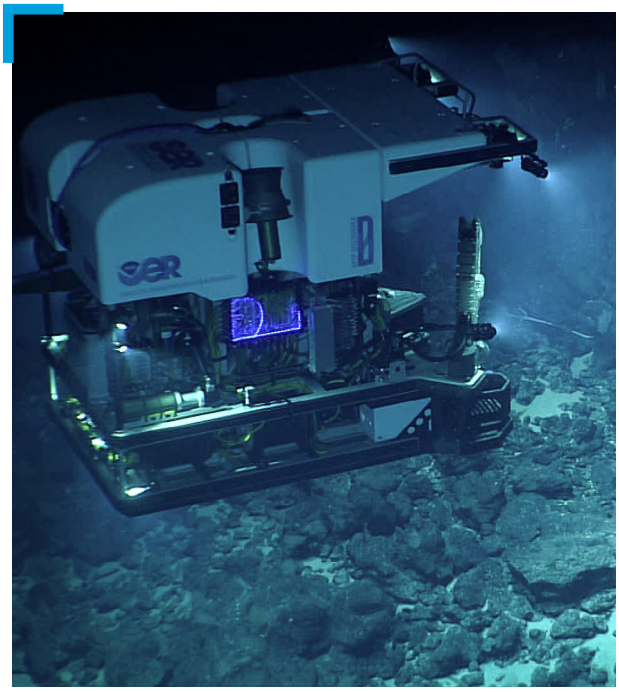
ROV *Deep Discoverer*

Can Do

ROV *Deep Discoverer* ("*D2*" for short) can dive up to 6,000 meters (19,685 feet) below the surface of the ocean, meaning it can explore just about anywhere in the ocean, with the exception of deep trenches. *D2* carries a variety of camera equipment, sampling tools, and sensors to collect as much information as possible about the deep sea during a dive. Its primary camera can zoom in on a three-inch long organism from 3 meters (10 feet) away and pan out to capture a wide view, helping view everything from tiny organisms to larger scale habitats in the deep ocean. Live video from *D2* travels from the seafloor to the ship and then via satellite connection to scientists located on shore. They use the real-time video to provide guidance to the pilots on where to go and which samples to collect. *D2*'s multi-joint manipulator arms are very dexterous, giving operators the ability to maneuver and collect both biological and geological samples. Pilots can also control the grip strength of the manipulator arm jaws, allowing them to gently clip fragile coral samples or pick up heavy rock or mineral samples. The live stream ROV video is also broadcast to the Internet, allowing anyone to join in on *D2*'s adventures.



ROV *Deep Discoverer* documents the benthic communities at Paganini Seamount in the central Pacific ocean. *Image courtesy of the NOAA Ocean Exploration.*

ROV *Deep Discoverer*

SIZE	L 3.2 m (10.4 ft) x W 2 m (6.4 ft) x H 2.6 m (8.5 ft)
WEIGHT	4,400 kg (9,700 lbs)
DEPTH	Maximum of 6,000 m (19,685 ft)
SPEED	Cruises along the bottom at 1 knot (1.2 mph) under its own power or 3 knots (3.6 mph) while towed
COST ($ - $$$$$)	$$$$$
OPERATED BY	NOAA OCEAN EXPLORATION

Equipment and Features

- Remotely operated vehicle (ROV) - tethered to and operated from a ship.
- Part of a "two-body" ROV system, working in tandem with its sister ROV vehicle, *Seirios*.
- Connected to *Seirios* and NOAA Ship *Okeanos Explorer* by a tether, or long fiber optic cable that transmits commands from the ship above down to the ROV and sends data from the ROV back up to scientists on the ship above.
- Thrusters on the back, sides, and bottom move *D2* in all directions.
- Numerous high-resolution cameras are mounted at different angles to illuminate and collect high-quality video imagery during a dive.
- 20 LED lights illuminate the surrounding waters.
- Two multi-joint manipulator arms on the front of the vehicle can be fitted with different jaws to collect a variety of deep-sea samples.
- A suction sampler can gently "slurp" up more delicate biological specimens.
- Sample baskets store biological and geological samples to be brought to the surface.
- Can carry five 1.7 liter (0.5 gallon) Niskin bottles to collect water samples at various depths during a dive.

