

# SUB-contractor gets

By Correspondent Tonia Jurbin

Nuytco Research Limited of North Vancouver, BC, is involved in a number of research projects, the most exotic of which is designing and building compact submarines. Their customer base varies considerably from the entertainment industry where two of their subs, the Aquarius and the Deep Rover were used in the 1989 movie *The Abyss*, to educational and research for regular customers like the National Geographic, and underwater inspections of submarine utilities and construction sites.

Associated business activities include research in subsea communications technology, manipulator (robot arm) technology, lighting and video recording. Because Nuytco is a leader in the field of submersible work systems, they require lighting that is lightweight, versatile to mount, and that could vary in wattage output to meet different filming requirements. When they could not find the lighting they needed, it became a natural extension of their research to develop the lighting that will maximize colour resolution during video production.

Halide Metal lamps have been a big success for Nuytco, with 200 watts at full power, they put out about 5 to 6 times more light per given watt than the standard tungsten halogen bulb. The output can be varied in 20 watt increments from 100 watts to full power.

Most of the submarines that they build are sold outright to subsea contractors who use them primarily either for the entertainment industry, scientific research including



sampling or inspections. They are worth about US \$600,000. Their typical submarine has a steel hull, a titanium battery tube that holds about 20 deep cycle lead acid batteries (depending on the model), a Programmable Logic Controller (PLC) for monitoring currents, voltages, lights etc. with a touch screen interface, and a 1HP - DC brushless motor. It weighs about 4000 lbs, about a quarter of which is batteries. The sub is a little smaller than a Volkswagen beetle, has a maximum speed of about 3 knots and can work

in depths of up to 620 m.

Nuytco recently won the contract with BC Hydro to inspect several sections of the cables that supply Vancouver Island. The total value of the contract is about \$200,000 and is expected to take about 10 days. Specifically, the submarine pilot will be following a 2 km section of the DC cable and a 20 km section of the 6 - 500 kV AC transmission cables in about 310 m of water. They want to inspect the catenary, that is where there is some bending or sagging from suspensions from one high



# s down to business

The sub, a little smaller than a Volkswagen, is capable of depths to 620 m.



Sub pilot Mike Reay makes final preparations before a dive.



point to another. Traditionally these are the problem areas as the armor of the cable is subject to abrasion caused by tidal currents and contact with the hard or rocky seabed material. BC Hydro is considering inspecting the cables on a 5 to 7 year cycle, depending on these inspection results.

During the last inspection in 2000 that was not completed, a Remote Operated Vehicle (ROV) was used.

“Using an ROV, you can cover a lot more ground in a shorter period of time because a manned sub can only stay down about 4 to 6 hours, but the ROV is more expensive to move, demove and track” says Vinnie Antao, Cable Technologist for BC Hydro. “If you’re looking for something specific, a manned sub can also provide a valuable pair of eyes. Inspecting a 28 km section of cable using a manned sub would take about a month compared with 5 to 10 days using an ROV. You can’t really compare the two, they are different methods for different applications”. With manned subs, there is no umbilical cable so video cannot be viewed at the surface in real time therefore accurate tracking becomes even more important. The quality of the audio is not that great in manned subs for the same reason. ROV’s

have been used a lot in the past to inspect gas pipelines, fibre optic and power cables, however, using compact manned subs for cable inspections is fairly new. This is only the second time that BC Hydro has used one since the cables were installed in 1983.

On launch day favourable weather is crucial for the launch and recovery of the Deep Worker. The launch starts with the predive inspection that will take about an hour. The submarine is tested for power levels and life support systems, then all of the ancillary systems are checked out; video, lighting, communications, and tracking systems. Finally the pilot makes his last pit stop and bundles up in preparation for working

on the ocean floor in a steel hull for a 4 – 6 hour stretch. The temperature inside the sub will be about 4 degrees C. Heating the submarine would require precious room and more weight in terms of the batteries required to power a heater. Just before the submarine is lowered into the water with a crane, all the seals are tested for watertightness, and the ‘O’ rings are preloaded by applying a slight vacuum.

When the submarine is in the water, the dive supervisor on the barge gives the pilot directions, however when it is completely submerged, the tracking technician directs the pilot. When the sub is on the seabed, and there is confirmation that the tracking and communications devices are working as expected, the tracking technician continues to navigate. After the cable is located the pilot can follow it visually. Electrical or fibre optic cables can also be tracked using tone induction techniques, but outages are required for using this method to track electrical cables.

The deliverables for this contract are; full time videos, 35mm photographs of anything interesting such as damage or suspensions, and accurate cable location details that are based on the tracking data.

Accuracy issues are very important, but the safety of the pilot is paramount. The pilot is always in contact with the mother ship and there is triple redundancy in the life support systems (oxygen and carbon scrubbers). If for some reason the submarine loses power the pilot can jettison the battery tubes and other equipment and the sub will safely surface. The gear would be recovered later by another submarine. ♦