tubes onto the pushrods 5.12 and 5.13.
- Slide the pushrods and tubes through the slots in part 5.3.
- Connect the pairs of pushrods 4.11 and 5.12, and 4.12 and 5.13, using the collets 5.15 and grubscrews 5.16.
- Hold the horns against the control surfaces. The pushrods should run as straight as possible, and not be under tension. If necessary, file out the slots in part 5.3 until this is so.
- Make sure that the horns are positioned far enough outboard on the control surfaces to eliminate any danger of them fouling the propeller.
- Loosen the grubscrews 5.16. With the control surfaces at neutral, glue the horns to them with instant glue. **Caution:** the holes in the horns and the pushrods must be located exactly at right-angles to the pivot axis of the hinges - note the dotted line in the plan view and the side view.
- Bend one end of the switch pushrod 5.17 as shown on the plan, and install the third guide tube 5.14.
- Slip the pushrod 5.17 through the bottom slot, and connect it to the pushrod 4.3 by means of the collet 5.18 and the grubscrew 5.19.
- Glue the guide tubes to the rear hull section.

Checking the working systems

- **At this stage you should check that the various systems work correctly. First switch the transmitter on. The motor controller stick must be at the "Motor off" position.**
- Pull the pushrod 5.17 back to switch the radio control system on. **Caution:** as the main battery 4.2 supplies power to the radio control system as well as the main motor, the motor will run briefly when you switch on. Keep your fingers well away from the propeller, **to avoid injury.**
- The control surfaces should be exactly at centre when the servos are at "neutral" (sticks and trims central).

- If you need to adjust the linkages, undo the corresponding grub screw 5.16. Slide the pushrods to the correct position, then tighten the screw again.
- Check the control surface deflections and the direction of servo rotation. If any control system works in the wrong "sense", reverse the servo inside your transmitter.
- Check the direction of motor rotation once more. The propeller must rotate to the left (anti-clockwise) for forwards running, when viewed from the rear.

Stage 6, completing the hull, parts 6.1 - 6.14

- Drill and file out the upper slots in the top rear hull section 6.1, along the marked lines.
- Cut out the top rear hull section 6.1 where indicated. It is about 3 mm oversize, to allow for accurate trimming on both sides.
- Cut out the slots for the fixed control panels 5.1 as accurately as you can.
- Undo the side self-tapping screws 5.4, to allow you to trim the top section 6.1 to fit snugly against the bottom section 5.3. Place the top section 6.1 on the model, fitting the oversized long edges inside the bottom section, and slotting the front corners between the buoyancy hull cap and the bottom section. Part 6.1 must finish flush with the flange of the rear buoyancy hull cap at the front. The hull top must rest on the cap at the front, and line up accurately with the buoyancy hull.
- You can now mark the cutting line on part 6.1 by scoring lightly along the edges of part 5.3.
- Remove part 6.1 and cut back the edges to the marked line. Sand the cut edges smooth, and check that the part fits accurately.
- **The centre hull sections and front hull sections are trimmed and fitted together in the same way at a later stage.**
- Fit the side self-tapping screws 5.4 again.
- Cut the locating plates 6.2 and 6.3 for the top and bottom rear hull sections 5.3 and 6.1 from the half-round scrap pieces cut from the end of the bottom hull section 5.3, cutting to the marked lines.
- Glue the plates 6.2 into the bottom rear section, as shown on the plan, leaving about half their length projecting at the top.
- Mark the position of the top plates 6.3 on the outside of the bottom rear hull section, between the bottom plates 6.2 and the lateral notches. Glue the plates 6.3 to the inside of the top section.
- Fit the top section 6.1 on the model and check that it fits snugly on the bottom section. If necessary, bend the plates slightly to follow the curvature of the hull.
- Bend the screw doublers 6.4 to shape, and glue them to the corresponding plates 6.2.
- Drill a 1.5 mm hole centrally through the hull rear section 6.1 and the **flange of the buoyancy hull cap** from the top, and fix part 6.1 in place with the self-tapping screw 6.5.
- Drill the 1.5 mm holes where marked at the rear, in the area of the control surface assembly.
- Mark the position of the remaining holes. Drill through the top rear hull section 6.1 and the plates 6.2 and doublers 6.4 together.
- Fit the rear self-tapping screws 6.6.
- **Drill the holes for the self-tapping screws 6.7 through the rear hull section 6.2 into the flange of the buoyancy hull cap - but do not drill right through.**
- Remove the hull rear section, **then drill right through the flange of the cap.**
- Fit the rear hull section on the model again, and secure it with the self-tapping screws 6.5 - 6.7.
- Drill and file out the slots in the top centre hull section 6.8. Cut out the centre section along the marked lines, and sand the cut edges smooth.
- Place the model in the boatstand and set it exactly horizontal, as previously described. Measure from the depth vane tips to the workbench to check this.
- Place the top centre hull section on the buoyancy hull, and align it parallel to the fixed depth vane panels.
- Mark the exact position of part 6.8 on both sides of the buoyancy hull. There must be a gap about 2 mm wide between it and the top rear hull section 6.1, otherwise it will not be possible to compress the O-ring 4.19.
- Glue part 6.8 to the buoyancy hull in the centre only - not along the edges or to the front buoyancy hull cap - applying a thin coating of Stabilit Express. Take care **not to glue** the rear buoyancy hull cap and the O-ring at the same time.
- Cut out the bottom centre hull section 6.9 along the marked lines, and place it on the buoyancy hull with the edges overlapping on the top

