

## ***Manned Underwater Vehicles Activity Overview for 2010/2011***

William Kohlen  
President/CEO, SEAmagine Hydrospace Corp.  
Chair, Manned Underwater Vehicles Committee  
Marine Technology Society

### **Introduction**

The submersible industry was busy again in 2010 despite a general economic slowdown on all fronts. The biggest event of the year was without doubt the oil spill in the Gulf of Mexico, a catastrophe with dimensions of environmental impact that are not all that clear yet. The mobilization of a wide range of subsea vehicles enabled the eventual shutdown of the leak, but not without having released millions of gallons of crude oil in the sea. The accomplishments of the ROVs working on the wellhead were spectacular although in terms of commercial deployment of MUVs in the GOM, very little was mobilized.

On the tourism front, few new submersibles were put in operation in 2010, with the exception of the CuraSub in Curacao, in the Caribbean. The travel market slowdown has affected operators around the globe. Operations in Korea appear to continue diving. Atlantis Submarines is also maintaining its existing fleet of submersibles which continue to operate in Guam, Hawaii, Grand Cayman, Aruba, Barbados, and Cozumel. Likewise, Pacific Subsea in Saipan continues operation of the DS48 DeepStar submersible, an operation that was launched in the late 1980's. One noticeable development in 2010 has been an increase in the regulatory scrutiny by the American Bureau of Shipping for all activities within North America and the Caribbean. The evolution of these rules and regulations has brought about a number of new questions for submersible operators that are now required to conform to rule changes in order to maintain ABS classification. Atlantis with its large fleet of submersibles classed in the 90's, has experienced additional work in responding to ABS requirements that had never been imposed before. This was also reported by several manufacturers and operators, including commercial, private and research submersibles.

On the Research front, the major change has been the decision by Florida Atlantic University to close down the Johnson Sea-Link submersibles operations at the Harbor Branch Oceanographic Institute. The two subs, JSL I and JSL II, had been relegated to a slow schedule since 2009. In 2010, the support research vessel, Seward Johnson, was sold to Petrobras in Brazil and JSL II was chartered to perform work for deep water oil exploration and environmental monitoring off the coast of Brazil. At Woods Hole the ALVIN replacement HOV project formalized the overhaul program in 2010. ALVIN will undergo a phased approach to the upgrade to 6500m. This will consist of Phase A to replace the Personnel Sphere and cabin ergonomics, maintaining the depth rating of 4500m, followed by Phase B which will replace the external systems to achieve the full 6500m depth rating. The new ALVIN was scheduled to be ABS classed. A new decision was made by Woods Hole (WHOI) and National Science Foundation (NSF) to seek dual certification for the submersible, to include both ABS and US Navy certification. This has and will continue to produce a comparative review process of rules and regulations between the NAVSEA and ABS rules, as efforts are made at WHOI to seek mutual approval for design changes. Due to this increasing overlap of rules and regulations between commercial and navy projects, the 2011 MTS MUV program scheduled an extended discussion on the similarities and differences of US Navy rules. As the reconciliation effort continues to match the rule requirements, it is likely that the commercial code experience significant review to address what is likely to be areas of concern by the US Navy that have traditionally not been addressed in the ABS rules. This projects to become an important area of attention for the MUV community in order to maintain a reasonable and practical commercial code.

On the international front, both Japan and France have had limited activity with the NAUTILUS and the SHINKAI 6500. An update from both agencies was submitted and reported below in the Activity Table. The MIR submersibles completed their three year exploration of Lake Baikal, in Siberia, and

plan to be diving in Lake Geneva in the summer of 2011. Deep Ocean Expeditions is also planning to return to the TITANIC with the MIR submersibles for the 100<sup>th</sup> anniversary of the shipwreck, which occurred on April 14<sup>th</sup>, 1912. The MIR submersibles are scheduled to deploy for Spring and Summer 2012 to dive guests to the sea floor and visit the wreck.



In China, construction and testing of the new 7000m submersible continues in a progressive fashion. During the summer of 2010 the submersible completed a test regimen in the China Sea completing a series of 17 dives; 7 reaching depths past 2000m and four dives diving below 3000m. The deepest dive was made to 3759 meters. The project is led by Dr. Wang Fei, deputy director of the State Oceanic Administration with participation of the National Science and Technology administration, and several Chinese industry associations.


