EPA Region 10 Dive Unit - Equipment Inventory
December 2012

In this document:

Personal Floatation Devices

A Personal Flotation Device (PFD) worn on the diver and tenders is required on all EPA dive operations when: 1) loading and unloading a vessel 2) when on the open deck of the dive platform (i.e. anywhere outside the cabin), and 3) when operating around water, e.g. on a pier or dock float. PFDs can help personnel avoid drowning when falling overboard, especially if the person is knocked unconscious on their way into the water, by at least keeping the victim's body from sinking long enough for rescue. PFD usage is not required on a fully zipped drysuit diver unless the vessel is underway. EPA has both foam (USCG type 3) and hydrostatic inflatable vests (USCG type 2 recreational, type 5 commercial), such as the Mustang hydrostatic inflatable technology vests. Though the hydrostatic vests are far more comfortable to wear, and minimize heat stress in the summer, they do sometimes fail to operate. Hydrostatic vests are also difficult to air transport for away missions due to TSA regulations that apply to the CO2 cartridge. Thus hydrostatic vests may not be appropriate for EPA operations outside of calm seas, for a user who is not a strong swimmer, and accustomed to the shock of sudden immersion in 40 degree water, for operations requiring air travel, or for solo boat operations.

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"Helmet" Camera

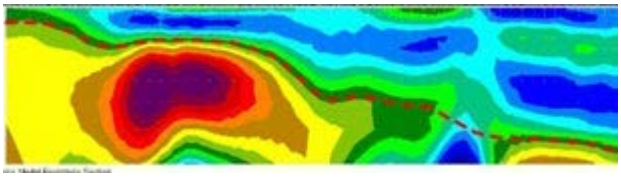
In 2009 an Ocean Systems delta vision color drop camera was purchased to support video needs during tethered diving operations. When diving on tether often the diver's hands are occupied with tasks such as filling a sample jar, or in maintaining trim in heavy current, such as river diving. The camera is now mounted on the diver's hand (see photo) allowing video to be taken of the operation, while keeping the diver's hands free for sampling or other underwater work. Topside, narration and video can be viewed by tenders and recorded to a laptop. The unit is powered by a small 12 volt battery, and has a 200 foot tether and 10 inch topside display now connected to Region 10's surface supply umbilical. The camera itself can focus on images at least three inches away and beyond, and has built in LED lights. A second "helmet" camera was purchased in 2012 and is permanently affixed to the 300 foot surface supplied umbilical. Return to top

Continuous Resistivity Profiler to Focus Transition Zone Water Sampling

Towed array that measures differing conductivities in the subsurface. Global Positioning System (GPS) is displayed atop the vessel towing the array. The continuous resistivity profiler is a geophysical instrument purchased in 2008 from Advanced Geosciences, Inc (AGI). This instrument induces an electrical current in the water column or subsurface soils and measures an array of resulting voltages at known points along a cable. As the whole array moves, either by hand on the ground, or while being towed behind a boat (as shown in the figure), large numbers of observations are made of the electric field. Software sorts through all this data to help find a best answer as to the subsurface electrical conductivity distribution which could cause the observed voltage measurements. The cable purchased is approximately 200 feet long – but may be shortened for higher resolution when desired. Typically you will see down to approximately 20% of the electrode spread length. The Marine Log Manager software allows you to edit the recorded data, plot the boat track and the resistivity data on an imported map image and to format the data for the inversion software. Key benefits include:

- 8 channel simultaneous measure capability;
- Short cycle times makes for dense data recording, almost 3 readings per second;
- Extra high current for low resistance water operation, 2 amperes in many cases;
- Special cable for marine environments will not corrode to influence results;
- GPS interface for accurate location of survey can use standard Garmin equipment;
- Dataset management software with mapping capability;
- Accurately handles electrode positions on meandering logging cable; and

- Conversion to Universal Transverse Mercator (UTM) coordinates for presentation on standard USGS maps.



Differing conductivities in transition zone water displayed graphically. Mapping out discharge zones helps to pinpoint areas for sample collection to determine what concentrations of contaminants are discharging from an upland area to a water body, like Puget Sound.