- section. Trim both long edges of part 6.9 back until they fit snugly against the top section. Part 6.9 must rest flat on the surface of the buoyancy hull.
- Glue the top and bottom sections to the buoyancy hull - but not to the buoyancy hull caps. Apply a long strip of adhesive tape along both sides of the bottom section to hold the component in place. Check once more that the parts fit together really accurately.
- Cut the slots in the top front hull section 6.10 and the bottom front hull section 6.11. Do not drill the holes for the front depth vanes yet.
- Place part 6.10 on the flange of the front buoyancy hull cap, and align it with the centre section using a ruler. Tape the front section 6.10 in this position. It is a good idea to tape the ruler in place as well, for additional support.
- Trim the bottom front hull section 6.11 to fit snugly, and hold it against the top front hull section.
- Apply tape along the entire length of the joints on the outside.
- Fit the assembled hull nose on the hull, and check that it fits closely over the buoyancy hull cap. It should also be a snug fit to the hull centre section.
- Spot-glue parts 6.10 and 6.11 together on the inside using instant glue. Glue the locating plates 6.12 on the inside, noting that there are no plates where the buoyancy hull cap fits. Apply a fillet of Stabilit Express to all the joints on the inside.
- You will find the joint strip 6.13 on the transfer sheet; apply it inside the hull nose, along the flange of the buoyancy hull cap.
- Place the hull nose against the hull and align it with the centre section.
- Mark the position of the screw holes around the circumference, drill them, and fix the nose to the buoyancy hull cap using the self-tapping screws 6.14.
- Leave the tape strips in place until it is time to paint the model.

