TECHNICAL REPORT

VEII Viking Explorer II
Long Beach City College
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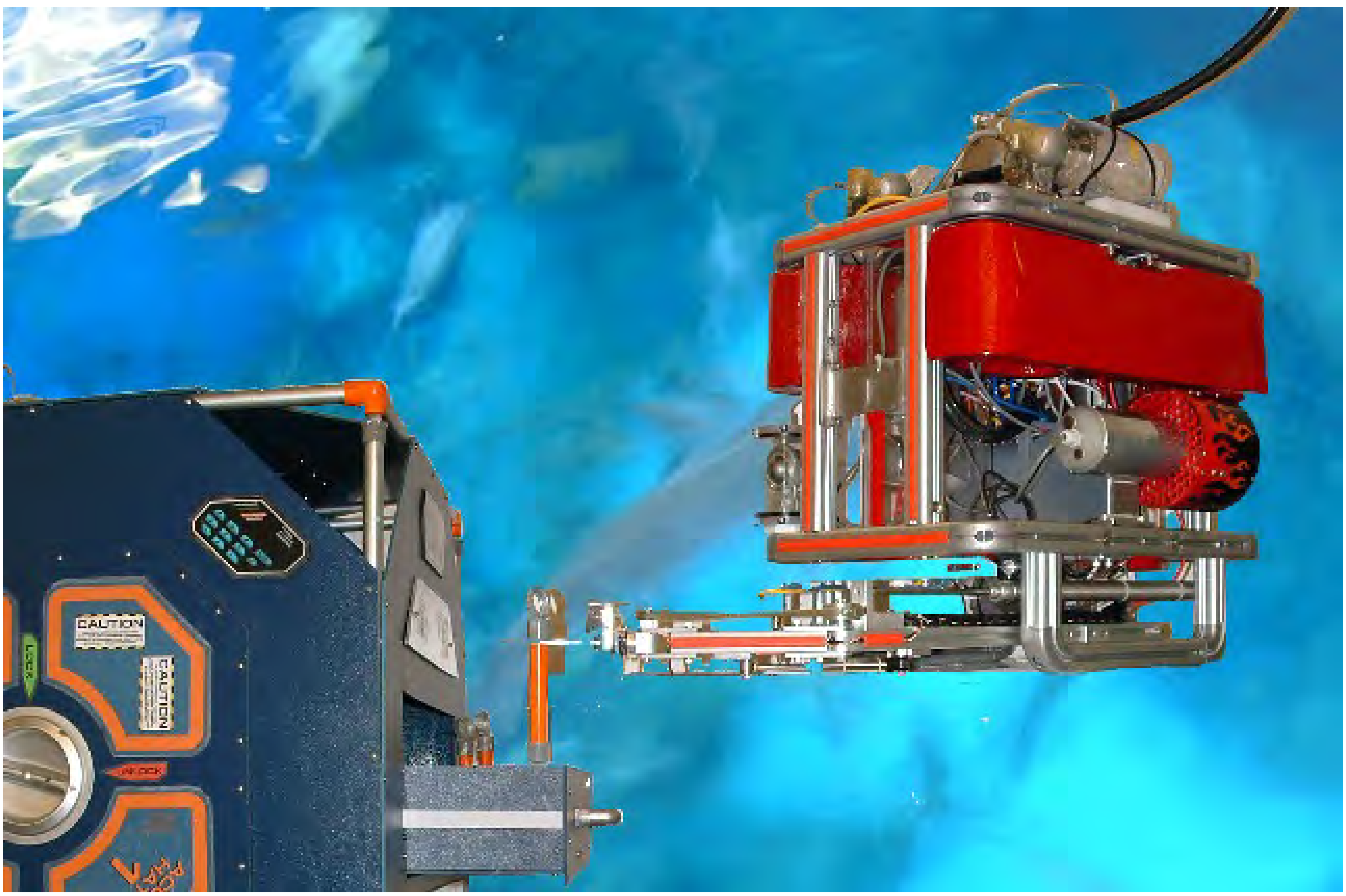
Abstract