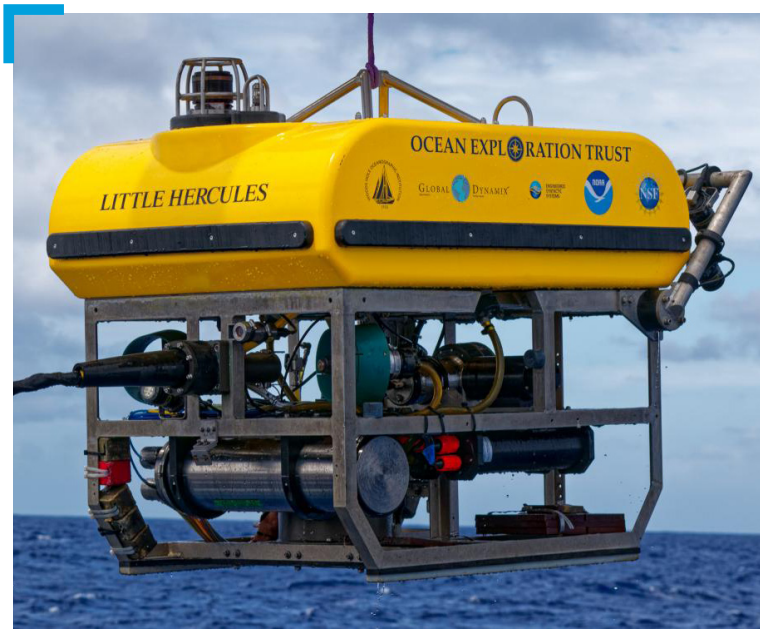
WATCH ME IN ACTION:

https://oceanexplorer.noaa.gov/technology/subs/deep-discoverer/deep-discoverer.html

ROV *Little Hercules*

Can Do

ROV *Little Hercules* is one of four ROVs that dive from E/V Nautilus. Pilots on E/V Nautilus "fly" *Little Hercules* through the ocean with the assistance of its onboard sensors. Navigation transponders communicate with transponders on the ship to tell pilots the vehicle's location on the seafloor. There is no GPS underwater! *Little Hercules* uses sonar scans to gather data on objects that are out of view from its cameras and lights. While its "big brother" ROV *Hercules* is similar in size to ROV *Deep Discoverer* (NOAA Ocean Exploration) and ROV *SuBastian* (Schmidt Ocean Institute), ROV *Little Hercules* is specifically designed to be a much smaller observation platform vehicle. Its smaller size makes this ROV highly maneuverable, meaning it can move up/down, forward/backward, and turn with ease and speed. This, combined with its extensive lighting and camera equipment, make ROV *Little Hercules* a powerful tool for documenting organisms, underwater cultural heritage sites, and habitats in the deep sea.



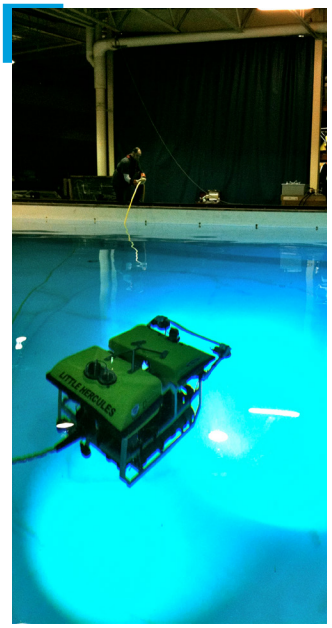
Little Hercules is launched from the NOAA Ship *Okeanos Explorer* during a test dive off Hawai'i. *Image courtesy of the NOAA Ocean Exploration.*

ROV *Little Hercules*

SIZE	L 1.4 m (4.6 ft) x W 1 m (3.3 ft) x H 1.2 m (3.9 ft)
WEIGHT	400 kg (900 lbs)
DEPTH	Cruises along the bottom at a maximum speed of 2 knots (2.4 mph)
SPEED	Cruises along the bottom at 1 knot (1.2 mph) under its own power or 3 knots (3.6 mph while towed)
COST ($ - $$$$$)	$$$$
OPERATED BY	NAUTILUS LIVE OCEAN EXPLORATION TRUST

Equipment and Features

- Remotely operated vehicle (ROV) - tethered to and operated from a ship.
- Part of a "two-body" ROV system, working in tandem with either ROV *Atalanta* or *Argus*.
- Connected to *Argus* or *Atalanta* and Exploration Vessel (E/V) *Nautilus* by a tether, or long cable containing fiber optics that transmit commands from the ship down to the ROV, and sends data from the ROV up to the team on the ship above.
- Thrusters on the back, sides, and top move *Little Hercules* in all directions.
- Many LED lights are mounted at different angles to illuminate creatures and features in the surrounding waters.
- A high-definition or ultra high definition (4K) video camera and two mini-utility cameras collect high-resolution video imagery during a dive.



