



3D Printable

KwikJet – RC Jet Boat

1/8th scale

550mm (21 inches)

Fully printable RC boat for your 3Dprinter

Future of boating - Print your own boat: [Video](#)

Kwikjet RC jet-boat is based on proven New Zealand jet-boat design principles to give the best handling possible. This 1/8th scale jet boat features a fully 3D printed integrated jet pump, two cooling loops for high cooling performance, and a vacuum effect bilge pump to keep the hull dry should any water enter



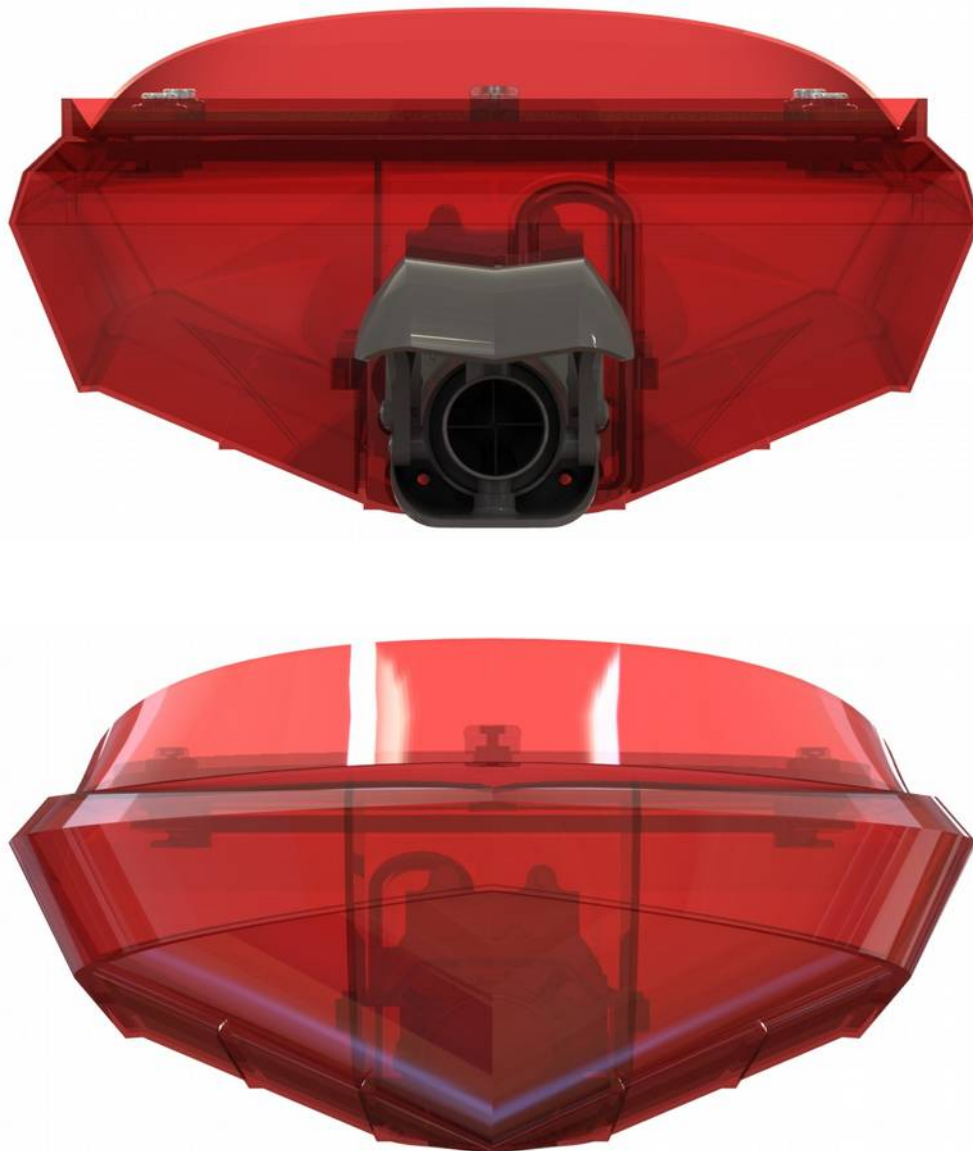
Details:

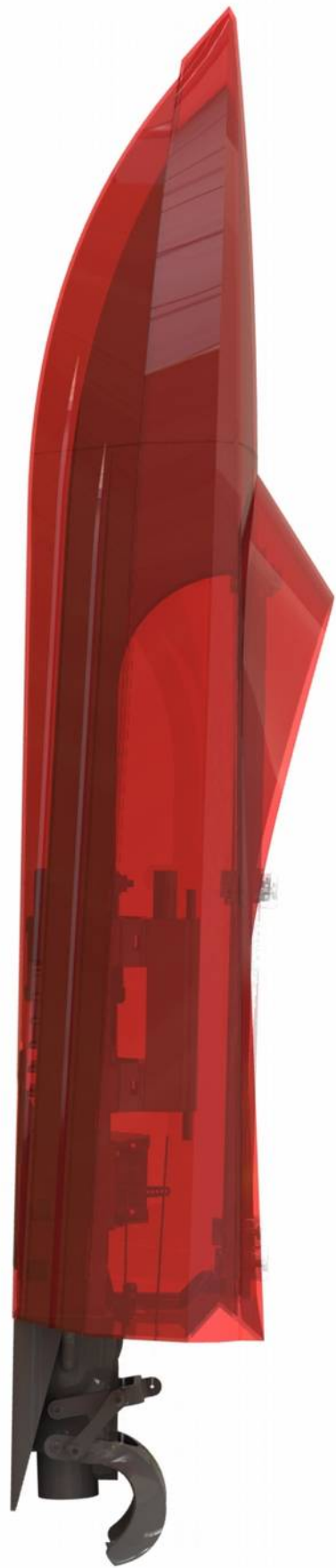
Scale:	1/8th
Length:	550mm
Width	241mm
Jet pump diameter:	35mm
Impeller pitch:	28mm
Exit nozzle diameter:	23.5mm
Power Draw with Fast setup	610 watts
Faster setup:	890 watts
Very Fast setup:	1290 watts *see details on page 7
Top speed with Fast setup:	35Km/hr (22mph)
Faster setup:	Somewhere in between
Very Fast setup:	52km/hr (32mph)

History

Jetboats were originally designed by [Sir William Hamilton](#) (who developed a waterjet in 1954) for operation in the fast-flowing and shallow rivers of [New Zealand](#), specifically to overcome the problem of propellers striking rocks in such waters.

