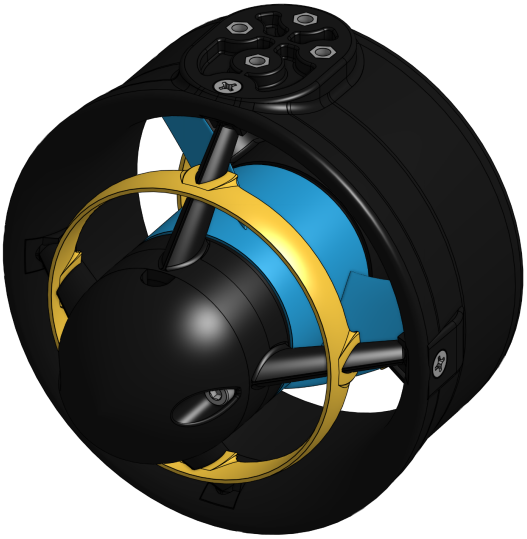
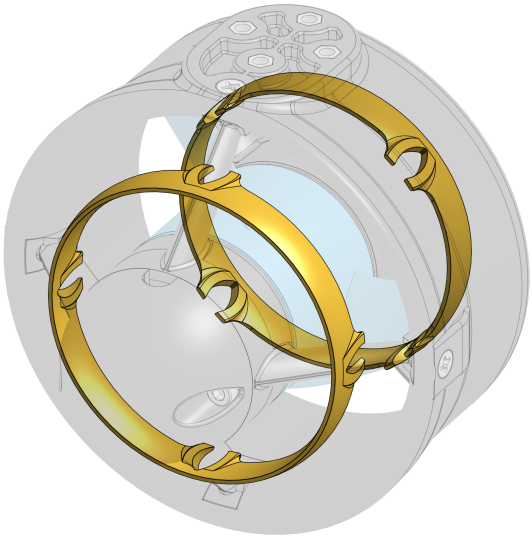
UWROV

Introduction

The Underwater Remotely Operated Vehicles Team (UWROV) at the University of Washington has designed integrated 3D-printed custom thruster guards for Blue Robotics T200 and T100s that are IP2X compliant (gaps < 12.5mm). These guards are acceptable for MATE ROV Competition safety inspections and have a lower impact on thrust than traditional shrouds.

These thruster guards are available open source. Anybody can download, manufacture, install, or improve these parts. This guide will walk you through the process of acquiring the files, printing the guards, and installing them onto your thrusters.





Parts and Tools

For Manufacture:

1x 3D printer

6.13 grams PLA Filament per set

For Installation:

1x Flush Cutters (optional)

1x Soldering Iron (optional)

1x Superglue (optional)

1x Blue Robotics T200 or T100 Thruster

Downloading / Copying the Files

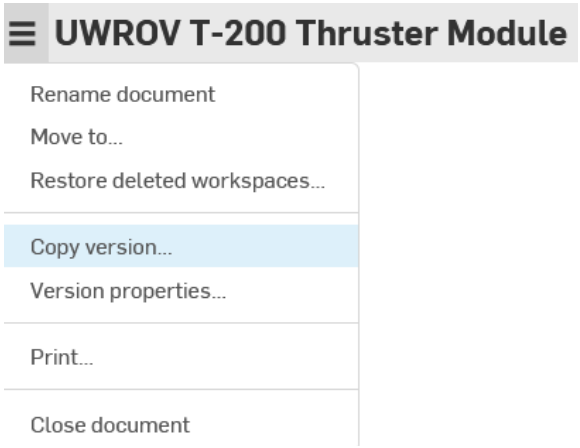
Download through Google Drive

1. Go to this link to access our Google Drive folder.
2. Download "`UWROV T-200 inlet guard R1.stl`" and "`UWROV T-200 exhaust guard R1`"

Optional: Edit through Onshape

See ways that this design could be improved? Great! Through Onshape, you can easily make a copy of our parametric design and improve it as you see fit.

