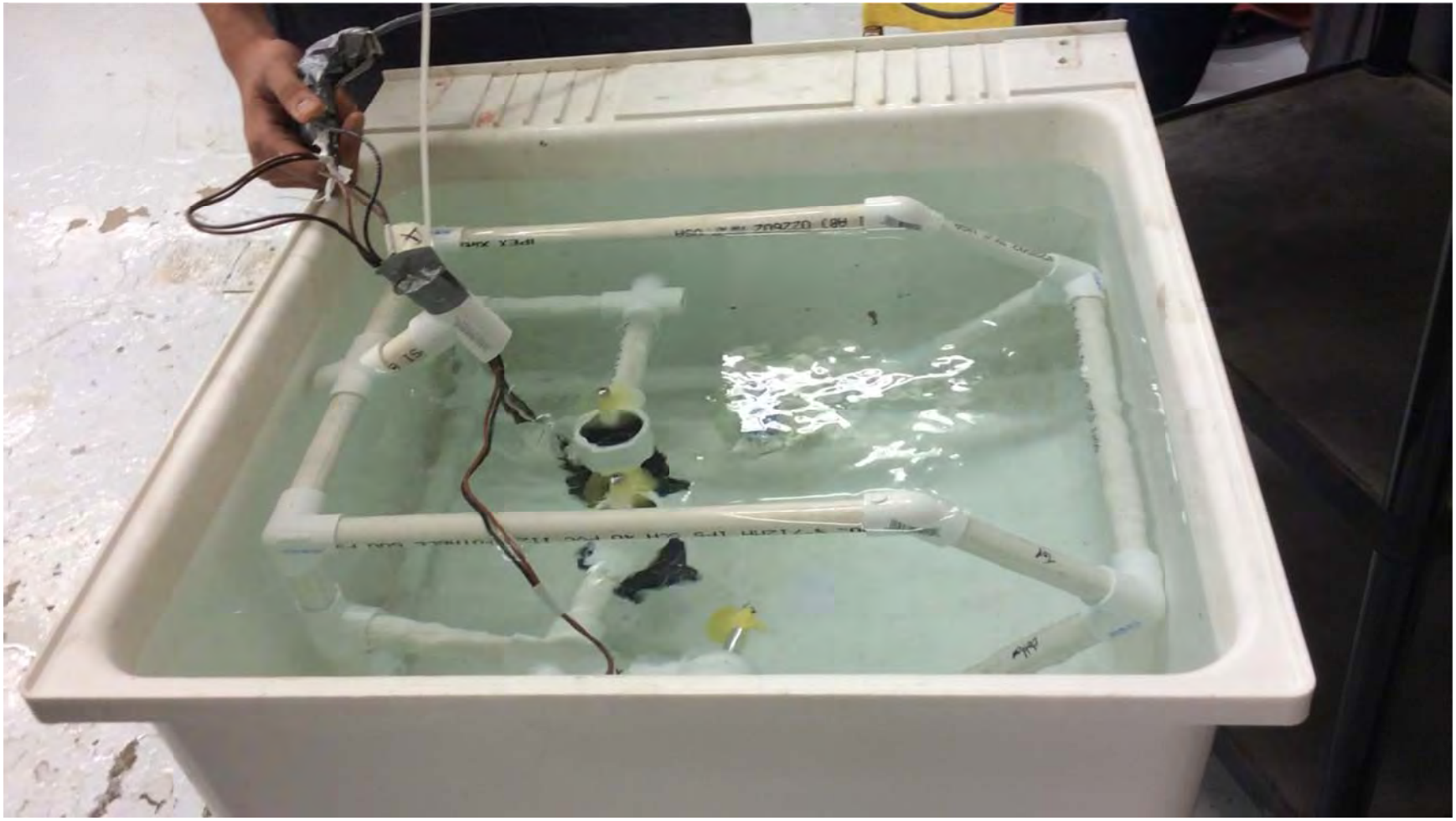
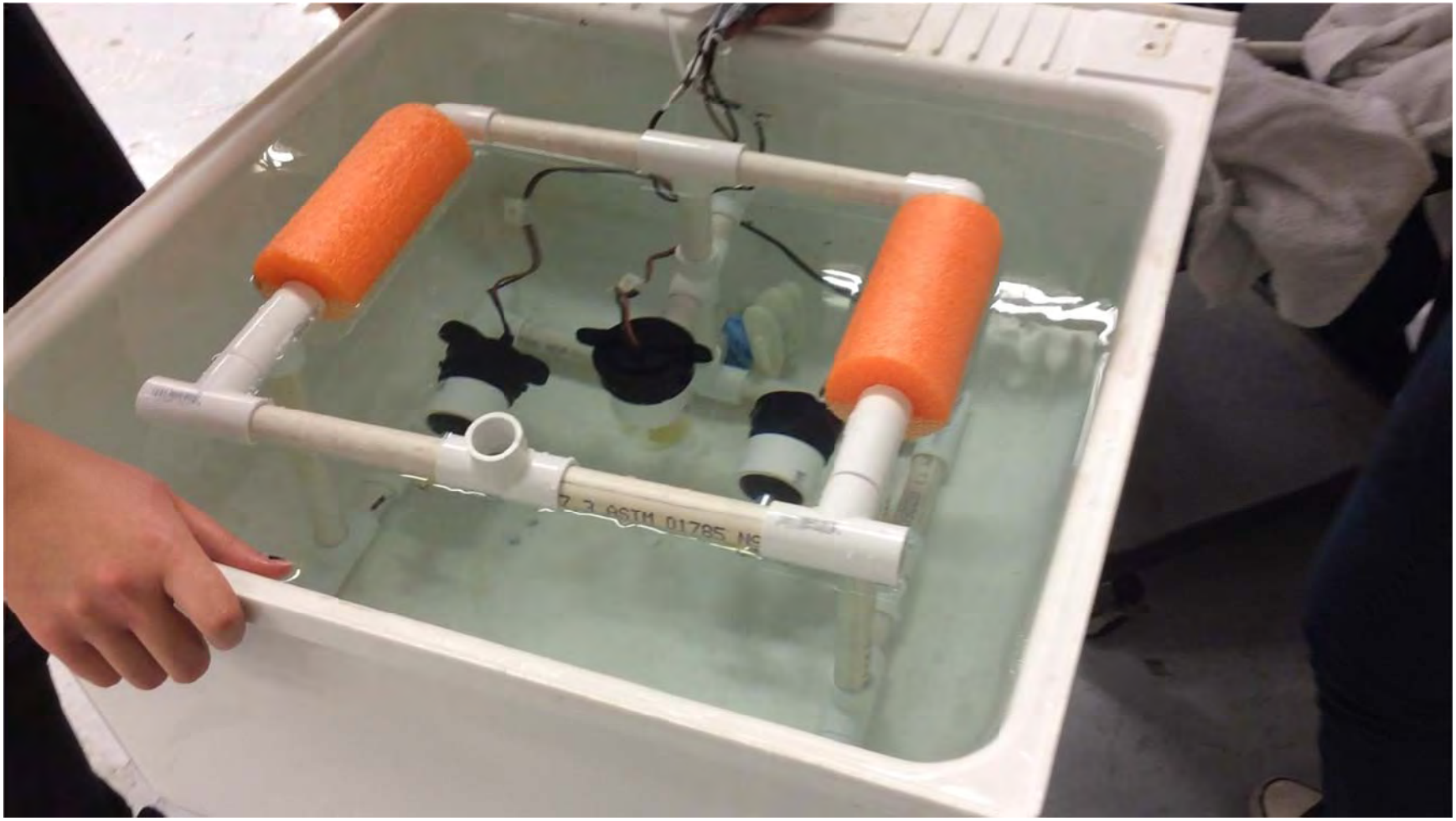
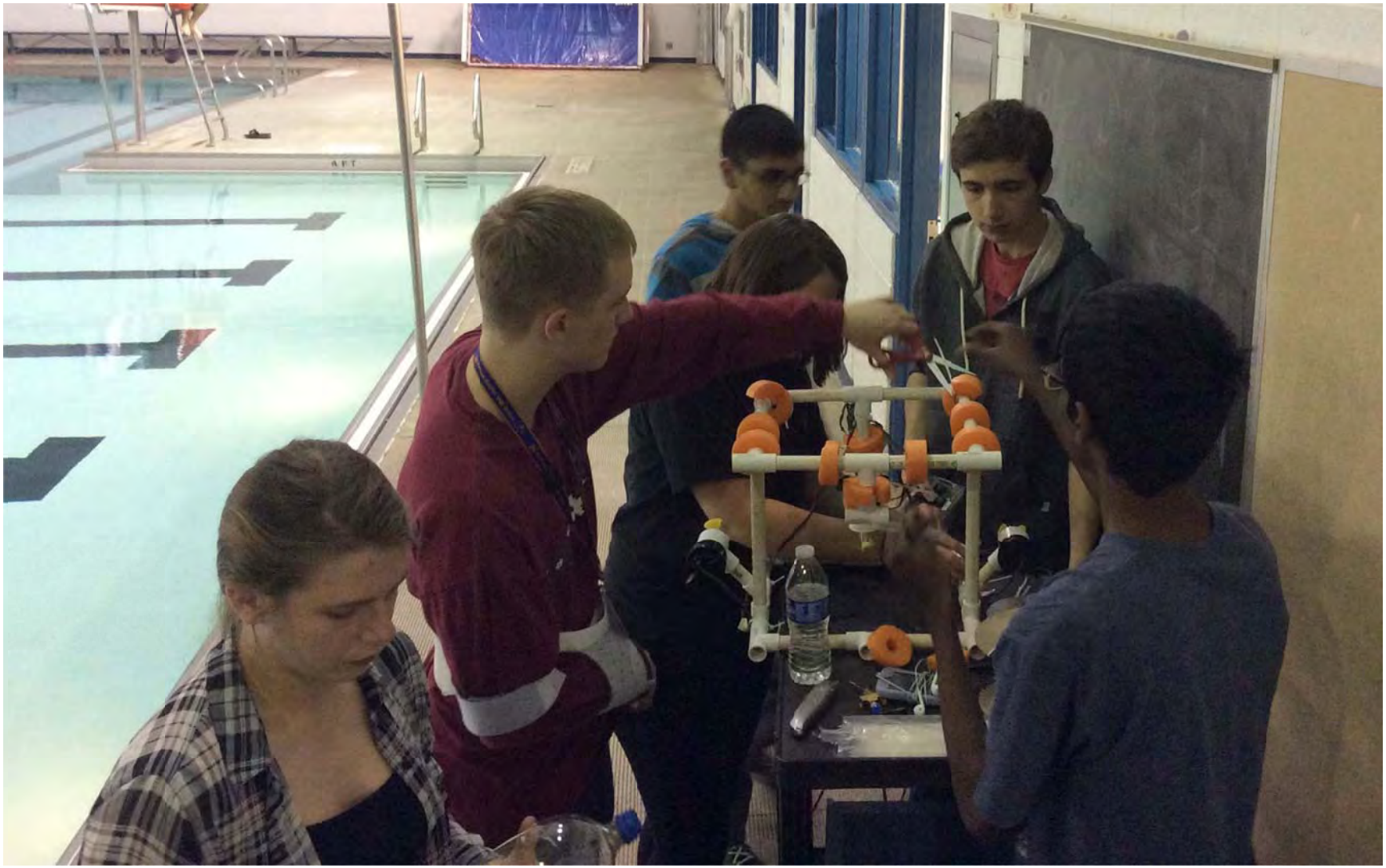


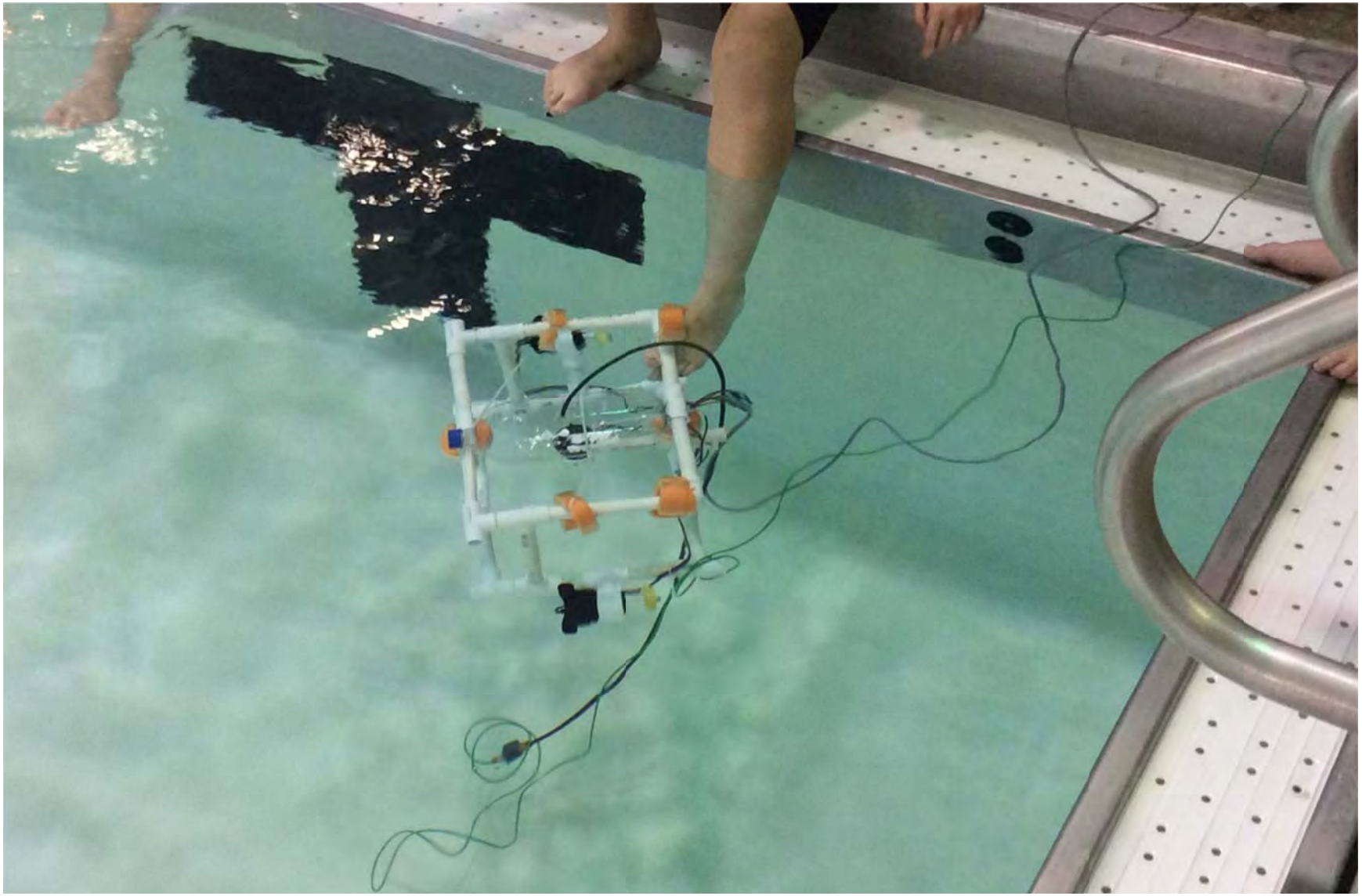
First prototype test in tub.  Designed using the kit provided by the Shedd ROV Club.



Second prototype using pool noodles for buoyancy.

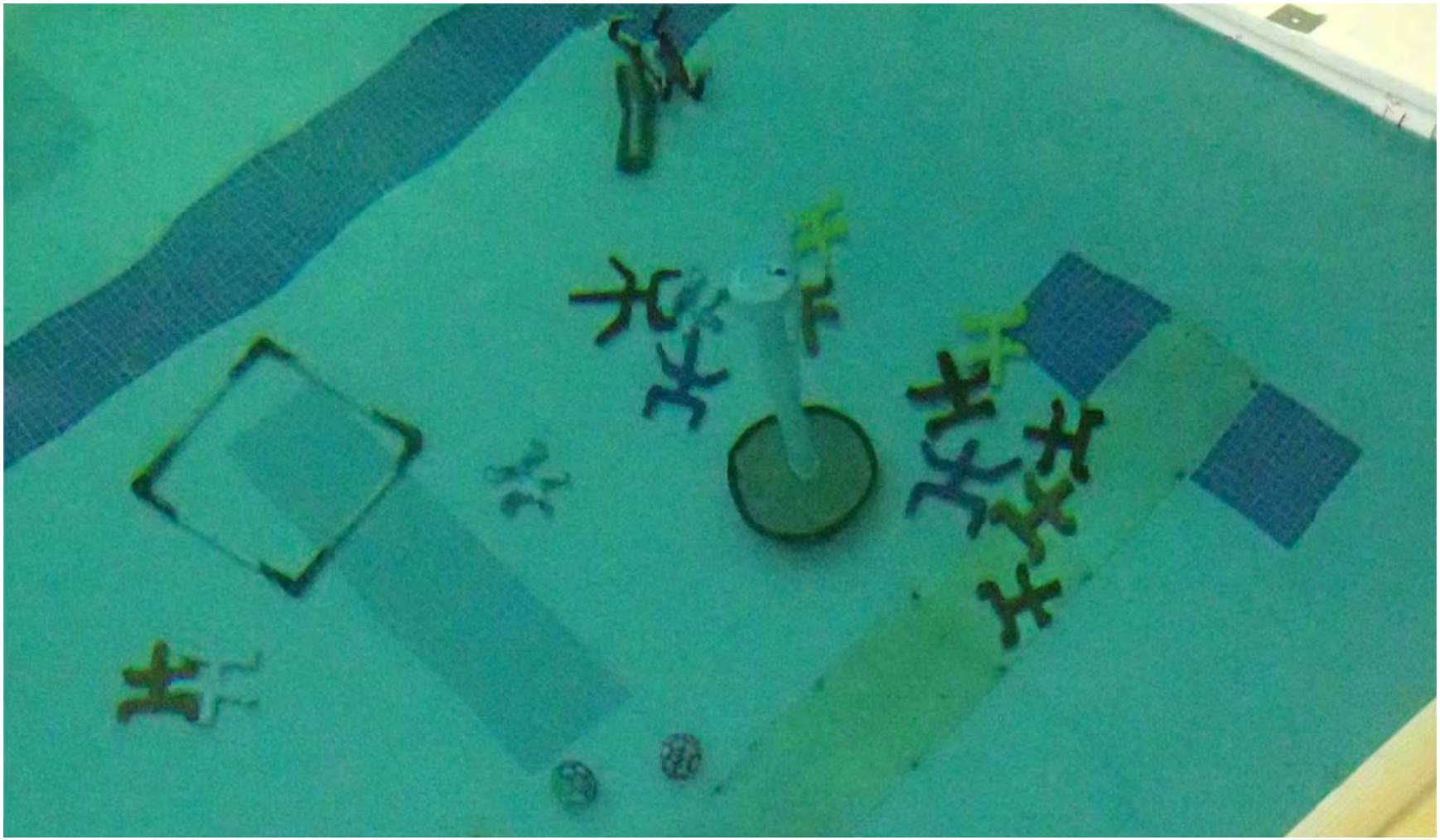


Preparing to test the second PVC design in the pool. The horizontal motors have been turned to the outside of the frame for better control. Buoyancy has been reduced.