Hamilton had a specific need for a propulsion system to operate in very shallow water, and the waterjet proved to be the ideal solution. The popularity of the jet unit and jetboat increased rapidly. Through further developments, it was found the waterjet offered several other advantages over propellers for a wide range of vessel types, and as such, waterjets are used widely today for many high-speed vessels, including passenger ferries, rescue craft, patrol boats and offshore supply vessels.





Requirements

3D printer:

- Minimum 3D printer build volume: 202 x 202 x 185mm
- Any standard slicing software (Cura, Simplify3D, Slic3r etc)
- 0.4mm nozzle.

Tools:

- Soldering iron with solder
- Craft knife
- Screw drivers
- Allen keys
- Side cutters
- A drill with a 3mm and 5mm drill bit
- Tools to cut 5mm shaft to length, and to cut or file a flat spot. Any workshop will be able to do this for you.

Bill of materials:

- 800g of filament of your choice. PLA is good. Nylon, PETG and HTPLA+ are ideal. They offer a high degree of toughness and impact resistance for rough river running. ABS is easy to get a good finish on as it can be acetone smoothed but is relatively soft and ABS impellers can be damaged by small gravel if sucked up. PLA or other hard/tough materials work well for the impeller.
- [Velcro](#) to hold batteries in place
- 1x [ceramic 695 bearing](#)
- 1x [ceramic MR105 bearing](#)
- [1 meter 4mm ID \(inner diameter\) silicone tube](#)
- CA [Super glue](#) Medium viscosity
- D profile weather strip seal. The one I used was 6x6mm.
- 5mm to 5mm [universal joint](#) or [5mm to 5mm flexible coupler](#)
- A radio control system with 2 channels or more (channel 3 is used for the optional reversing bucket). I use the flysky i6 (~\$55usd with receiver)

- A way to waterproof your electronics – I opened the servos and packed them with grease. The radio receiver had its plastic shell removed and was dipped into the pot of polyurethane to cover all of it's circuit board to waterproof it. Take care to get none on the connectors.
- 3x [20cm servo extension lead](#)
- 1x [Male XT60 connector](#) for ESC
- 3x [Female 4mm banana plug](#) for ESC
- 1x [XT60 parallel connector](#)
- [6mm Heatshrink 1M](#)
- 1x [Water cooling jacket for 36mm motor](#) try to get one with 90 degree connections as it routes the pipes nicer that way.
- 2x [9g servo](#)
- [1x 5mm diameter, 115mm long stainless steel shaft](#)

Fasteners:

- [4x M3x4 grub screw – stainless steel](#) (optional – see Impeller section, page 8)
- [25x M3x12mm self tapping screws](#)
- 8x [M3x6mm](#)
- 5x [M3x10mm](#)
- 7x [Cable ties](#) 1-4mm wide or similar for cable management.

Fast Setup:

Good speed, well balanced: [Video of speed](#)

- [3674 Brushless motor, 1900kv](#)
- [90A boat ESC](#) – waterproof with water cooling
- [2x 3S 2200mAh](#) lipo batteries in parallel. Or [2x 3S 4000mAh](#) lipo batteries for longer run time. I used 2200mah batteries in the video.

~61A max power draw. 610w. 35Km/hr

Faster Setup:

Great speed, a bit overpowered. [Video of speed](#)

- [3674 Brushless motor, 2250kv](#)
- [120A esc](#)
- [2x 3S 2200mAh](#) lipo batteries in parallel. Or [2x 3S 4000mAh](#) lipo batteries for longer run time. I used 2200mah batteries in the video.

~83A power draw, 890w. Somewhere in between the speed of the setup below and above.

Completely overpowered Setup:

Ridiculous speed, you will never need this much!!

- [3674 Brushless motor, 1900kv](#)
- [120A esc](#)
- [2x 4S Lipo batteries 3000mAh](#) in parallel

~91A power draw, 1290w. 52 Km/hr

Print settings:

Resolution:

- Layer height should be 0.25mm for all hull sections.
- Other parts can be printed with 0.2mm layers.
- Impeller works best when printed at 0.1mm layers.

Supports:

- Only use supports for the reversing bucket. No other parts need supports enabled as they have been built into the model for optimum results.

Infill:

- For the **1x-impeller-housing.stl** and **1x-hull-front.stl** use 100% infill.
- For the other parts use 20% infill. Grid infill is recommended – one beta tester reported issues on other infills.

Other:

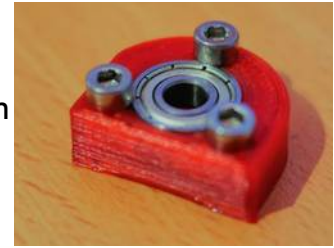
- Printing at 40mm/s is recommended.
- Use 3 perimeters on all parts (hull has 1.20mm wall thickness).
- Please make sure the extruder temperature is set high enough for good layer bonding, if in doubt, do a test piece and test that parts bond correctly and are strong.

