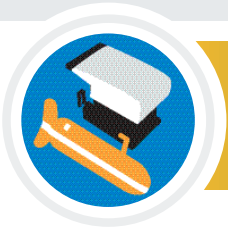


EXPLORATION NOTES Underwater Robots



Pilots “Fly” Using ROVs

Career Profile: [ROV Pilot](#)



By [Trevor Shepherd](#), ROV *Hercules* Pilot

The Exploration Vessel *Nautilus* has two remotely operated vehicles (ROVs) to explore the ocean. The two ROVs work together as a two-body system. ROV *Hercules* is connected by a tether to ROV *Argus* and *Argus* is connected to the ship using a long armored cable. Each ROV has one pilot to operate and oversee the safety of its systems. Within the larger expedition, each watch team has two ROV pilots, so as many as six ROV pilots are aboard *Nautilus* at any time. To “fly” ROV *Hercules* across the seafloor, pilots must work closely together and communicate clearly with the [navigator](#) in the control room to position the ROVs safely and avoid impacting each other or delicate features of the seafloor.

Flying From the Surface to the Seafloor

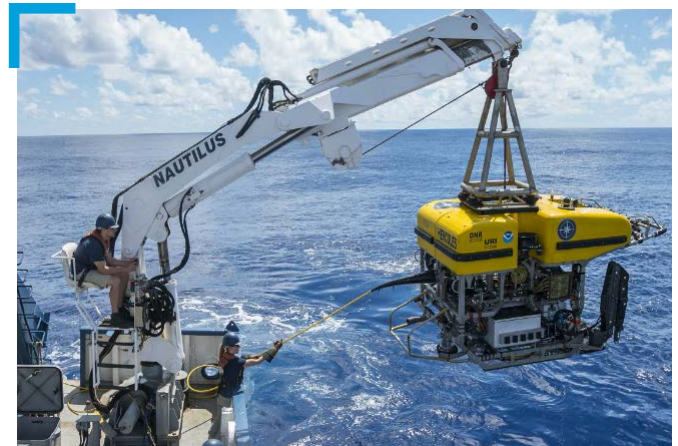
ROV pilots are engineers and technologists who maintain and control the large remotely operated vehicles Ocean Exploration Trust’s Corps of Exploration uses to explore the seafloor and water column. Pilots ensure the cameras, sampling tools, and sensors of each robot are ready for the science team to complete their goals.

The pilots of *Hercules* are typically senior level and are responsible for the overall operations while the vehicles are in the water. They are also responsible for ensuring the operational team communicates and works together to successfully complete the science objectives determined for each dive. ROV *Argus* pilots control ROV *Argus* and also take on additional tasks – such as monitoring the system’s many gauges and operating one of the manipulator arms – to support the *Hercules* pilot.

When the ROVs are deployed to the seafloor, pilots “fly” the vehicles for four hours at a time. While in the control room on the ship, the pilots sit side-by-side in front of a series of touchscreen monitors, joysticks, and keypads which control different ROV systems. During a dive, *Hercules* pilots control the thrusters that move *Hercules* forward, backward, side-to-side, and vertically using a joystick and touchscreens. The pilot also controls the ROV’s right arm, a special arm called a Kraft manipulator, to collect biological, geological, or water samples that help researchers answer questions about the seafloor or overlying water column. The Kraft-brand manipulator arm is controlled by moving a miniature version of the arm in the control room.

Remotely operated vehicle *Hercules* mid-launch. Image courtesy of Ocean Exploration Trust/Nautilus Live.

“Learning to use the manipulator arm is a bit like learning to walk. You know you have all these joints and you know how they work, but you have to practice for a long time to get comfortable moving all the joints together.”



Launching of ROV *Hercules*. Image courtesy of Erin Ranney/OET.



Team members at work in the control van aboard the E/V *Nautilus*. Image courtesy of OET/Nautilus Live.



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ROV Hercules team members installing camera. Image courtesy of OET/Nautilus Live.



Team members at work launching ROV Argus. Image courtesy of OET/Nautilus Live.

Argus pilots control *Hercules*' left arm, an ISE-brand manipulator arm, using a 12-key control pad. The *Argus* pilot also controls the lateral thrusters which swivel *Argus* and the tilt of the high-definition camera to provide variable views of the seafloor as well as keeping a close watch on the tether between vehicles. Another important role is to control the winch (the lifting drum which holds all the cable) onboard *Nautilus* to raise or lower *Argus* adjusting the 'delta,' or distance, between *Argus* and *Hercules*' depths. Monitoring the delta depth ensures the tether doesn't get pulled tight and yank *Hercules* and prevents the ROVs from moving dangerously close together. Both pilots monitor systems looking for spikes or dips in oil pressure, temperature, and power to different systems like navigation, lights, cameras, or samplers.

A Pre-Dive a Day Keeps Trouble Away

Being an ROV pilot also involves contributing to the maintenance, troubleshooting, and repairs of the ROVs. Maintaining ROVs between dives includes tasks like testing hydraulic pressure, installing and removing new sensors or sampling gear, cleaning equipment, designing new solutions to problems the team encounters, and repairing any systems that malfunction, as quickly and precisely as possible so expeditions can stay on schedule.

Pilots work together to conduct pre-dive checks that involve looking closely at and physically touching each component to ensure it's functioning correctly. Pilots check that every pressure housing, thruster, sensor, camera, and light is mounted to the vehicle, that mountings are tightened, and that inputs and outputs are secure. Inputs and outputs could be pressure compensated oil, hydraulic oil, electrical power connection, and fiber data connection.

A pre-dive also includes checking that the deployment and recovery equipment is ready. Pilots check the lifting bale on ROV *Hercules* (a series of strong ropes which connect to the crane), the lift line on the crane, the signal strobe on the top of *Hercules*, and the tether connection point and bendable strain relief fitting on ROV *Argus*. There are mechanical checks that include all moving pieces of the vehicle, like the main camera pan/tilt bracket and freely-spinning thrusters – and pilots even tighten every fastener on the manipulator arm joint. The ROV's sonar, sensor, and high-voltage systems are also checked before a dive is launched and the ROVs are lowered into the water by the ROV team, the Deck Chief, and other *Nautilus* team members.

THINK ABOUT IT...

- Q: How could experience in “gaming” help someone develop skills that would benefit an ROV pilot or team member?
- Q: Which part of the job of being an ROV engineer would you enjoy the most? Why?

ADDITIONAL RESOURCES

Career Profile: <https://nautiluslive.org/career/rov-pilot>
Pilot: <https://nautiluslive.org/people/trevor-shepherd>
ROV Hercules (photo): <https://oceanexplorer.noaa.gov/technology/subs/hercules/media/hercules1-hires.jpg>
Navigator (text): <http://www.nautiluslive.org/career/navigator>
ROV Hercules (launch): <https://nautiluslive.org/career/rov-pilot>
Nautilus control room (photo): <https://nautiluslive.org/blog/2011/10/04/control-van>
ROV Hercules camera (webpage): <https://nautiluslive.org/tech/rov-hercules>
ROV Argus (webpage): <https://nautiluslive.org/tech/rov-argus>