## **ORGANIZATION OVERVIEW**

The following are short updates on status and developments from the major manufacturers and operators around the world. These updates were obtained for a large part through direct communication with the author and supporting news releases from the internet.

**GENERAL TABLE OF ACTIVITY**

The following provides a listing of news and activities across the submersible industry in 2010-2011.

Submersible	Operator	Country	Activity
<p><b>ALVIN</b></p>	<p>Woods Hole Oceanographic Institution</p>	<p>USA</p>	<p>www.opentheoceans.com</p> <p>The ALVIN is the deepest diving submersible in the US today. Rated to a maximum depth of 4500m, the submersible has been slated for a complete overhaul to bring its diving capability to 6500m. 2010 saw the project through its final design review and the specifics of its two-phase overhaul program defined. The Replacement HOV program (RHOV) will include the fabrication and integration of a new titanium personnel sphere, rated to the maximum diving depth of 6500m. The sphere was fabricated by Southwest Research Institute and will be pressure tested in mid 2011. The ALVIN submersible returned to WHOI in December for its yearly maintenance refit, where it will remain throughout 2011 for the PHASE A modifications. This will include the integration of the new sphere onto the original frame. The improved ergonomics and scientific equipment will be integrated into the new personnel sphere, which includes much better viewport visibility for the pilot and scientists, as well as a much upgraded navigation, video recording and data collection computer system.</p> <p>The major challenge for 2011 remains the need to certify the design and all changes to both American Bureau of Shipping (ABS) and US Navy rules. The original ALVIN was and is US Navy certified, and still owned by the Office of Naval Research. This type of dual certification has never been done for a deep submergence vehicle like ALVIN and is sure to bring with it many new challenges in an effort to manage the cost and schedule of the program. Sea Trials are planned for first half of 2012 with a return to diving operation at the end of that year. The new submersible will be heavier than the original but will still be operated from the ATLANTIS mothership.</p> 
<p><b>Antipodes</b></p>	<p>OceanGate</p>	<p>USA</p>	<p>www.opentheoceans.com</p> <p>On January 6, 2010, OceanGate took possession of the ANTIPODES submersible. An ABS-classed vehicle capable of taking 5 people to 936 feet, the sub was deployed in 2010 to engage the company's corporate mission of supporting ocean exploration and marine research. The corporate headquarters are based in Seattle, Washington. In Fall 2010, the submersible was mobilized to Southern California to perform a series of research and public outreach dives on Catalina Island. A full report of the lessons learned are presented in a separate presentation during the 2011 MUV technical program of UI2011.</p> 

<p><b>Antipodes Sister</b></p>	<p>Hoffmann Marine</p>	<p>USA</p>	<p><a href="http://www.subdive.com">www.subdive.com</a></p>
<p>“Antipodes Sister” Is similar in design to the “Antipodes” (ex. XPC1501), sharing the same full diameter 150 degree forward viewport and 54” ID hull diameter. They were both created primarily from segments of the modular hull of the 1200’ operating depth ABS classed Perry diver lock out sub called the PC1501 or PC15C built for Vickers Oceanics (VO) in 1973. Vickers referred to the sub as the L-1, Lima 1, or VO L-1.</p> <p>“Sister”/ XPC1502 will be a 3 to 5 pax sub depending on final assembled hull length. She has a Perry style 38” 114 degree viewport aft and a 24” 180 degree acrylic hemi for the con tower hatch. Battery power will be provided from internal battery banks of AGM batteries or Perry style external 20” diameter battery pods. Most of “Sister”s structural components originated in the ABS classed PC1501 but we are not seeking ABS classification for her.</p> <p>Hoffmann Marine is creating an XPC1503 sub “kit” – from a combination of new components and other original PC1501 parts. There is no plan to seek ABS classification, even though most parts were originally part of ABS classed assemblies. The kit will include original Perry drawings where available, and the following original components: steel bow dome with viewport assembly; tail cone and rudder; lock out chamber trunk with inner and outer hatches which could be used as a con tower insert/nozzle; forged seat ring and matching intermediate hatch originally used for passage from the Pilot Compartment into the Lockout Chamber; 6” medical lock out assembly with inner and outer hatches; forward machinery room 2:1 head; various stainless steel ballast tanks; and possibly the 20” battery pods from “ Sister” if it is decided to install batteries internally on that assembly.</p>			
			