Impellers:

- 28mm impeller pitch is recommended. A higher pitch will load up the motor more than it is rated for and can destroy your ESC, batteries or motor. *Only use the other pitches if you know what you're doing.* They can be useful if you already have a higher or lower speed motor that you wish to use.
- If you intend to run in rivers and places where the jet pump is likely pump gravel or silt at times its best to print in PLA or another hard material. Gravel tends to damage the leading edge of plastic impellers which causes priming times to go from half a second to a few seconds.
- Shapeways.com metal impeller option: You can get the impeller printed in brass impregnated steel for ~\$38USD. Use the impeller files with **shapeways** in the file name. You'll need a M3 tap to create the screw thread for the grub screw which you will need – you can find them in the parts list with a link.
- If sucking gravel and silt is not a risk, ABS is great because it can be sanded easily then acetone smoothed for best performance. Other materials like PLA will work just fine, but are a little more difficult to sand and do best when coated with a filler and sanded back again.
- Impeller should be printed with 0.1mm resolution and lightly sanded for best results.

Assembly instructions

1. Print **test fit.STL** with the settings and material you would use for the hull. Make sure that the 695 bearing can be inserted without too much difficulty. Best is a tight friction fit. If the bearing fits but not very tightly, a bead of superglue can be put around the outside of the bearing but be very careful not to get any into the bearing as that would ruin it.



You may need to calibrate your 3D printer's extrusion multiplier to get the correct fit. If you are having trouble getting a correct fit consider using "horizontal size compensation". This setting controls how many millimetres the features printed will be enlarged or shrunk by. If the fit is too tight, try -0.1mm compensation, if its still too tight, try -0.2mm etc. In Slic3r this can be found under Print settings -> Advanced -> XY Size Compensation. In Simplify3D open your Process settings, click "Show advanced" to show all the settings, click the tab labelled "Other" and then find Horizontal Size Compensation.

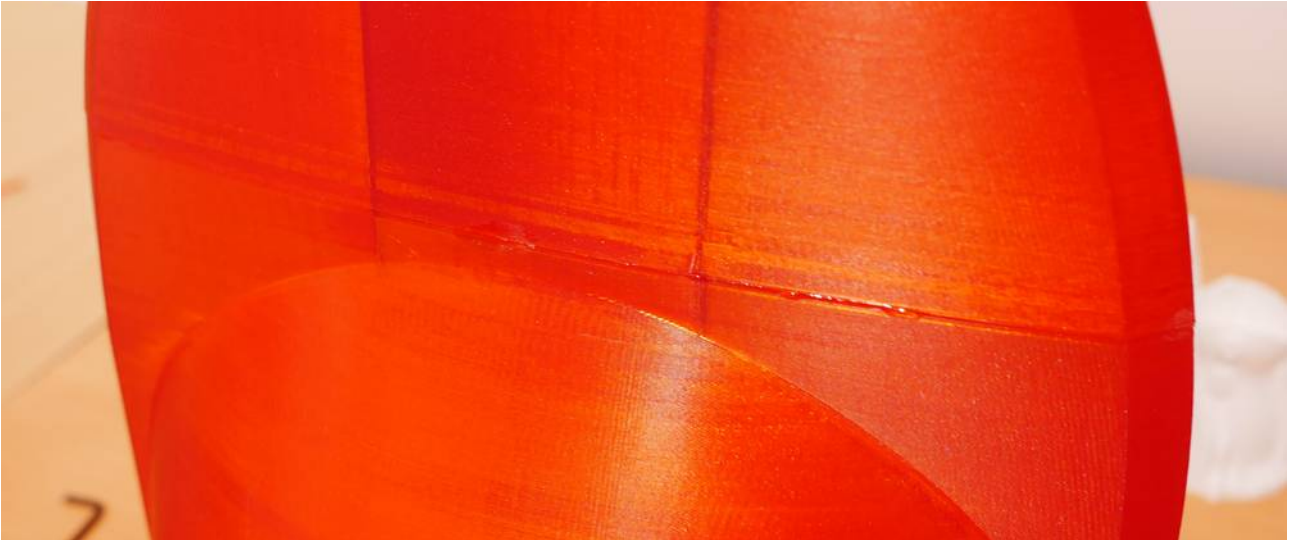
2. Once your extrusion multiplier has been tuned and the bearings fit correctly, you can print all the parts with the settings as on the previous page:



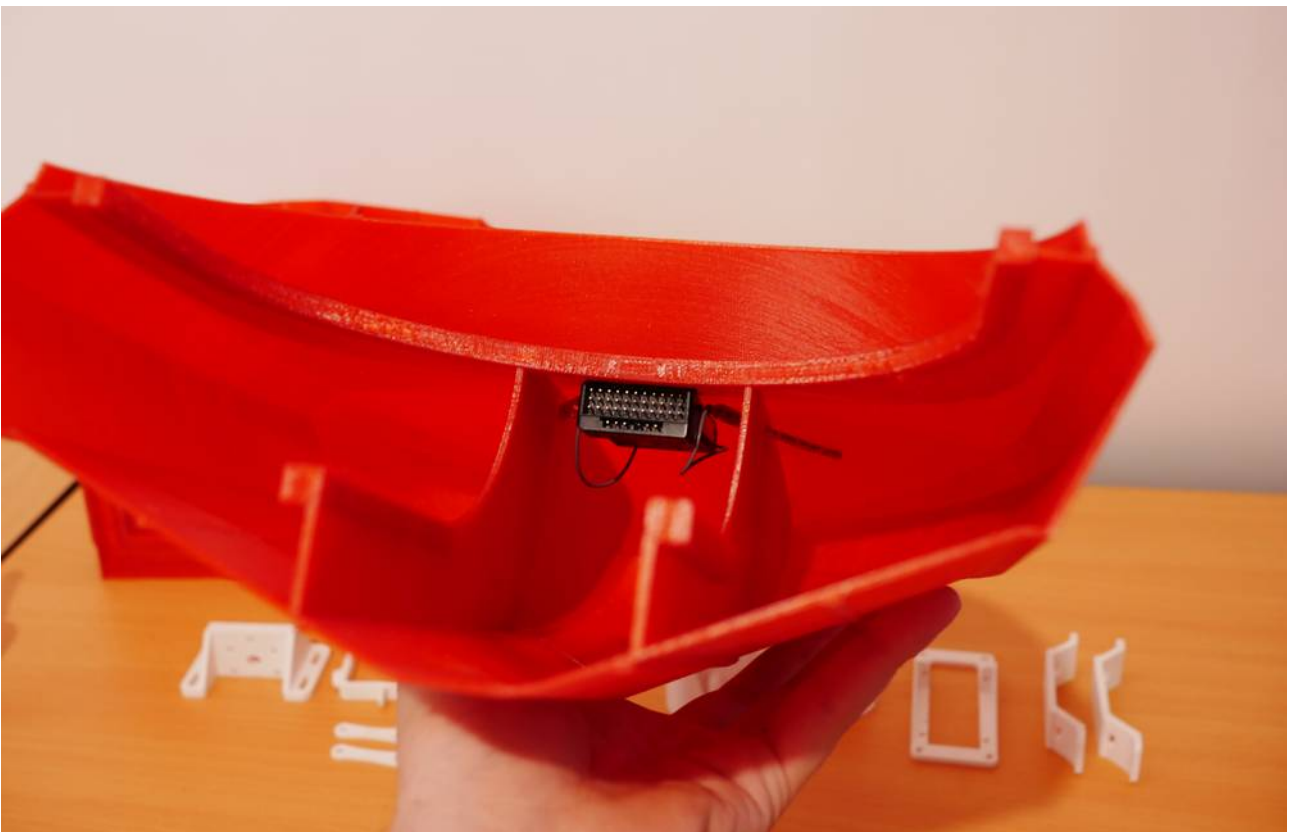
3. Insert the 695 bearing into the rear hull section. If you are worried about it loosening during operation you add a bead of superglue around the outside ring of the bearing to secure it in place. Make sure to seat it quickly, as the glue sets quickly, and then secure with 3x M3x6mm screws



4. Glue the front and middle sections of the hull together. Make sure there is a good fit between the parts before applying glue.



5. Cut a strip of velcro to the size of your receiver and apply one side to the receiver. Cut another section of velcro to the same size and stick under the front of the deck. Mount the receiver in place and place the antennae through the holes provided.

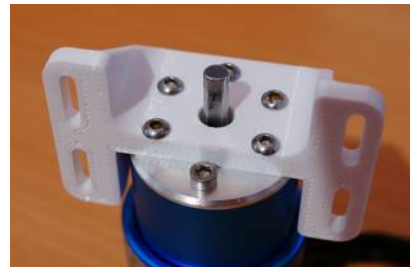


6. Next glue the two hull halves together. Be careful to check alignment and fit before applying glue.

7. Use a craft knife to cut out the built in support material as marked in black on each side.

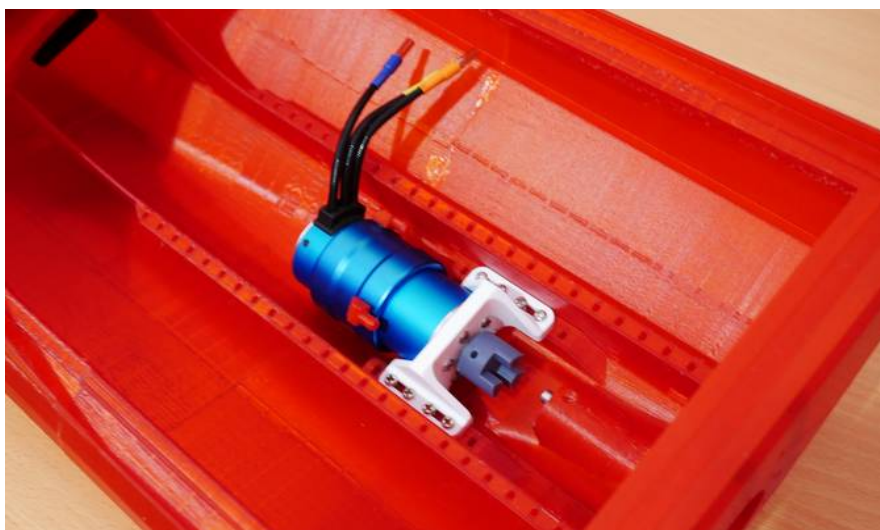


8. Put the water jacket over the motor and mount the motor to the motor mount.



I put a screw into the bottom hole of the motor to prevent water entering, but in hindsight leaving it open would probably have been better to prevent moisture build-up inside.

9. Mount the motor into the hull. Use the self tapping screws here and don't tighten them down yet. Attach your metal universal joint coupler to your motor (in this picture I was using a 3D printed coupler which wasn't very reliable – I later moved back to a metal coupler).



10. Insert the MR105 bearing (the smaller bearing) into the centre hub of the impeller housing. If it isn't a tight fit, you can apply a small bead of superglue around the outer perimeter to fasten it in place. Take care not to get any in the bearing as that would ruin it.

In this picture I'm using a bronze oilite bushing as part of testing which later failed. Ceramic bearings are a proven option which is why I recommend them.



11. Now the impeller. You can use a unsanded impeller but top speed is reduced and pump priming takes longer. See discussion on page 8 on material choice. If you decided to print the impeller in ABS, follow these instructions below to get a near perfect finish. The critical part is the leading edge, it should be smooth and sharp.

Steps for ABS impeller:

Print the two impeller halves:



Join the two halves by applying acetone to each half and putting them together. Once they're a little bit stuck together go ahead and dunk the whole thing in acetone and let it dry for an hour.



After it has dried enough to sand, get some 150grit sand paper and sand lightly. It doesn't have to look amazing the aim is to just remove high spots. Use a craft knife to tidy up some of the join lines if required.



Here is my impeller after sanding. Drill a 5mm hole in it., hold it with the round end of the drill and dunk in acetone every 30 seconds or so until you've dipped it in 3 or 4 times. Let to dry. While its drying its best to hold the part by the drill bit.