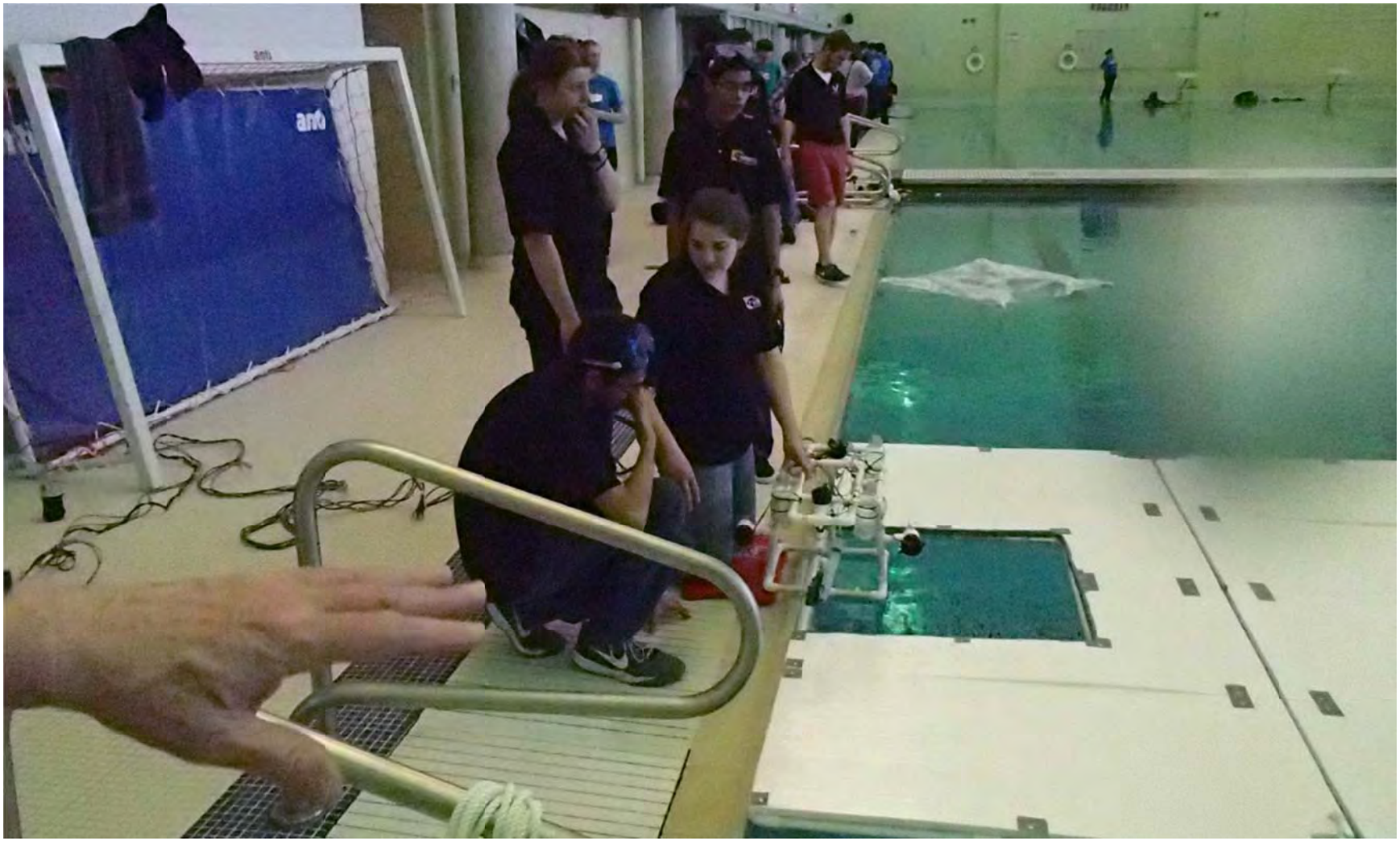


First pool test.

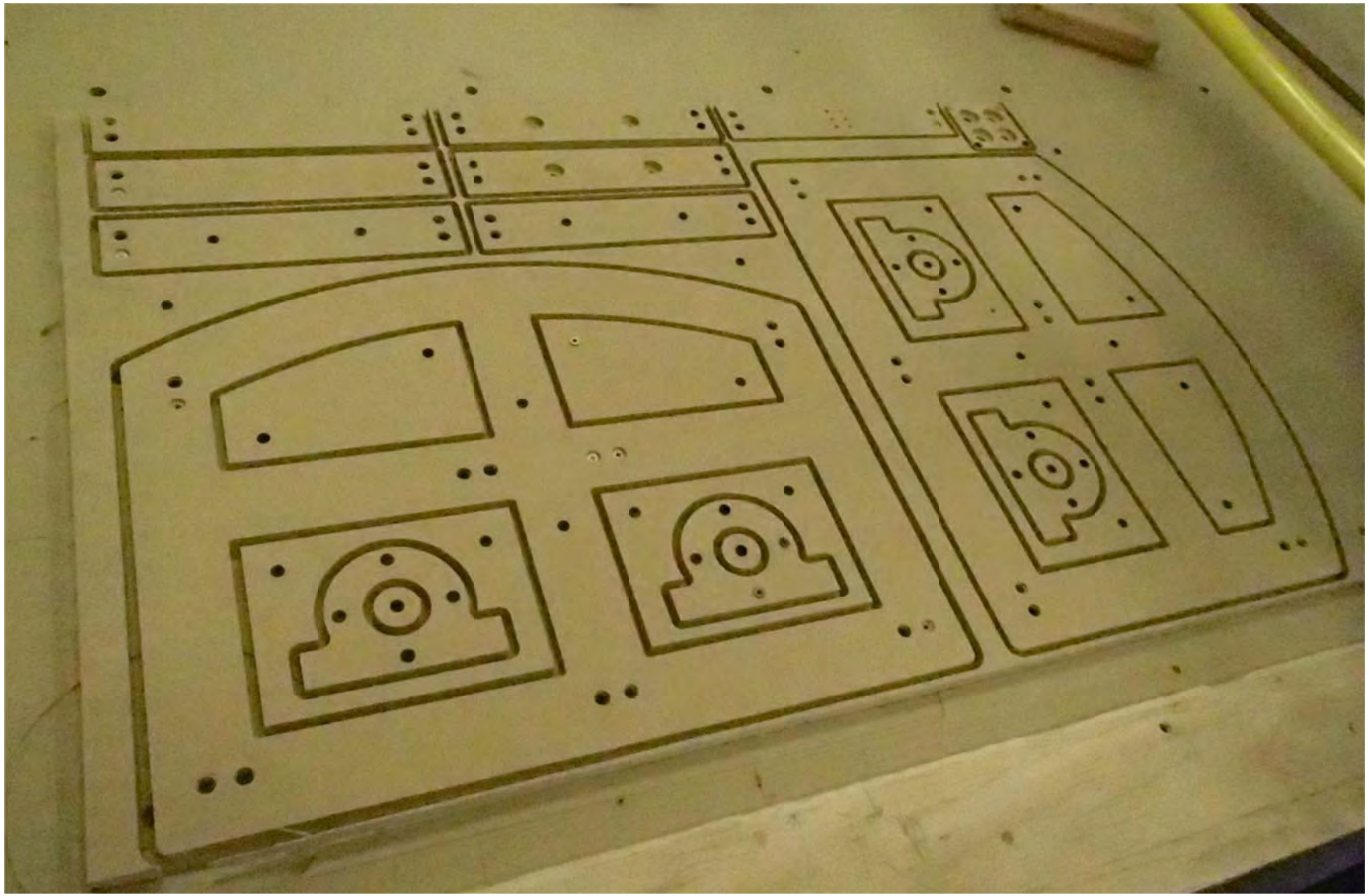
Mock Sales Presentation at the Shedd ROV Club Event. Note the modified frame design – the top is elongated. There are now two vertical motors attached to the top frame at the front and back. Pool noodles have been replaced with plastic bottles. The first version of the claw is attached to the front of the ROV.



Mission tasks at Shedd ROV Club Event – The ROV is supposed to count the “sea stars” on the bottom and identify the quantity of each color, retrieve one of the “sea urchin” O-balls, bring the passive sensor (top center) to the PVC square, remove the cap on the vertical PVC pipe, insert a gasket in the open pipe and replace the cap. The people at the control station may only use camera feeds from the ROV to accomplish these tasks – the students on the deck cannot relay information about what they see.

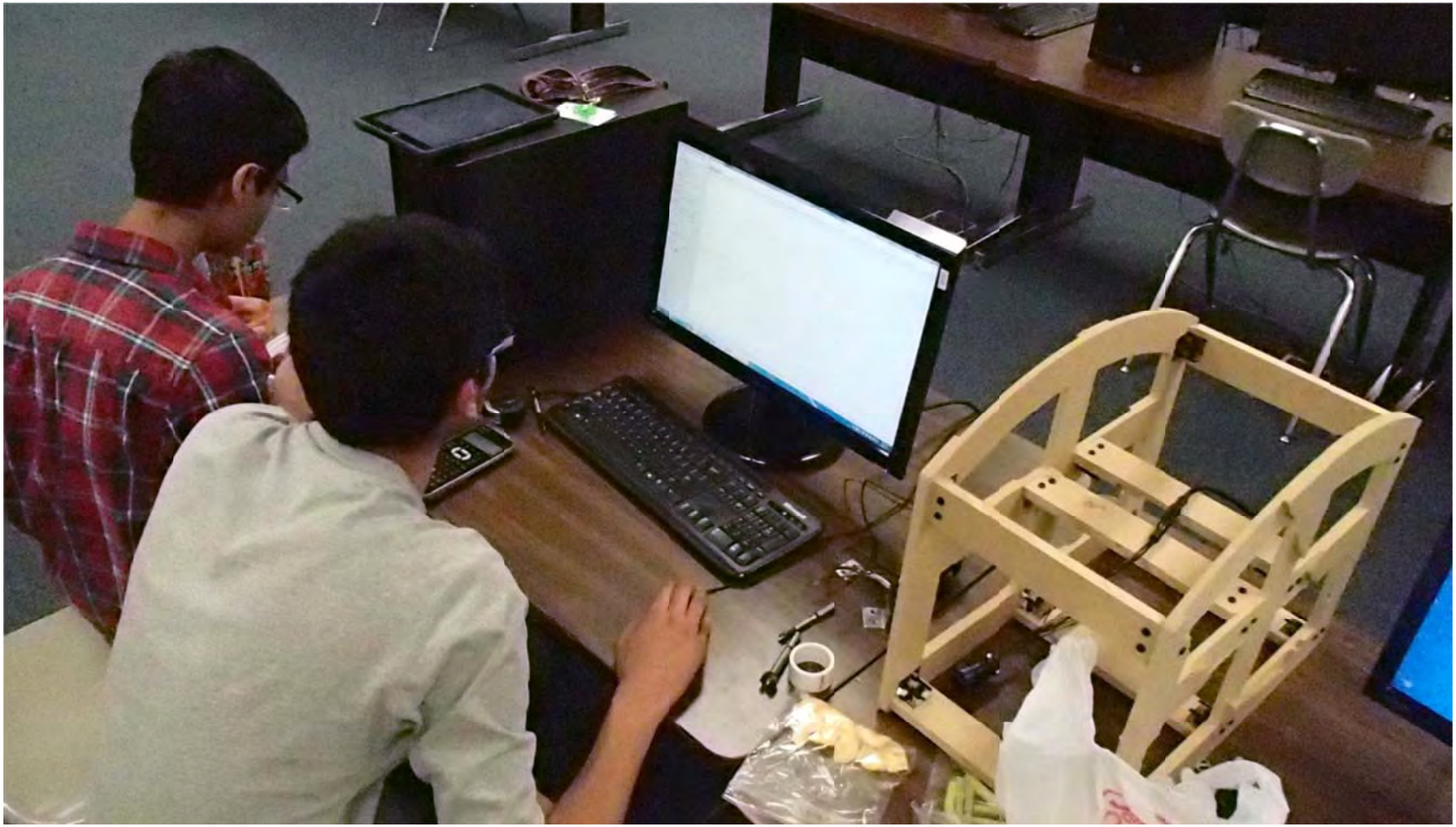


Launching the ROV through the “ice sheet” to complete the tasks shown on Page 6.

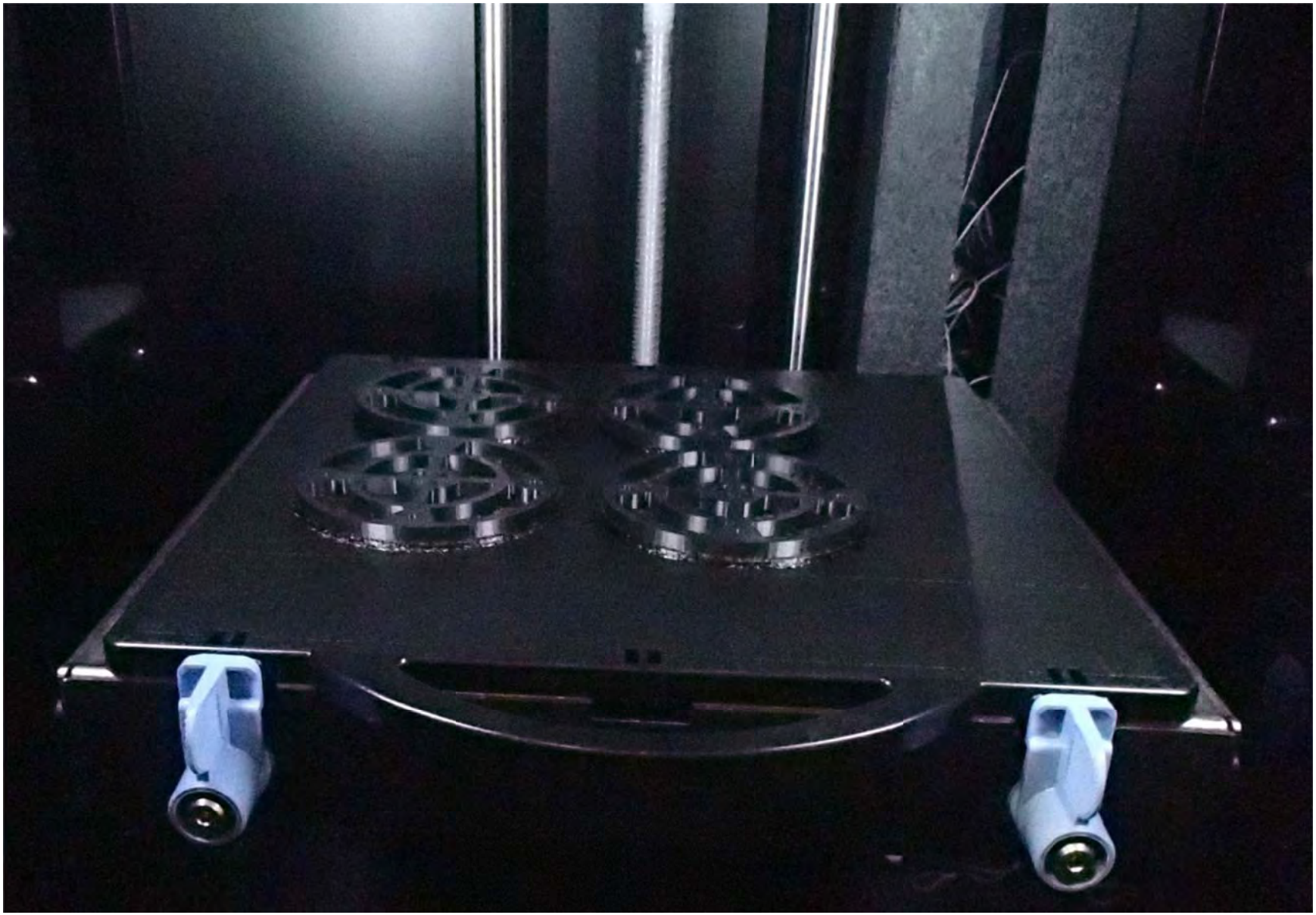


CAD designed prototype parts cut on the ShopBot.