The system is intended to be used for groundwater discharge mapping at Superfund and other cleanup sites. Highest contrasts are found at sites where freshwater is discharging into salt water, or vice versa. Contaminant plumes may also create sufficient conductivity changes to be accurately mapped, such as significant chrome contamination in freshwater. Use of this technology is key to understanding where discharges occur into water bodies. Sampling in known discharge areas where groundwater discharges to surface water, the "transition zone," can give an accurate measure of what level of impact is occurring for benthic life. Taking expensive transition zone water samples without knowing where areas of discharge are requires an enormous amount of locations (e.g. piezometer samples) to determine where the highest zones of discharge are—essentially "sampling blind." The conductivity profiler allows mapping to take place to optimize a dive or other sampling effort of transition zone water. Return to top

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Underwater Pingers and Pinger Locators

Figure: Pinger locator (right) and pingers (left)

In 2008, pingers (RJE International Model ULB-364) and pinger locators (RJE Model PRS-275, boat and diver based) were purchased. The purpose of these devices is to enable easy relocation of high value pieces of equipment, even if it is moved by current or otherwise dragged. If the equipment is nowhere within range in a particular water body, this can be quickly determined without putting divers in the water. Pingers are typically placed on acoustic Doppler current meters (ADCPs) and other high value equipment, as this equipment can be very expensive to replace. Pingers might also be used on biological uptake sampling devices, as failure to locate these stations could represent a loss of irreplaceable data. The pingers require two 9 volt lithium or alkaline batteries and last between 6 and 150 days depending on what type of battery and wattage (0.125 watt, 0.5 watt, and 2 watt options) are selected. The five pingers purchased are activated by a water switch and operate at a range of up to 3000 meters on frequencies 27 (2), 37 kHz (2), and 45 khz (1) and are rated to a 1000 foot depth. Return to top

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Contaminated Water Diving & the Viking Pro Magnum Drysuit, Interspiro AGA Full Face Mask, and OMS Chemically Resistant IQ Pack

The standard diver's dress used by the EPA Region 10 Dive Unit for moderately polluted water typical of scientific diving operations is the Viking Pro Magnum dry suit equipped with dry gloves. When selecting a suit for use in potentially contaminated water, (either microbiological or chemical), a number of factors need to be considered. For microbiological contamination, ease of decon / decontamination is of key importance. Studies have shown that smooth rubber-shell style suits, such as the Viking can be decontaminated by spraying with a dilute Betadine solution (1). It is much more difficult to decon / decontaminate coated pack-cloth or neoprene-style dry suit material. It has been reported that a number of microorganisms can survive many hours or days in salt water (2). Micro-organisms can survive in pack-cloth or neoprene-style suits even after decontamination (1). For chemically contaminated environments, caution must be exercised because the chemical contaminates may have an adverse effect on the materials of the divers dress or permeate through the suit material. Permeation through suit material can be reduced by using various synthetic and natural rubber blends, thicker suit material can also reduce the possibility of permeation. However, the latex parts of the suit may be the least resistant to attack, permeation, or degradation by chemicals. There is very limited information available on the chemical resistance of the divers dress or other rubber parts of diving equipment (2, 3). Therefore, caution must be exercised if diving is required in areas of chemical contamination.

The Viking Pro Magnum suit is constructed of heavy weight blend of synthetic and natural rubber having a smooth exterior allowing for easy cleaning or decontamination. Unlike other drysuits equipped with latex rubber hoods, the Viking Pro Magnum has a dry hood constructed of the same heavy material used in the body of the suit. The heavy material used for the hood reduces the potential for permeation of chemicals compared to latex rubber. The AGA Divator MK II full-face mask is a mask / regulator combination that operates under positive pressure. The positive pressure feature is an advantage when diving in potentially contaminated environments because the positive pressure will aid in keeping contaminates out of the mask versus a normal scuba regulator that operates in a slight negative pressure mode. The AGA mask can be used in a free scuba diving mode, which allows greater freedom to move about than a surface-supplied diver (4). The AGA mask can also be equipped with a microphone and underwater communications system (2, 4) (see below). For extremely hazardous conditions or in highly contaminated water, a surface-supplied helmet mated to the drysuit should be used. In 2008, all Viking drysuits currently assigned to Region 10 divers were retrofitted with hazmat valving, including the Viking X2 exhaust and hazmat inlet valve. Both of these valves are designed to substantially minimize leakage of contaminated water into the suit over the standard valves, thereby limiting dermal exposure to the diver. While the Viking suit has lasted over a decade of regular use in the past for a typical diver, of late the unit's suits have had to be replaced every 6-8 years due to earlier failure. This could be due to more intensive usage and/or contaminants encountered during dive operations.