Finished impeller:



12. Remove the impeller from the drill bit.

13. Now it is time to prepare the drive shaft. Cut the shaft to 115mm long. File or cut a flat that is 20mm long, 10mm from the end of the shaft. This is the end the impeller will go on. File or cut another flat on the other end of the shaft, 5mm long. This is where the universal joint coupler will go.

14. You can use 2x M3, 4mm long grub screws to hold the impeller on the shaft if you've made it from PLA. Take care not to over-tighten the screws. On ABS and other softer materials the grub screw tends to rip out and cause it to slip on the shaft.

15. Superglue is the better method for impellers that are not made from PLA. To glue it in place, push the narrow end of the impeller 5mm onto the shaft. Now pour a little superglue into the impeller shaft hole and quickly push the impeller down, onto the shaft leaving the impeller 10mm from the end.



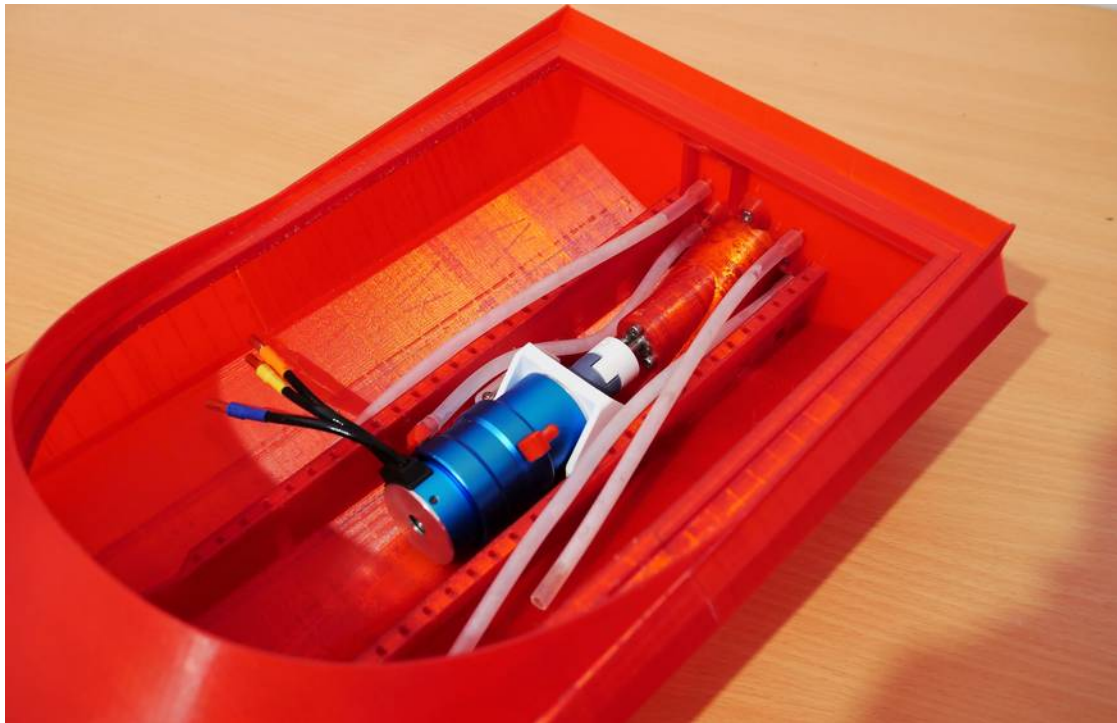
16. Next put the shaft with impeller into the hull and connect it to the universal joint and tighten. In this picture I was testing a printed coupler, which proved unreliable and I switched to using a flexible coupler later. Steps to assemble are exactly the same.



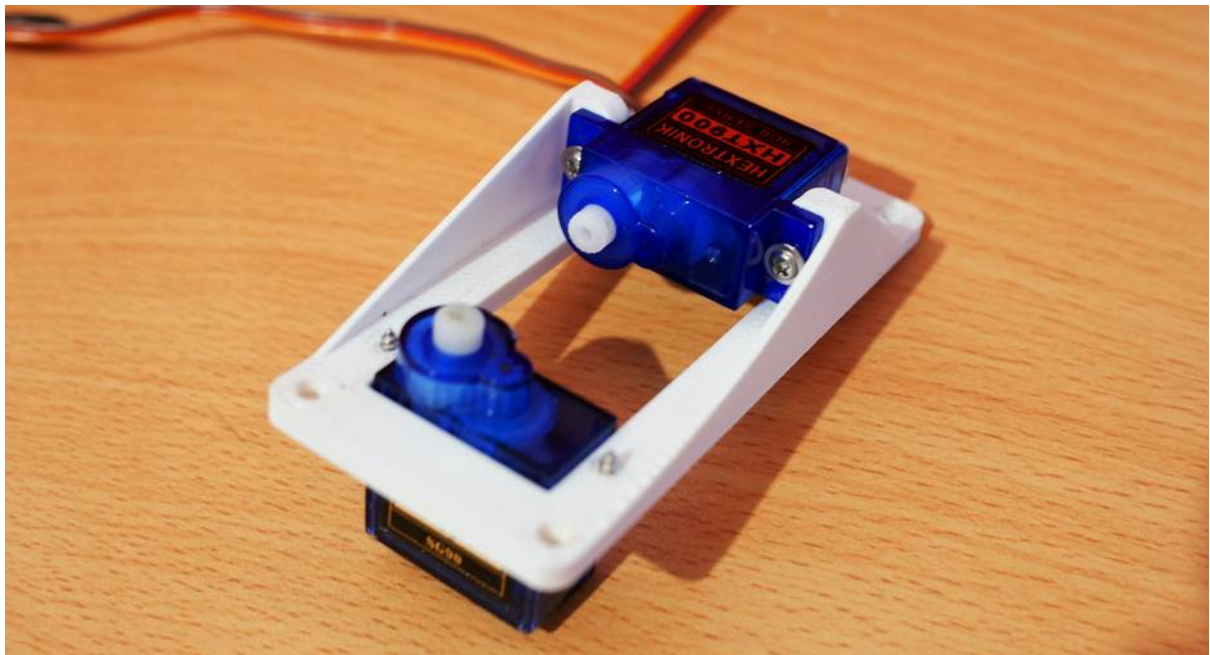
17. Screw on the impeller housing on the back. As you tighten the screws, the impeller will be pushed forward. Make sure the motor can move forward freely. If it is a little stiff to turn the shaft, the impeller may be rubbing on the housing slightly. Make sure everything is assembled correctly and apply a quick burst of throttle, this will take off the high spots that were rubbing and the shaft should now rotate freely. If its still a little stiff, loosening and re tightening the coupler can sometimes help.