The VEII Remotely Operated Vehicle (ROV) is an industrial grade apparatus designed to withstand the abuse and extremes of extraterrestrial environments. Fabricated of anodized aluminum extrusion, rugged fiberglass floatation, and pressure tested to 7kg-force/cm^2; it will survive the harshest situations. It is 58cm long x 57cm wide x 78cm high. It displaces 36.91 liters and weighs 44 kg. With the addition of 7 liters of flotation, the ROV is neutrally buoyant. There are 4 thrusters, an array of science instrumentation including a digital temperature sensor, a sampler, and 4 Ethernet controlled cameras. It is controlled over fiber optic Ethernet link, operates on 48 volts dc and utilizes helium for pneumatics power. Four variable buoyancy chambers provide up to 6kg of lift. The tether provides both electrical and pneumatic power and an exhaust path for the waste helium. The tether also has variable buoyancy by inflating the internal polyvinyl tube housing the power. The tether is cased in a constricting nylon sleeve to keep everything in a tight and uniform package. This is one tough ROV.



Design rationale.

Water Dynamics: Last year's Viking Explorer ROV was designed in a limited amount of time for the tasks given. Issues such as water dynamics and size were not a high priority. This year with the VEII (the modified Viking Explorer) there was much more time to discuss these issues. Our first change was to downsize the ROV to fit within the constraints of the new scenario. We created new mounts for the horizontal thrusters and brought them in approximately 110mm. The old gripper also had to be removed to accommodate the size limits. Once we solved the issue of size we tackled water dynamics. Rather than leaving the vertical thrusters mounted by L brackets to extrusions, we chose to make thin T mounts that could be welded to one side of a thruster. This cleared about 35% of the path for water to flow. We then slid an acrylic cylinder around each of the vertical thrusters to straighten the water path. For the horizontal thrusters we moved the mounts to new locations out of the water path.

Then we hit our biggest improvement! We discovered a honeycomb grill design on the internet that was being used for improving thrust on tug boats. After discussions with the Innerspace Corporation, they provided us with a set of dimensions to design our own honeycomb grills. These grills were honeycomb shaped to straighten the flow of water. The blades were shaped similar to wings with a sharp side and a blunt side to speed up the exiting water. The grill was designed in SolidWorks by our team and built using a procedure called stereo lithography. In smoke testing we observed a significant difference with the added grills. Without the grills the exhaust smoke swirled outward creating a one meter wide vortex and we actually observed currents back feeding into the thruster. With the grills applied the swirling vortex was corrected to form a perfect column 0.2 meters in diameter and over 2 meters long. All current was straight and uniform. And the smoke was visible at 3x the distance from the thruster. This was a great improvement and success for the VEII.

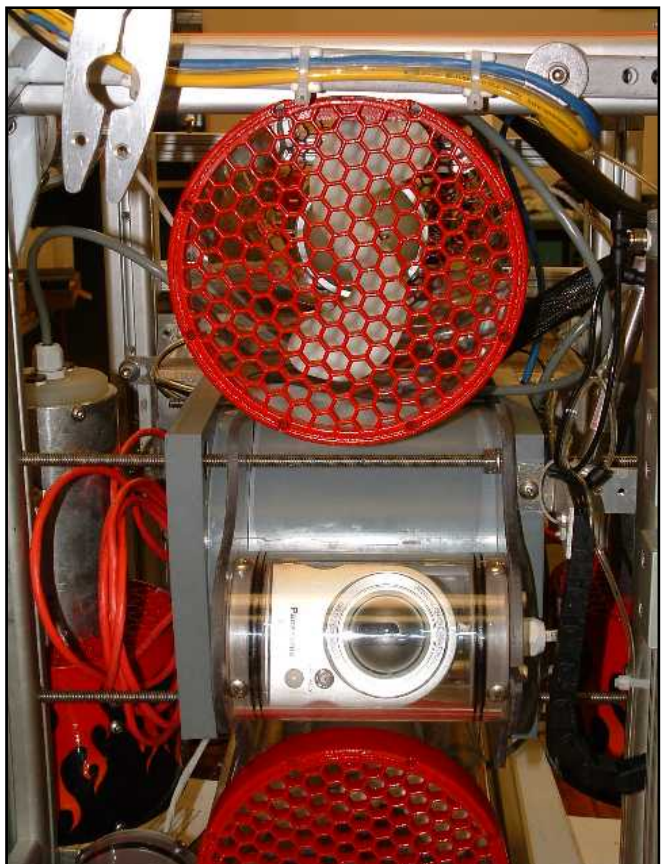


Figure 1 Bottom of ROV Showing Screens

Acknowledgements

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