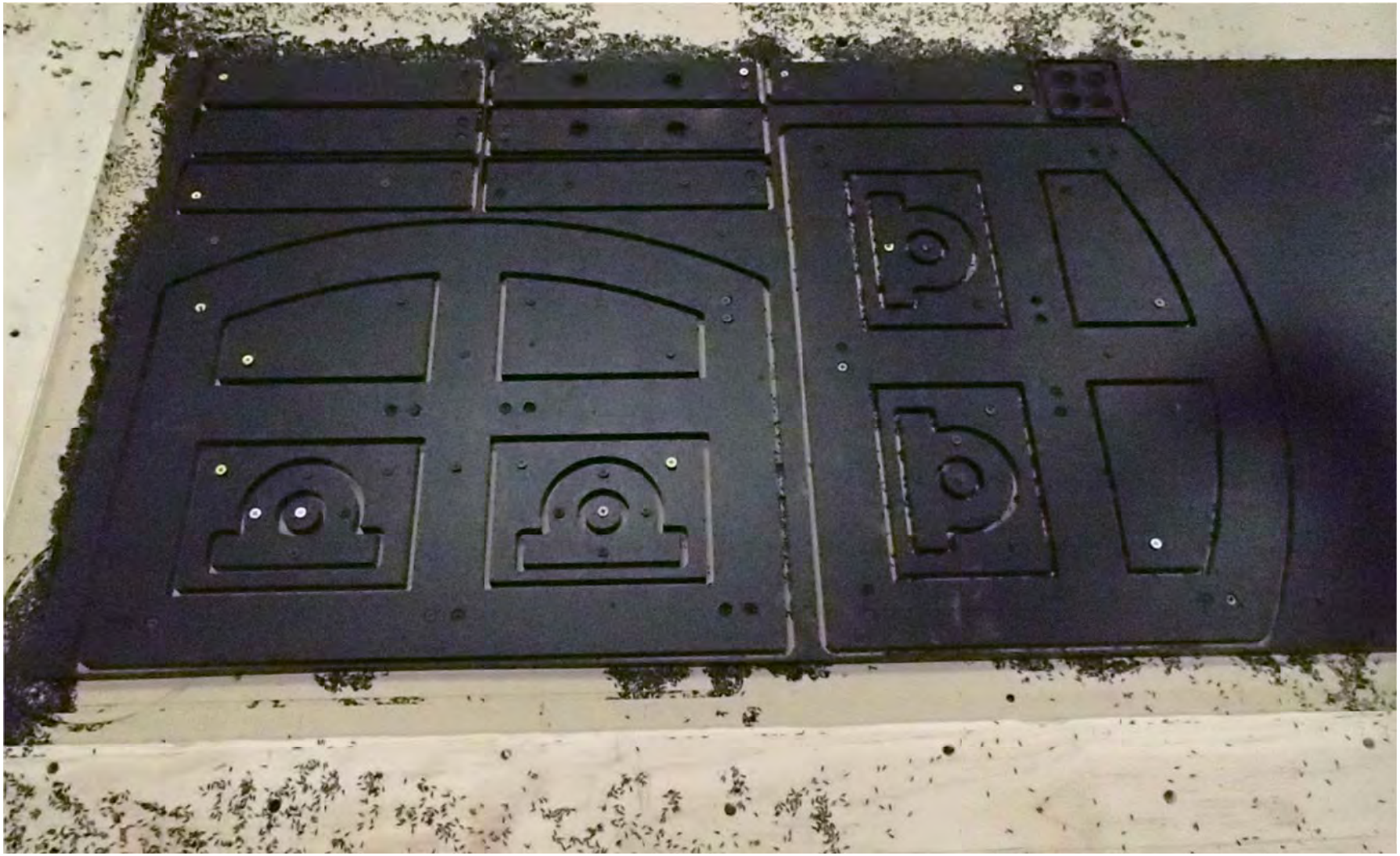
Removing the prototype parts.



Assembled MDF prototype of new frame design prior to cutting HDPE.

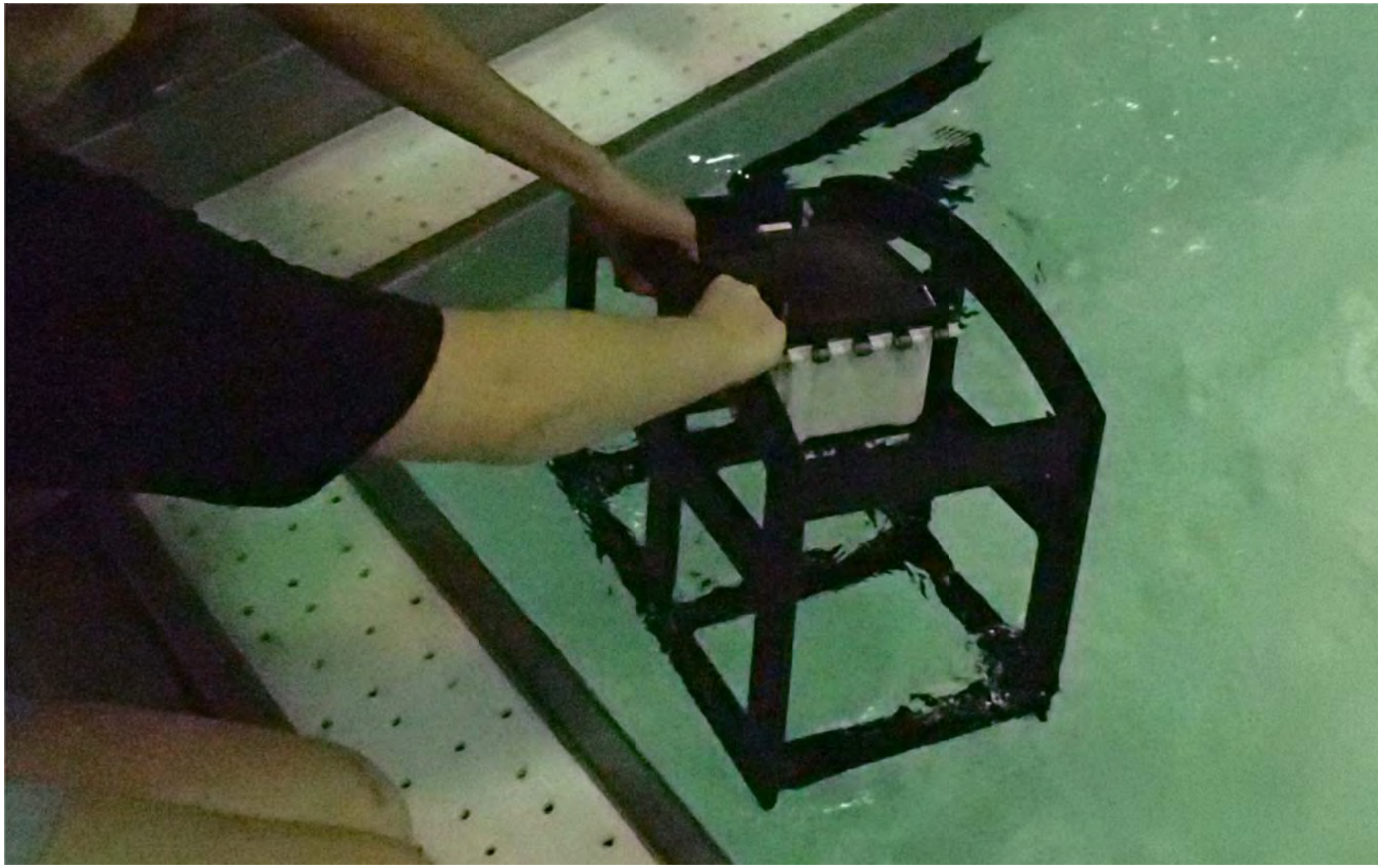


CAD designed propeller shrouds being 3D Printed.

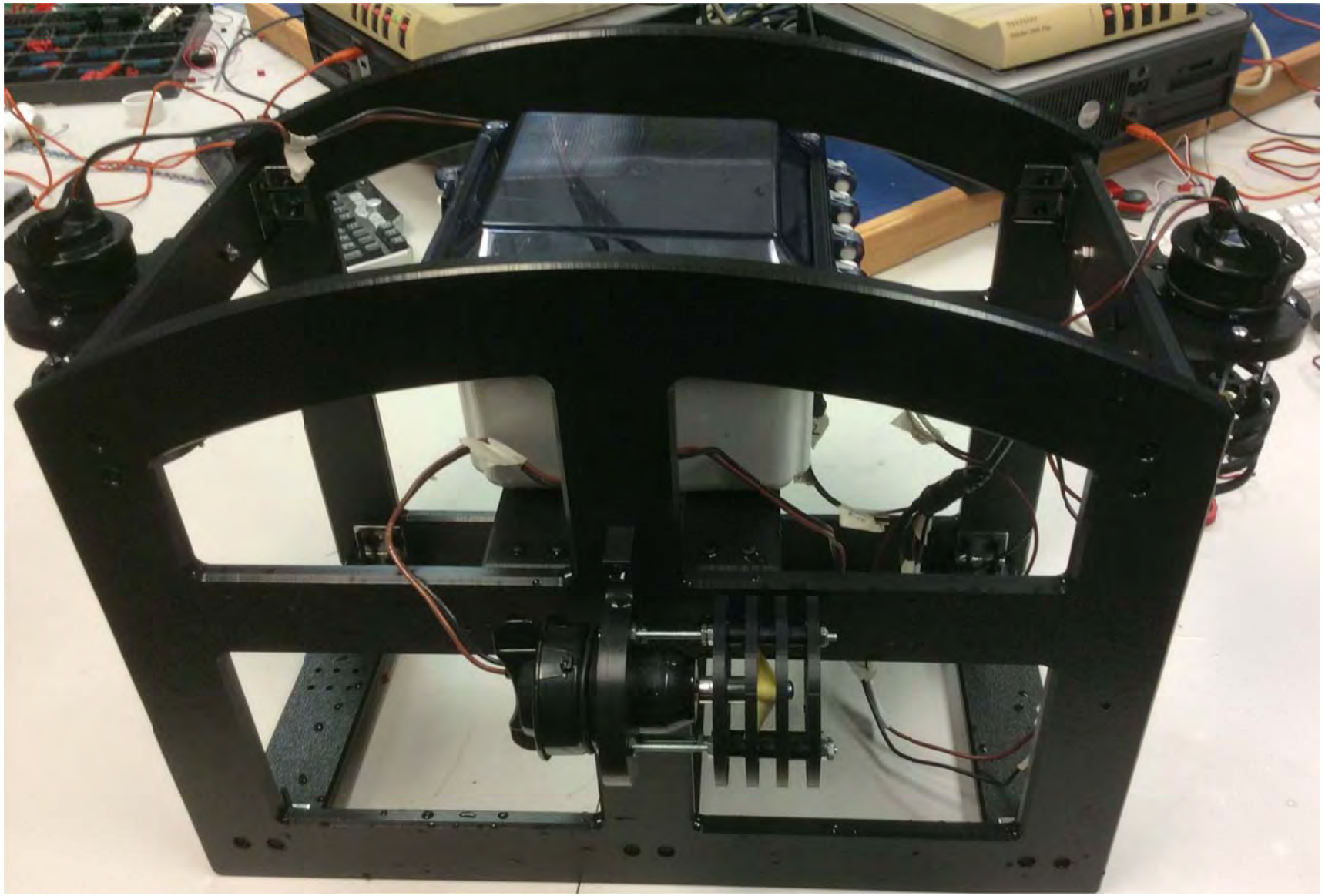


HDPE parts cut on the ShopBot.

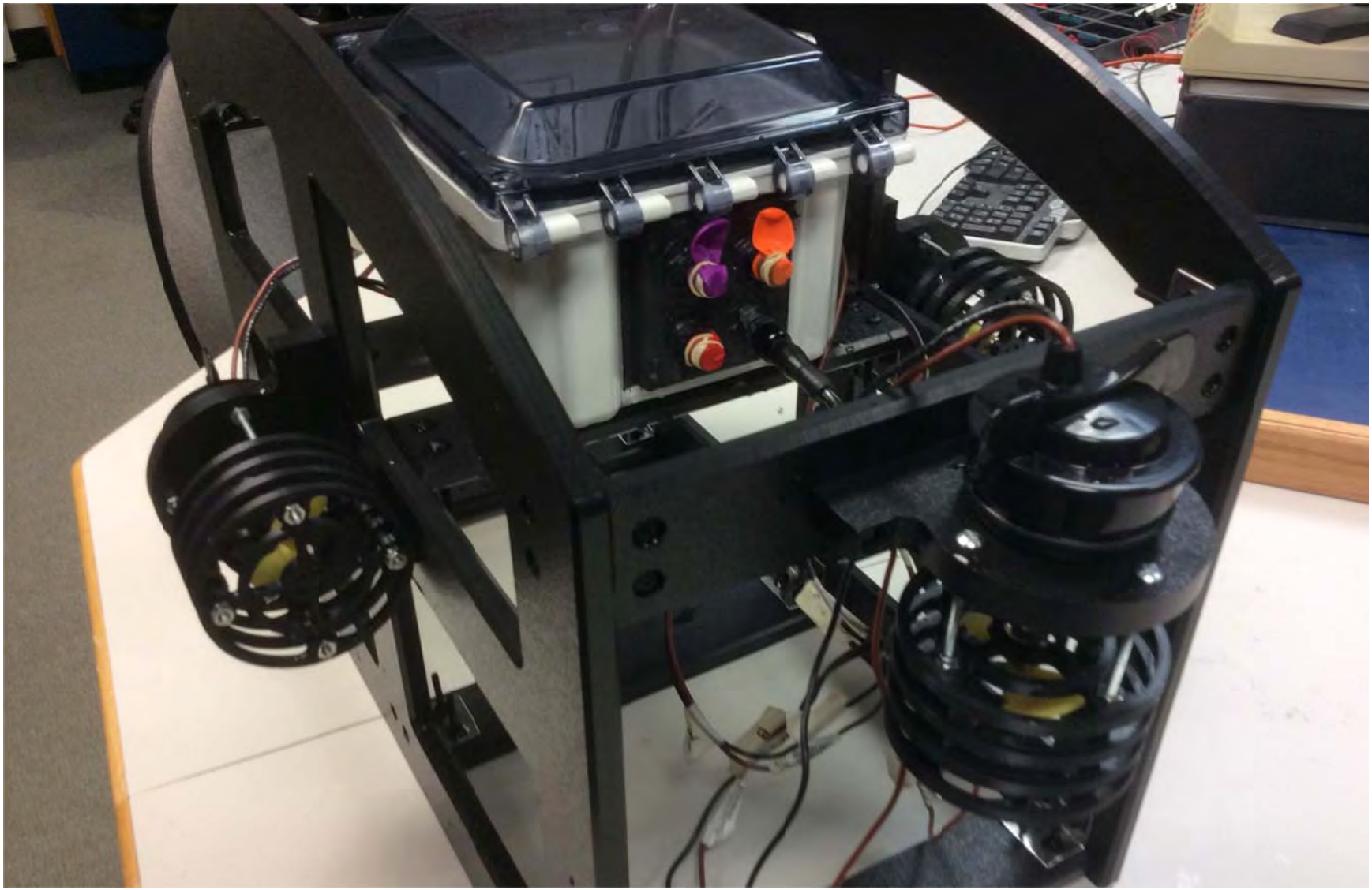
Edge finishing HDPE parts on table router.