Little Hercules ROV at the University of New Hampshire during tank testing. *Image courtesy of the NOAA Ocean Exploration.*

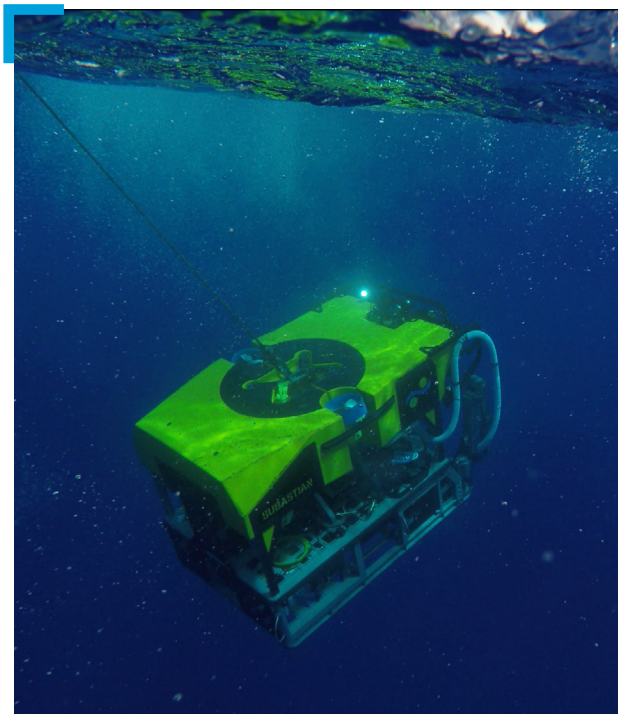
LOOK AT THE INCREDIBLE FOOTAGE I CAN CAPTURE:

https://www.youtube.com/watch?v=HDjqBNMWniY

ROV *SuBastian*

Can Do

Remotely Operated Vehicle (ROV) *SuBastian* can dive to 4,500 meters (14,764 feet), which is shallower than similarly sized ROVs *Deep Discoverer* and *Hercules*. While it may not be the deepest diving ROV, it is still a very useful tool for deep-sea research. *SuBastian* has a modular frame, which means that scientists can easily change the tools it carries for each dive or expedition. *SuBastian* can carry a maximum of 200 kilograms (441 lb) of equipment or samples at a time. It also has two incredibly maneuverable arms that can move seven different ways. Both arms have claws on the end of them that act like hands. Pilots can use the claws to grasp and pick-up samples from the seafloor, operate sampling equipment like a net or scoop, and deploy or recover additional equipment to the seafloor for long-term studies. Ten high-definition cameras record images from all angles of the vehicle. The images can then be stitched together to create a larger, realistic image of the seafloor, called a photo-mosaic. Scientists use *SuBastian*'s ultrahigh definition (4K) camera to capture and live stream video. A live stream of *SuBastian*'s work enables both scientists and the public to participate virtually in ROV operations.



ROV *SuBastian* returns to R/V *Falkor* after a successful dive during sea trials off the coast of Guam. *Image courtesy of the Schmidt Ocean Institute.*

ROV *SuBastian*

SIZE	L 2.7 m (9 ft) x W 2.2 m (7.2 ft) x H 1.8 m (6 ft)
WEIGHT	3,200 kg (7,055 lbs)
DEPTH	Maximum of 4,500 m (14,764 ft)
SPEED	Cruises along the bottom at 1 knot (1.2 mph)
COST ($ - $$$$$)	$$$$$
OPERATED BY	SCHMIDT OCEAN INSTITUTE

Equipment and Features

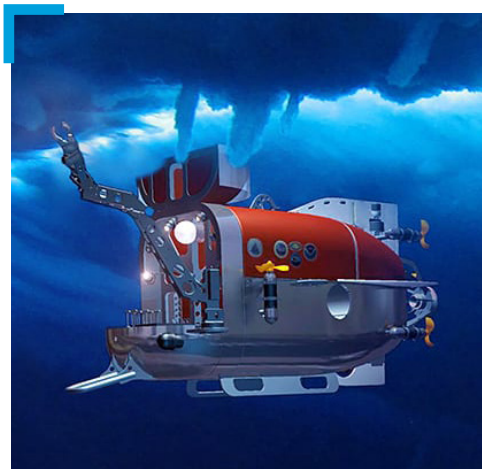
- Remotely operated vehicle (ROV) - tethered to and operated from a ship.
- Connected to Research Vessel (R/V) *Falkor (too)* by a tether, or long fiber optic cable that transmits commands from the ship above down to the ROV and sends data from the ROV back up to scientists on the ship above.
- Thrusters on the back, sides, and bottom move *SuBastian* in all directions.
- Many LED lights and 10 cameras are mounted at different angles to illuminate and collect high-quality video imagery during a dive.
- Two multi-joint manipulator arms on the front of the vehicle can be fitted with different jaws to collect different types of samples and control additional sampling tools like scoops, nets, or cutters.
- A suction sampler and multi-chamber, insulated biobox are used to collect delicate organisms and safely transport them back to the ship for scientific analysis.
- Niskin bottles and a custom push core system help collect water and sediment samples.