Figure: Interspiro AGA donned onto a Viking Pro Magnum drysuit. This is standard EPA diver dress for lightly to moderately contaminated water, to which the AGA full face mask is well suited. Highly polluted water diving, e.g. in pure product, should use a helmet mated directly to the drysuit as the AGA can at times leak water droplets into the mask. Return to top

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Figure: Viking X2 Hazmat Exhaust Valve (left) and Viking X2 Hazmat Inlet Valve (right); OMS IQ Pack Buoyancy Compensator with slick outer surfaces designed for decontamination and to minimize chemical/microbial adherence(below).

Go to Safety / SOP page for more information on decon procedures used by the Region 10 Dive Unit for polluted water scientific diving

Read more about EPA publications on contaminated water diving

Ocean Technology Systems diver recall units

A diver recall unit has been a standard piece of equipment used on all Region 10 scientific diving operations since an OTS DRS-100 was purchased in the early 1990's. This consists of a power box/console, underwater hydrophone, and microphone. The diver recall unit can be used to send out two different tone signals to divers underwater to carry out specific activities. By adding a microphone, the surface support personnel can provide verbal directions to the divers. Depending upon water conditions, communications can be heard several hundred yards away from the hydrophone. A new OTS DRS-100B was purchased in 2007 to supplement the DRS-100. Though also rated at 100 watts, the DRS-100B is less audible in the water (and sometimes difficult to hear at distance and through the Viking pro-Magnum hood) than the older DRS-100. Return to top

Ocean Technology Systems Through Water Wireless Communication Equipment

Figure: EPA Diver Rob Rau using an OTS through water communication system (SSB-1001B) during an ASARCO sediment cap survey and mapping operation.

This diver communication system consists of two major components, a surface unit and diver-carried units. This communication system operates in the ultrasound frequency range, so at times a diver may block the signal. The surface unit is a power console with a transducer that is placed in the water. The diver units have a microphone and headset that are inserted/attached to the AGA mask and a waterproof module containing the batteries, electronics, and signal transducer. The diver units can be operated in either a push-to-talk mode (similar to a walkie-talkie) or in a voice-activated mode. The voice-activated mode is preferred when the divers may be using their hands for collecting samples, photographic work, etc. Depending upon water conditions, transmission range may be several hundred yards. The surface station can receive and understand about 50% of all transmissions. Some reports have stated that 80% understandability of communications is considered excellent for this technology (5). This system enhances safety during scientific diving missions by allowing divers to communicate in limited visibility conditions, or to communicate dive progress to the surface personnel. Units were updated in 2005 with three 10 watt transducers (OTS SSB-1001B) and adapted to also allow a diver to conduct narration while simultaneously recording video and using through water communication. In 2007, two additional 70 watt diver wireless transducers (OTS MAG1001D) and a new surface station (OTS MAG 1000S) were purchased to aid in audibility, which can be difficult to understand at times. Two surface stations are currently in inventory. All wireless units broadcast on channel 1 (33 khz) to ensure signal to noise ratios are maximized, and to ensure compatibility with older units. Return to top

Automatic Identification System (AIS)

In 2007 a Nauticast automatic identification system (AIS) Class A was purchased for use aboard EPA dive platforms. For mid-channel cap inspections, divers must sometimes cross busy shipping lanes. Though a notice to mariners is given, alpha and recreational dive flags are flown, emergency procedures are reviewed with divers, and appropriate VHF channels are monitored (e.g. 13, 14, 16) these requirements do not relay up to the moment location information to vessel traffic controllers to allow conflict management for inbound vessels. The purpose of the AIS system is to broadcast the dive platform exact location to Puget Sound USCG Vessel Traffic Service (VTS) and large ships transiting the area in order to head off vessel conflicts before they occur to enhance diving safety, especially for tethered SCUBA dive operations. Return to top

Canon Powershot with Ikelite Autoflash Strobe

In 2010, a Canon Powershot SD970 was purchased with an ikelite autoflash strobe and 32 gigabyte SDHC 32GB SD memory chips. The camera can shoot high definition (HD) video as well as 12 megapixel photos. The camera can store 9800 photos or 200 minutes of HD video at the highest resolution settings on the 32 GB memory sticks. In 2011, this was supplemented with a Canon A3300. Return to top