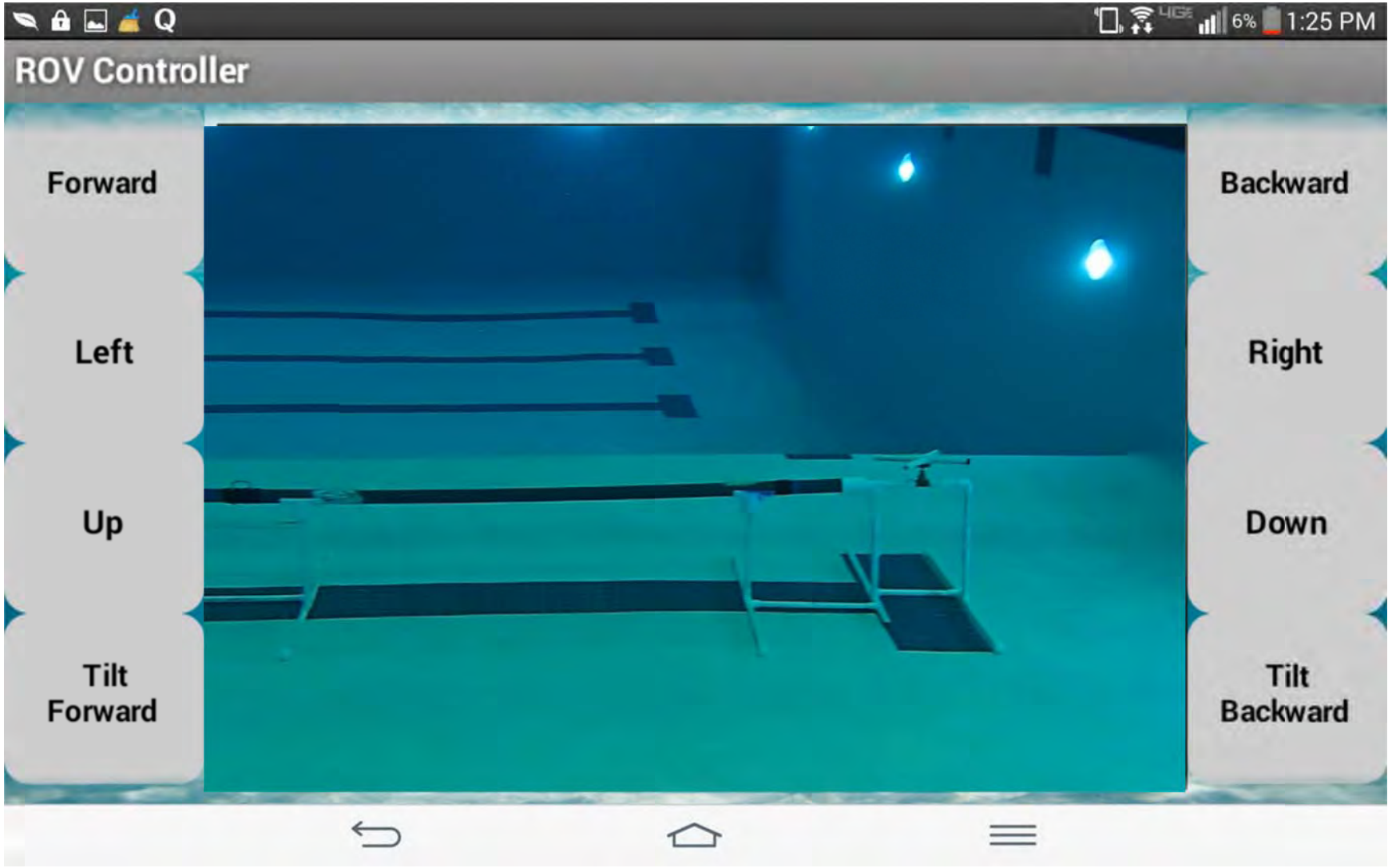
Buoyancy test of HDPE frame with Attabox waterproof enclosure.



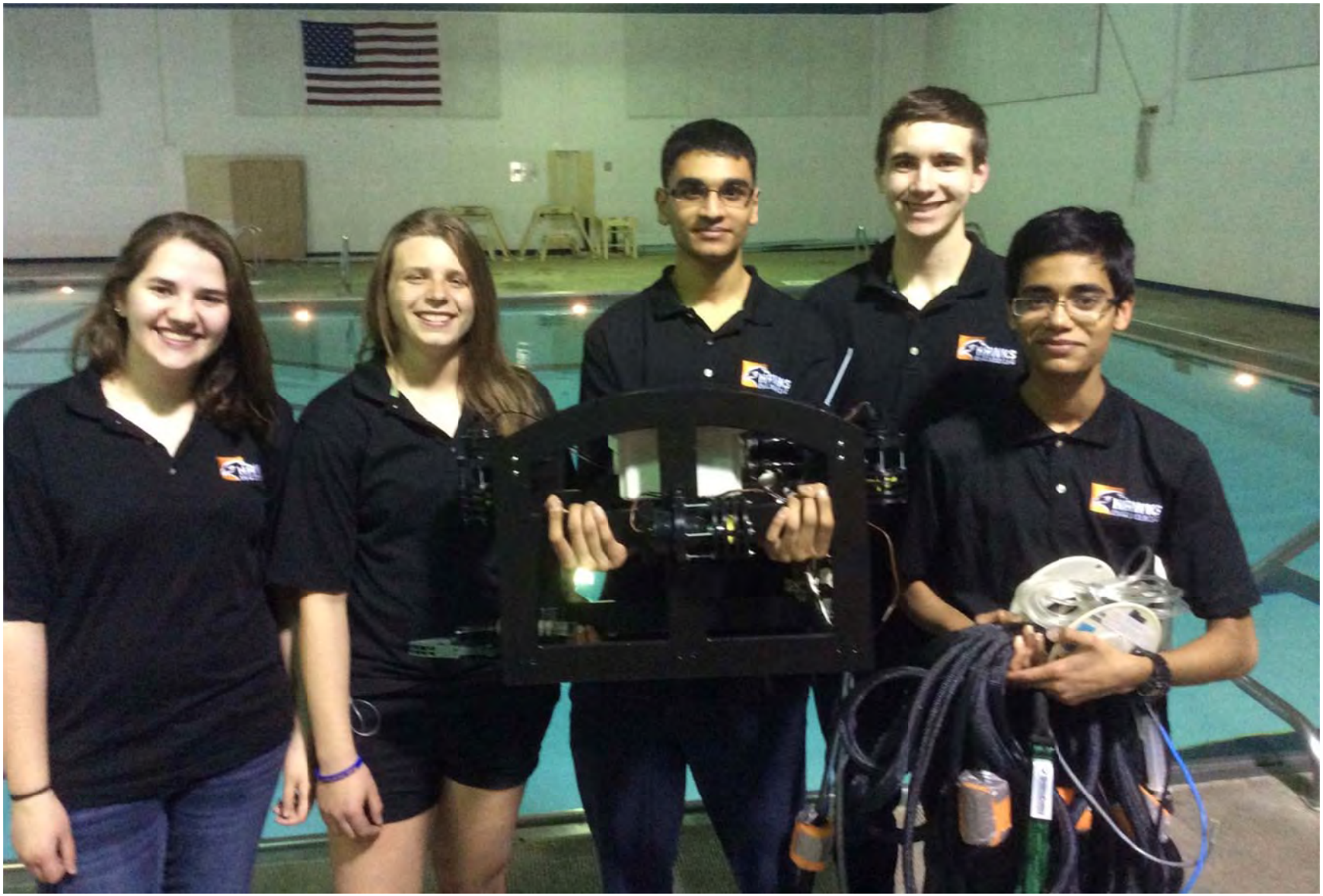
Assembled ROV with motors, shrouds and waterproof Attabox enclosure. The enclosure was intended to house most of the control system in order to reduce the number of wires running through the tether to the control station.



Another view of the assembled ROV. The balloons are covering the contact pins of the waterproof wire connectors. Unfortunately, the connectors failed at a depth of 12 feet. Much time was spent trying to fix the problem. The solution was to relocate all electronics to the surface and only use the box for buoyancy. The tether was then permanently attached to the motors and cameras.

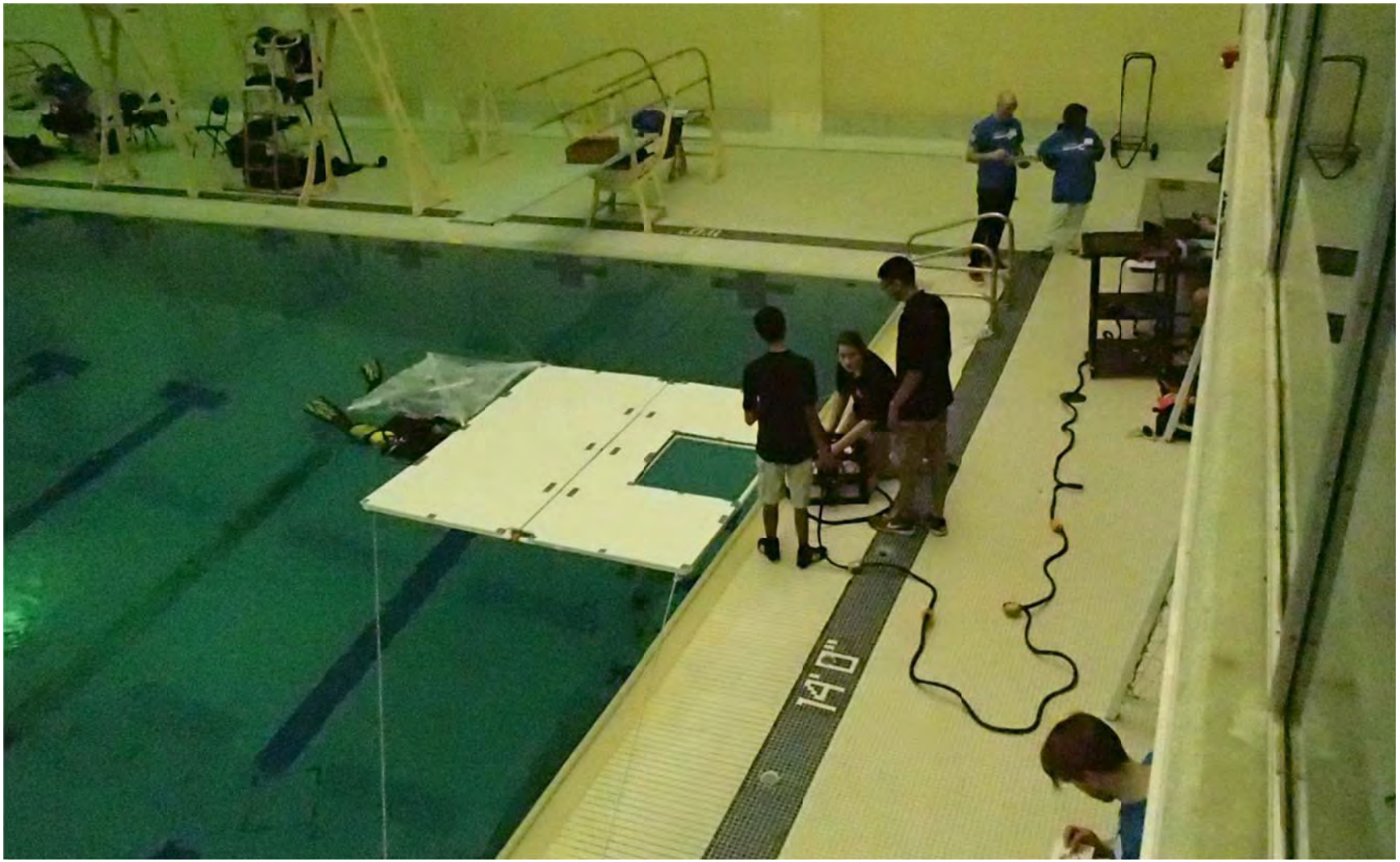



Screen shot of the first control app for the Android compatible tablet. The camera image is simulated. The Android operating system allowed for customization of the app that was not feasible using Apple products without being a Developer.

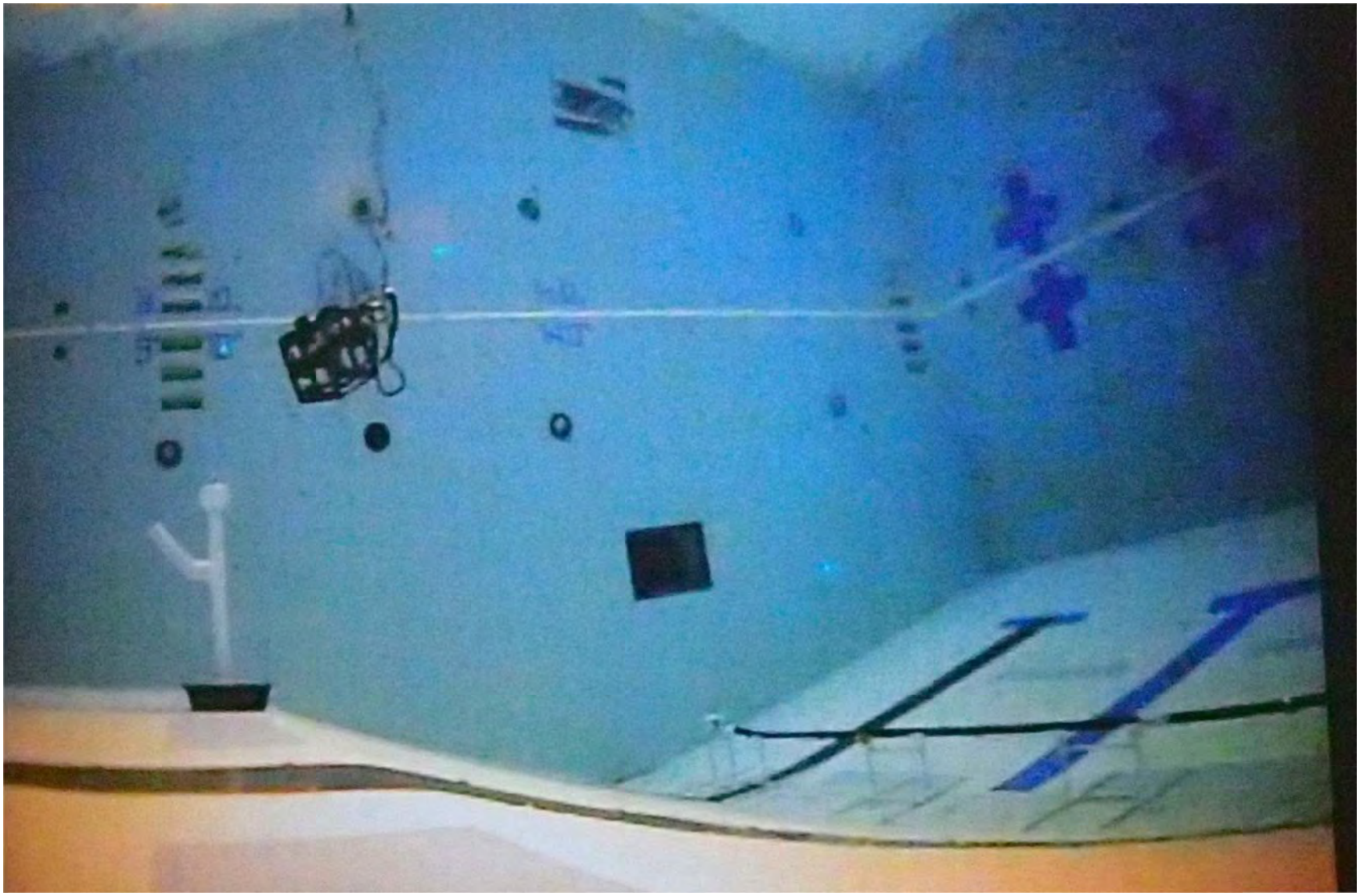


Grace, Laura, Dillon, Thomas and Miraj before the Shedd Regional Competition.

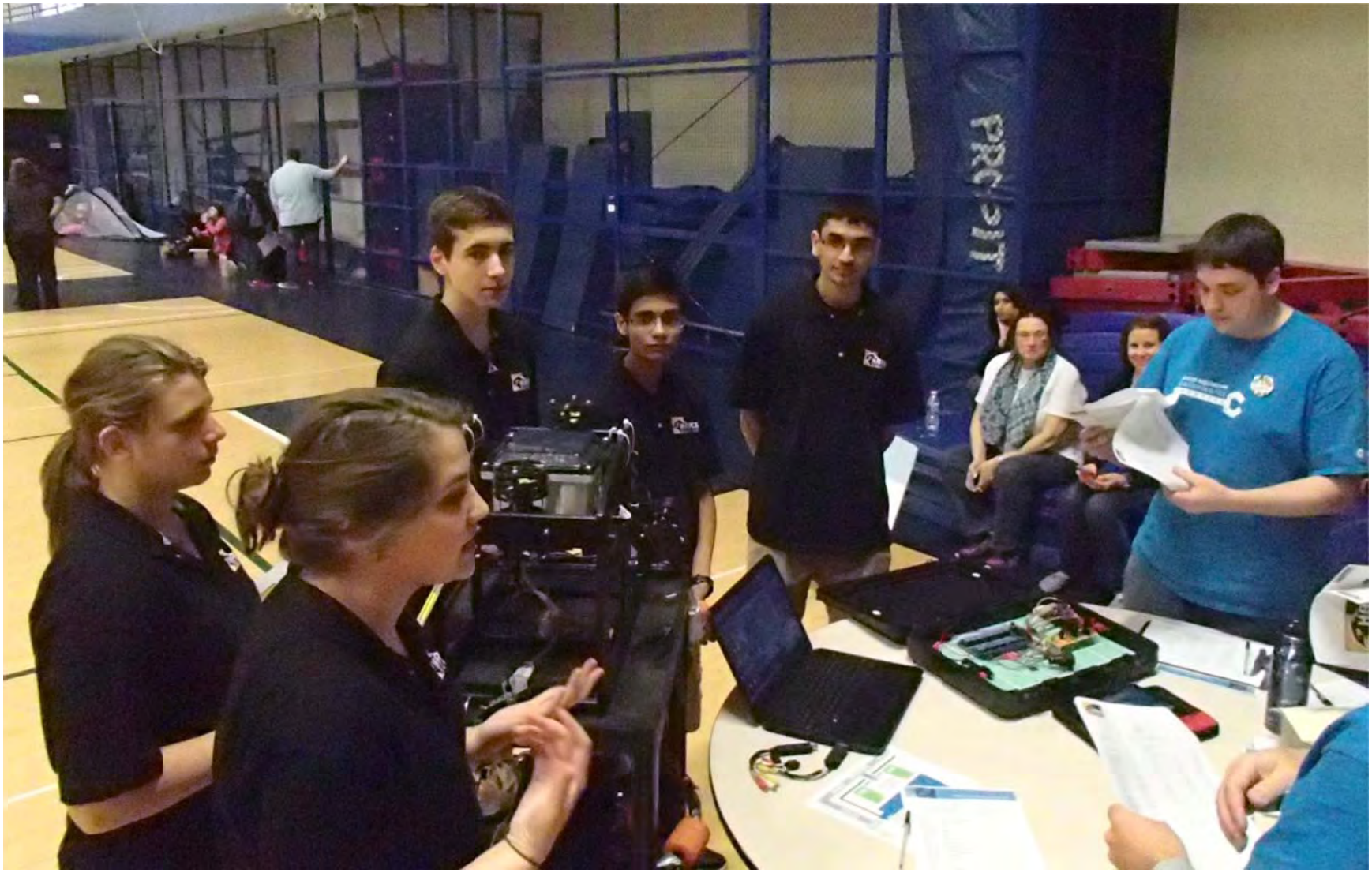

Safety inspection at the Shedd Midwest Regional Competition.