WATCH ME IN ACTION:

https://www.youtube.com/watch?v=FyuKDxItBAM&list=PLJGVqQI3okzan288rq5mEwrHAv_qGvMex&index=3

HROV *Nereid Under Ice (NUI)*

Can Do



Nereid Under-Ice, a hybrid remotely operated vehicle designed and built by researchers in WHOI's Deep Submergence Laboratory. *Image courtesy of Casey Machado, Woods Hole Oceanographic Institution.*

Hybrid ROV (HROV) *Nereid Under Ice (NUI)* can operate in a variety of configurations. During fully autonomous underwater operations, *NUI* completes a pre-programmed mapping operation and during tethered operations, *NUI* is controlled by a pilot on board a ship. *NUI* also has a semi-autonomous mode where it can receive a new mapping mission mid-dive from another underwater vehicle deployed nearby. Even during tethered operations, *NUI* can travel up to 40 kilometers (25 miles) laterally away from a research vessel. It can do this because it is powered by batteries on board, which allows its tether to be a hair-thin optical fiber. This is different from standard, bulky ROV tethers that provide both power and communication with the ship but limit how far ROVs can move laterally away from the ship. *NUI*'s clamshell-like workspace closes while moving to be more streamlined. The workspace opens up once at the research site, revealing all of the standard equipment of an ROV. *NUI*'s ability to travel long distances and operate in different modes of operation make it particularly well suited for exploring difficult to reach places. It is equipped with sensors on both the top and bottom of its frame so that *NUI* can sample or survey both the seafloor and under ice shelves above. Its high-definition video equipment allows researchers to visualize mapping and survey data in real time. *NUI*'s manipulator arm can retrieve samples and install scientific instruments. Data gathered by *NUI* helps scientists learn about the under-ice ecosystems and can help climate modelers forecast the future of the Arctic and Antarctic.

HROV *Nereid Under Ice (NUI)*

SIZE	L 3.7 m (12 ft) x W 1.8 m (6 ft) x H 1.8 m (6 ft)
WEIGHT	1,800-2,000 kg (3,968-4,409 lbs) depending on configuration
DEPTH	Maximum of 5,000 m (16,400 ft)
SPEED	Cruises along the seafloor or under ice at 2 knots (2.4 mph)
COST ($ - $$$$$)	$$$
OPERATED BY	WOODS HOLE OCEANOGRAPHIC INSTITUTION

Equipment and Features

- Hybrid vehicle - operates as a remotely operated vehicle (ROV) tethered to a ship or as an untethered, autonomous underwater vehicle (AUV).
- Can travel up to 40 kilometers (25 miles) away from the ship in tethered or autonomous configurations.
- Powered by onboard lithium-ion batteries.
- The main body, or workspace, opens and closes like a clamshell.
- One multi-joint manipulator arm on the front of the frame with a claw on the end to grab samples or operate additional probes or tools under water.
- Many LED lights, still cameras, and high-definition video cameras mounted to the front of the frame document high-quality imagery of deep-sea environments.
- Eight thrusters help *NUI* maneuver and move long distances away from the ship and provide back-up should one or more fail on long missions.
- Carries a suite of chemical and biological sensors to collect data throughout a dive.

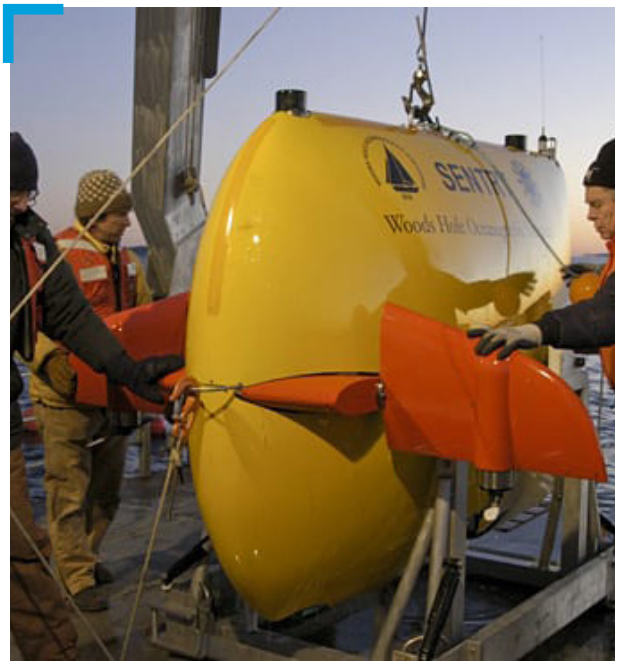
WATCH ME IN ACTION:

https://www.whoi.edu/multimedia/nereid-under-ice-video-montage/

AUV *Sentry*

Can Do

Autonomous underwater vehicle (AUV) *Sentry* can be used for a wide variety of ocean exploration or deep-sea research missions. Its hydrodynamic shape, fins that can each move 180 degrees, and four powerful thrusters allow it to move through the water quickly, efficiently, and with precise movements. This maneuverability combined with its precision altimeter and sonar systems allow *Sentry* to cruise very close to the seafloor, easily navigating around various seafloor features. *Sentry* is also built to be especially tough. Not only can it endure high pressures during dives up to 6,000 meters (19,685 feet), it can also explore and collect data in extreme environments like rugged terrain or around hydrothermal vents. Cruising close to the seafloor allows *Sentry* to use its onboard multibeam echosounder to generate very detailed 3D models of a variety of seafloor features ranging from deep-sea coral reefs to shipwrecks and oil wells. Its high-resolution digital camera can take a picture every three seconds. *Sentry* can also be customized with additional scientific equipment such as a mass spectrometer or pumped filter samplers that collect plankton to answer mission-specific research questions.