Stage 7, conning tower and forward depth vanes, parts 7.1 - 7.13

- Place the boat in the stand with the rear depth vane assembly exactly parallel to the workbench.
- Mark the position of the holes for the front depth vanes of the automatic diving system on both sides, at the moulded-in depression. Measure from the workbench surface, to ensure that you drill at the same height on both sides. Be sure to drill the holes at the moulded-in depressions, to avoid the danger of positioning one vane further forward than the other.
- Open up the holes to 4 mm diameter, using progressively larger drills.
- Cut out the conning tower 7.1 and sand the underside flat. File out the slot for the radar mast (8.10). Drill the 3 mm holes in the conning tower top. Drill the 4 mm holes at the top for the adjuster screws. Drill the 3.2 mm hole at the bottom for the rivet nut.
- Glue together the pairs of conning tower bulkheads 7.2 - 7.4 with their edges flush.
- Glue the conning tower bulkhead 7.2 to the hull nose only, aligning it with the marked line and the inner aperture.
- Place the conning tower 7.1 on the model and check that it is an accurate fit on the hull.
- The central conning tower bulkhead 7.3 must not be glued in place. The automatic diving system mechanism is built onto this component.
- Push the central conning tower bulkhead 7.3 up against the front conning tower bulkhead 7.2, to act as a spacer.
- Position the rear conning tower bulkhead 7.4 and glue it to the hull centre section. Remove the loose central conning tower bulkhead.
- Unscrew the hull nose.
- Cut down the shaft of each front depth vane 7.5 to the length shown in the detail drawing "W".
- Fit the tubular rivets 7.6 in the holes in the hull nose.
- Cut the tiller 7.7 to the shape shown in the drawing, insert the collet 7.8 and fit the screw 7.9.
- Cut the front pushrod 7.10 to length, form a double bend in one end, and connect it to the tiller.
- Cut the connecting sleeve 7.11 to length and file a slot into it at each end, as shown in the drawing "V".
- Fit the grub screws 7.13 into the collets 7.12.
- Slip the tiller and the collets onto the connecting sleeve.
- Slide the depth vanes into the tubular rivets on both sides, fitting the connecting sleeve over the vanes in the centre.
- Set the depth vanes to the same angle on both sides.
- Rotate the collets until the grub screws are located over the filed slots, and tighten them.
- Align the tiller as shown in the side elevation, and tighten the screw 7.9.

Stage 8, the automatic diving system, parts 8.1 - 8.27

- Drill 3.2 mm holes where punched in the vertical conning tower bulkheads 8.1 and 8.2. Press the rivet nuts 8.3 into the holes and secure them with a drop of instant glue.
- Screw the jig screw "HS" through both rivet nuts and set a spacing of 26 mm between the bulkheads.
- Place this assembly inside the conning tower and position it centrally under the slot. Fix the bulkheads in the conning tower with instant glue.
- Remove the jig screw. The screw is accessible through one of the adjuster holes.
- Fit the two screws 8.4.
- Fit the nuts 8.5 on the tip of the screws 8.4 and secure each with a drop of instant glue.
- Mount the hull nose on the model again. Fit the conning tower, align it accurately, and glue it to the front conning tower bulkhead 7.2 and the hull nose only, using Stabilit Express.
- Glue the doublers 8.6 to the centre conning tower bulkhead 7.3, keeping the outside edges flush.
- Drill 2 mm holes through the vertical plates 8.7 where punched, and fit the jig screw "HS" through the holes.
- Glue the vertical plates in the angle between the conning tower bulkhead 7.3 and the doublers 8.6.
- Remove the jig screw, and open up the holes to 4 mm diameter.
- Fit the grub screw 8.9 into the collet 8.8 and slip it onto the radar mast 8.10. Position the collet in the exact position shown on the plan, and tighten the grub screw.
- Push the solder tags 8.11 up against the collet from underneath, rotate the end through 90 degrees, and bend them down, as shown on the plan.
- Solder the solder tags to each other and to the collet.
- Drill a 1.5 mm hole through the formed end of the solder tags.
- Slip the machined aluminium sleeve 8.12 onto the bottom end of the radar mast.
- Solder the S-hook 8.13 to the base of the radar mast; the return spring is attached to this later.
- Hold the radar mast between the vertical plates and fix it in place with the screws 8.14 and the tubular rivets 8.15. Tighten the screws to the point where the mast is clamped firmly, but still rotates freely.
- Cut the pushrod 8.16 to length, form a double bend in one end, and connect it to the hole in the solder tags.
- Remove the hull nose and conning tower from the model.
- Fit the radar mast into the conning tower from underneath. Push the centre conning tower bulkhead, complete with mechanism, up against the front conning tower bulkhead, as far as it will go. The bulkhead should end up flush with the bottom edge of the conning tower.
- Mark the position of the four self-tapping screws 8.17. Drill 1.5 mm holes through the conning tower and into the conning tower bulkhead 7.3. Secure the assembly to the conning tower using the self-tapping screws 8.17.
- Connect the ring bolt 8.19 to the S-hook 8.20, and fit the spring 8.21 between the two S-hooks 8.13 and 8.20.
- Fit the ring bolt through the front hole in the conning tower, screw the rivet nut 8.18 onto it from the outside, and press the nut into the hole.
- Set up the eye-bolt in its basic position, as shown on the plan.
- Connect the two pushrods 7.10 and 8.16 using the collet 8.22 and the grub screw 8.23. The front depth vanes should be set to about 2 degrees "down".
- Cut out the radar screen 8.24 and glue it to the collet 8.25.
- Slip the radar screen onto the mast and fix it in place by screwing the grub screw 8.26 into the collet.
- Drill a 1.5 mm hole in the radar screen, as shown on the plan.
- Bend the wire 8.27 to the shape shown on the plan, cut it to length, and glue it into the hole in the screen.