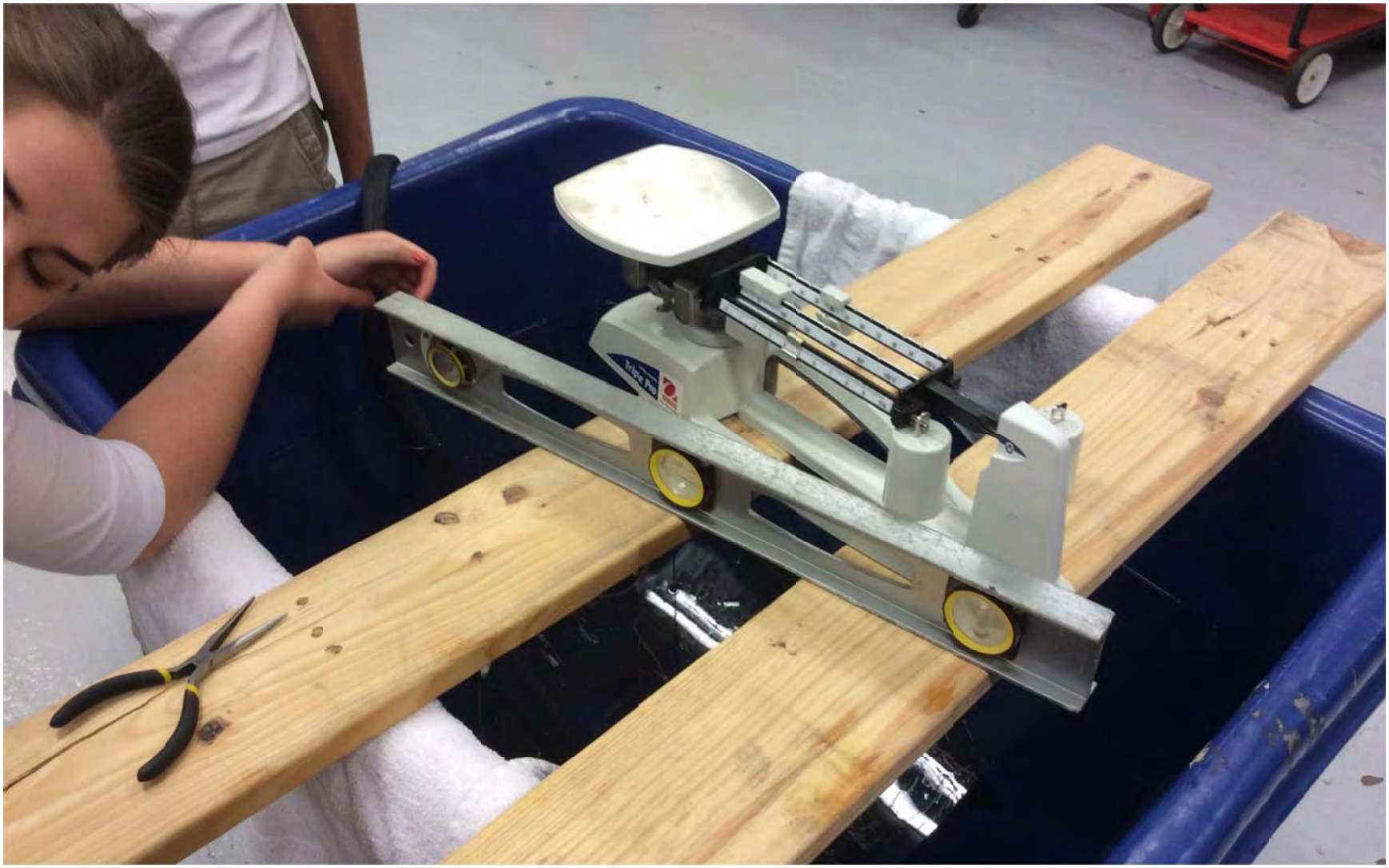

Preparing to launch. Dillon, Miraj and Grace by “ice sheet” while Thomas and Laura are out of view at the control station to the right of the black cart.



Underwater camera view of ROV heading toward PVC wellhead on the second mission of the day. The bottom right shows part of the underwater pipeline inspection and repair mission.

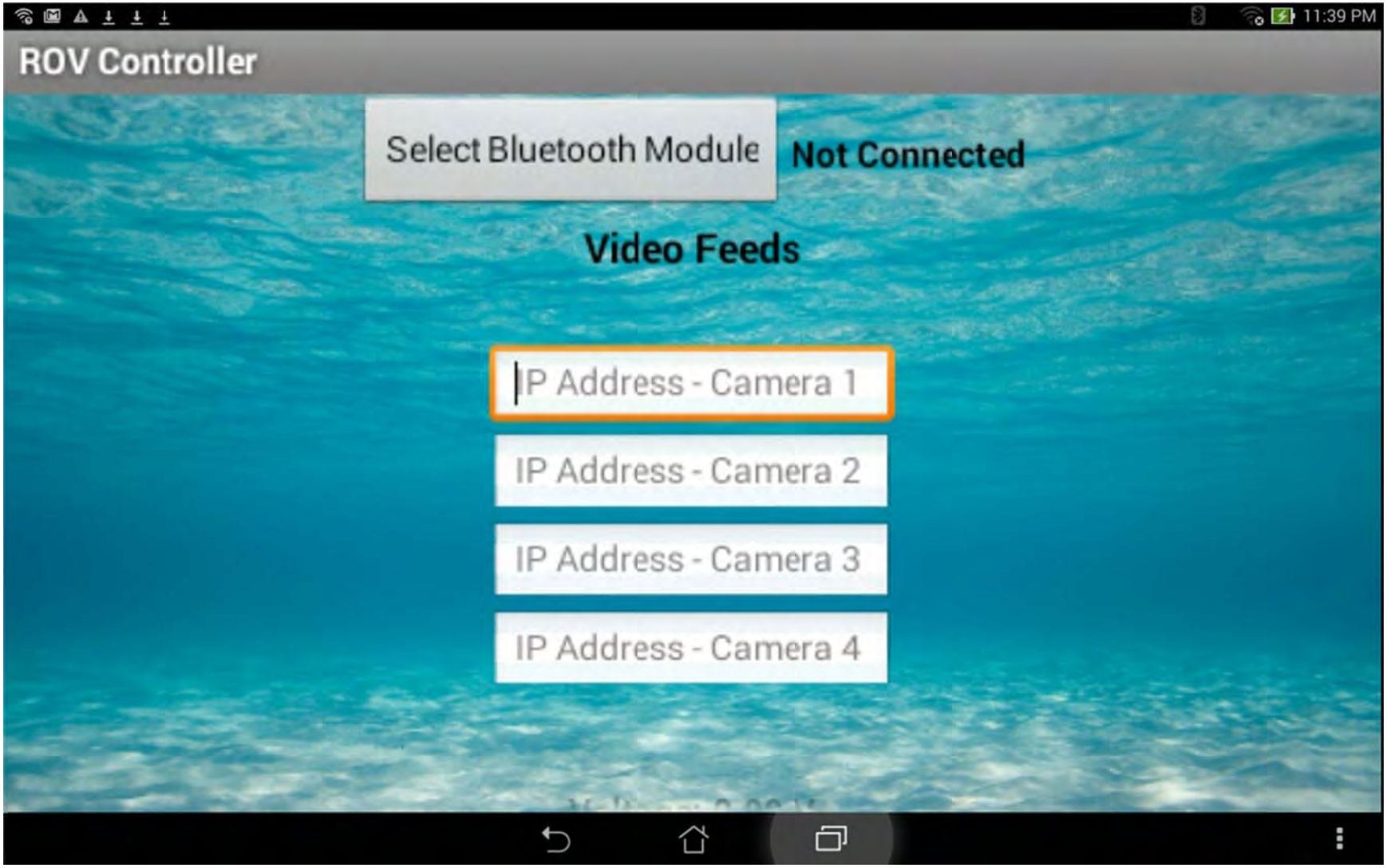


Sales presentation at the Shedd Midwest Regional. The laptop is used to send video to the tablet via a Wi-Fi connection. The black case on the table is the Arduino based control system.

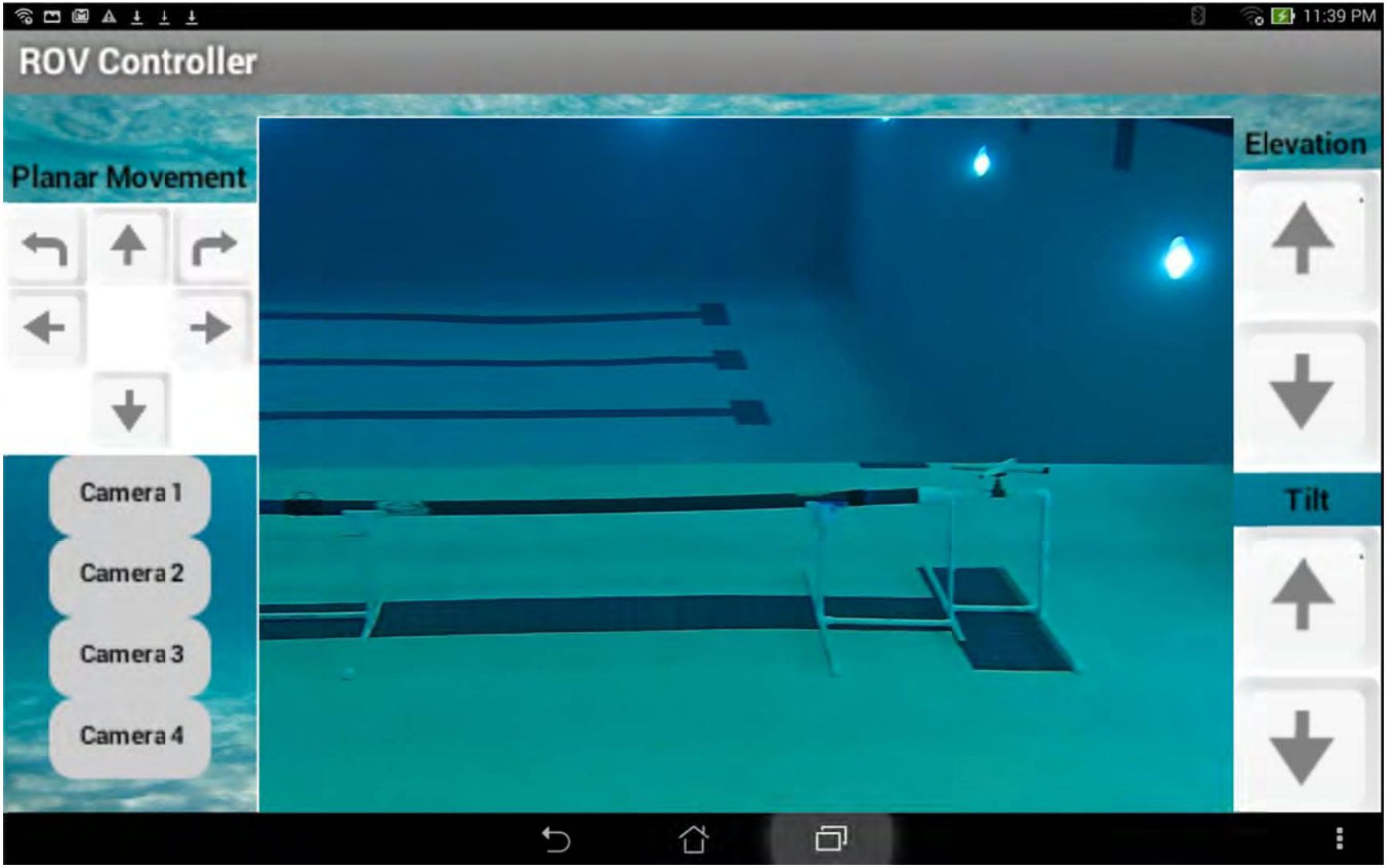


Measuring the weight of the final version of the ROV in water. The ROV is attached to the balance and submerged in the water. The ROV weighs approximately 18 pounds out of the water and approximately 3 pounds in the water. The original goal was to create a ROV that is slightly positively buoyant to float to the surface in the event of a system failure. With the tether attached the ROV ended up being neutrally buoyant in fresh water.

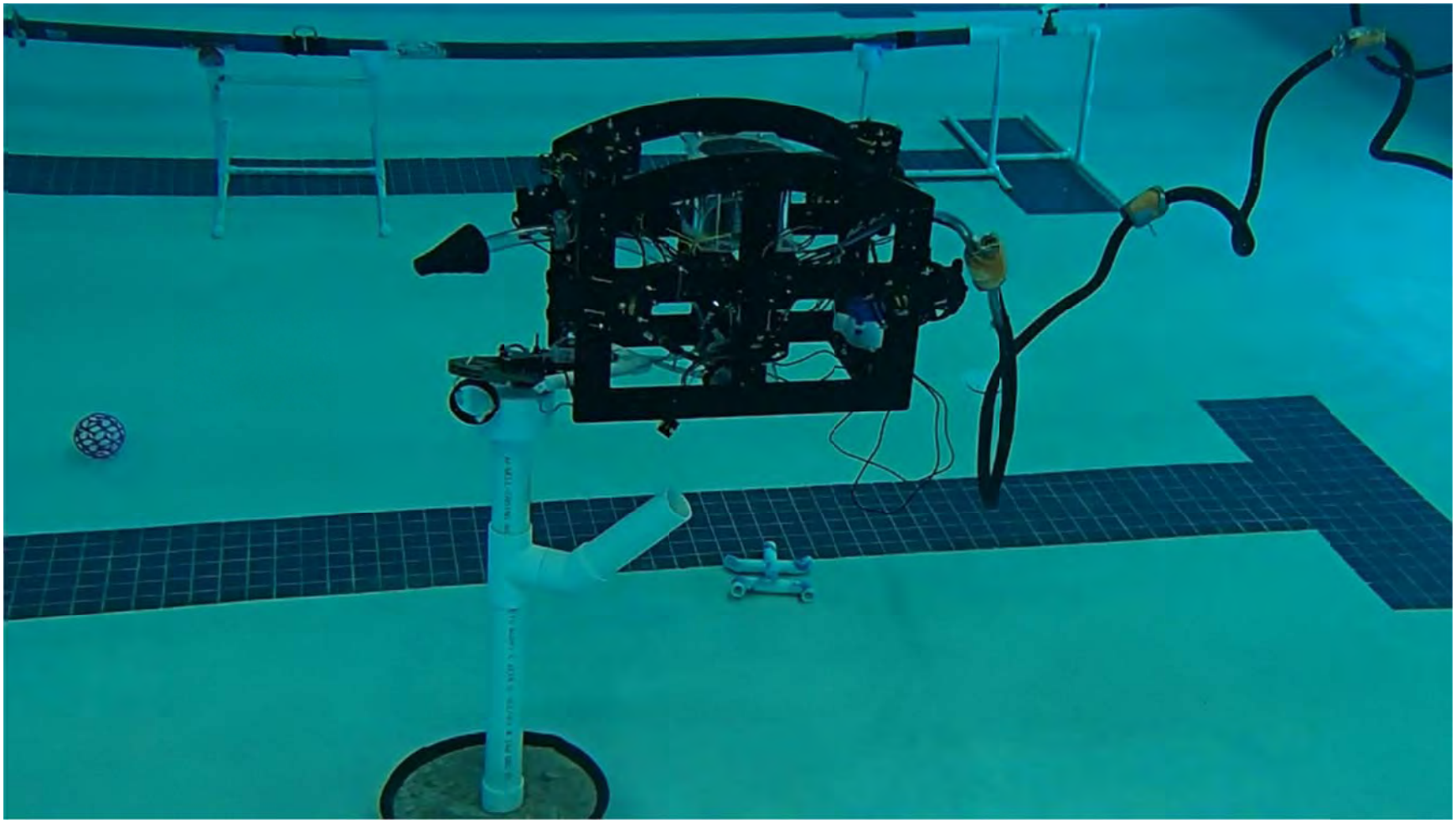
Final version of the ROV. The Attabox has been replaced by a custom acrylic tank for buoyancy. The four horizontal motors are mounted at the corners and angled. The motor mounts have slots cut into them to increase thrust force.