18. Cut the 1 meter of silicone tubing into equal, 25cm long lengths and connect them to the back of the hull. Save offcuts as you will need them later.



19. Mount the servos to the servo bracket with the screws that were provided with the servo.



A close-up photograph of the syringe pump assembly. A blue syringe is mounted on a white plastic base. A blue arrow points to the syringe barrel. The assembly is connected to clear plastic tubing. The background is a red surface.

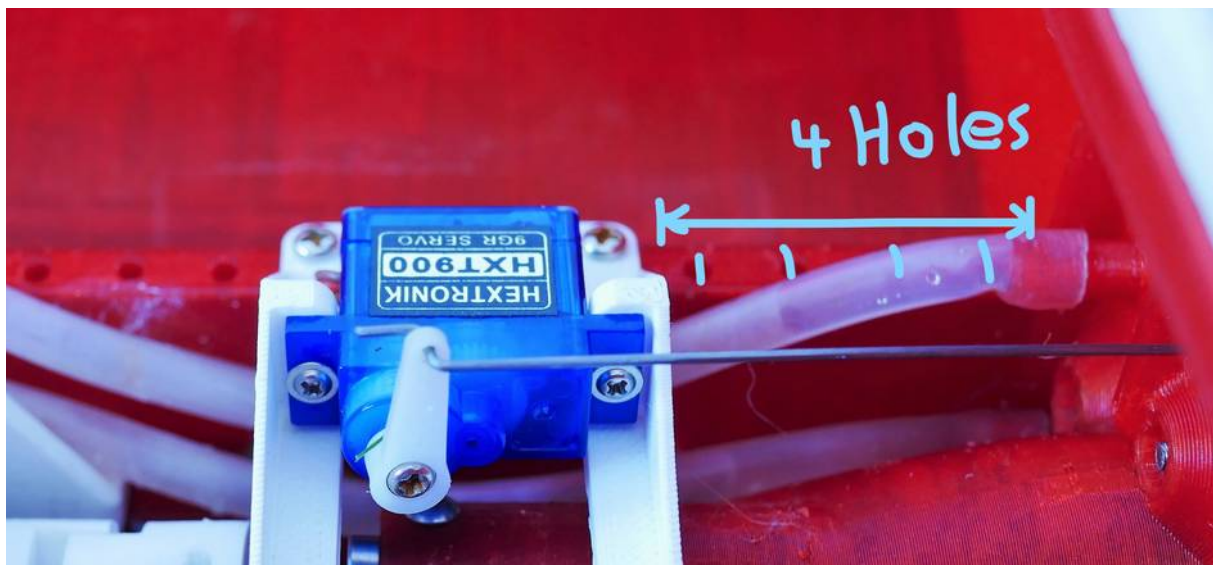
A photograph of the assembled robot chassis. The red frame is visible, with the blue motor and white servo mounted. Various wires and components are connected to the microcontroller, including a black cable and a small black component. The assembly is shown from a top-down perspective.

22. Cut 130mm of 1mm push rod wire. Make a Z shape as shown in one end. The parallels of the Z's should be spaced 110mm from the other. Cut off excess wire.



23. Insert wire piece into the top-middle hole at the rear of the hull by following the curvature of the wire. Centre the servo either by using your RC system or by estimating where the middle of the servo's motion is. Insert the wire into the furthest hole from the end of the servo horn and screw into place.

24. Using the self tapping screws, screw down the servo bracket 4 screw hole spaces from the rear of the hull (4 holes being free just behind the bracket).

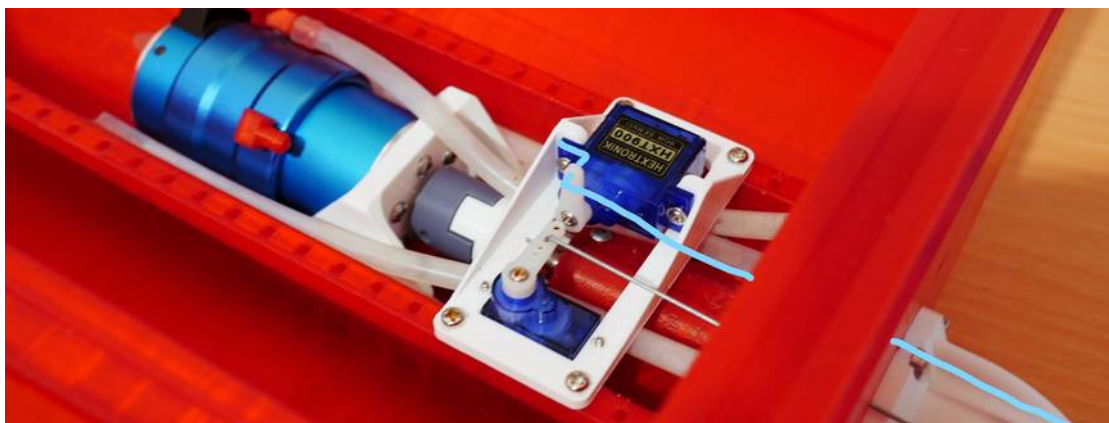


25. Attach the servo extension leads and cable tie the rest of the cabling into place.



26. Next, we make the steering linkage. Cut 1mm servo wire to 150mm long and put a z shape into it. Put another z into the other end of the rod so that the parallel parts are 126-127mm apart.