1. Go to this link to access our public Onshape file.
2. To make a copy, select the hamburger menu in the top left next to the Onshape logo and select **"Copy version…"**. You will need to be signed into Onshape to access this feature.



3. After selecting where to save your file, you'll be brought to the new workspace. Using the tabs on the bottom, you can navigate between the assembly, part studio, drawing, and license. To get more familiar with Onshape, check out the Onshape Learning Center.

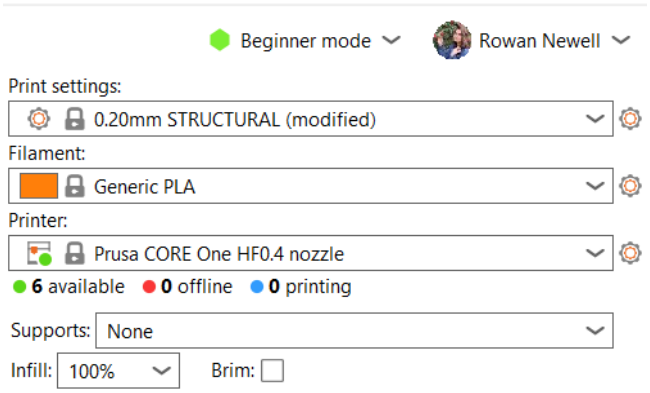
Manufacturing the Guards

These thruster guards are intended to be 3D-printed. UWROV prints these in PLA on a Prusa Mini or Prusa Core One with a 0.2mm layer height, 0.4mm nozzle, and 100% infill. Strength, snap force, and durability will vary with different print settings. It is your responsibility to make sure that these guards suit your needs.

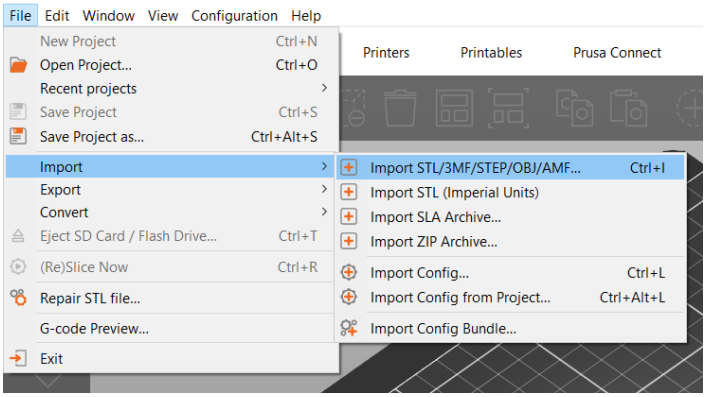
If you're already familiar with preparing files for 3D-printing, feel free to skip ahead to Installing the Inlet Guard. If you'd like a step-by-step guide to prepare your file to print, continue reading.

To print a 3D-model, we first need to prepare it using a slicer. In this example, we will be using Prusa Slicer, which can be downloaded here.

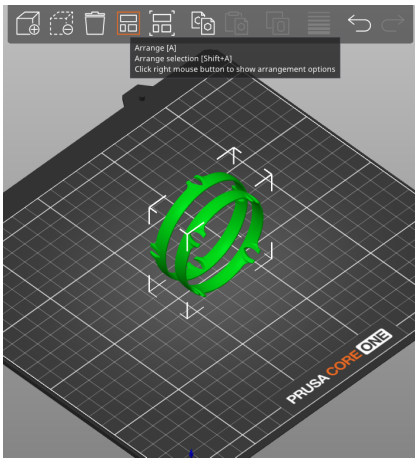
1. Open PrusaSlicer. On the right panel, adjust the following settings:
    - Print Settings: **0.2mm STRUCTURAL**
    - Filament: **Select your filament**
    - Printer: **Select your printer**
    - Supports: **None**
    - Infill: **100%**
    - Brim: **None** (box not checked)



