# ROV Fact Sheet

Common components to all ROVs:

- Cameras and lights - Includes video, still-photo, low-light, and high-resolution cameras.
- Control console - Topside control of all ROV functions and peripheral equipment (for example, sonar, tracking, and manipulator functions).
- Umbilical - Connects ROV to control console. Provides power, data transfer, and strength member. Usually copper wire or combination of copper wire and fiber optics.
- Thrusters (or ailerons on towed vehicles) - Allows pilot to fly the vehicle to its destination while avoiding obstacles.
- Floatation - More floatation that's built into the vehicle increases its payload capacity. Usually syntactic foam, a sealed air chamber, or a combination of both are used. Only larger ROVs have variable floatation capabilities.

Principal Applications - Biology, Geology, Chemistry

- Video/photographic documentation - Most common and easiest. Provides visual record for proof or later analysis in lab.
- Site or structure survey - General information, comparison data, structural arrangement or condition.
- Light instrumentation deployment/retrieval - Makes ROV more than just a "swimming eyeball." Provides data collection capabilities.
- Sample collection - Collect objects (data) by discrete sampling of sediment, water, plankton, algae, etc.
- Search and recovery - Most difficult. If you can find it, can you attach a line to it?
- Pre-dive (scuba or submersible) survey - Save limited scuba dive time and time on expensive submersible operations.
- Test platform for new equipment - Test concept design and function of equipment, and adds to arsenal of tools for data collection capabilities.
- Education - Outreach, knowledge, and information dissemination.
- Behavioral monitoring - Mating aggregations, survival techniques, feeding habits, etc.

Advantages of using ROVs for undersea research:

- Portability - Fly or land transit anywhere in the world.
- Minimal support personnel - Requires only one technician/pilot and usually one other person (staff or science crew) for deck operations.
- Deployable from "vessel of opportunity" - Just about any size vessel with AC power will work. Smaller vessels are often better since they're more maneuverable than larger vessels. The ROV has even been deployed from docks and even sea ice.
- Highly maneuverable - Up, down, forward, backward, crab to either side or combinations.
- Bottom time limited only by operator endurance - Center policy limits dives to less than four hours due to pilot fatigue. Piloting requires total and continuous concentration. Having more than one pilot to work in shifts is highly advantageous.
- Can operate in free-swimming or "downweight" configuration - Variations on both of these configurations provide a range of deployment techniques. Operational requirements determine which technique is utilized (i.e. free-swimming for maximum mobility or when the potential for entanglement is high, and downweight in high currents, deep deployments, or transect work.)

Disadvantages:

- High maintenance - Seawater and electronics do not mix! Mechanical maintenance is usually easy and quick to repair. However, electronic maintenance requires extensive troubleshooting and electronics knowledge. Spare printed circuit boards are kept on hand to facilitate faster repair and preclude cancellation of missions.
- Affected by current/sea state - Currents deter mobility. Current acts more on the umbilical than the ROV itself. The downweight deployment method is frequently used to counteract the effects of current on the umbilical. The ROV is severely limited in currents exceeding two knots. Sea state mainly affects deployment and recovery of the vehicle. In heavy seas, this is the most dangerous activity for the ROV and deck personnel. Once away from the vessel or in deeper water, the ROV is relatively safe, however, sea state also affects the maneuverability of the support vessel.
- Entanglement - Entanglement is the leading cause of vehicle loss. Not surprisingly, it is usually the umbilical, not the ROV that becomes entrapped or snagged. This is especially true with umbilicals that sink and drag across the bottom. Newer umbilicals often float directly above the ROV. A well-trained deck person is a great tether management system and can reduce the risk of entanglement. The ROV pilot needs to be continuously aware of potential hangs and how the umbilical is reacting to operational and natural influences.

- Minimal payload capacity/support - The center's Super Phantom can support 32 pound of payload (in water) before floatation must be added. The Phantom 300 can support 4 pounds of weight. Payload weight must be distributed evenly in order to maintain the vehicle's horizontal trim. Additionally, floatation is generally bulky and creates more drag. A general rules of thumb is that the weight goes on the bottom of the vehicle and the floatation on top. Plus, it's imperative to only use floatation that will not change with depth/pressure.
- Scaling/measurement from two-dimensional TV screen - "How big is that?" is probably the most common question asked on ROV missions. Objects look bigger or closer underwater. Different angle of view from camera to camera make objects appear to be different sizes, and objects appear larger as they get closer to the camera. Ancillary equipment, such as stereo cameras, parallel laser beams (which introduce a scale into the picture), and computerized scaling equipment provide quantitative measurement capabilities.
- Lack of peripheral vision - Vision through a camera lens is finite, often compared to having blinders on. Oftentimes, you can be right next to the object that you're looking for and not "see" it. Pilots combat this by staying up off the bottom and looking far ahead to get the biggest panoramic view. Also, pilots can sweep the vehicle or camera from side to side to see more. Water clarity, ambient light, and the light sensitivity of the camera are also contributing factors.