Seafloor Characterization of the U.S. Caribbean
2010 Field Season
March 18-April 6, 2010

Day 15: March 31, 2010

Anatomy of an ROV

Over the course of this expedition on the R/V Nancy Foster, we have made several references to Remotely Operated Vehicles (ROVs), and all of the detailed information our ROV has helped to gather about benthic and biological characterization of the surrounding seafloor. We've discussed why the ROV is important, in that it enables us to verify what organisms exist in some of the areas that are being mapped. But exactly what ***is*** an ROV? What components and features are required to explore places in the ocean that we as humans cannot go? Today, Lance Horn, an expert from UNC – Wilmington, talked to us about what it takes to be an ROV…

There are many styles, shapes, and types of vehicles used to explore the depths of the ocean. Manned submersibles, autonomous underwater vehicles (AUVs), and buoys are some of many ocean based tools used to learn more about the places that humans cannot work efficiently, based on our "underwater deficiencies." Until we grow a set of gills, these tools provide important capabilities that allow us to study the ocean. ROVs are one such vehicle used for ocean exploration, and are unique in that they require remote operation via a cable, or "umbilical" chord.

"The critical components that all ROVs must have to work are: a control console, an umbilical chord, and the vehicle itself" says Horn. "The structure of an ROV can be as simple or complex as you want, but they typically all need some sort of flotation capability, cameras, lights, thrusters, and a heading (compass) and depth sensor" he adds.

Parts of an ROV:

Electronics – the electrical wiring required to run the ROV capabilities is housed in the two cylinders on either side of the ROV structure. The heading and depth gauge is also contained here. Air space and syntatic foam housed in these cylinders provides buoyancy for the ROV.

Digital Still Camera – Takes digital pictures. Has zoom function, and is wired to the strobe light positioned above on the ROV structure.

Digital Video Camera – displays digital video imagery seen on control console screen and science station screen. Imagery can be recorded (see control console information). Small camera lights located above camera lens provide necessary lighting.

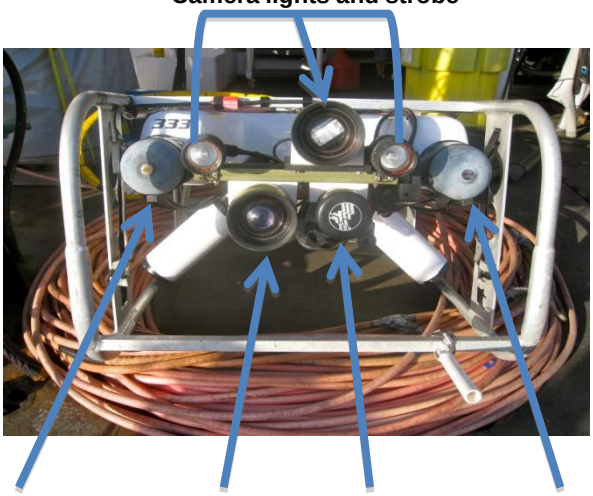
Lasers – projects two laser beams (10cm width) to provide scaling.

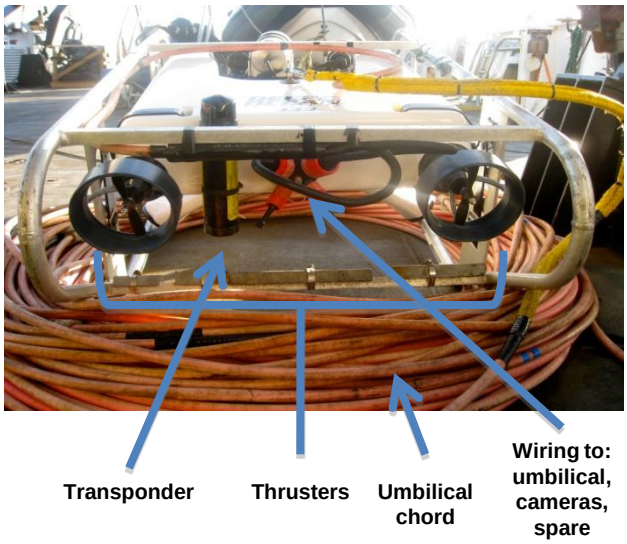
Transponder – used for acoustic tracking of the ROV's location (latitude and longitude).

Thrusters – two of four thrusters used for mobility (other two are in the middle of the vehicle and face different directions for increased pivotal movement)

Umbilical cable – transmits signals from the control console. The cable for this ROV is 900 ft long.

Wiring Port – attachment for umbilical cable, camera wiring, and spare apparatus attachments.





Depending on the ROV, their anatomy may differ from one to the next, depending on what type of work it will be used for. Thrusters, for example, which enable the up/down and side-to-side movement of the vehicle through the water column, can be mounted in various positions on the structure of the ROV, depending on how you want the vehicle to move around underwater. Similarly, materials used for buoyancy may differ – some use syntactic foam, where others may just use air-space in the structure.