Sony HC1 and HC7 Digital Video Cameras with Light and Motion Bluefin Housing and Sunray 2000 Lighting System; Canon HFS-30 with Light and Motion Bluefin Pro Housing and Sola 1200 lighting

The Sony HC1 and HC7 digital video cameras allow the capture of high definition video to tape as well as still images. The high definition video itself is of sufficient resolution that screen captures can allow still images of approximately 1 megapixel in resolution. The digital media allows not only higher resolution video and still images (HC1: 1 megapixel, HC7: 5 megapixel) to be possible, but also enables faster video editing of dive operation footage. The video cameras are used for EPA Region 10 scientific diving operations including documentation of existing bottom conditions at Superfund sites before or after cleanup has been undertaken. In 2008 a sunray 2000 lighting system was purchased, which utilizes LED lighting to produce 2000 lumens per light head. Batteries are rated to last 75 minutes and the battery pods are rated to 300 feet. The lighting system weighs a total of 6.1 pounds, dry. In 2011, a canon high definition camera with sola 1200 lights was procured. This camera has the advantage of being able to record directly to

a camera flash card, rather than digital video tape for ease of post-processing. All cameras are outfitted to allow narration by the videographer in-water. Return to top

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Dacor Seasprint Diver Propulsion Vehicles (DPVs)

The SeaSprint DPVs are used by the dive unit to survey or search large areas. These DPVs can propel a diver through the water at 0.5-1 knot. The batteries for these DPVs will last from 30-45 minutes, allowing large areas to be searched by a pair of divers for scientific diving needs such as mapping algal growth or locating large areas of product seepage. Return to top

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Underwater Mapping

The EPA Region 10 Dive Unit has demonstrated a survey technique for underwater digital photography integrated with GPS location data at the Blakely Harbor, ASARCO, Jackson Park, and Wyckoff sites. A survey procedure is conducted with a two person dive team surveying the underwater environment. The dive team searches for submerged aquatic resources, objects, or features and documents the item(s) with digital photos of the features in question. An inexpensive recreational Global Positioning System (GPS) device is towed in a raft directly above the dive team which records positions throughout the dive. Commercial software is later used to relate the GPS information to the digital photos resulting in geo-located digital photos that can be viewed on a map or Geographic Information System (GIS) for later analysis of the seafloor environment. This survey technique is now used to support a wide variety of EPA scientific diving needs in polluted and non-polluted waters. Return to top

More information: Siwiec T., S. Sheldrake, A. Hess, D. Thompson, L. Macchio, P. B. Duncan, 2008. Survey Technique for Underwater Digital Photography with Integrated GPS Location Data. Proceeding of the American Academy of Underwater Sciences 27th Symposium pp. 159-166. (PDF) (8 pp. 2.1MB)

GPS in drybag

GPS Raft with Dive Flag

Laptop used during documentation

Tethered SCUBA Diving

Figure: The tender talks to a diver via OTS headset/mike during Columbia Shuttle Recovery dive ops.

In 2004, Region 10 acquired Ocean Technology Systems (OTS) tethered SCUBA diving gear including two 200 foot communication (comm) ropes (OTS cr4), 3 ear/microphone setups for the Full Face AGA mask (ema2) and a headset/surface unit (mk7) to monitor one or two tethered divers. In 2007, this was supplemented with a backup OTS MK7 unit due to design flaws making electrical shorts in the surface tender headset microphone possible, four additional ema2 ear mike setups, and

two 300 foot comm ropes for a better span of operation from one anchor point where conditions allow. Comparatively to free swimming divers, tethered SCUBA operations allow better monitoring of the diver in low visibility environments such as the Duwamish and Willamette Rivers and allows solo diving where the diver may focus on the task at hand. Being able to focus on a particular task is a huge advantage in low visibility conditions, where keeping track of a buddy can otherwise take a diver's full attention to ensure safety. In addition, the tether offers stability in high current diving conditions such as that found in the Yakima and Columbia Rivers and tidally influenced areas like Henderson Inlet and Willapa Bay. To allow solo diving under EPA and Region 10 safety guidelines, a Kirby Morgan manifold "bailout" block is utilized with a 13, 19, or 30 cubic foot pony bottle to allow the diver a safe escape from working depths of up to 100 feet. The 30 cubic foot reserve capacity gives a safety margin designed to allow for a free flow emergency, even at maximum working depths. Two sets of blocks, pony bottles, and main tank mounts were purchased to allow this bailout equipment to be used while diving untethered with a buddy as well. Higher capacity SCUBA tanks and DIN adaptors were also purchased to enhance the safety factor allowed for solo diving. In 2008, an additional headset was purchased due to ongoing surface tender headset (mk7) problems. A replacement 200 foot comm rope was also purchased to replace the one purchased in 2004 which had become frayed from frequent usage near encrusted pilings. In addition, two spare 30 cubic foot bailout bottles and Kirby Morgan manifold blocks were purchased in 2008 to allow better continuity of operations during equipment maintenance downtime.