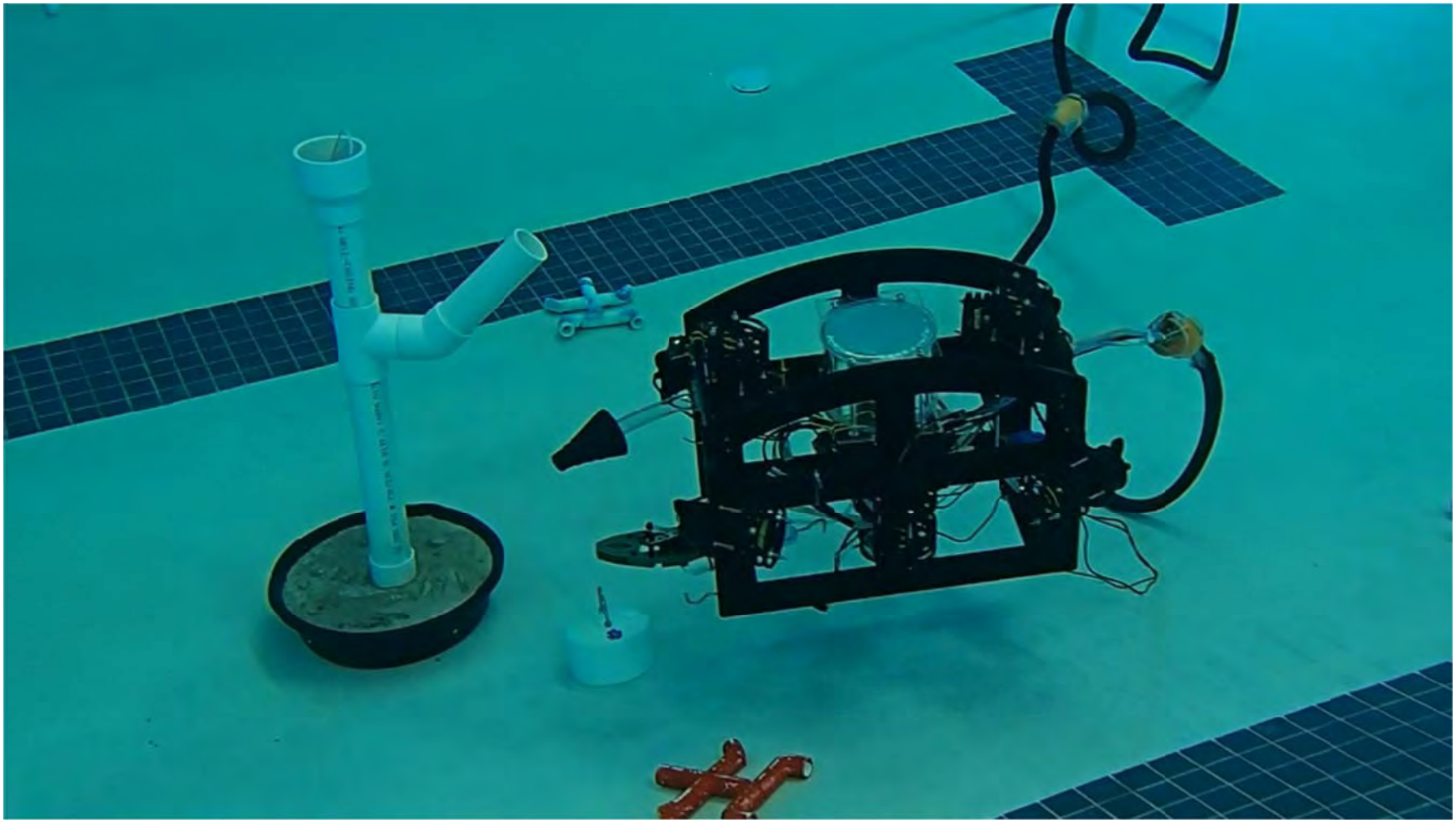

Screenshot of the setup screen for the second version of the control app. Four camera feeds are available through the Wi-Fi connection to the laptop.



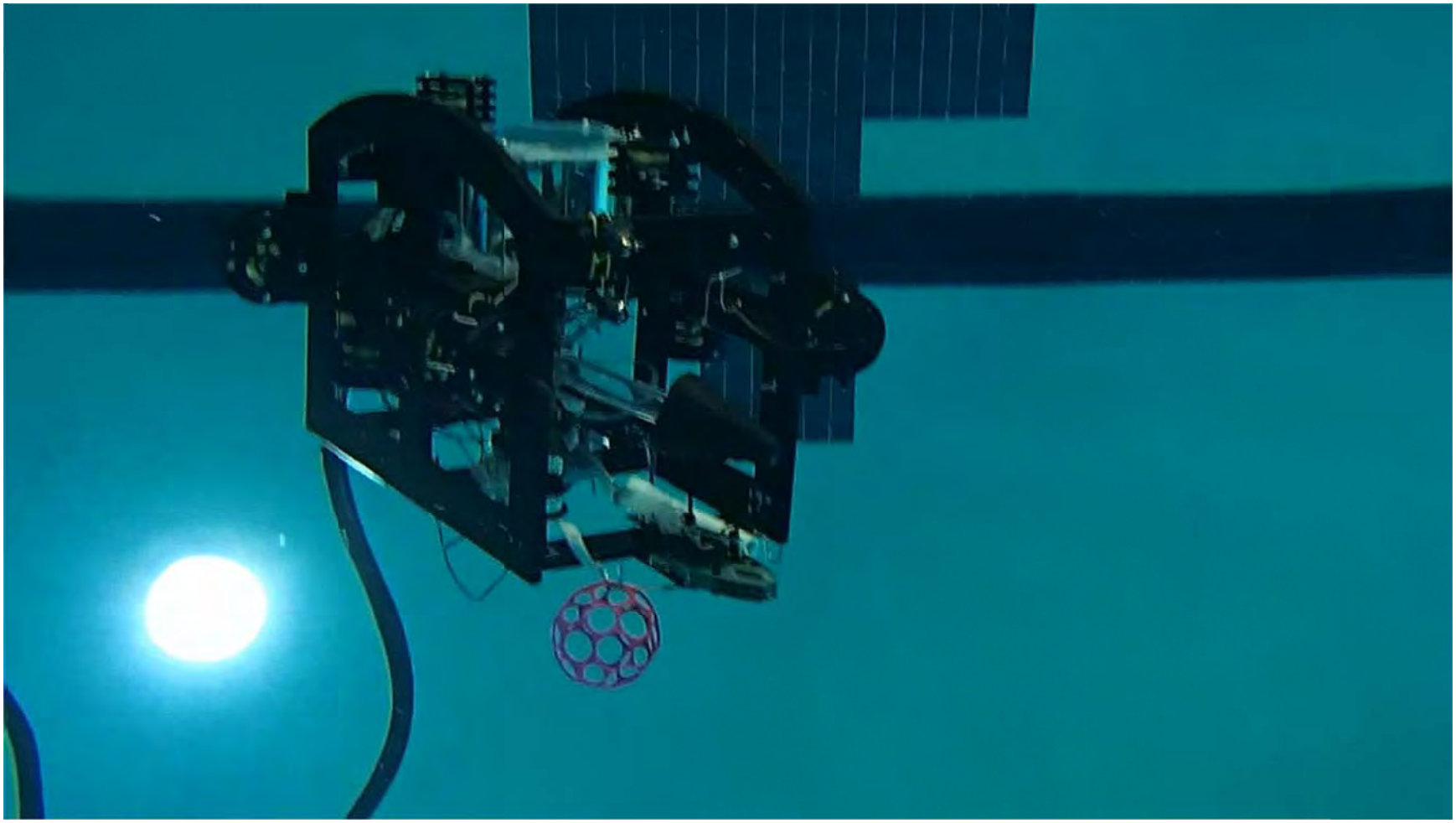

Screenshot of the second version of the control app. The camera image is simulated. This version includes the ability to select different camera views as well as rotate right and left.



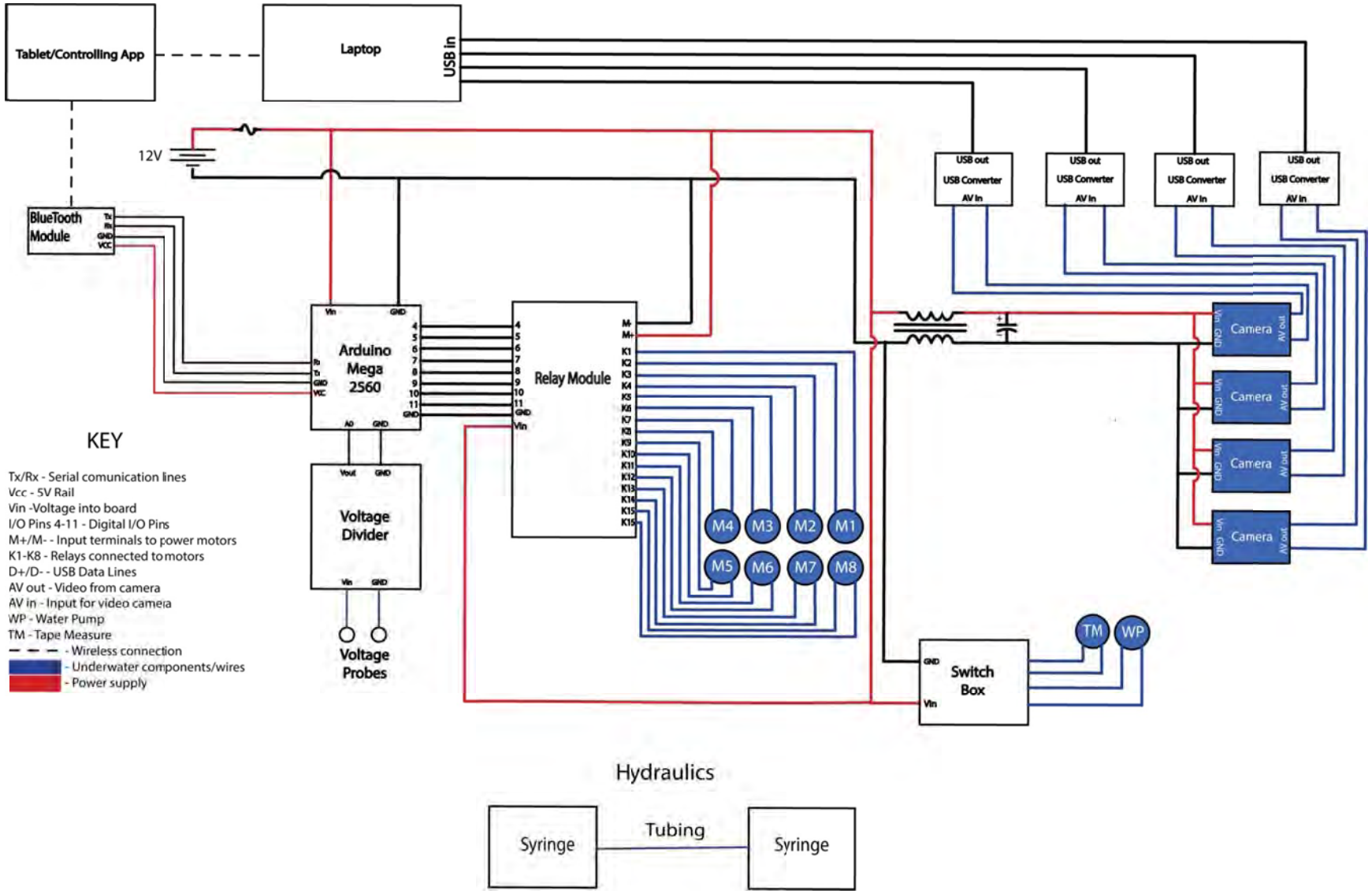
Last day of practice at Conant. The ROV prepares to remove the cap from the top of the well head. The claw holds the gasket to be inserted in the well head.



The hydraulic claw prepares to pick up the well cap. The cone shaped object is a flanged tube designed to push water through the pipeline in the Flume Tank. There is also a hook shown just below the claw. The plan is to remove the cap with the hook, insert the gasket from the claw and replace the cap.



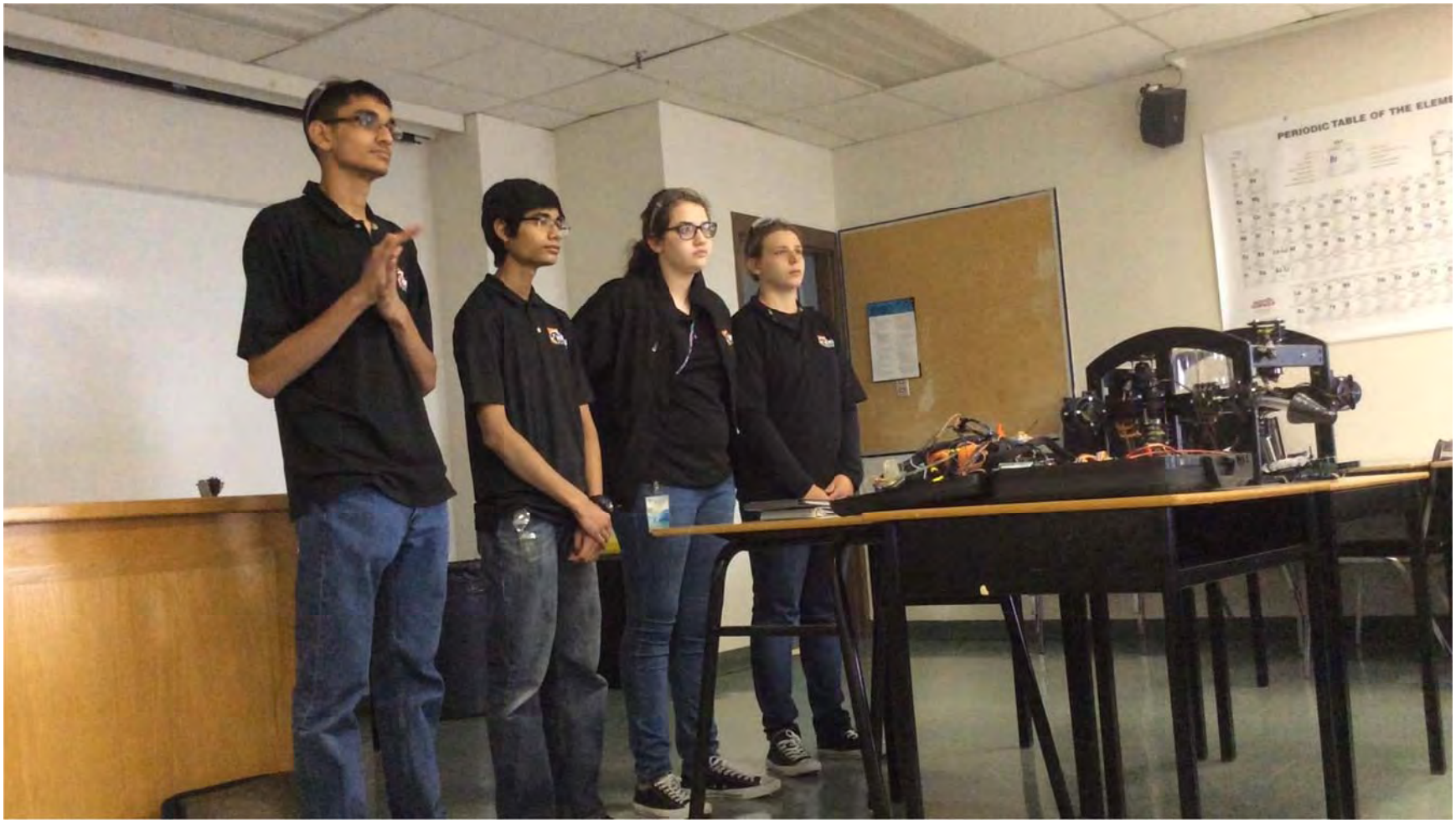
Retrieving the “sea urchin” O-ball on the hook.




Systems Integration Diagram


Laura, Grace, Dillon and Miraj before the International Competition.

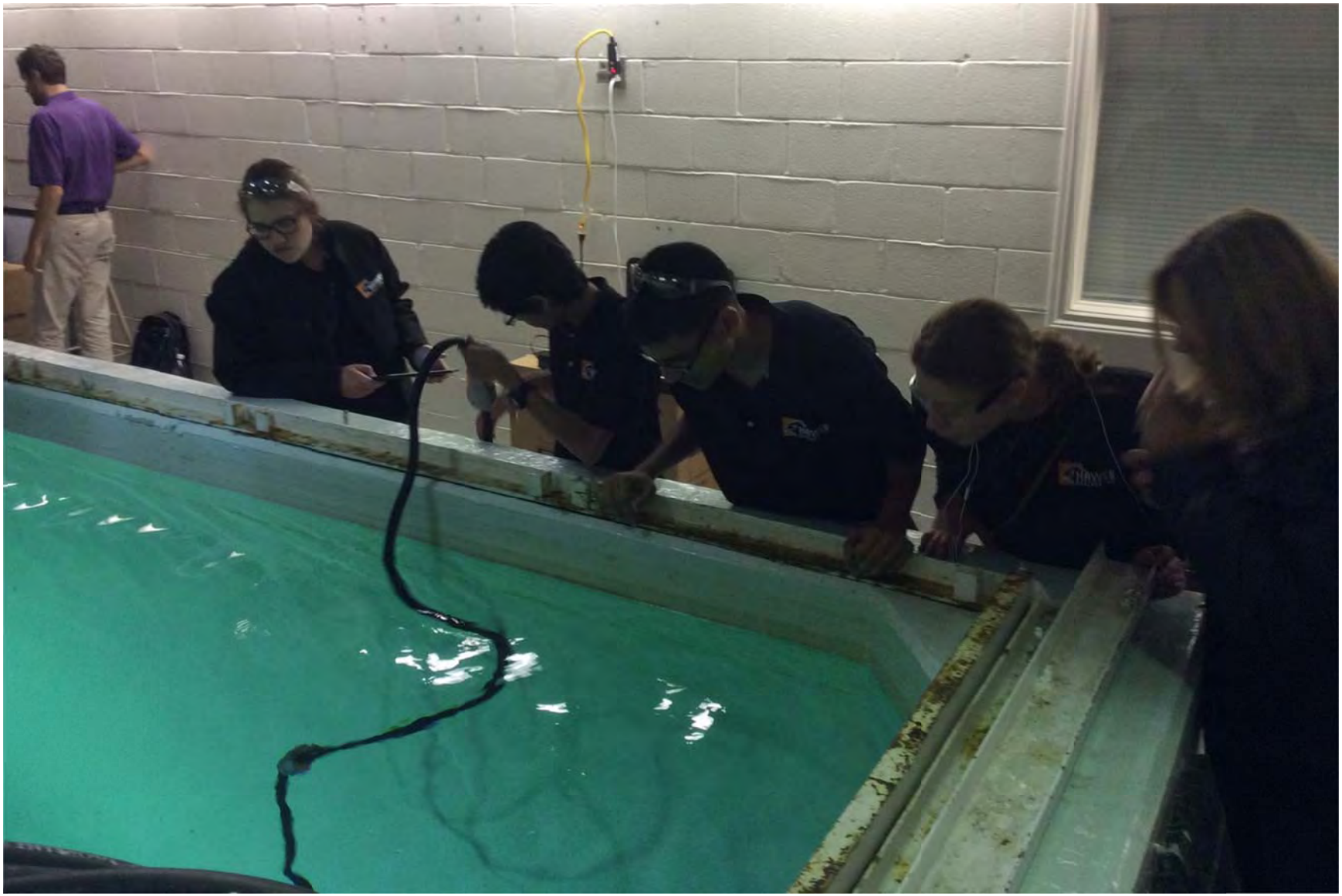
The “Pit” area at the Marine Institute on Thursday, June 25, 2015. All 61 teams at the competition had to pass a safety inspection here before they could enter the water. HEHS had to pass prior to giving their sales presentation that afternoon.




