

## R/V *Nanuq* Underway System

Nanuq now offers a new suite of scientific services and shared-use equipment for underway data collection. These include an uncontaminated seawater system, outside transducer pole, and a server workstation to provide basic infrastructure for the acquisition, logging, and display of underway oceanographic data. Please make any service/equipment requests during the pre-cruise planning process, particularly if you are interested in integrating additional gear.

### Uncontaminated Seawater System



Spears Low-Extractable High-Purity PVC System was selected for all piping and fittings. This material is specially developed for ultra-pure water systems used in laboratories and hospitals. It is a non-contaminating material with exceptionally smooth surface characteristics, low TOC & chemical extraction, and fast particle rinse-up.

The 1" seachest intake is located in the forward bilge. Seawater first flows through a basket strainer with 1/32" mesh that helps remove particulates (i.e. jellyfish, seaweed) that could clog sensor flow-cells. The system features a Sethco 1/4-horsepower magnetic-drive, seal-less, end-suction pump with a maximum flow of 18 GPM. Completely corrosion resistant, there is no metal contact with the seawater being pumped, and no shaft seal means leaks are eliminated. Downstream of the pump's expansion joints, the system has been provisioned in case a vortex debubbler needs to be added at a later date.

A check valve gives way to a 3-port parallel manifold with 1/2" ball valves. A Seabird Electronics Thermosalinograph (SBE 45) is permanently installed, and there is space for additional flow-thru instruments such as fluorometers or other environmental sensors (e.g. nitrate, dissolved oxygen). Sensors can either be plumbed in parallel or serial depending on flow requirements. On the discharge side of the manifold is an electronic flow meter, as well as a 1" bypass line that allows for a range of adjustment to the flow rate through the manifold.

Downstream is a 1/2" line that runs into the aft bilge and then up to the vessel's sink where a gooseneck lab fixture provides topside access to surface seawater for more elaborate flow-thru instrumentation (e.g. pCO<sub>2</sub>, mass spec), deck incubators, or routine spot sampling for later analysis. Increasing back-pressure on the final discharge valve in the forward bilge allows for flow-rate control topside.

### Overside Transducer Pole



The overside transducer pole is for the use of acoustic sensing equipment such as an Acoustic Doppler Current Profiler (ADCP) or other portable scientific echo sounders. All piping, fittings, and flange material are 2" Schedule 80 galvanized steel. Two deck-mounted Babbitt bearings with split housings allow the pole to be rotated - horizontal/stowed when transiting, or vertical/deployed when surveying. Lexan tubing wraps around the pipe to meet the bearing shaft diameter, provide galvanic isolation, as well as provide a low friction coefficient when rotating the pole. Lateral movement is restricted with the use of shaft collars butted up against the sleeve bearings.

The pole's mounting flange sits about 2.5 meters below the surface. A stainless-steel adapter plate has been made to mount a TRDI Workhorse ADCP. Other adapter plates can be made to accommodate different instruments. The above-water section of the pole is roughly 2 meters high, and can be used for co-locating navigation devices such as an IMU. There are lifting eyebolts on both the lower and upper pole sections to aid with rigging and stays.

A dedicated UHDAS server has been built to acquire data from an ADCP and ancillary navigation sensors (e.g. GPS, gyrocompass), and uses CODAS processing to incrementally build a dataset of averaged, edited ocean velocities. Processed data and plots of currents will be available in near real-time.

## Data Server

Inside the cabin facing aft, an overhead shelf contains the Data Server, which consists of the following electronic equipment:



- Marquis server workstation custom built by ASL has both Windows 10 and Linux Ubuntu operating systems. Data storage includes three 2 TB solid-state drives configured for RAID 5, with room to expand up to five more 2.5" drives. The video card is capable of running up to four monitors. Loaded with software such as Labview and Matlab, the workstation provides robust runtime environments for acquiring, logging, processing, and displaying underway data.
- Permanently installed Seabird Electronics carousel deck unit (SBE 33) provides sea cable telemetry for real-time operation of select Seabird underwater CTD units (not provided).
- SBE 45 interface box is conveniently located, providing remote power and data interface to the TSG located in the forward bilge.
- Two Maretron NMEA 2000 Gateway devices multiplex data sentences from the vessel's navigation electronics — GPS, gyrocompass, echo sounder. The workstation logs this information and can time stamp sensor data so it is geo-referenced. Navigation data is rebroadcasted via UDP over the local network so other computers like UHDAS can incorporate into their own datasets.
- Peripherals include an 8-port RS-232/422/485 selectable serial device hub, 10-port managed ethernet switch, and 10-port USB 3.0 hub. An APC 1500 Back-UPS is powered by a dedicated 110 VAC 15-amp circuit on the vessel's inverter bus.

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