Standard Region 10 safety procedures for tethered diving include a thorough dive briefing of communication protocols, including line signal backups should wired communications fail. All dive operations deploy with a backup tender headset given known problems. Divers are also briefed on the characteristic topside "squeal" that indicates the diver has accidentally popped the wet connection loose between the ema2 and comm rope, and the diver is instructed how to reconnect this if surface tender communications are lost for more than a few seconds. Surface tenders frequently monitor the diver's air pressure, and check this against remaining tasks to allow ample safety margins. The diver is always to keep their primary and reserve tank submerged pressure gauges in view, to ensure that they know which tank they are breathing off of at all times (e.g. if the manifold were to be bumped during the course of the dive), and the status of both of their air supplies. EPA developed an SOP for tethered SCUBA diving in 2010 which was published via AAUS. Return to top

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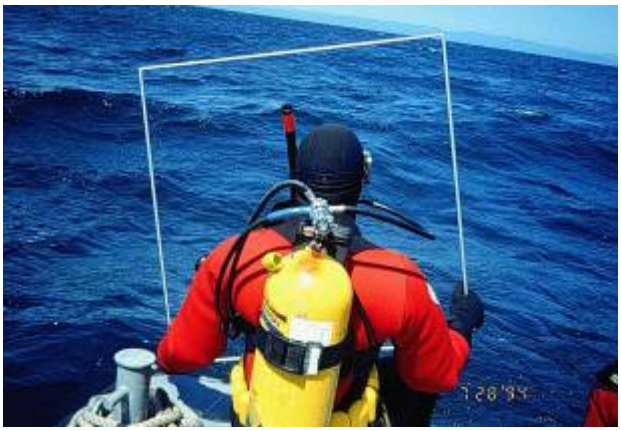
SCUBA Tanks



Region 10 had conducted its own visual cylinder inspections for nearly 30 years and operated nearly exclusively with aluminum 80 cubic foot cylinders to support the Region's scientific diving needs. With the advent of new electronic cylinder inspection techniques that do not rely on the naked eye to detect the development of small cracks in the neck of a scuba cylinder, this was discontinued. Aluminum tanks are now put through the "visual plus" eddy current based inspection process which detects potentially catastrophic cracks much earlier, before cracks are visible to the naked eye. The compressed gas cylinder inventory was substantially expanded in the early 2000's due to discovery of the lack of compressor testing at many NW area dive shops, necessitating that tanks sufficient for the dive operation be brought to the dive site. 6 Aluminum 80 tanks and 29 high pressure steel DIN/K 120 tanks are currently in service. 4 of these steel tanks are dedicated to NITROX use. In addition, 8 pony bottles are in inventory as emergency gas supplies for SCUBA operations, ranging in size from 13 cubic feet (2), 19 cubic feet (2) to 30 cubic feet (4).

Figure: Diver entering the water to conduct an algal survey offshore of the Elwha River delta in the Strait of Juan de Fuca with a USD aluminum 80 tank manufactured in the mid-1970's. Return to top

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Safety Equipment

Region 10 acquired a Phillips Heartstream FR2 Automatic External Defibrillator in 2004. Due to the often remote nature of Region 10's inspection / scientific diving work, and the fact that success of revival drops 10% for every minute that passes after a cardiac arrest (American Heart Association), location of an AED at the dive site would offer an enhanced ability to respond to all types of diving accidents. The AED is located in the dive unit primary first aid kit and is

deployed with the team on all projects to increase dive safety. Extra batteries, pads, and data cards ensure the unit is able to stay in service at all times. As part of a government wide AED program administered by the Public Health Service, placement of this equipment with the dive unit requires regular rescue/first aid exercises on shore and on vessel. In 2008, the dive team AED was updated to conform with the 2005 American Heart Association guidelines to maximize life saving capability of the unit and match unit performance with diver CPR/AED training. Return to top

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Personal Locator Beacon

Figure: Personal Locator Beacon on left (green), Emergency Position Indicating Radio Beacon on right (white).

