Review of Manned Submersibles Program

By: William Kohnen
MTS Manned Underwater Vehicles Committee, Chair

Dr. George Bass from the Institute of Nautical Archaeology of Texas A&M University shared his exuberance in underwater exploration.

Mr. Ravi Tanwar from the American Bureau of Shipping updating regulatory issues.

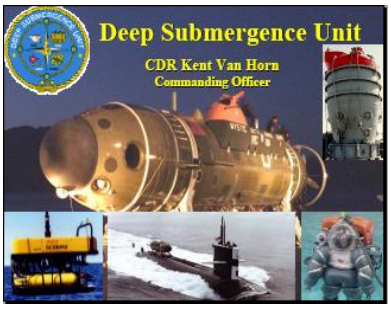
Special guests Mr. Jean Pierre Leveque and Jean-Francois Drogou from France's IFREMER with Program chair, Will Kohnen.

Tampa hosted Underwater Intervention 2006 and with it the third annual Manned Submersibles tract sponsored by the MTS Manned Underwater Vehicles committee. Despite the change in venue and the rescheduled dates for the conference due to Hurricane Katrina, the majority of registrants were still able to attend. As always, ADCI and the MTS ROV committee organized the Underwater Intervention conference as both a unique industry technology venue and an excellent forum for professionals and colleagues around the world to get together. The Manned Submersibles tract had a diverse and busy program, with 20 presentations given over a period of two days. With a growing international outreach, this year's presenters came from six countries; Canada, Costa Rica, France, Japan, United Kingdom and USA.

Overview of the Industry

The Manned Submersible tract started on Tuesday, Jan 24th and was kicked off by a series of three overviews. Will Kohnen, as tract chair and chair of the MTS MUV committee, compiled a condensed overview of more than 80 active submersibles currently operating around the world. There were several requests for copies of this presentation which will be available from the MTS MUV 2006 Proceedings.

Justin Manley, from NOAA reviewed manned submersible activity at the Office of Ocean Exploration, and a US Navy overview was given by CDR Kent van Horn, from the Deep Submergence Unit in San Diego. The latter included an incredible look at the Russian submersible rescue operation in 2005. A copy of this presentation is also available as part of the MTS MUV proceedings.



DEEP SUBMERGENCE RESEARCH VEHICLES

The next sessions focused on deep submergence research vehicles around the world. Bob Brown, from WHOI, started the presentation sequence with a US overview of the status of the Replacement HOV project which is scheduled to replace the aging ALVIN in 2009. The presentation reviewed the concept model and the general cabin layout. The submersible is to be ABS classed and several new technologies will be integrated into the design, including lithium batteries. A great deal of work has been achieved on the new hull design and viewports. The project is financed through the National Science Foundation and will be funded in several phases. WHOI awarded the contract for the hull design to Southwest Research Institute, in San Antonio, Texas. Jerry Henkener from Southwest Research Institute finished the presentation with a brief overview of the main pressure hull design drivers, planned viewport placements and the projected construction schedule.

This was followed by a riveting presentation by Terry Kirby from the Hawaii Undersea Research Lab (HURL) on their expedition undertaken in 2005. The PISCES IV and V submersibles spent 5 months diving a series of underwater volcanoes along the Pacific ridge, from Tonga to Samoa to New Zealand and back. The dives, images and discoveries were simply awesome. The MTS MUV committee is particularly thankful to John R. Smith, the acting Science Director and Collin Wollerman, for their active participation and hard work that make this marvelous presentation possible.

This year we had the good fortune to have more international participation. Mr. Tetsayu Komuku from JAMSTEC, in Japan, reviewed the detailed operational procedures adopted by JAMSTEC in the operation of the Shinkai 6500 deep submergence vehicle. Presently the deepest diving submersible in the world, rated to 6500 meters, Mr. Komuku provided a full overview of its auxiliary instruments and maintenance schedules and provided additional information on the performance of the Lithium Ion batteries that were installed in the submersible in 2004. This presentation also included of the emergency procedures developed at JAMSTEC for the recovery of the submersible.