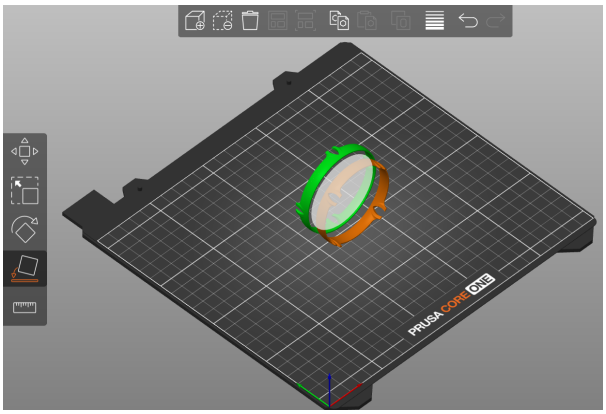
2. Import the two files for the inlet and outlet thruster guard by using the top toolbar to navigate to "`File>Import>Import STL/STEP/OBJ/AMF...`". Press "`shift+click`" or "`ctrl+click`" to select multiple files at once.

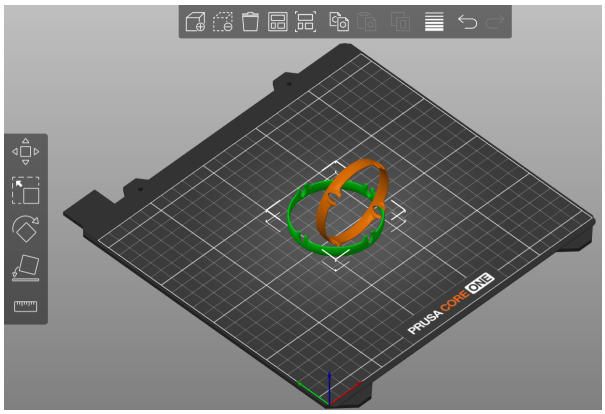


3. Press "A" on the keyboard or the fourth button from the right on the top toolbar (Arrange) to separate the guards. Alternatively, you can drag them apart manually using right click and dragging with the mouse.

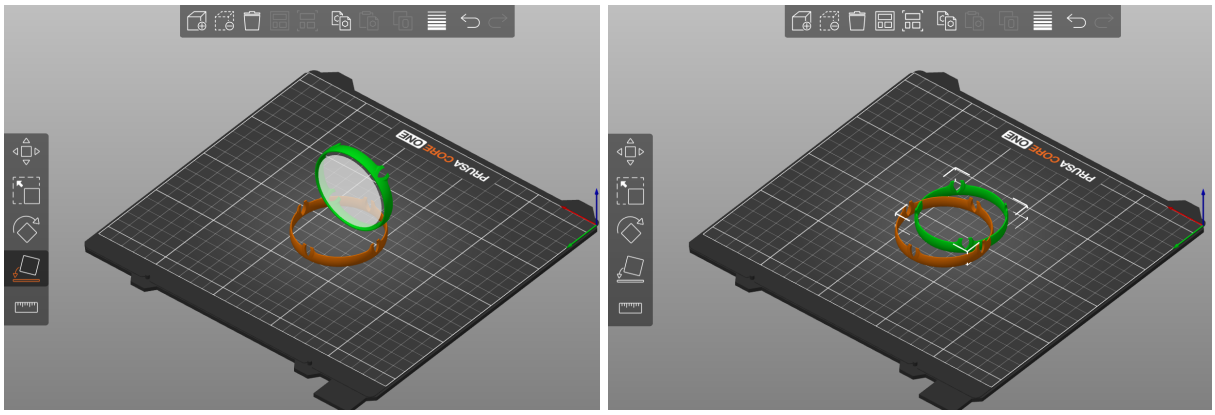


4. Right click on the guard facing away from you. Press "F" on the keyboard or select the fourth icon down on the left toolbar (Place on Face). Select the face opposite of the clips.