WHOI engineers prepare to test *Sentry* off of the coastal research vessel *Tioga*. *Photo by Ken Kostel, Woods Hole Oceanographic Institution.*

AUV *Sentry*

SIZE	L 2.9 m (9.7 ft) x W 2.2 m (7.2 ft) x H 1.8 m (5.8 ft)
WEIGHT	1,250 kg (2,750 lbs)
DEPTH	Maximum of 6,000 m (19,685 ft)
SPEED	Cruises along the seafloor at speeds up to 2 knots (2.4 mph)
COST ($ - $$$$$)	$$$$
OPERATED BY	WOODS HOLE OCEANOGRAPHIC INSTITUTION

Equipment and Features

- Autonomous underwater vehicle (AUV) - completes pre-programmed exploration missions without connection to a pilot on a nearby ship.
- Battery powered, can operate up to 60 hours (30 hours maximum of continuous mapping operations).
- A hydrodynamic body allows it to move quickly and save energy during operations.
- Four large, moveable fins (wings) each have a thruster on the back of them helping *Sentry* to be highly maneuverable, able to turn or ascend/descend very quickly.
- Several sonar systems and a magnetometer produce a variety of maps of the seafloor helping scientists identify interesting seafloor or midwater features.
- A high-resolution digital camera mounted to the front of the vehicle takes detailed images of seafloor features.
- Carries a suite of biological and chemical sensors to collect data during a dive.

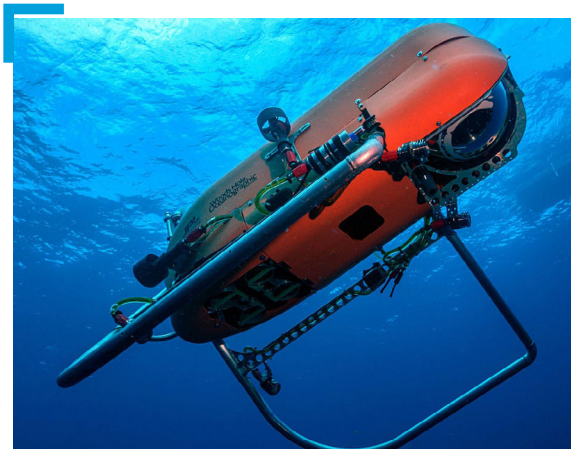
WATCH ME IN ACTION:

https://www.youtube.com/watch?v=5LoteZYrfeA

AUV *Orpheus*

Can Do

Orpheus is a relatively small, nimble AUV that specializes in exploring the hadal zone, which includes waters deeper than 6,000 meters (19,685 feet). It is one of only a handful of ocean exploration vehicles capable of exploring the full ocean depth, including trenches. *Orpheus*'s vision-based navigation technology is similar to rovers deployed to Mars. This technology uses extremely high-resolution cameras to detect seafloor features, including potential hazards, helping *Orpheus* maneuver close to and land on the seafloor without disturbing the surrounding environment. The imaging system can also recognize features that were previously imaged, allowing explorers to pick up a new mission exactly where it left off before. *Orpheus*'s small size allows it to be easily deployed from many vessels ranging in size from smaller fishing boats to large research vessels. Its relatively simple frame and plastic outer shell were carefully designed to minimize production costs and make it easy to mass produce in the future as multi-vehicle operations become more feasible. For now, *Orpheus* has only one identical twin, *Eurydice*, that was developed and built at the same time to test the ability of the two vehicles to work in sync with one another. The goal is to eventually create a fleet of other underwater drones working simultaneously to explore large areas of the seafloor. Developed in collaboration with NASA's Jet Propulsion Laboratory, *Orpheus* will set the stage for future exploration of other ocean worlds, such as the ice-covered liquid ocean on Jupiter's moon Europa.