<p><b>ATLANTIS</b></p>	<p>Atlantis Adventures</p>	<p>USA</p>	<p><a href="http://www.atlantisadventures.com">www.atlantisadventures.com</a></p>
<p>Atlantis continues to operate its worldwide fleet of tourism submersibles: There are 5 submersibles operating in Hawaii (Kona, Maui, Oahu), 4 in the Caribbean (Aruba, Barbados, Cozumel and Grand Cayman), and 1 in Guam. The company’s safety record of excellence continues to provide access to tourists around the world, having safely accrued nearly ½ million dives of its submersibles. Although Atlantis is not directly involved in underwater exploration, it is providing millions of people, young and old, with the opportunity to see the underwater world through their own eyes rather on a documentary. As the general public becomes aware of the underwater world increased interest will help advance future exploration, scientific research and development of this vast new world.</p>			
<p><b>CAROLYN</b></p>	<p>Institute for Nautical Archeology, Texas A&amp;M Univ</p>	<p>Turkey</p>	<p><a href="http://inadiscover.com/">http://inadiscover.com/</a></p>
<p>The Carolyn submersible returned to its manufacturer at SEAmagine after 10 years of service for a checkup and refit. The submersible was fully overhauled in California in Spring 2010 and returned to Turkey in July for a dive expedition at a Bronze Age (13th century B.C.) shipwreck site off Cape Gelidonya. Carolyn is a two passenger submersible operated by the Institute of Nautical Archaeology, rated to a maximum depth of 55m. The submersible was tested in California before</p>			

shipment by land to the East Coast and via Ship to the Port of Izmir. Stationed in Bodrum, the submersible is subject to an increasing regulatory environment by the coast guard and port authority which establish very strict controls of the operation of any submersible vehicles in national waters. These concerns are all the more stringent when diving near ruins and shipwrecks, all considered high priority cultural heritage assets.



CAROLYN test dive in California



CAROLYN on return trip to Bodrum, Turkey

**C-Questor**

U-Boat Worx

Netherland




[www.uboatworx.com](http://www.uboatworx.com)

UBOAT Worx is a manufacturer of two and three passenger submersibles based in the Netherlands. The company produces the C-Questor model available in 2 (CQ2) and 3 (CQ3) sizes, both rated to a depth of 100 meters and classed by Germanischer Lloyds, based in Hamburg. The company launched a new model, called the C-Explorer based on a spherical acrylic cabin which provides better visibility. In 2010 the company manufactured four C-Questor 3 submersibles with classification survey under Germanischer Lloyds. The company also built its first C-Explorer 2 model which was demonstrated at the Monaco Yacht Show in September 2010. Engineering design and construction of a glass bottom C-Questor 2 was started in an effort to improve the downward visibility of the submersibles.



C-Questor 3 Submersible

The company performed a number of demonstration dives and operated the submersibles in South Africa aboard a private research vessel, in the Seychelles, France, Monaco and the US during the Fort Lauderdale Yacht show in Oct. 2010. The subs were also used to dive in the Caribbean in Aruba and St Maarten.

				<div style="border: 1px solid black; padding: 5px; text-align: center;"> <p><i>C-Explorer 2 Submersible</i></p> </div>
<p><b>Curacao Sub</b></p>	<p>Curacao Public Aquarium Substation Curacao</p>	<p>Curacao</p>	<p><a href="http://www.substation-curacao.com">www.substation-curacao.com</a></p>	
	<p>Nuytco Research Ltd of Vancouver, Canada delivered its new 5 person submersible for the Curacao Sea Aquarium which operates tours at its Substation Curacao. The submersible has a capacity of 5 occupants, 1 pilot and 4 passengers and is ABS classed to a maximum depth of 1000 feet. The submersible was received at the Aquarium in Curacao in July 2010 and touring operations have logged 200 dives to date. The Aquarius submersible, owned and operated by Can-Dive Ltd., had been deployed to Curacao earlier to start training of aquarium staff in anticipation of the new sub arrival.</p>			
<p><b>Deep Flight Challenger</b></p>	<p>Hawkes Ocean Technologies</p>	<p>USA</p>	<p><a href="http://www.deepflight.com">www.deepflight.com</a></p>	
	<p>Deep Flight Challenger was originally commissioned by the late adventurer, Steve Fossett, to dive to the Mariana Trench to set the ultimate solo dive record for all time (37,000 feet). Having developed this full ocean depth submersible, the company found a new client to pursue the goals of DeepFlight Challenger, work which is being done in Australia. The company also designed a new, ambient pressure vehicle for Sir Richard Branson. Due to space limitations on the owner's yacht, the Necker Belle, the Company had to come up with an entirely novel design. In February 2010, Hawkes Ocean Technologies delivered its 6th generation DeepFlight vehicle, DeepFlight Merlin (since re-named Necker Nymph") to Sir Richard Branson. Necker Nymph is an "open cockpit", vehicle based on Necker Island and also operates from S/Y Necker Belle.</p>			 <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p><i>DeepFlight Merlin – Necker Nymph</i></p> </div>