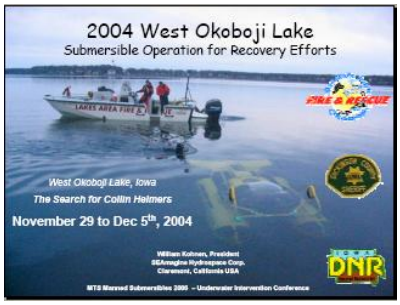
Mr. Jean-Pierre Leveque and Mr. Jean-Francois Drogou from IFREMER followed up with a review of the NAUTILE, France's deep submergence vehicle rated to a maximum depth of 6000m. Mr. Leveque presented the submersible's capabilities, discussing the major upgrades from its 2001 overhaul. Mr. Drogou then gave an overview of the deployment of the Nautile submersible for exploration and remediation on the Prestige oil tanker that sunk in Deep Ocean off the coast of Spain. If the attendance and question sessions were any indicators, these papers were very well received and yielded a great exchange of information.

SUBMERSIBLE OPERATIONS

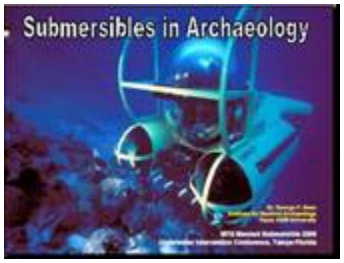
After this intense series of reviews, the day was closed with a fascinating historical presentation by Dr. Stewart Nelson on the fate of the first arctic submersible: the Nautilus of 1931. It is the story of Australian adventurer determined to be the first to navigate a submarine under the Arctic Ocean via the North Pole. With support of Simon Lake and modification of a US Navy submersible, the expeditions experienced a series of setbacks which brought it to Spitzbergen, Norway, and led to its ultimate scuttling near Bergen in Norway in 1931. Dr. Nelson recounted how he learnt about this story, how it inspired him to spearhead his own mission, a journey that led him to dive in the German submersible JAGO in 2005 to inspect the Nautilus for himself at a depth of 1138 feet. Dr. Nelson has an adventurer's passion and a gift for storytelling; he rounded up a superb day of presentations on a very high note. Some of the presentation material is available on the MUV Proceedings but most of the material will appear in a book he is writing. The presentation provided a privileged sneak preview and the book should be interesting.

DAY 2 started early in the morning with a presentation from Tom Bissett of Oceanworks International and LCDR Keith Lehnhardt of the US Navy Deep Submergence Unit. This team provided a complete account of the participation and deployment of the US Navy's atmospheric dives suits (ADS2000) in support of NATO's Submarine rescue Exercise at the Sorbet Royale in Italy in 2005. The presentation gave an excellent perspective on the level of readiness, logistics, equipment and personnel involved in rescue operations, including the loading, flying and deployment of the equipment on site.

Dr. Phil Nuytten of Nuytco Research, based in North Vancouver, Canada, presented a series of videos summarizing recent operations performed with the Deepworker 2000 and the Dual Deepworker submersibles. The Deepworker and Dual Deepworker are one and two-person submersibles rated to maximum operating depths of 2000 ft. The video footage illustrated the vehicle dexterity and maneuverability in a number of different applications from inspection to intervention. The presentation included advances and development of Nuytco's lighter Exosuit and specialty R&D work on robotic hand technology for NASA that offers fascinating ideas to extend the capability of the human hand to remote manipulators.

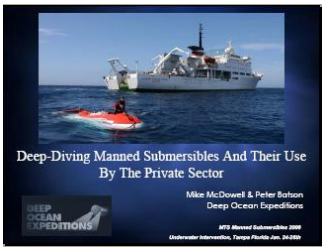


The morning session was concluded by Will Kohnen, from SEAmagine Hydrospace Corp, presenting a search and recovery operation in a cold lake in northern Iowa, using the SEAmobile submersible. The presentation offered a series of lessons learned from an expedition which, after 6 weeks of scuba diving by 14 dive teams from 5 states, was called in as a last ditch effort to retrieve the body of a 12 year old child. The submersible cleared 40 acres in 5 days when the lake was closed due to hazardous frost conditions. When the body surfaced in the summer of 2005, it was determined to have been within 20 yards of the end of the search zone.



The mid morning session was headed by Dr. George Bass, world renown for his underwater archaeological achievements. Dr. Bass gave a review of the operation of the Carolyn submersible, based at the Institute of Nautical Archaeology in Bodrum, Turkey. The two-person submersible, rated to a depth of 150 feet is deployed for archaeological excavation and for exploration of the Aegean coast in search of new wrecks. Dr. Bass provided a high spirited talk on current activities and the slated 2006 expedition in search of a much coveted Minoan wreck in shallow waters, which would allow for a full excavation.