EPA acquired a Personal Locator Beacon (PLB) for the Dive Unit in 2009. The 406 MHz PLB uses search and rescue satellites to bring search and rescue aircraft within 115 meters of the divers' position by pressing one button. For comparison, a simple marine radio call might be triangulated at best to over a 3 square mile search area. EPA vessels Monitor and Wooldive are also outfitted with Emergency Position Indicating Radio Beacons (EPIRBs) rigged for hydrostatic release as of 2009, which automatically deploy during a vessel sinking, greatly improving access to rescue for Region 10 field personnel.

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Metal Detector

The dive unit uses the Fischer 1280x underwater metal detector on occasion to find buried metal objects underwater, or in the case that sampling equipment should become buried. Return to top

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Dive Platforms

The EPA Region 10 28 foot research vessel 'Monitor' is available to EPA personnel to support scientific diving, surface based sample collection, and site reconnaissance/site tours. It features a cabin, dive ladder, potable water supply for diver decontamination, AC/DC power, sounder/sidescan chart plotter, and removable A-frame. In 2007, the Monitor's engine was retrofitted, which helped to reduce vehicle emissions. In addition to reducing carbon monoxide by 40 percent, the cleaner, tier 2 engine will reduce particulate matter by 78 percent, nitrogen oxides by 39 percent and hydrocarbons 22 percent. Contact Doc Thompson or Brent Richmond for more information on using the Monitor for your project at 360-871-8721 and 360-871-8711.

EPA purchased two Wooldridge boats in June of 2005, one 20' and one 17'. Both boats are built to support EPA sampling needs. The 20' boat was built to support EPA Region 10 dive operations both in terms of size and features. The 20' boat includes the following specific features:

1. 3/16" hull thickness;
2. 50 gallon fuel tank;
3. canvas top and sides;
4. swim step;
5. cut transom for swim step (port side);
6. dive ladder;
7. Tank racks for 10 tanks;
8. GPS Mount for Garmin 276c (no external antenna);
9. GPS Plotter/Sounder: Furuno GP1650WF GPS Plotter;
10. VHF Radio: Icom M422 Marine VHF;
11. 25 gallon freshwater tank, pump, sink to support potable water diver decon;
12. 3' long storage box under upholstered seat;
13. 1250 gph bilge pumps;
14. 150 hp Honda primary; 9.9 hp Honda kicker trolling motor; and
15. EZ load trailer.

The 17' boat is not specifically built to support diving; it has no swim step, no cut transom for entry/egress, no Garmin GPS mount for ease of uploading/downloading waypoints, and lacks the potable water tank/pump decon assembly to support polluted water diving. The 17' boat is a jet boat, and can travel in as little as 4 inches of water. The 20' Wooldridge, driven by a conventional outboard, requires almost 3' of water for travel. Return to top

Remotely Operated Vehicle (ROV)

Figures: ROV & micromanipulator arm after grabbing onto a fish cage poly-line.

In 2007 a Videoray PRO (EXTGO) microsubmersible remotely operated vehicle (ROV) was purchased for use by EPA for diving and nondiving purposes. The ROV is intended to investigate areas that may not be safe or cost effective to dive, or to expedite diving operations by locating underwater targets for further diver investigation or sample collection. It is depth rated to 500 feet and can reach a top speed of 4.1 knots. Total system weight is 105 pounds. An underwater navigation system (ORE 4330B-D, Trackpoint 3) used in tandem with Hypack Lite software for the ROV (and for dual diver tracking and underwater mapping use) utilizing ultra short baseline (USB) technology was also obtained such that video recorded of areas of interest can be mapped. The ROV also has a SeaSprite sector scan sonar to expedite searches for underwater objects.

A micromanipulator arm was purchased in 2009 to allow the ROV to secure itself to an object of interest, place lines on instruments, and even bring small objects to the surface. A Blueview sidescan sonar was also purchased in 2009. The ROV itself was upgraded from a PRO 3 to a Videoray PRO 4 in 2011.