Hawkes Ocean Technologies (HOT) also continued work on the full ocean depth components that were originally developed for DeepFlight Challenger. Many of these components are now integrated into the current production DeepFlight Super Falcon models. The Company is currently upgrading its client's Super Falcon submersible, in preparation for an upcoming submersible expedition in the South Pacific. HOT also operated its own DeepFlight Super Falcon submersible to introduce people to the oceans and to promote the need for ocean exploration and conservation. In 2010, the company ran expeditions in Monterey Bay National Marine Sanctuary, with plans in 2011 for an expedition to the Middle East.



**DEEPSEE**


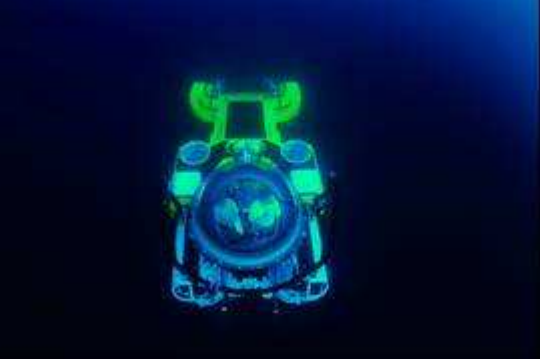



Undersea Hunter

Costa Rica



[www.underseahunter.com](http://www.underseahunter.com)

The DEEPSEE submersible, a three person, ABS classed SEAmagine sub rated to 457m continues operating from Coco Island and has logged more than 1,200 dives since start of operation in 2005. The submersible operates aboard its mother ship ARGO and makes monthly dive expeditions to Coco Islands for passengers, researchers and film makers. Equipped with a 7DOF Orion manipulator, the submersible provides Hi-Def camera filming capabilities mounted on a Pan & Tilt system operated from the cabin. A full complement of HMI lights provides underwater illumination controlled on five channels. For 2010 the submersible performed its three year Special ABS Survey and continues in 2011 with expeditions to Coco Islands and charters for science and research expeditions.



			
<p>DeepSee, 3-Person 457m rated ABS Submersible, SEAmagine TRIUMPH Model</p>			
<p><b>DELTA</b></p>	<p>Delta Oceanographics</p>	<p>USA</p>	<p><a href="http://www.deltaoceanographics.com">www.deltaoceanographics.com</a></p>
	<p>The DELTA submersible is an ABS Class submersible rated to 1200ft operating from Ventura, California. The submersible is presently in overhaul condition which will replace its acrylic windows and complete its ABS survey. The submersible was in overhaul during 2010 and remains in layup. The schedule for 2011 is not yet determined.</p>		
<p><b>DSRV FALCON</b></p>	<p>US Navy Deep Submergence Unit And Phoenix International</p>	<p>USA</p>	<p><a href="http://www.phnx-international.com">www.phnx-international.com</a></p>
	<p>Phoenix International Holdings and the US Navy conducted a load out of the Submarine Rescue Diving and Recompression System (SRDRS) onto the USNS SIOUX in February 2010 in San Diego, CA. Following a surface transit to Catalina Island where a portable training fixture is located, the Pressurized Rescue Module (PRM) Falcon performed eight (8) dives with open hatch operations on the training fixture. The training focused on qualifying Naval Internal Attendants and Phoenix pilots/co-pilots as well as proficiency training for all. In 2011, SRDRS will be flown to Spain to participate in the NATO Exercise Bold Monarch 11, where it is scheduled to mate with the submarines of at least 4 other NATO countries. In addition, the system will be conducting 4 local training periods near San Diego.</p>		
			