27. Insert the wire into the hull, and mount the wire into the 3rd hole from the end of the servo hole and screw the servo into place. It should look like this: (please excuse my MS paint skills – I didn't have a photo of this part of the assembly so had to draw the wire)



28. Mount the steering nozzle. Use M3, 10mm long screws. Take care when inserting the wire, as forcing it in will split the lever along its printed layer lines. Use a lighter to warm the wire (take care not to overheat it) and push it through into place if required.



29. Mount the rest of the reversing linkages. Use the M3 6mm screws. Make sure everything moves easily and is not tight fitting. If the moving parts are too tight you can drill the part the screw passes through with a 3mm drill bit.

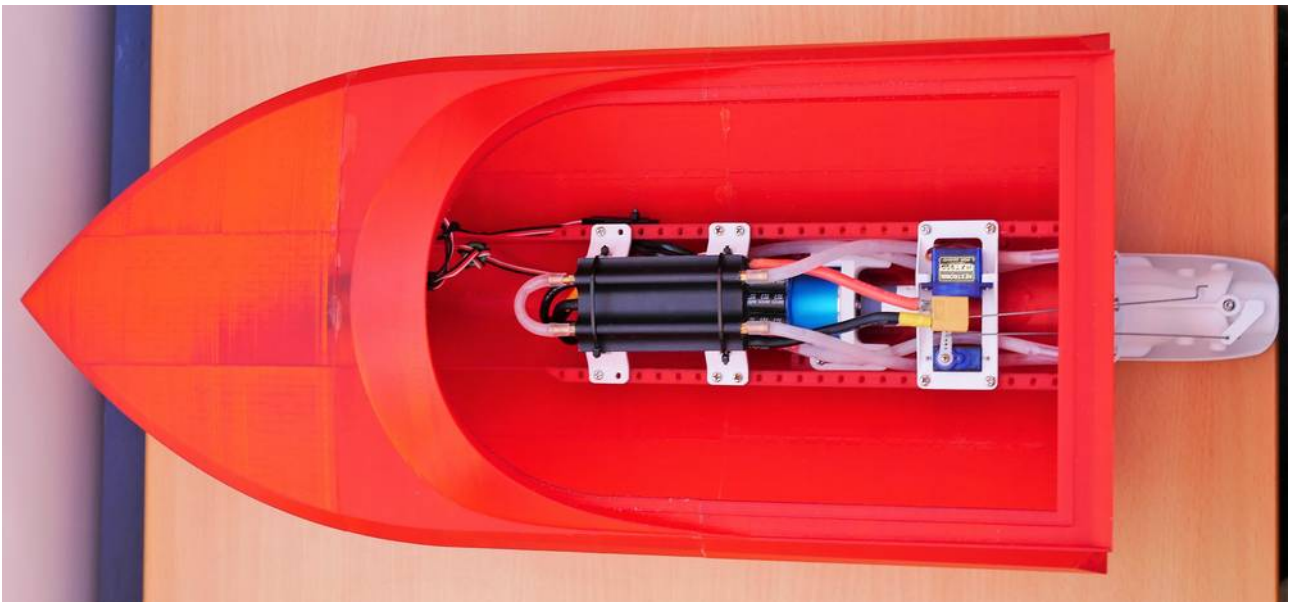


The newer version of the white parts as seen above have connectors to connect a piece of leftover silicone tubing between the steering nozzle and impeller housing. This is for the vacuum bilge pump. When the jetpump is operating at high speed it will create suction effect and slowly take any water in the bottom of the hull out.

30. Solder the 4mm bullet connectors to the 3 wires coming out of the ESC and use heatshrink to insulate them. A hot air gun, hair drier on high heat or a lighter can be used to shrink the heatshrink. Solder the XT60 connector to the other two leads coming out of the ESC taking care to put the red wire on the side of the connector that is marked with a +

If you need some help soldering, [this video here has](#) some tips. There's many resources online show how to solder effectively.

31. Mount the ESC using self tapping screws and cable tie the ESC into place. You can also connect all the silicone tubing and cut the tubes to length. Cut off parts can be used to connect the two ends of the ESC piping together.



32. Cut 5 pieces of wire to 88mm long with 3mm bent at 90 degrees. Glue into place on the bottom of the hull using superglue.



