

VPR performance on NBP12-01

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Includes D. McGillicuddy's Edits

Summary

Over all the VPR performed well in the chilly Antarctic waters. A few small problems were overcome. There was a complete failure of the oxygen subsystem. The VPR was towed 17 times (two test deployments, 15 science tows, two of which were portions of the same cruise track split by sea ice) and one failed deployment and immediate recovery. The instrument was towed over 170 hours, collecting over 1.6 TB of data.

Engineering Analysis

The Flying Fish flew best with 3 degrees of rudder bias. It was easier to add in the rudder bias than to turn the servo slightly and try to test out a new optimum rudder bias. Most of the cruise we towed between 5 and 110 meters. The last 5 or so tows we tow-yoed between 5 and 130 meters. On an early tow with no apparent cause the port wing recovery ring detached itself from the bottom of the pod. This ripped a hole in the top of the pod, and it is surmised that this was due to a failed weld as there was no impact with the ship. This was resolved by cutting off both rings and covering the hole on the port pod. A future improvement maybe to weld the ring to the pod tip where there is more material and a better weld may form. Barring that a reinforcement plate welded on to the pod may help and increase robustness.

On one of the later tows, the tail skids broke mid tow. Again there was no impact with the ship, it is surmised that the stress of part of the weight of the fish on the tail and vibrations caused the fracture. The fracture point appears to be at the weld point. The remedy for this solution was to replace the tail skids with the spare set brought along. Future tail skids should be heat treated for better wear capabilities.

The metering block did not function, but should with minor adjustments. Once made the block should work with the winch's built in display. Lack of metering was overcome by using the hash marks sprayed onto the cable during spooling, and marking a stop point.

The Alaska Dynacon winch made a great replacement for the VPR winch. The increased speed decreased deployment and recovery times significantly. The winch base mounting system was also a success. Very little modification was needed to fit the winch to the deck due to the modular nature of the mounting base. The X shaped base plates were lighter and easier to move than the comparable square plates. The raised winch kept critical components dry during the transit. A small amount of water was found in one of the j-boxes. It is recommended to change these boxes to NEMA 6, submersion type

boxes. Due to the height of the winch and the a-frame a stand for the wire fairleader was provided by WHOI and then modified by RPSC. In the future with a shorter a-frame a smaller platform may be better suited for the job. A snatch block was used to level wind the wire (up to the fairing), allowing the winch to haul in at full capacity. The hydraulic oil and filters should be checked on the winch's return.

Science Analysis

All standard VPR instruments performed well. There was one failure of the CTD due to a splice in a cable that had gone bad.

VPR data was abundant. Data collected was approximately 1.6 TB of data. On a tow during a single hour 16 GB of data was collected. All four computers, plus a spare hard drive were used to collect the data. Due to the large volume of data collected there were times of very low frame counts and missed data. With the massive amount of data being collected, a SAN is recommended to be faster and more reliable data storage.

Another possible recommendation is to move to an enterprise O/S which may be slightly more stable. One computer's power supply blew a fuse causing us to miss 30 minutes of data while troubleshooting and swapping machines occurred.

It has been found in the past that a large percentage of images were blurry, it may be useful to have a tighter focus in the future.

The oxygen subsystem, while performing adequately in OC471 did not perform well on NBP12-01. The programs to collect data worked better on NBP12-01 than on OC471, but with no oxygen data to collect they were not much use. Early on a leak in the optode connector caused an unrecoverable failure at sea (it should be fixable on shore). The SBE43 yielded data early in the cruise, but the values were suspect. Initial troubleshooting efforts focused on the processing algorithm, but when that did not bear fruit it became clear there was a sensor problem. To verify this, the instrument was installed on the CTD rosette for comparison with the secondary SBE43 on that package, and indeed the VPR SBE43 bore no resemblance to the properly functioning sensor. A spare SBE43 sensor was borrowed from the ship. From that point forward no more oxygen data was collected. Bad wiring either to the sensor or the pump was suspected and replaced. A loose screw in the auxiliary housing was also found. During the activity, tiredness caused carelessness causing a cascade of failures to the auxiliary housings fiber optic system. A removed connector allowed ice to freeze in the bulkhead causing an unrecoverable failure of the system. In the future, one or more extra bulkhead connectors for the auxiliary housing should be carried in inventory.

Personnel

Josh Eaton acted as the operating engineer and deck boss, also the principal watch stander during the noon to midnight shift.

Robb Hagg acted as the instrument technician and winch operator, also the principal watch stander during the midnight to noon shift. He learned the system and took care to pay attention to the

details while maintaining the idea of the bigger picture. His careful study of the system along with the operating engineer's guidance was able gain an understanding and full appreciation of the system. It is recommended that he continue to work with the instrument.

Dennis McGillicuddy as the chief scientist utilized the VPR to guide the adaptive sampling of NBP12-01. He acted as the cable fair leader and helped watch standers.

Elise Olsen acted as the VPR pilot and the second watch stander on the midnight to noon watch.

Olga Kosnyrev acted as the second watch stander for the noon to midnight watch.

Analysis of Ship

The NBP is a capable vessel and provided a stable working platform. The one difficulty with the ship was the failure of the ships UPS. This made the available power less reliable, so all systems were placed on small UPS power units.

The RPSC and ECO crew were very good. The one difficulty was the need for the science party to go through RPSC to communicate with the ECO crew. With in that frame work things worked well.

RPSC added a great deal to our understanding of the operating conditions in the Antarctic. A 10 ft ISO shipping container was provided by RPSC for storing the VPR and keeping it out of the elements on deck, to great benefit of our operation. It was placed next to the winch on the fantail. A possible improvement/complication for future deployments might be a pair of 10 ft containers for storing and shipping the VPR. This may give a ship more flexibility of placing smaller containers. RPSC also had provided the suggestion for raising the winch off the deck. This worked well and provided more advantages than just dry feet. The winch operator was provided with a better view of the deck.

System Maintenance and Improvements

Further improvements should be considered other than those mentioned above. The oxygen system should be more tightly integrated with the VPR data collection software (Deck.exe) and Visual Plankton.

The frame should be stripped down and thoroughly cleaned and holes repaired. All skins should be gone over and repaired if needed and painted. The new fins should be fitted to the system and new depth limits should be applied to the flight control software (vpr2.exe).