<p><b>ICTENEU 3</b></p>	<p>Ictineu Submarins SL</p>	<p>Spain</p>	<p><a href="http://www.ictineu.net">www.ictineu.net</a></p>
<p>The ICTENEU-3, a new three person deep research submersible is under development by Ictineu Submarins, based in Barcelona, Spain. The submersible will be rated to 1,200m and classed by Germanischer Lloyds. The submersible is under construction with the pressure hull completed and the large 150 deg spherical sector acrylic window delivered. The submersible is designed to use lithium technology batteries under GL certification. The submersible is scheduled for sea trials in 2011.</p>			
<p><b>JAGO</b></p>	<p>IFM-GEOMAR, Kiel</p>	<p>Germany</p>	<p><a href="http://www.ifm-geomar.de">www.ifm-geomar.de</a></p>
<p>JAGO is a two-person, 400m depth rated submersible operated from the IFM-GEOMAR research institute in Kiel, Germany. The submersible is under Germanischer Lloyds class certification and continues to operate as a workhorse in Europe and Africa. All operations are managed by Karen Hissmann and Juergen Schauer in Kiel.</p> <p><b>Expeditions In 2010</b></p> <ul style="list-style-type: none"> <li>- 11 April - 08 May 2010. Black Sea / Ukraine. Submersible dives at the Ukrainian shelf west of the crimea peninsula within the transition zone of oxic and anoxic environment. Chief scientist: Prof Antje Boetius, Max Planck Institute for Marine Microbiology Bremen. Objectives: EU-Project HYPOX In situ monitoring of oxygen depletion in hypoxic (low oxygen) ecosystems of coastal and open seas, and land-locked water bodies. Support vessel: RV M.S.MERIAN, Germany</li> <li>- 06 June - 20 June 2010. Cap de Creus, Costa Brava, Mediterranean. Submersible dives in the Cap de Creus Canyon and on the surrounding shelf. Chief scientist: Prof Maria-Josep Gili, ICM Institut de Ciències del Mar (CMIMA-CSIC) Barcelona, Spain. Objectives: EU-Project LIFE-INDEMARES Marine Protected Areas (MPAs) in the western Mediterranean: Inventory and designation of marine Nature 2000 areas in the Spanish Sea. Support vessel: RV GARCIA DEL CID, Spain.</li> <li>- 09 Sept - 14 Sept 2010. Balears, Mediterranean. Submersible dives in the Menorca Channel between the Balearic Islands Mallorca and Menorca. Chief scientist: Prof Maria-Josep Gili, ICM Institut de Ciències del Mar (CMIMA-CSIC) Barcelona, Spain. Objectives: EU-Project LIFE Marine Protected Areas (MPAs) in the western Mediterranean: Inventory and designation of marine Nature 2000 areas in the Spanish Sea. Support vessel: RV GARCIA DEL CID, Spain.</li> </ul> <p><b>Outlook for 2011</b></p> <ul style="list-style-type: none"> <li>- 31 March - 14 April 2011. Balears, Mediterranean. Submersible dives in the Menorca Channel between the Balearic Islands Mallorca and Menorca - expedition 2. Chief scientist: Prof Maria-Josep Gili, ICM Institut de Ciències del Mar (CMIMA-CSIC) Barcelona, Spain. Objectives: EU-Project LIFE Marine Protected Areas (MPAs) in the western Mediterranean: Inventory and designation of marine Nature 2000 areas in the Spanish Sea. Support vessel: RV GARCIA DEL CID, Spain.</li> </ul>			



German JAGO Submersible Recovery



JAGO 400m Two-Person Research Sub

**Johnson Sea-Link I & II**

Harbor Branch Oceanographic Inst.