A look up at the vision-based navigation system on the bottom side of AUV *Orpheus* that helps it navigate very close to the seafloor. *Image courtesy of Marine Imaging Technologies, LLC ©Woods Hole Oceanographic Institution.*

AUV *Orpheus*

SIZE	L 1.7 m (5.7 ft) x W 1 m (3.3 ft) x H 1.3 m (4.3 ft)
WEIGHT	250 kg (551 lbs)
DEPTH	Maximum of 11,000 m (36,000 ft)
SPEED	Cruises along the seafloor at speeds up to 2 knots (2.4 mph)
COST ($ - $$$$$)	$
OPERATED BY	WOODS HOLE OCEANOGRAPHIC INSTITUTION

Equipment and Features

- Autonomous underwater vehicle (AUV) - completes pre-programmed exploration missions without connection to a pilot on a nearby ship.
- Battery powered, can operate up to 8 hours.
- A small, hydrodynamic shape makes *Orpheus* very streamlined, allowing it to reduce drag and conserve energy while maneuvering in the water.
- Four fixed-directional thrusters move *Orpheus* forward/backward, up/down, and help it turn.
- A vision-based navigation helps guide *Orpheus* to softly land on the seafloor.
- A small glass sphere protects all sensitive electronics and batteries from the extreme pressure while exploring the deepest parts of the ocean.
- A high-resolution camera can take video and still footage during each dive.
- Can carry a variety of additional biological and chemical sensors or sampling tools on the lightweight frame to collect data for specific research questions.

WATCH ME IN ACTION:

https://www.youtube.com/watch?v=41mimZXzbeM

USV *DriX*

Can Do

DriX is incredibly versatile, capable of operating in many different environments and supporting a variety of exploration objectives. *DriX* is commonly deployed from a vessel, but it can also be launched from shore, which makes it less expensive to use. When *DriX* is remotely-controlled, a pilot is actively steering the vehicle, controlling its every move. During autonomous operations, *DriX* completes pre-programmed missions while a pilot supervises the movements. Autonomous work allows explorers to use both the ship and *DriX* to map larger areas of the seafloor at the same time. *DriX* can also work with other vehicles helping track, communicate with, and give instructions to other vehicles including additional *DriX* vehicles and other autonomous vehicles working underwater.

Numerous navigation and communication systems mounted on top of USV *DriX* allow it to operate autonomously or remotely-controlled from a pilot on land or on shore. *Image courtesy of Ocean Exploration Trust.*

USV *DriX*

SIZE	L 7.7 m (25.3 ft), W 0.8 m (2.6 ft), H 5 m (16.4 ft)
WEIGHT	1580 kg (3480 lbs)
DEPTH	*DriX* operates at the ocean surface, with the bottom half of its body extending ~2 m (6.7 ft) below the surface
SPEED	Can cruise at 10+ knots (11.5 mph)
COST ($ - $$$$$)	$$$
OPERATED BY	CCOM JHC; NOAA; OCEAN EXPLORATION COOPERATIVE INSTITUTE oeci EXPLORING THE NATION'S BLUE FRONTIER

Equipment and Features

- Uncrewed Surface Vessel (USV) - supports ocean exploration operations from the ocean surface; does not carry people.
- Can operate in a remotely-controlled (piloted) mode or supervised autonomous mode.
- Powered by a small and efficient diesel motor with onboard batteries to support onboard equipment when the engine is secured.
- Can explore for up to five consecutive days at speeds of up to 5 knots (5.7 mph), covering nearly 600 nautical miles.
- Can operated via satellite from anywhere in the world by pilots in a command center, which may be ashore or aboard a ship.
- Equipped with an advanced collision avoidance system.
- Equipped with multibeam sonar systems to map the seafloor up to 3,000 meters (9,843 feet) deep.
- Equipped with very sensitive water column sonar systems for analyzing plants and animals in the mid-water.
- Equipped with an underwater positioning system and acoustic modem to track and communicate with underwater vehicles during collaborative missions.
- Carries communication systems including WiFi, military grade network radio systems, Starlink satellite-based radio system and a backup system to "talk" with remote operator centers aboard a ship or on shore.
- Modular gondola below the vessel can be custom fit with a variety of sensors to collect different types of ocean data.

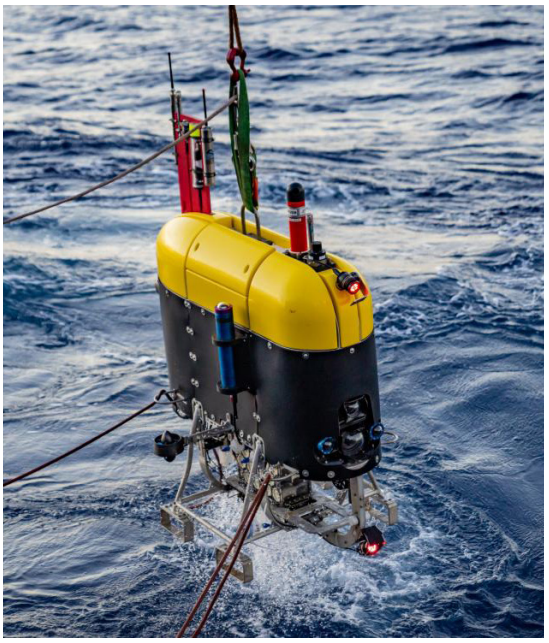
WATCH ME IN ACTION:

https://nautiluslive.org/video/2023/10/11/updated-usv-drix-advances-ocean-mapping-and-exploration