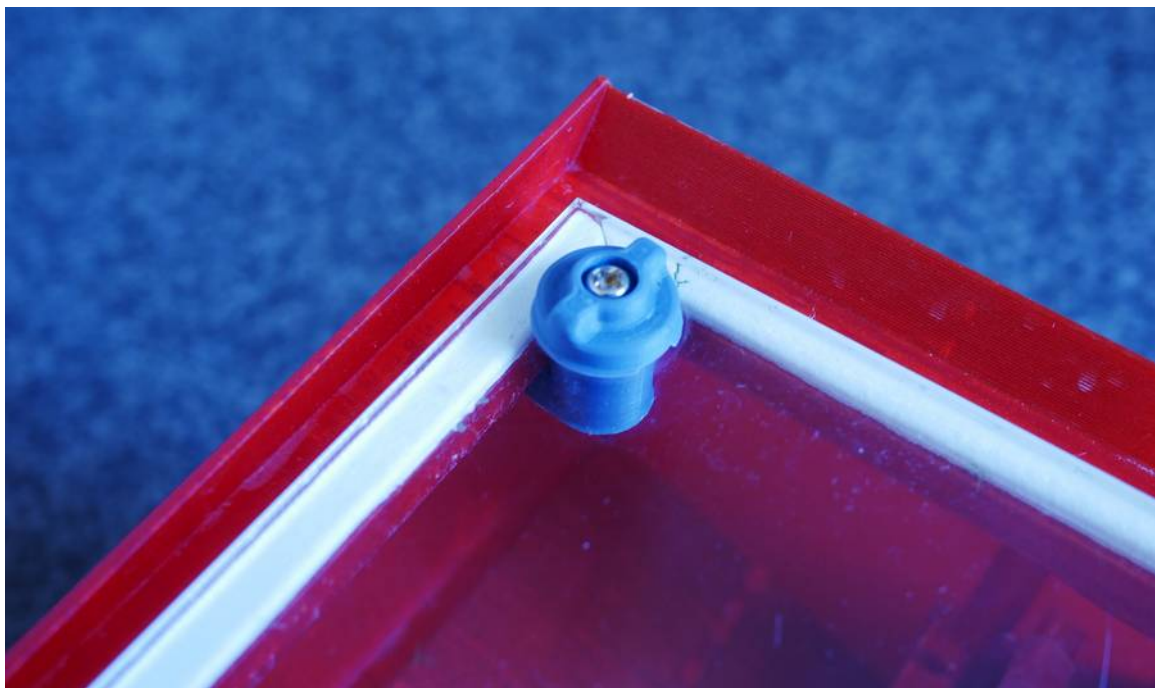
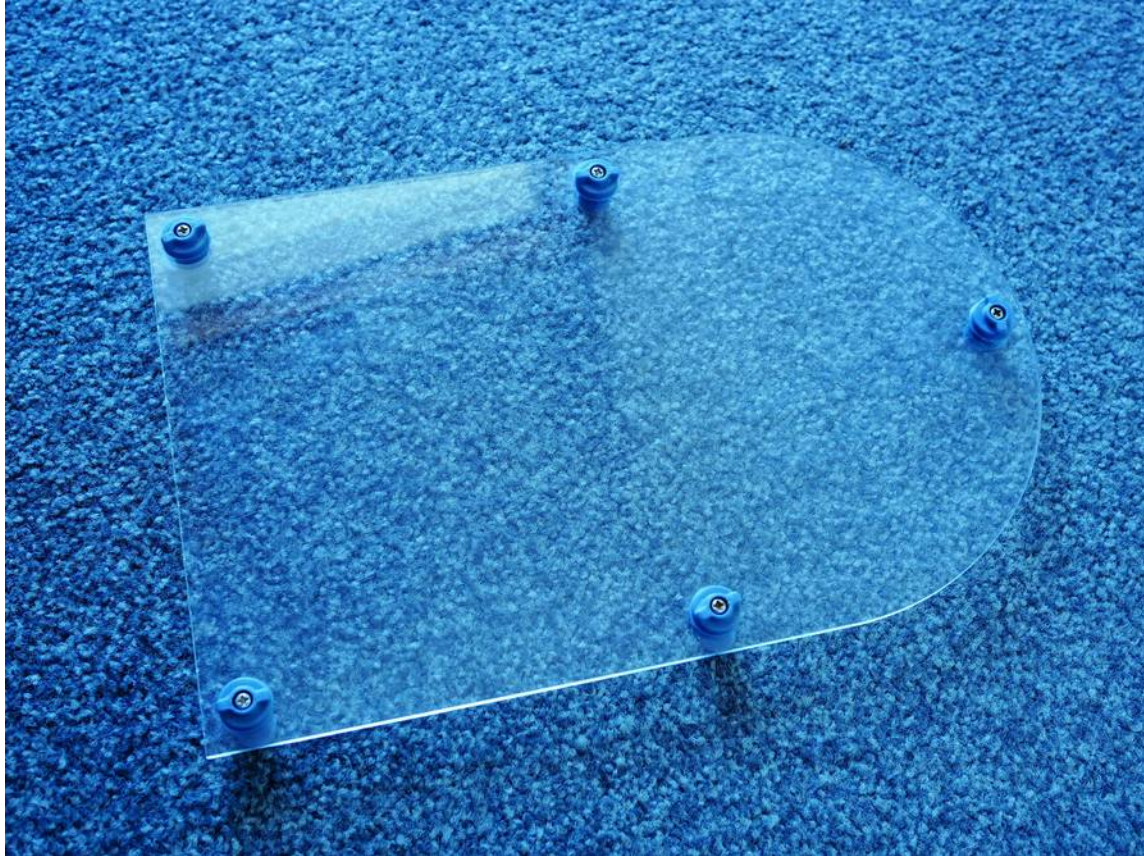
33. Print the lid latch parts and either use the included printable lid file or get the lid laser cut. If you're using the printable lid, glue the halves together using superglue.



34. Line lip of the hull with D shaped foam. Commonly sold in hardware stores and available off amazon as a draft stopper. I used a 6x6mm D profile weather strip.



35. Assemble the lid with the printed parts. Use the self tapping screws. I chose the to use the laser-cut acrylic option. You can use the 3D printed lid option, the instructions and use are the same. I chose the acrylic lid as I like the transparency. The 3D printed lid would need the two parts glued together using superglue.





Radio setup:

It is very important that fail-safe is enabled on the pump motor. In case of the boat losing signal the motor must shut off. In my testing I did not have fail safe on, the boat went under water, lost signal and pushed itself into the bottom of the pond!

I like to have exponential for the steering set to -70 on my Flysky i6 transmitter. It makes it easier to finely adjust direction at high speeds.

Finally there is centre of gravity to be tuned and the nozzle angle. I find the 2 degrees upward nozzle works best with the batteries 20-50mm forward from the rear of the hull.

I hope you have enjoyed this project as much as I have enjoyed designing it.

Happy boating!

By supporting this project you've made it possible for me to continue developing exciting 3D printed projects. I ask that you please keep these files for yourself and don't share them on - this makes it possible for me to continue creating new projects. Thank you!