USA

[www.hboi.fau.edu](http://www.hboi.fau.edu)

The Johnson Sea Link I & II have been in operation at Harbor Branch Oceanographic Institution. After 40 years of operation and impacted from the economic crisis. Florida Atlantic University completed the sale of the research vessel Seward Johnson and chartered JSL II to Petrobras in Brazil. Johnson Sealink I as well as a Dual Deepworker from the Waitt Institute remain at the Harbor Branch facilities. In addition, the retired Research Submersible Clelia P.C.1204 is now on display at the Georgia Aquarium.



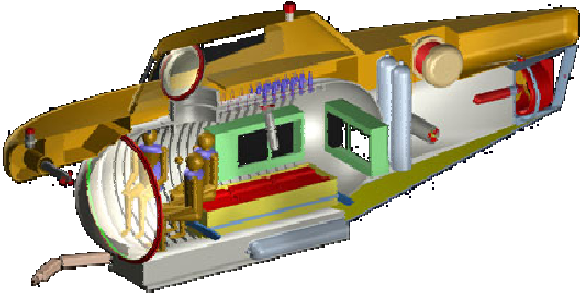



Gulf of Mexico Expedition – On top of JSL (right to left) Don Liberatore, Shirley Pomponi (pink shirt), Dr. Jane Lebchenko

**2010 JSL Activity**

During 2010, JSL II was mobilized to the Gulf of Mexico where the team lead by Shirley Pomponi and Don Liberatore performed several dives, including several dives with the Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator, Dr Jane Lubchenko. Dr. Lubchenko participated in several dives at the end of the Gulf mission and was very supportive of the manned sub operations.

In December 2010, the Seward Johnson along with Johnson Sealink II sailed to Brazil for a one month survey of the Abrolhos Archipelago reef system about 500 miles north of Rio de Janeiro. In

	<p>Abrolhos, the multidisciplinary lead by Cepemar Group, consisting of Brazilian and international observers had the opportunity to meet the ship and submersible, and gather preliminary data on coral and high average depth in order to support future scientific projects in the region. After the expedition to the Abrolhos, Petrobras plans to direct the Cepemar Group to conduct a survey of the marine environment along the Brazilian coast.</p> <div style="display: flex; justify-content: space-around;">   </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <span>Seward Johnson Research Ship</span> <span>Johnson SeaLink II</span> </div>		
<p><b>LULA 1000</b></p>	<p>Azores Rebikoff-Nigeller Foundation,</p>	<p>Portugal</p>	<p><a href="http://www.rebikoff.org">www.rebikoff.org</a></p>
<p>The Rebikoff-Nigeller Foundation (RNF) operates a research submersible in the Azores. The company which is managed by Joachim and Kirsten Jakobsen, has operated the LULA 500 since 2000. The sub is a three-person submersible ABS classed to a depth of 500 meters. The LULA 500 is presently for sale by RNF and since 2009, the company has been developing a deeper submersible, the LULA 1000, which is a new construction rated to 1000m. The pressure hull was completed in 2010 and the submersible is in final construction under classification with Germanischer Lloyd (GL) in Hamburg. The company is very pleased with its decision to seek classification of the new vehicle with GL.</p> <p>The acrylic dome for the conning tower is completed and the front bow viewport is in production. Final pressure testing isschedule for earlt 2011. The deck is being built in Northern Germany, to be integrated after the pressure test. All electrics and other systems are being configured and built, with a schedule sea trials of mid 2011.</p> <div style="display: flex; justify-content: space-around; margin-top: 20px;">   </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <span>LULA 1000m cross section view</span> <span>LULA 1000 Stainless Steel Pressure Hull</span> </div>			
<p><b>MIR 1 &amp; 2</b></p>	<p>PP Shirshov Institute of Oceanology</p>	<p>Russia</p>	<p><a href="http://www.sio.rssi.ru/">www.sio.rssi.ru/</a></p>
<p>The MIR 1 &amp; Mir 2 Submersibles are two 6000m rated deep ocean research vehicles that have been operated by the PP Shirshov Institute since 1987. The submersibles gained great fame in the</p>			

many dives and filming activities for the film TITANIC. The twin submersibles are three-person vehicles and are classed by the Germanischer Lloyds group in Germany.

In 2010 the submersibles finished a three years research expedition on Lake Baikal in Siberia. The expedition made news headlines in 2009 when it dove in Lake Baikal with Mr. Vladimir Putin, the prime minister of Russia. The expedition made a total of 178 dives, the deepest of which was to 1640 meters. Very interesting discoveries were made, most important among them the hard gas-hydrate hills under the sediments at the bottom of the lake.