Sales Presentation at the Marine Institute Thursday afternoon.


After the Sales Presentation at the Marine Institute.

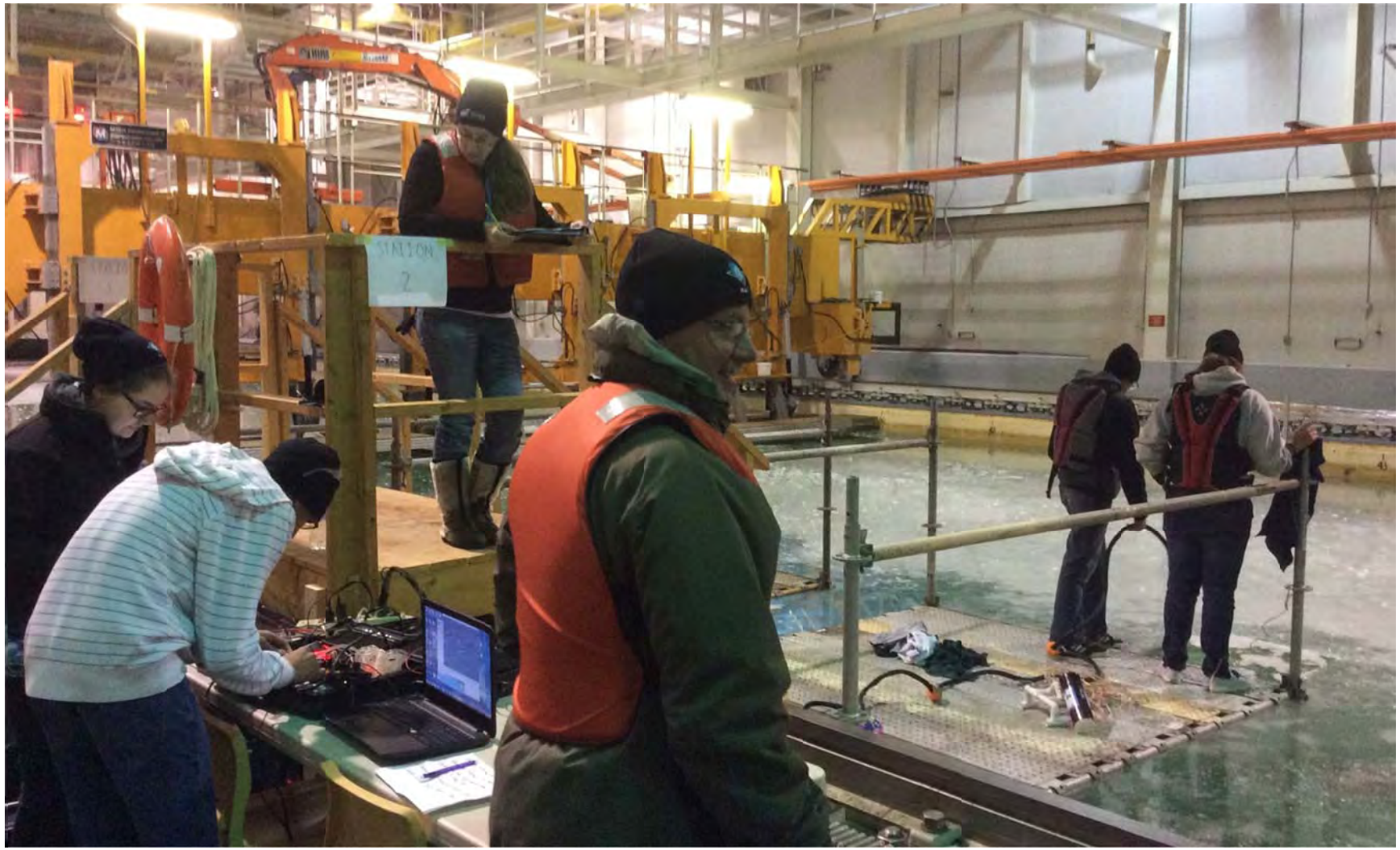
Buoyancy and systems check at the Marine Institute to verify everything survived the flight to St. John's.



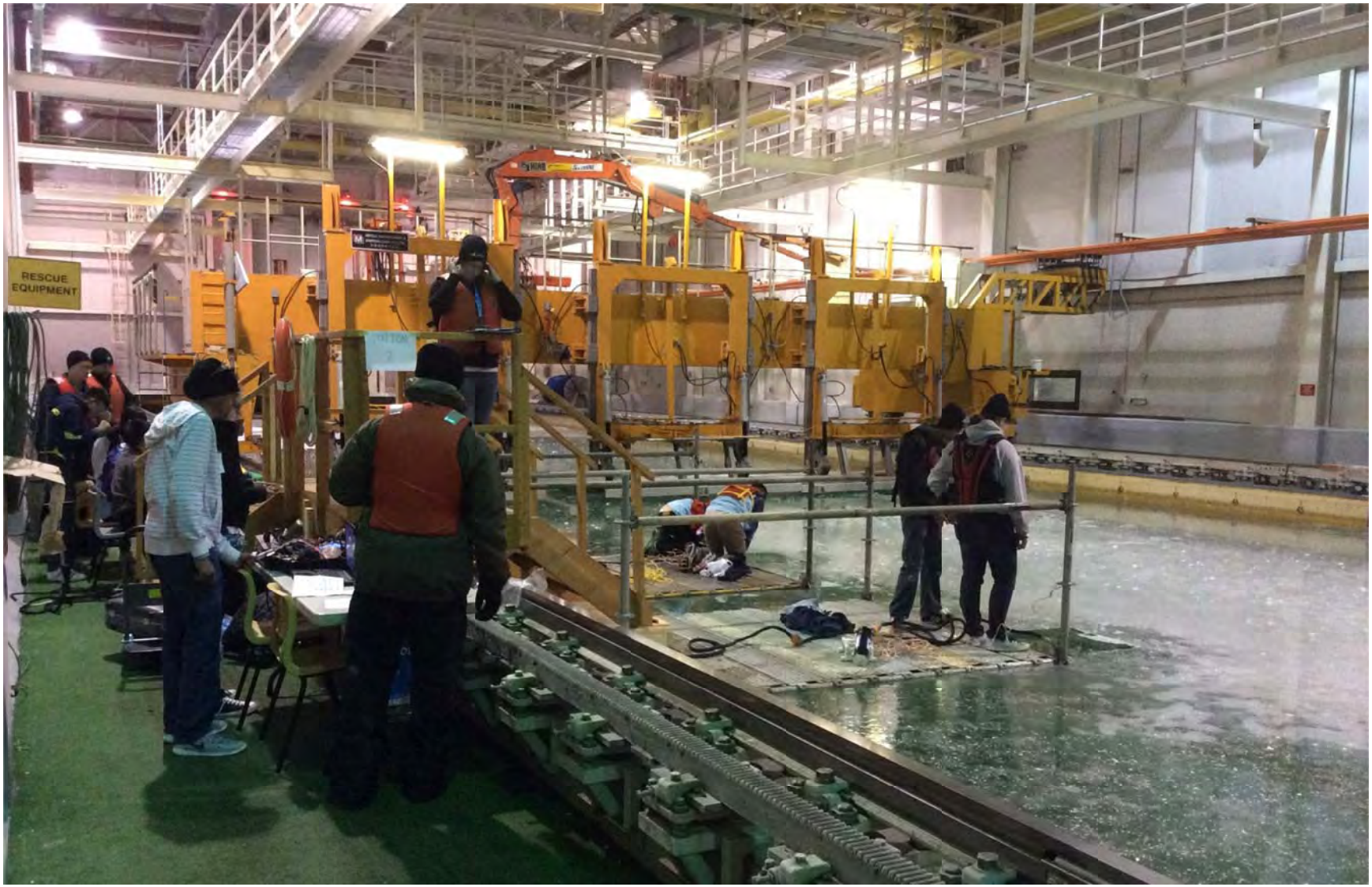
Buoyancy and systems check at the Marine Institute.


Leaving the Marine Institute Thursday afternoon.

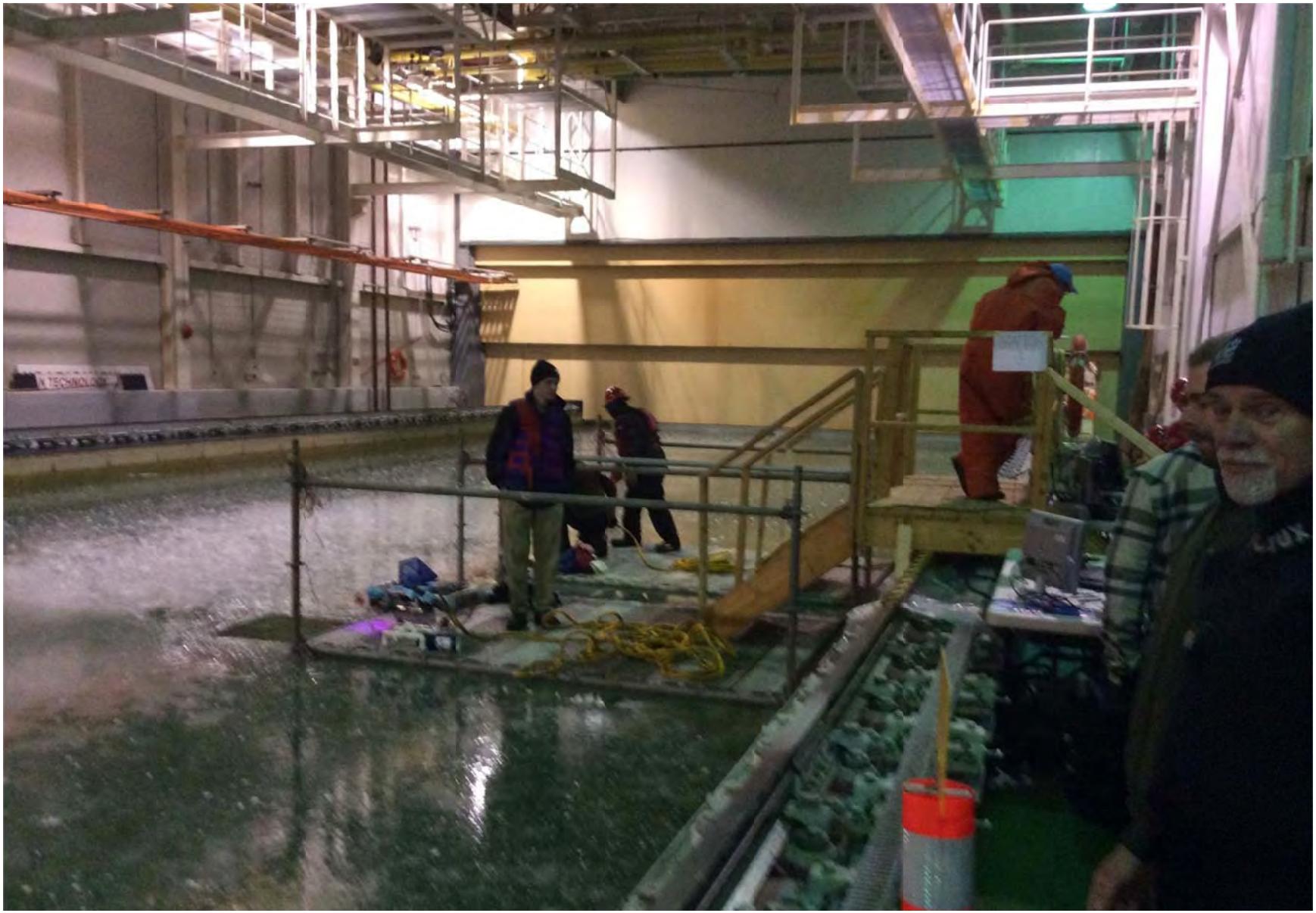
View from Thursday evening banquet overlooking St. John's Harbour.  Signal Hill is on the left of The Narrows leading to the ocean.



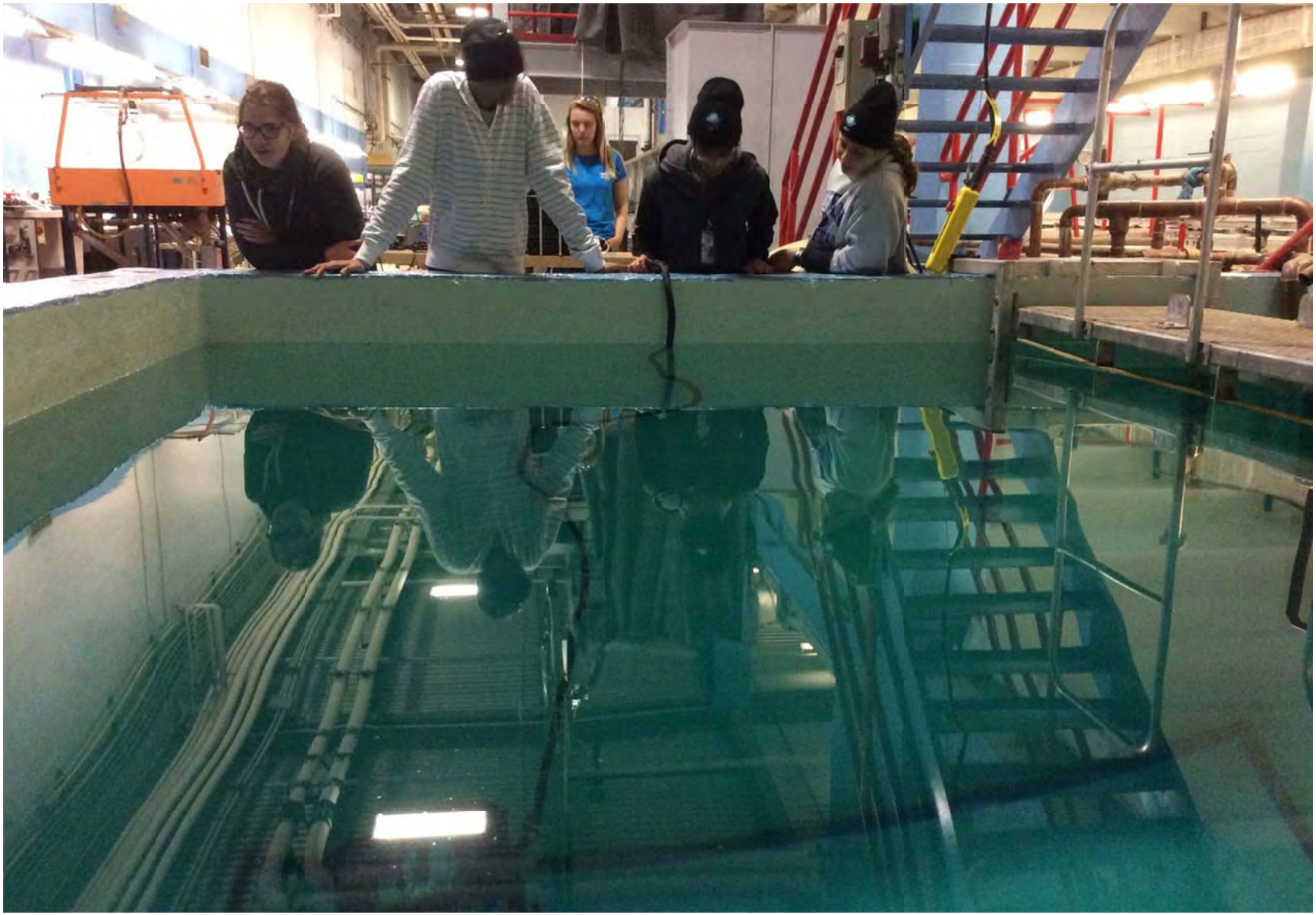

The Ice Tank at the Ocean, Coastal and River Engineering Facility at Memorial University on Friday morning. Laura and Miraj are on the platform. Dillon and Grace are at the control station. This mission included deploying the acoustic sensor, counting sea stars and retrieving an O-ball as shown in the picture on Page 6. Air temperature in the room is 0°C. The salt water tank is used to reproduce conditions found in the ocean. For the competition, there was a layer of ice roughly an inch thick on the surface.