HROV *Mesobot*

Can Do

Mesobot is designed to study physical and chemical processes in the ocean and organisms in the mesopelagic, or midwater, zone between 200 - 1,000 meters (656 - 3,280 feet) deep. As a hybrid vehicle, *Mesobot* can complete various types of deep-sea surveys. During tethered operations, *Mesobot* is connected to a ship above and remotely-controlled by a pilot to follow an interesting target, like falling marine snow or bubbles rising from the seafloor. When operating autonomously, *Mesobot* can be programmed to make "adaptive" decisions for itself. For example, it can identify an animal of interest and change its direction to follow the animal. With a streamlined body, slow moving thrusters, and deep-sea lights and cameras, *Mesobot* is able to follow midwater organisms without disturbing them, allowing explorers to more easily study their behaviors. *Mesobot*'s ability to work for over 24 hours per mission helps explorers better understand how deep-sea organisms behave at different times during the day. *Mesobot* can collect water samples at various depths in its onboard Niskin bottles to be analyzed in a lab after it completes its dive. It can also be equipped with special equipment that pumps seawater through filters, collecting eDNA samples live, during the dive.



With a streamlined body, slow moving thrusters, and deep-sea cameras, *Mesobot* is able to follow midwater organisms without disturbing them, allowing explorers to study their behaviors. *Image courtesy of Ocean Exploration Trust.*

HROV *Mesobot*

SIZE	L 1.5 m (4.9 ft) x W 1 m (3.3 ft) x H 1.5 m (4.9 ft)
WEIGHT	250 kg (551.2 lb)
DEPTH	Maximum of 1,000 m (3,280 ft)
SPEED	Cruises at a speed of 1-3 knots (1.2 - 3.6 mph)
COST ($ - $$$$$)	$$$
OPERATED BY	WOODS HOLE OCEANOGRAPHIC INSTITUTION

Equipment and Features

- Hybrid vehicle - can operate as a remotely operated vehicle (ROV) tethered to a ship or as an untethered, autonomous underwater vehicle (AUV).
- Large, slow-spinning propellers to hover and move through the water.
- Battery powered, can operate longer than 24 hours.
- Two monochrome (black and white or in varying tones of only one color) cameras to support low-light imaging in the deep sea.
- White and red lights to "see" organisms in the deep sea.
- 4K color video and a still camera to capture high-resolution imagery of deep-sea organisms.
- An acoustic modem to communicate with a vessel or other vehicle while operating below the sea surface.
- Modular frame can be customized with different sampling tools and ocean sensors. Some examples include: equipment that pumps seawater through filters to collect environmental DNA (eDNA) and/or sensors that detect salinity, temperature, depth, dissolved oxygen, and other data about the ocean.

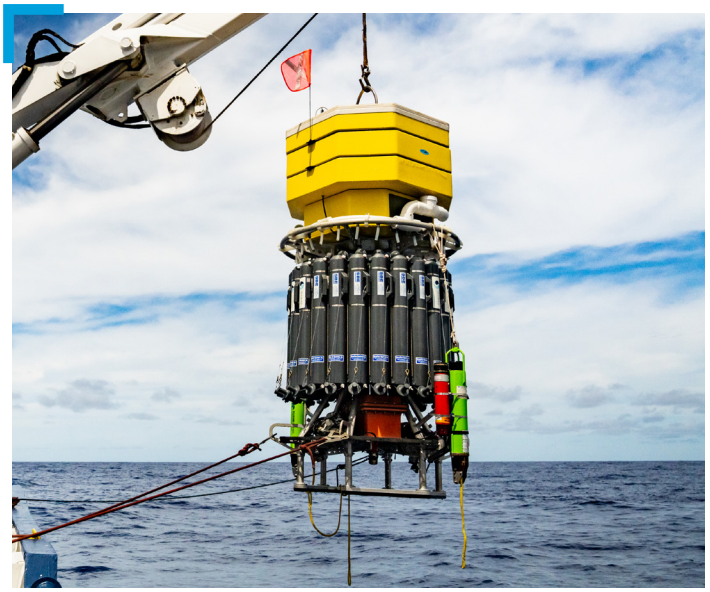
WATCH ME IN ACTION:

https://www.youtube.com/watch?v=qb2rmgRi_cw&t=1s

Deep Autonomous Profiler (DAP) Lander

Can Do

The *Deep Autonomous Profiler (DAP)* is one of very few exploration vehicles that is capable of operating in the extreme pressure, temperature, and darkness of the hadal zone, the deepest part of the ocean. It can work as deep as 11,000 meters (36,089 feet) below the ocean surface! Its primary use is to collect water samples throughout the ocean. *DAP* can complete a pre-programmed water sampling mission, collecting water at regular intervals during a dive. It can also be programmed to make its own sampling decisions based on the data it collects. In this mode, the vehicle records data as it travels down to the seafloor, analyzes the data to identify specific places in the water column that are interesting, and collects water samples at those depths during the return trip to the surface. Operating autonomously also makes *DAP* much less expensive to operate than a standard CTD (conductivity, temperature, and depth) rosette, which must be tethered to an exploration vessel and operated by explorers on board.