For 2011, The two MIR submersibles will be deployed to dive in Lake Geneva, Switzerland. The project will be managed through the University of Lausanne (l'Ecole Polytechnique Fédérale de Lausanne, EPFL), with researchers from the Universities of Geneva and Neuchâtel.



Discovery of gas hydrate hills at the bottom (1400m) Of Lake Baikal, in Siberia



Dr. Anatoly Sagalevich, Sylvia Earle and James Cameron before the dive Aug 2010



MIR submersibles with support ship and basic work barge on Baikal lake in 2010

**NUYTCO**

Nuytco Research Ltd.

Canada

[www.nuytco.com](http://www.nuytco.com)

2010 saw a variety of activity at Nuytco and Can-Dive, based in Vancouver, Canada. The company completed and delivered its new 1000-foot tourist sub for Curacao in July, which operates from the Sea Aquarium to tour visitors along the reefs. The sub is ABS classed and has already logged more than 200 dives in the first months.

Nuytco also fulfilled a multi-year contract with NASA and the Canadian Space Agency in 2010, and trained various astronauts as sub pilots. The company also used 'Aquarius' and 'Dual DeepWorker' to do scientific surveys on the coast of California for the University of California, National Marine Fisheries, and NOAA. The company was also heavily involved in the 2010 formation of the 'Deep Ocean Group', comprising 28 experts in marine engineering and science (as well as government and oil industry technical advisors), assembled to provide technical input to NOAA and the US Environmental Protection Agency on the methodology for control of the BP spill and sub-sea monitoring of the spill effects on the bottom of the Gulf of Mexico.



In 2010 Nuytco did a number of major re-certs on DeepWorkers and Dual DeepWorkers DDW 02 which operates from its mothership MV ALUCIA. The company also took delivery of a large North Sea lock-out sub, which is scheduled to be rebuilt in 2011. Other efforts for 2010 included the start of fabrication of three prototype Exosuits (the current generation of ADS from Nuytco's subsidiary, Hard Suits Inc.). The first of these new 1000-foot suits is scheduled for delivery in mid-2011.



DeepWorker 2000



Dual DeepWorker 2000



Mockup of new Exosuit

**NAUTILE**

IFREMER

France

[wwz.ifremer.fr/institut\\_eng](http://wwz.ifremer.fr/institut_eng)

Nautile is a deep ocean research submersible rated to a maximum depth of 6,000m, operated from the French research institute, IFREMER. The submersible was launched in 1987 and accommodates a cabin for three occupants. The submersible operates from its mothership the "Pourquoi Pas?".

**In 2010**

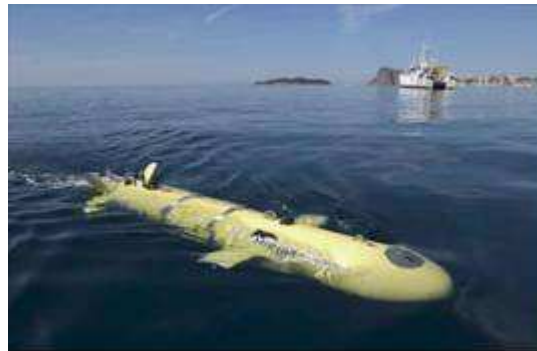
On January 2010 Nautile was mobilized on the support ship Atalante and performed a short 2 dive preoperational mission before engaging in four missions from March to September 2010. The first three missions took place west of Mexico for geology and biology exploration on the East Pacific Rise as well as in the Guaymas Basin / Gulf of Mexico; The last






mission aimed to study the biodiversity and the potential resource in the French Polynesia EEZ. During this expedition, Nautilie completed a total of 83 dives.

Some maintenance issues we discovered, probably because the sub first spent a very long time aboard the support ship Pourquoi pas? during 2009 and then on the support ship Atalante from the beginning of 2010, sometimes with very rough sea state conditions. It was discovered that some cracks were unfortunately found on the titanium beams of the main frame; fatigue fractures are suspected. Short term reparations were made in the field to allow the completion of the mission programme. Nevertheless a major reparation standby is now necessary and scheduled during the first semester of 2011 which aims to modify and replace some of the titanium frame parts.