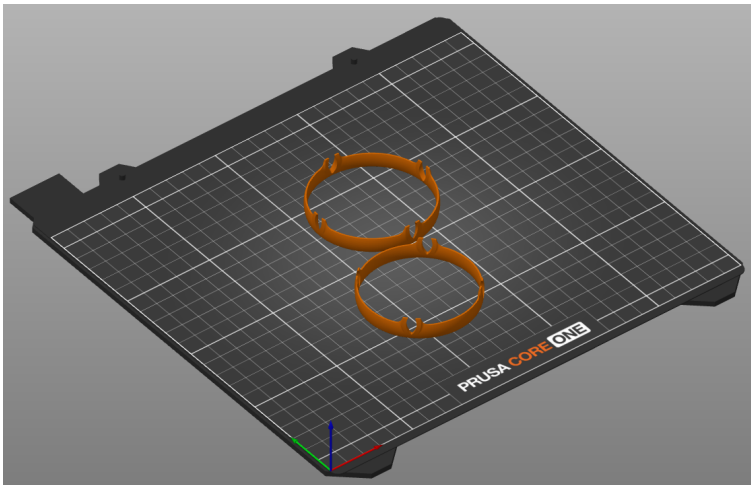




5. Repeat the same process to the other thruster guard, using “F” or “Place on Face” to place the face opposite of the clips on the print bed. Right click and drag on the print bed to rotate as needed.



6. Press “A” or “Arrange” to rearrange the guards.

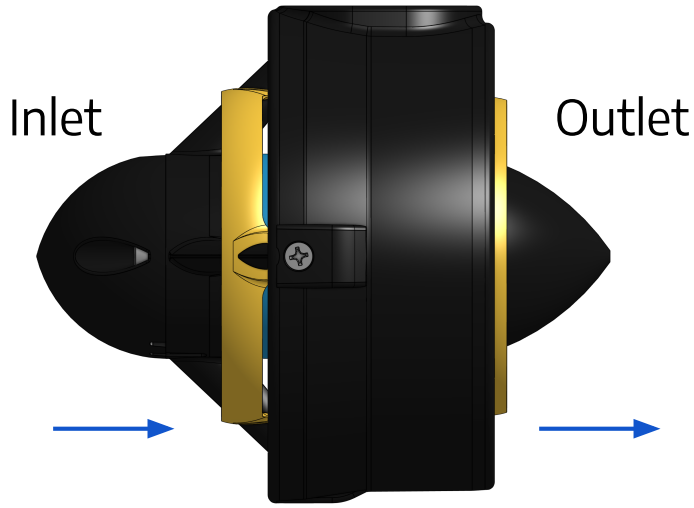


7. **Optional:** If you’d like to print more guards, use the copy and paste commands (Ctrl+C, Ctrl+V) to create multiple inlet and outlet guards. Use “A” or “Arrange” to see how many guards you can fit on one plate.
8. At the bottom of the right panel, select “Slice Now”. Depending on your printer, use either “Export G-code” or “Send to Connect” to print out your brand new thruster guards.

Installing The Inlet Guard

Once you have your guards printed, it's time to install. Luckily, the installation is quick and easy. First, let's start with the inlet guard.

The inlet guard is the larger of the two guards. Ensure you are installing the correct guards, or else the thruster will not be IP2X rated. The inlet of the motor has a rounder side profile, protrudes further, and has the wire coming out of it. It is recommended that the thruster guard is installed prior to the thruster being installed into a backplate, however, it can be installed afterwards.



Installation before attaching thruster to backplate

1. Run the thruster cable through the center of the guard, then clip the guard onto the struts connecting the core to the nozzle.