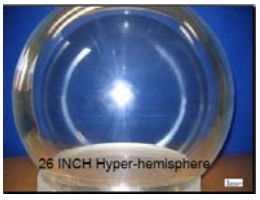
Peter Batson from Deep Ocean Quest followed with a general overview of the work planned for the company's new ship, the DeepOcean Quest, which used to be the NADIR from IFREMER. The mothership is scheduled to operate both Deep Rovers DR1001, DR1002 and a Dual Deepworker. The company was in overhaul in the Gulf area and was severely impacted by Katrina. They are working hard to catch up on work in 2006 and continue to pursue its new model combining opportunities of tourism income streams to fund deep sea marine science projects.



Charles Kohnen, from SEAmagine Hydrospace Corp. ended the morning session with a comprehensive overview of the company's pilot training program. Focusing primarily on the training just completed in fall 2005 for its new three-person deep submersible, the DeepSee, rated to a depth of 1500 feet, the review highlighted the experience gained over 8 years of training pilots. The presentation included several video clips from training and dive operations on Cocos Island, Costa Rica.

RULES AND REGULATIONS

The remaining six presentations after lunch dealt mostly with technical issues for submersible design, and regulatory discussions. Guy Richards from Blanson Ltd. started the first session with a look at the intricacies of working with cast acrylic and meeting the stringent requirements of ASME's Pressure Vessel for Human Occupancy (PVHO) standards. This ASME standard is almost universally accepted by all classing agencies worldwide, and particularly by the American Bureau of Shipping (ABS), and should be well understood by all submersible manufacturers. Mr. Richards provided a full overview of the issues that pertained to the manufacture, handling and maintenance of acrylic viewports. The company also presented its broad production capabilities for making flat disks windows, cylinders, hemispherical domes and hyper hemispheres.



Ravi Tanwar from ABS added an overview of the rules for classing manned submersibles and highlighted the major rule changes proposed for the 2006 code revision, to be submitted for approval in the coming months. All inputs from the industry were welcomed and Mr. Tanwar stayed an extra day for an Ad Hoc open meeting to address outstanding questions and discuss the changes in more detail. The MTS MUV committee would like to commend ABS for their participation in the conference and allowing industry to actively participate in the process of updating the ABS Rules. It is also appropriate to highlight the commitment on the part of Mr.

Harald Pauli from Germanischer Lloyds, based in Hamburg, Germany. Mr. Pauli made special arrangements to attend this year's conference again and provides a European perspective to rules and regulations on a broad range of underwater vehicle applications.

Due to a last minute cancellation, Will Kohnen supplemented the open session with a statistical review of the safety record of manned submersible operations over the past 40 years. Submersibles in the 80's and 90's have a safe operation record, with no recorded fatalities, during a 25 fold increase in the number of dives made each year from the baseline level of activity in the 70's. The reason for the safety record is not due to industry inactivity but is rather a reflection of very strong, maturing safety codes and standards which speaks well of the existing regulations. These statistics were compared to annual fatality rates of other transportation modes published by the U.S. Department of Transport.

ROUND TABLE PANEL DISCUSSION

After a short break, the technical presentations were concluded by the traditional round-table panel discussion. This year's topic centered on life support systems. We had the privilege to hear three of the leading experts explain the intricacies of maintaining proper levels of breathing air in closed systems. The panel consisted of Peter Readey from Steam Machines Inc, manufacturer of US Navy approved rebreathers, Rick Oddo from Micropore Inc., manufacturer of specialty gas absorbent material, and Dr. Mike Clarke from Molecular products Ltd, manufacturer of CO2 absorbent chemicals based in the UK.

From left to right: Peter Readey (Steam Machines), Mike Clarke (Molecular Products), and Rick Oddo (Micropore)

In the discussions it was clear that everyone had a different way of controlling life support environments, yet each had a common point, which demonstrated how individual environments impact system requirements. The best revelations came out during a very active question session that extended past the 1.5 hour allotted time, but all were more than happy to keep going. Everyone learned something new, and the day ended on a high note from an exuberant panel and a participatory audience.

The third day of the conference was left open for various meetings. The first was an early morning meeting with Mr. Ravi Tanwar of ABS. This meeting was specially scheduled to allow industry to provide constructive input, to discuss proposed rules changes and extend the opportunity to industry members that did not have a chance to attend the Ad Hoc meetings held at ABS during 2005. The meeting offered a good forum to discuss present changes considered in the code in preparation for the ABS Annual Meeting, to be held March 9 and 10th in Houston.

The annual meeting of the MTS Manned Underwater Vehicles Committee was held right afterwards and was attended by twelve members. It was resolved unanimously that we would come together again for Underwater Intervention 2007, which will return to New Orleans.