The 3.2 meter (10.5 feet) tall *DAP Lander* features a CTD rosette of 24 large Niskin bottles to collect water samples at various depths. It is mounted on a heavy duty frame that can withstand extreme pressure at the bottom of the ocean. The bright yellow syntactic foam top is slightly positively buoyant to aid recovery at the end of a dive. *Image courtesy of Nova West, Ocean Exploration Trust.*

Deep Autonomous Profiler (DAP) Lander

SIZE	H 3.2 m (12 ft) x W 1.5 m (4.9 ft) diameter
WEIGHT	1,400 kg (3,086 lbs) in air empty and 1,700 kg (3,748 lbs) when full of water
DEPTH	11,000 m (36,000 ft)
SPEED	Descends/ascends at 1 m/s (3.2 ft/s)
COST ($ - $$$$$)	$
OPERATED BY	THE UNIVERSITY OF RHODE ISLAND GRADUATE SCHOOL OF OCEANOGRAPHY

Equipment and Features

- Autonomous Lander - operates without being tethered to a ship and can “sit” on the seafloor collecting data over extended periods of time.
- Equipped with a CTD rosette that includes sensors to collect salinity (conductivity), temperature, and depth data throughout the water column and 24 Niskin bottles that form a ring around the top of the lander. Each bottle can hold 12 liters (3.2 gallons) of seawater.
- Carries 4 additional small deep-sea Niskin bottles that each collect 135 mL (0.5 cup) deep-water samples while maintaining the high pressure and cold temperatures of the water where the samples were collected.
- Battery powered, can operate and sample continuously for up to 24 hours or even longer when programmed for “burst” sampling mode where it samples in routine intervals.
- Frame can be fitted with extra samplers and sensors including lights, cameras, baited traps, sediment cores, and more.

WATCH ME IN ACTION:

https://www.youtube.com/watch?v=hVn9WwFS8nM

AUV *Eagle Ray*

Can Do

The pre-programmable, self-powered design of AUV *Eagle Ray* allows the vehicle to complete mapping operations up to180 kilometers (112 miles) or 30 hours long, at a relatively low cost. This combined with the high-resolution multibeam sonar system means that *Eagle Ray* can map large areas of the seafloor at a very fine scale, making it a great tool for mapping highly detailed seafloor features, such as deep-sea habitats or shipwrecks. The low operation cost makes the vehicle useful for long-term monitoring projects too. The AUV's multibeam sonar system provides explorers with water column data and backscatter data, revealing important information about seafloor substrate (sand, mud, rock) and biological communities in the mapped area.

The large-bodied AUV *Eagle Ray* sits on top of its Launch and Recovery System (LARS), a unique ramp used to deploy it from the back of a research vessel like NOAA Ship *Okeanos Explorer*. *Image courtesy of Leonardo Macelloni, University of Southern Mississippi.*

AUV *Eagle Ray*'s torpedo shaped body makes it very hydrodynamic, helping the vehicle to conserve power and map the seafloor for up to 30 hours per dive. *Image courtesy of University of Southern Mississippi.*

AUV *Eagle Ray*

SIZE	L 5 m (16.4 ft) x Diameter 0.7 m (2.3 ft)
WEIGHT	900 kg (1,984.2 lb)
DEPTH	2,200 m (7,217.9 ft)
SPEED	Cruises along up to 3.4 knots (4 mph)
COST ($ - $$$$$)	$$
OPERATED BY	THE UNIVERSITY OF SOUTHERN MISSISSIPPI

Equipment and Features

- Autonomous underwater vehicle (AUV) - completes pre-programmed exploration missions without connection to a pilot on a nearby ship.
- Battery powered; can operate for up to 30 hours.
- Single thruster at the rear of its frame pushes the AUV through the water.
- Rises to the surface and dives to deeper water using two sets of maneuverable wings.
- Onboard altimeters, depth sensors, and a seafloor avoidance system guide the AUV to position itself between 15 and 50 meters (49-164 feet) above the seafloor and maintain that depth throughout missions.
- High-resolution multibeam sonar system to map the seafloor up to 3,000 meters (9,842.5 ft) deep and to a resolution as fine as 10 millimeters (0.4 inch).
- Carries a GPS and communication equipment including a radio, strobe beacon, tracking transponder, and an acoustic modem to send its location to a support vessel once it has completed its mission and is ready to be retrieved.

WATCH ME IN ACTION:

https://youtu.be/Qhh6usitDFY?si=IVc0a9BolMNSUEs3