Stage 9, final work, balancing, parts 9.1 - 9.6

- Sand the fixed conning tower control panels 9.1 to the profile shown in the cross-section, trim the inboard ends to match the shape of the conning tower, and glue them in place. Check that the two parts 9.1 are horizontal and in line.
- Open up the boat.
- Drill a 1 mm hole for the steel whip aerial 9.2 in the rear buoyancy hull cap 1.8, as shown on the plan. Drill two holes for the receiver aerial in

the insert plate.

- Cut down the flexible receiver aerial by 500 mm.
- Push the steel whip aerial 9.2 through the hole in the buoyancy hull cap.
- Make up the connection between the flexible aerial and the whip aerial, either by soldering the ends together, or by fitting a plug and socket.
- Glue the steel whip aerial in the hole in the buoyancy hull cap, using instant glue, and apply a fillet of Stabilit Express on the inside.
- Sand the top plate 9.3 to the shape shown in the drawing, trim it to fit on the hull top, and glue it in place.
- **Drill a 5.3 mm hole** for the valve 9.4. Press the valve into the hole and secure it by applying instant glue on the outside.
- Sand all parts smooth, using very fine glasspaper, and your model is ready for painting.
- Glue one lead sheet 9.5 exactly central in the hull nose, in the position shown on the plan, using Stabilit Express. Glue a further six sheets on top of the first, with the edges flush.
- Glue one lead sheet 9.6 in the bottom rear section, as shown on the plan. Glue a further 5 sheets on top of the first.
- Assemble the model completely.
- Blow into the valve 9.4 to check that the buoyancy hull is airtight. No air should escape to the outside when you blow.
- Place the submarine in a filled bathtub to allow you to fine-trim the model's balance. It should float exactly horizontal, with the top surface of the hull level with the surface of the water.
- To achieve this basic attitude, you will need to add about two more lead sheets at the front, and about one and a half more sheets at the rear. First place the sheets on top of the hull, and establish the size and number required. Glue them on top of the other lead sheets, and check that the model has no tendency to list.
- Before you run the model for the first time, the propeller shaft must be lubricated. Fit the grease gun over the lubricating nipple, and fill the stern tube completely with grease.

Setting up the automatic diving system

For your first attempts at running the model, the basic setting of the automatic diving system and the linkages should be exactly as shown on the plan. Once you have become accustomed to the model, you can modify the diving characteristics in the following way:

Slackening the front screw 8.4 provides a greater "down" setting of the front depth vane, which results in faster diving. Screwing the same screw further in reduces the "down" setting, and the model will dive more slowly. You can adjust the tension of the spring 8.21 by pulling it out and screwing the rivet nut in or out.

Unscrewing the rear screw 8.4 makes the boat surface more quickly. Screwing it in lengthens the diving phase. Here again the spring 8.21 will need to be adjusted to match the new setting.

Tips for the maiden voyage

It is a good idea to fit a small pennant, made of coloured trim film, to the tip of the steel whip aerial. This will make it easier for you to keep sight of the boat during the first attempts at diving.

Seek out an expanse of water, as far as possible devoid of water weed.

Place the boat in the water and slowly open the throttle. Do not allow the model to dive deeper than aerial height at first, and do not apply full throttle. If the depth vane is controllable, do not use it for the first runs, otherwise you might inadvertently set the boat into an abrupt dive.

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