The epicenter of an ROV in action is the control console – for this mission on the R/V Nancy Foster, this requires quite the set-up. This control console has a suite of dials and mechanics that allow scientists to gather the data they need to more accurately characterize the seafloor around the USVI. The console contains two major parts – the operational station, and the science station. The ROV driver uses the intricate system of computers, global positioning systems (GPS), video monitors, control dials and levers, and special software that integrates the ship's position with the ROV's position and the multi-beam data being collected, all to help steer the vehicle where its supposed to go! The science station has all of the video and still camera capabilities to record what is seen from the ROV during the dive. Scientists use this logged information not only to inform research efforts on the cruise, but also use this data for further scientific analysis once they are off the boat.

Parts of the Control Console:

OPERATIONAL STATION

GPS Tracking – identifies the location of the ROV in the water column.

Computer for tracking ROV and Boat – Uses Hypack software to track location of ROV in relation to the boat; can be integrated with bathymetric charts; aids in laying out transit line for boat to most efficiently collect data desired.

Screen to boat and ROV Tracking – Visual display of tracking system.

ROV Monitor – Displays video being captured by video camera on ROV and acts as view finder for ROV pilot.

Control Consol – Controls used to drive ROV (includes joysticks, thrust controls, etc.)

SCIENCE STATION

Microphone – Observing scientist uses for voice annotation of dive on video tape.

Video Overlay System – Records dive data on tape (date, time, location, dive series number, etc.)

Video Screen – Shows video imagery being collected on dive. Video can be recorded on DVD and tapes in console below.

Digital Still Screen – Control station for digital still camera. Can take pictures from here.

Operational Station

Science Station

The ROV aboard the R/V Nancy Foster for this research mission is a model Phantom S2, and is affectionately known as “R-O-V.” Lance has been working with this particular copper structured ROV for 23 years, and knows its ins and outs very well (all changes and repairs are intricately documented in her corresponding ROV manual). He notes that the utility of many ROVs is to be a “swimming eyeball,” and while that function is important, there are many enhancements that can make the tool even more versatile for conducting underwater research. For example, while “R-O-V” collects both still and video imagery, it has spare wiring capabilities that can attach tools such as manipulator arms, CTD samplers (conductivity-temperature-depth), and potentially even acoustic sonar, as they are needed for a given mission.

One thing that is abundantly clear about ROV operations aboard the R/V Nancy Foster, is the teamwork that is required to ensure a mission’s success. Lance’s right hand man is Glen Taylor, another ROV expert from UNC-Wilmington. The two have been working together on ROV operations for almost 20 years, and their expertise at this team effort is evident. They work seamlessly to operate the ROV from its deployment to its recovery throughout each dive. When asked why this particular ROV was the best for this research mission, Horn replies with a grin, “It’s not the ROV, it’s the *operators* that are best for this mission.” The duo has worked with Tim Battista, Principal Investigator on this project, for many years, and they are both known for their reliable and quality ROV operations. “The important thing is not necessarily the ROV itself, its what happens when it breaks!” Horn exclaims. Isn’t this the truth! (See Cruise Log Day 2: March 19, 2010).

Horn explains that while “R-O-V” has been enhanced over the years to conduct quality research, he has high hopes that there may be a new “shinier” ROV in his future. Fiber-optic frames and high definition (HD) imaging capabilities, among other new features will enable research at greater depths, and with higher resolution, which may prove useful for missions such as this one.

DID YOU KNOW …

- Deep-sea corals, also referred to as "cold-water corals," are a diverse collection of organisms that occur in deeper or colder oceanic waters. Unlike the well-studied shallow-water tropical corals, these corals inhabit deeper waters on continental shelves, slopes, canyons, and seamounts in waters ranging from 50 m to over 2,000 m in depth. Deep-sea corals lack symbiotic algae (zooxanthellae) characteristics of most reef building shallow water tropical corals.

- Unlike their shallow water relatives, which rely heavily on photosynthesis to produce food, deep-sea corals take in plankton and organic matter for much their energy needs. Deep-sea corals are also often extremely long-lived, slow growing animals, characteristics that make them particularly vulnerable to physical disturbance.

- http://coralreef.noaa.gov/

Glen Taylor deploys ROV for a dive (left); “R-O-V” sits aboard R/V Nancy Foster (middle); Lance Horn teaches Juan Torres how to drive ROV (right)

MEET THE CREW…

LT Dan Simon
Dan is the Executive Officer on the R/V Nancy Foster. He is responsible for carrying out the Commanding Officer’s orders and is charge of ship safety, personnel issues, and ship administration.

Jodie Edmond
Jodie is a Mate on the R/V Nancy Foster. She can drive the ship and is training to stand watch of the ship on her own.

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