Blueview Sidescan Sonar

Figure: ROV with Blueview sonar and micromanipulator arm installed under the VideoRay

itself.

A Blueview P900-130 sonar with VideoRay Pro 3 integration kit and software and sonar processor was purchased in 2009 primarily for ROV usage. This meant for ROV navigation and monitoring operations in low visibility waters. Due to the unit's size, the sonar can be mounted with a ROV's main system to provide camera/sonar synchronization. XE-GTO sonar is small camera The unit can be submerged to 1000 feet of depth, weighs approximately 5 pounds (about 1 pound in the water), and operates on a 900 khz frequency. The Blueview sidescan may be later adapted for diver handheld/standalone use as was the sector scan. Return to top

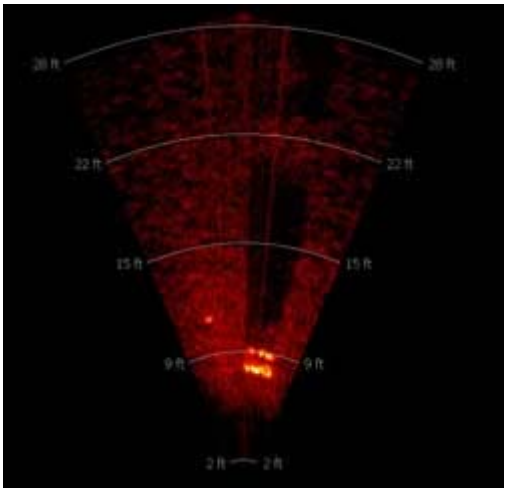


Figure: Image of fish cages on the bottom of Clam Bay, using Blueview sidescan.

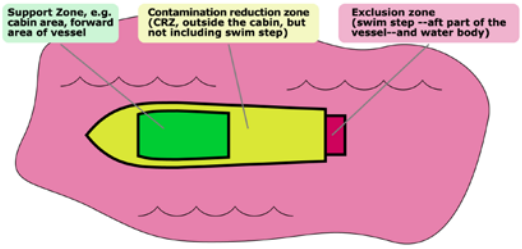
Sector Scan Sonar

Figure: Screen shot of sector scan images showing the diver and "target" which allows the diver to be directed to the vessel. View of the sector scan sonar, mounted on its tripod (black item on top of grey cylinder on a gimbal), being retrieved.

In 2007 a SeaSprite sector scan sonar was procured with the remotely operated vehicle (ROV) to expedite searches for underwater objects. The sector scan was adapted for standalone diver use in 2009 (i.e. without the ROV). As was used for Shuttle Columbia, Sinclair Inlet, and Crow's Nest underwater searches, the sector scan can be lowered into the water prior to diving a particular site to look for objects with a significant (i.e. at least 2 foot by 2 foot) sonar profile, such as a fish cage, abandoned vessel, or other object of interest. The sector scan is also used during diving to navigate the diver(s) to particular targets. The sector scan is lowered on a tripod (fabricated by Doc Thompson, EPA Manchester Lab, shown in picture) via an OTS cr4 communications rope, and connected to a laptop. The software allows various resolutions to be displayed by topside tenders--searching up to 100 meters from the device--and the diver navigated towards any targets found underwater, typically via tethered SCUBA or surface supplied air.

Surface Supplied Dive Operations

In 2009 EPA procured a surface supplied diving system for Region 10 dive operations. This system is intended to allow for additional safety when operating in low visibility, high entanglement areas, offer more time for work on the bottom, and allow for extended decontamination for Superfund Site work. The system procured is a Kirby Morgan KMACS 5 with 200 foot umbilicals set up for OTS ema2 ear/microphones on the AGA mask, with 50 cubic foot emergency gas bottles. The 200 foot umbilicals and control box are pictured on the Monitor at left. Note that the umbilicals remain in the vessel's contamination reduction zone (see below) to avoid moving contaminants forward in the vessel and cross contaminating other areas.



Currently, the system is used with the AGA full face mask, but may be later upgraded with a helmet for more significant levels of pollution. Surface supply is used by the ERT dive unit, and was used in the Shuttle Columbia search operation in 2003. In 2012, 300 foot umbilicals were purchased to allow for a broader range of operation from one anchorage. The primary 300 foot umbilical was purchased with a helmet camera twisted with the other components for more seamless operation.
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