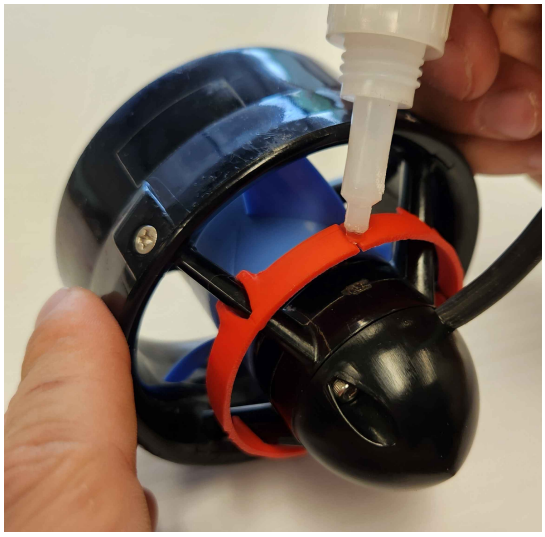
Installation after thruster is attached to backplate

If you cannot slide the cable through the guard due to the thruster being installed in a backplate, don't fret, installation is still simple.

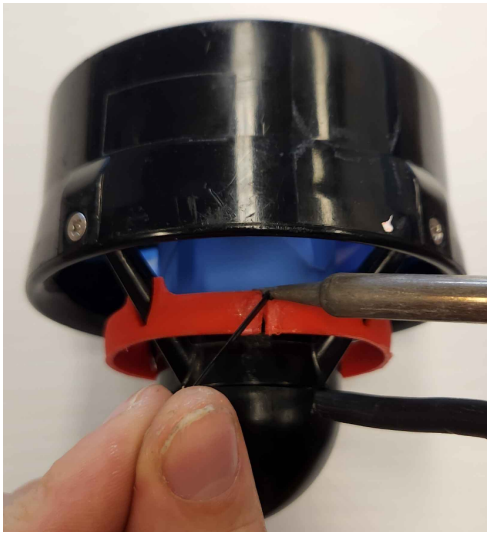
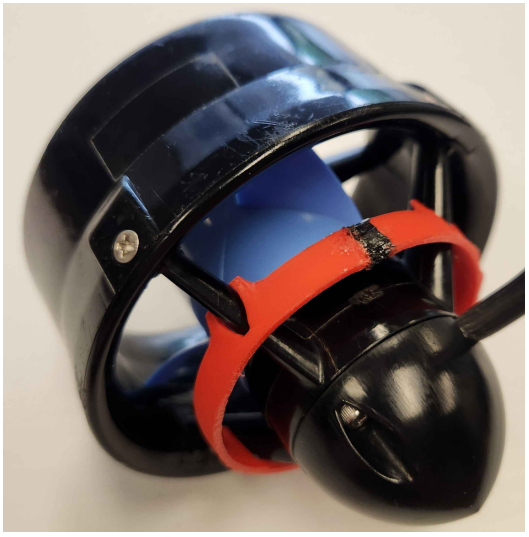
1. Using flush cutters, cut the thruster guard halfway between two of the clips. Below, the guard is being opened gently to emphasize the cut location.

2. Pulling the guard open gently, slide it onto the thruster cable. Push the clips of the guard onto the prongs of the core. They should snap into place.

3. Mend the cut in the guard. There are two methods of doing so:
    - Superglue: Apply one drop of superglue at the cut, and push the pieces together firmly for at least 30 seconds. Take care to not get glue on your skin, wiping excess glue with a paper towel if needed. **SAFETY NOTICE:** Use proper procedure when working with superglue and follow all safety precautions listed from the manufacturer.




- Soldering iron: using a soldering iron at 240F (115C), weld the pieces back together. It may help to use extra filament as a faux brazing material by melting it into the split. **SAFETY NOTICE:** Practice proper procedure when utilizing the soldering iron, such as working in a well ventilated area and/or using a fume extractor and exercising caution with heating elements.

Installing Outlet Guard

The outlet guard is the smaller of the two guards. Ensure you are installing the correct guards, or else the thruster will not be IP2X rated.

1. Since there's no cables on the back of the thruster, simply snap the thruster guard into place by pushing the clips onto the prongs of the core.

Conclusion

Congratulations, you now have fully installed UWROV thruster guards to make your Blue Robotics thrusters IP2X rated! Please contact the team with any questions, comments, and feedback at uwrov@uw.edu.