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14. ABSTRACT This proposal provided funds for the WHOI Deep Submergence Group to support the DSV Alvin overhaul. This was a 5-month major overhaul and was completed by June 2001 as originally scheduled. We then began the Alvin certification and engineering dives operating out of St. Georges, Bermuda. The Office of Naval Research share was twenty percent (20%) of the total overhaul expense plus approximately the same percentage of the Engineering and Certification Dives.					
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**FINAL PROJECT REPORT
N00014-01-1-0793**

ONR Share of DSV Alvin Major Overhaul - 2001

**For the period:
1 April 2001 to 31 December 2001**

PROJECT SUMMARY

This proposal provided funds for the WHOI Deep Submergence Group to support the DSV *Alvin* overhaul. This was a 5-month major overhaul and was completed by June 2001 as originally scheduled. We then began the *Alvin* certification and engineering dives operating out of St. Georges, Bermuda. The Office of Naval Research share was twenty percent (20%) of the total overhaul expense plus approximately the same percentage of the Engineering and Certification Dives.

Alvin Overhaul 2001

As handled in 1996/1997, the *Alvin* major overhaul funding was requested outside of the daily rate for the submersibles. A major overhaul is done on *Alvin* approximately every three years. The submersible is dissembled to the level of its smallest components and all items are inspected, tested, and repaired or replaced as required.

Major Overhaul Items - *Alvin*

Major equipment repairs/replacements included the costs associated with the *Alvin* major overhaul during the first five months of the year.

The current Schilling manipulator was no longer fully supported by the manufacturer and had been experiencing increasingly frequent failures. Even with adequate spare parts and support, it was difficult to maintain with shipboard personnel. In addition, science users indicated the need to improve our manipulator dexterity. We purchased a new state of the art manipulator with force feedback capability.

During 2000 we completed an NSF funded upgrade to the *Alvin* video control system and finished the process of upgrading the external video cameras and replacing the hi-8 video recorders with those using mini-DV digital format. This last change was at the request of the science community due to the observed rapid degradation of Hi-8 tape resulting from viewing and/or duplication. This proposal provided funding to complete this upgrade process in two important areas: 1) the existing video cameras were replaced with improved models now

available, and 2) we completed the transition to digital recording format by purchasing the remaining necessary recorders.

We replaced *Alvin's* depth transducers with two 'smart' transducers that transmit their data in digital form via RS-232. This improved reliability and still provided the necessary redundancy.

In order to provide more interior space in *Alvin* and reduce the current maintenance burden, the current steel oxygen storage flask storage system was reconfigured.

A doppler velocity log and a fiber optic gyro were installed as part of a new integrated dead reckoning navigation system that also displays acoustic long baseline navigation positions. This has led to remarkably increased efficiency and productivity.

All cathode ray tube based video monitors (5) were replaced with color flat screen LCD displays, some with touch screens.

The old 486 data logger computer was replaced with a suite of Pentium class compact PCI computers to allow for operation of the new navigation system and a new data logger system. This suite of computers also support a new CTFM sonar, a new Imagenex bathymetric profiling sonar, and other science applications.

An acoustic modem system was installed both on *Alvin* and the *Atlantis*. When this becomes fully integrated it should allow for a limited sharing of operational data between *Alvin* and the *Atlantis*.

Funds were provided for employment of a certified outside vendor to conduct the required periodic hull inspection. This work was combined with that required for continued Navy certification of the variable ballast and high pressure air spheres.

One of the most important tasks associated with any *Alvin* overhaul is the inspection and repair of the submersible's titanium frame. Much of the frame is certified and therefore this work must be done by certified outside vendors (welders and inspectors), either at their facility or at WHOI, depending on the amount of repair work required.

An additional major cost associated with an overhaul was that of repairs to the skins and syntactic foam blocks. The cleaning, preparation and painting involved required specialized OSHA approved facilities and therefore was done by an outside vendor. All of *Alvin's* skins and foam blocks required extensive refurbishment, beyond that experienced in the past.