Another view of the Ice Tank.  A team from Macao, China is at the station behind us.

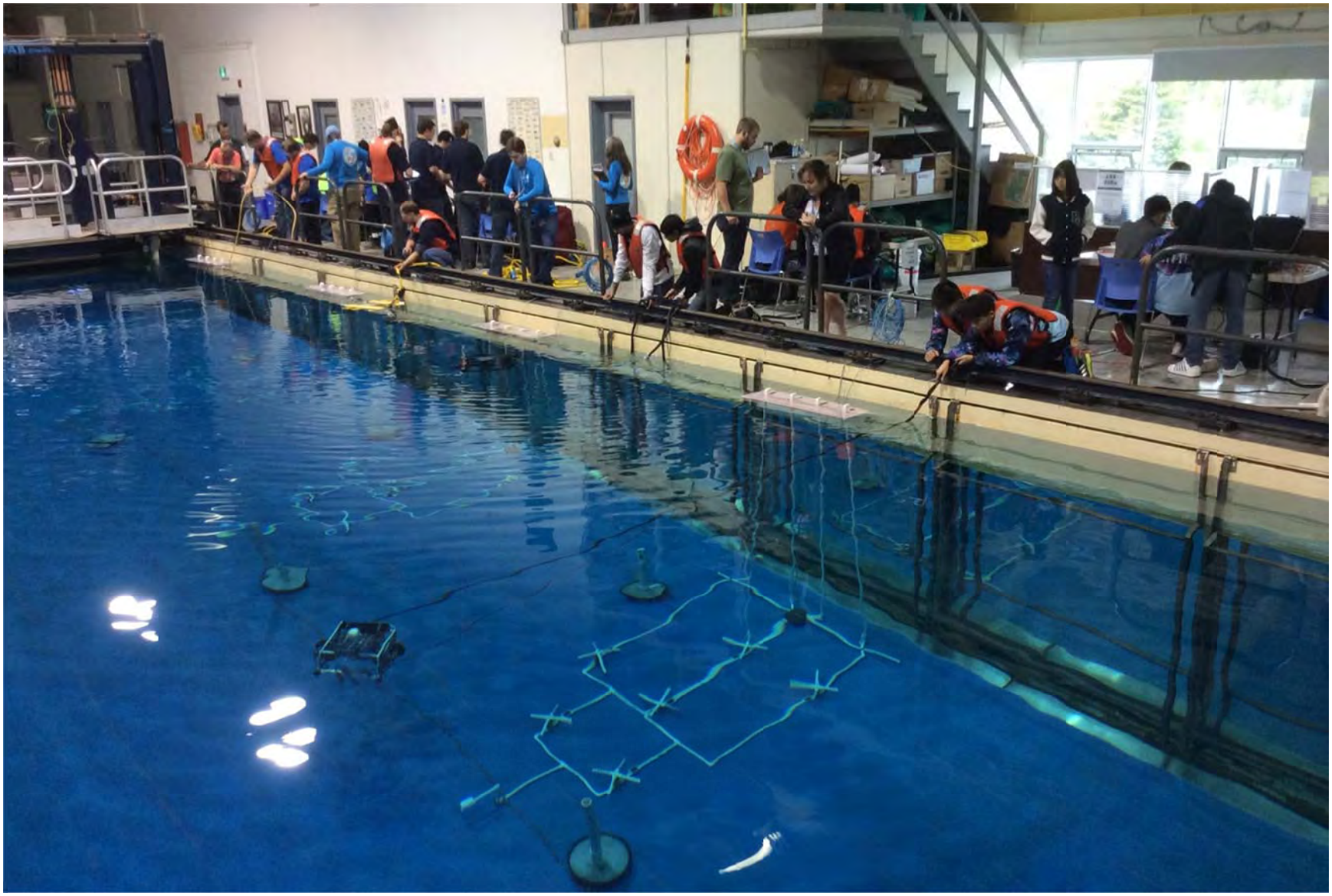


At the other end of the Ice Tank are teams from Arizona State and Long Beach City College.



Buoyancy and systems check at the Engineering and Applied Sciences Building after the Ice Tank mission.

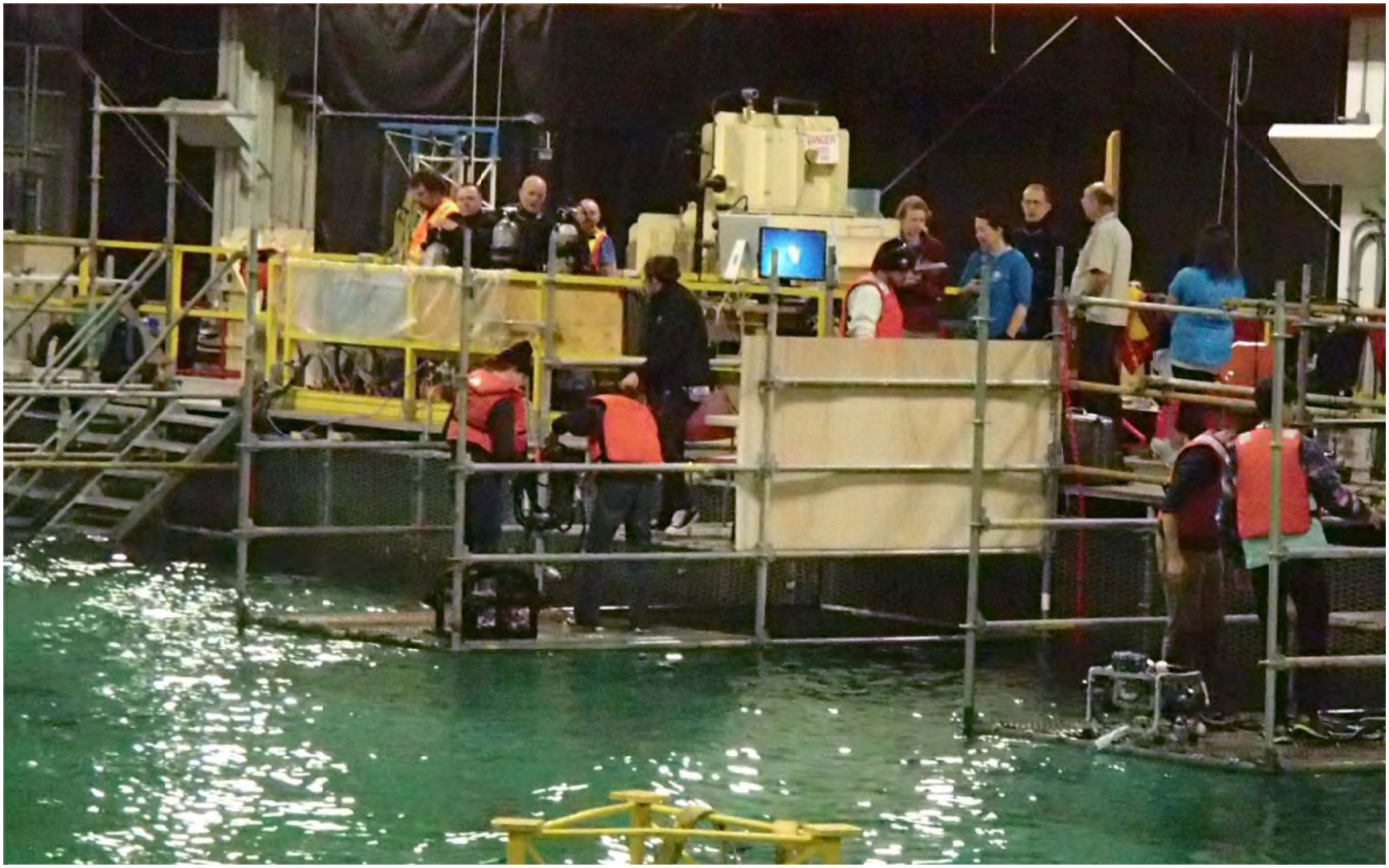
The Flume Tank while teams receive their safety briefing. This mission included reading a pipeline diagram to determine which valves to turn on and off. After turning the appropriate valves, water was expected to be pushed through the pipeline and exit through one of the four pipes at the surface. In addition, the angle of the PVC wellhead was to be calculated. The current in this tank was approximately 1.5 feet per second.



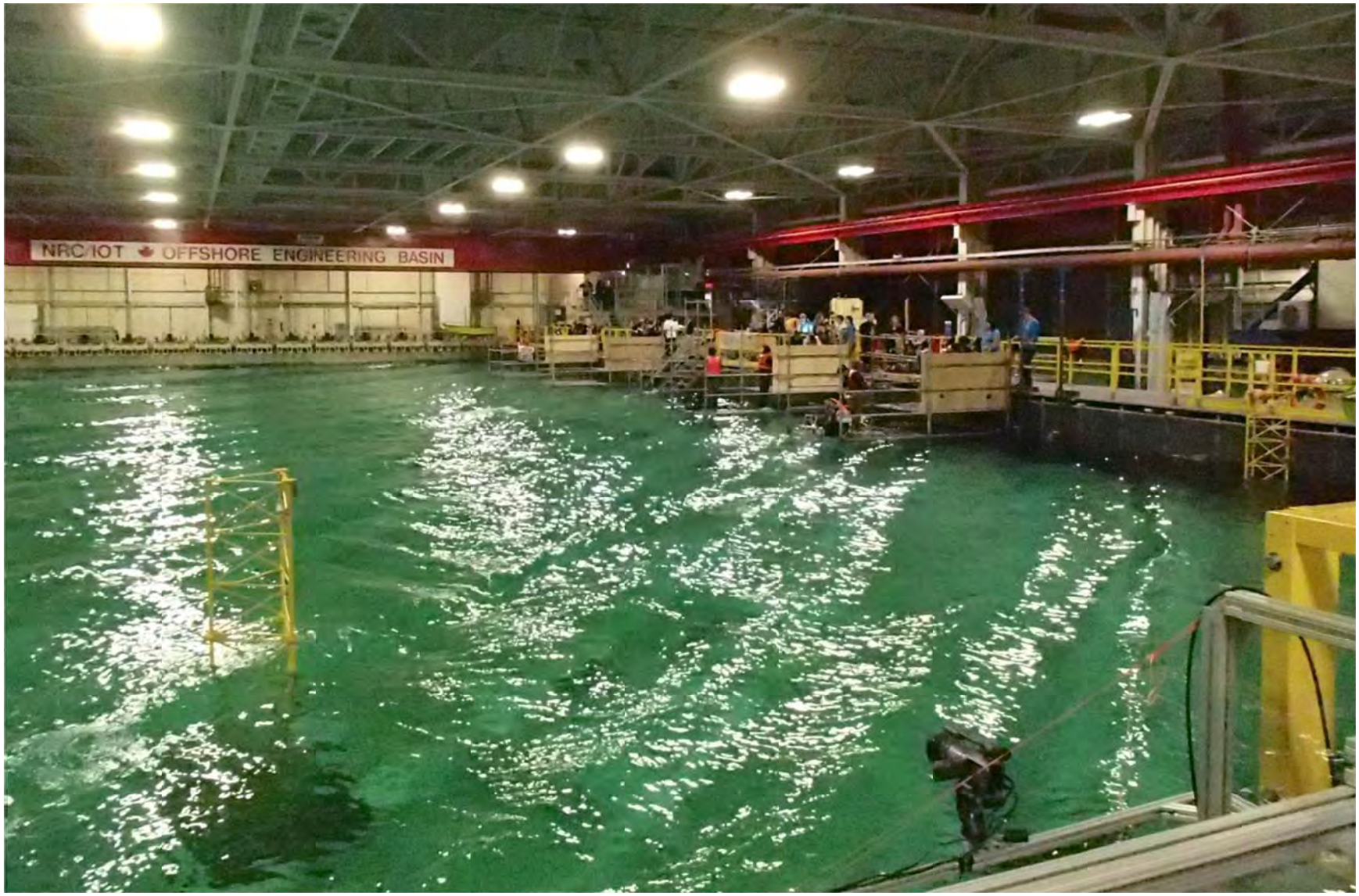
At the Flume Tank at the Marine Institute Friday afternoon. HEHS is the second from the right. The team on the right is from Macao, China. The two teams on the left are college teams from Mississippi and Oregon.

At the Flume Tank. Dillon and Miraj at the center. Grace and Laura at the control station seen just above the team from Macao.

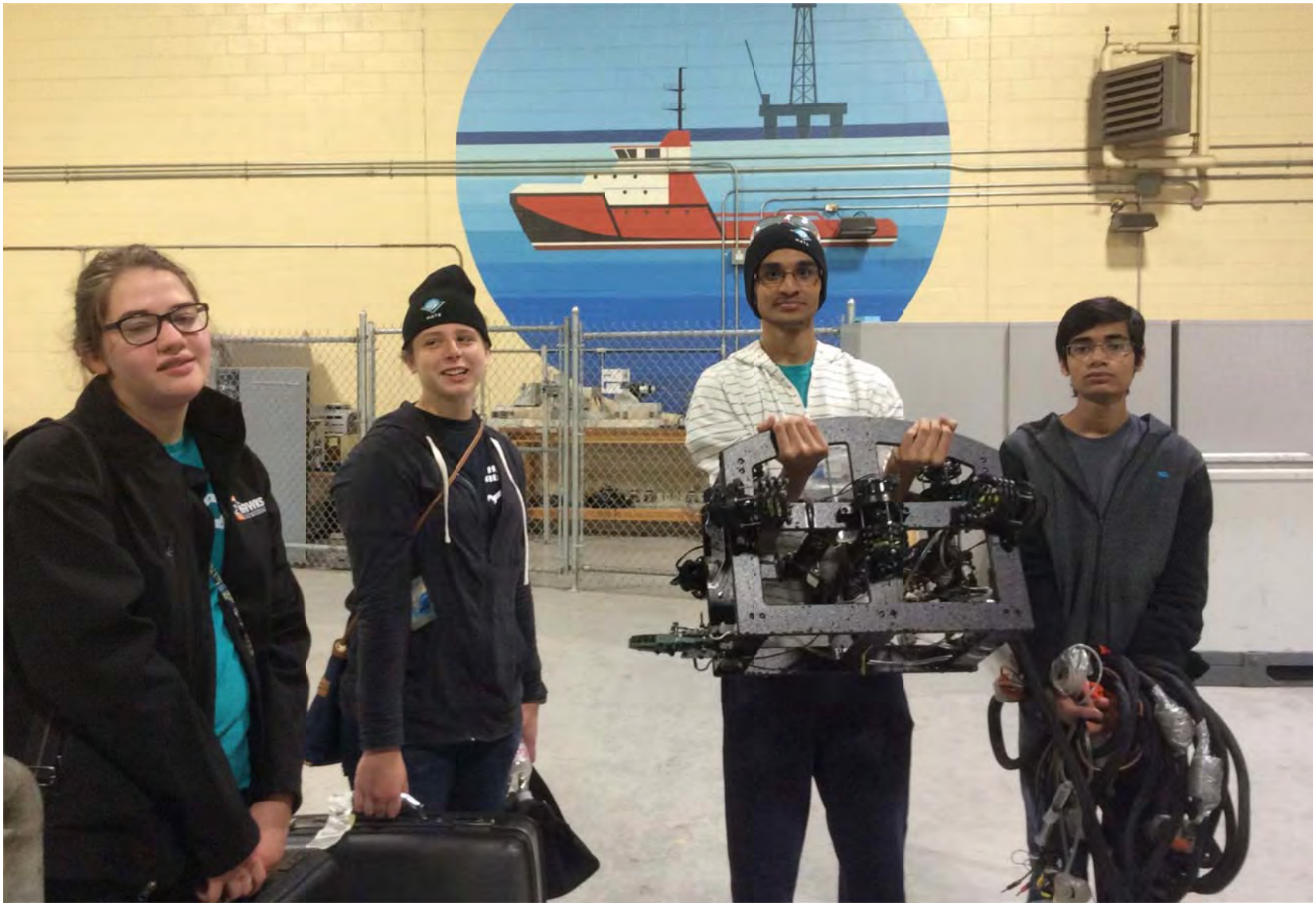

At the Wave Tank in the Offshore Engineering Basin at the Ocean, Coastal and River Engineering facility at Memorial University Saturday morning.



Laura and Miraj on the platform in the wave tank. Dillon and Grace at the control station behind the plywood board. The team from Macao, China is on the platform to the right. This mission includes the wellhead as shown in the picture on Page 6. It also includes shutting off a pipeline valve, inspecting the pipeline for corrosion, checking a pressure gauge to verify the valve is closed, attaching a lift line and removing the corroded section of pipeline. The setup is partially shown on Page 20.




The team from Macao, China is on the right platform. HEHS is on the second platform. The far two platforms are college teams from Nanjing, China and Scotland.



After the mission at the Wave Tank.


Dillon, Laura, Grace and Miraj on Signal Hill in St. John's on Saturday afternoon. Signal Hill is where Guglielmo Marconi received the first transatlantic wireless signal on December 12, 1901.

Another view from Signal Hill overlooking The Narrows. The Atlantic Ocean is to the left and downtown St. John's is to the right.