Included in the scope of work for 2011 is the improvement of the positioning and navigation system (which will use similar components of the Victor ROV and AUV systems) with completion of the original video system replacement with current standard HD cameras.



<p><b>PC8B</b></p>	<p>Inst. Of Oceanology, Bulgaria Academy of Sciences</p>	<p>Bulgaria</p>	<p><a href="http://www.io-bas.bg">www.io-bas.bg</a></p>
	<p>PC8B is one of the original Perry subs, the first model designed with a large acrylic bow window, a feature that became standard in all future models. PC8B operate in the Black Sea performing a multiyear mission to investigate the coastal shores with multibeam sonar and investigate detected points of interest using the submersible. The institute is in a 3 year research project for Deep Sea Archeology sponsored by the Ministry of Science and Education.</p> <p>Because of the economic crisis, BAS SIO did not have any significant submersible activities in 2010. The research funds in Bulgaria, like anywhere else, were severely cut and the planned expedition to explore a sunken sailing ship (120-180 years old) as well as 30 more promising acoustic targets, was cancelled.</p> <p>The submerdsible was used to perform a commercial contract for the annual UW survey of a 24 km. gas pipeline. The company plans to extend the contract to include and additional 12 km. of pipeline for 2011. There is also hope that in 2011 the institute will be able to explore the promising UW targets.</p>		

	<p>Additionally in 2010 was the first time the sea water temperature in the Black Sea (on the Bulgarian coast) rose to a record 30 deg. C, which caused very low UW visibility because of the plankton growth. If these phenomena continue, the institute reckons it will have to concentrate its efforts on depths in excess of 200 m where the H<sub>2</sub>S dissolved gas in Black Sea eliminate any form of life.</p> <div style="display: flex; justify-content: space-around;">   </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <span>R/V AKADEMIK mother ship since 1984</span> <span>PC8B with recovered Amphora</span> </div>		
<p><b>PISCES 4 &amp; 5</b></p>	<p>HURL, Hawaii Undersea Research Lab</p>	<p>USA</p>	<p><a href="http://www.soest.hawaii.edu/HURL/">www.soest.hawaii.edu/HURL/</a></p>
<p>PISCES IV and V are both 2,000m rated, ABS classed three person research submersibles operated by the Hawaii Undersea Research Lab, NOAA's Undersea Research Center for Hawaii and the Western Pacific. The center also operates the ROV RCV-150 all from the mothership R/V Ka'imikai-o-Kanaloa (RV KoK).</p> <p>Both submersibles remain in ABS Class and operational in 2010 and 2011. HURL like many other companies were affected in 2010 by a change in survey rules which required significant work to address existing systems that had been operational and ABS approved for many years. The work did not slow down the research activity but added a significant engineering burden on the operational team.</p>			
<p><b>S-301</b></p>	<p>Promare Submergence Group</p>	<p>USA</p>	<p><a href="http://www.submergence-group.com">www.submergence-group.com</a></p>
<p>In 2007 Submergence Group and M-Subs began prototyping a diver lock-in/out submersible, S301, for submerged launch and recovery from a nuclear submarine Dry Deck Shelter (DDS). The submersible was completed and launched in early 2009 and entered sea trials that carried through 2010, Following initial trials an extensive "Military Utility Assessment Test Plan" was conducted in concert with the US Navy in Hawaii.</p> <div style="text-align: center; margin: 10px 0;">  </div> <p style="text-align: center;">S301 Experimental Lockout Submersible</p>			

<b>SEAmagine</b>	SEAmagine Hydrospace Corp	USA	www.seamagine.com
<p>SEAmagine completed construction of two new Ocean Pearl models, SEAmagine No. 8 and No. 9, classed to ABS and Cayman Island Shipping Registry rules. Both are two-person submersibles, rated to a maximum depth of 1,250ft. and integrate a new HD video system, fiber optic digital recording in the cabin, with full lighting and navigation complement. SEAmagine No. 8 was delivered to Germany in September 2010 for integration onto a private yacht. The sub is additionally equipped with a 5 axis robotic manipulator and incorporates SEAmagine's external pilot console. This allows the owner to perform extended deep dives with a pilot from the cabin and to take two guests when entertaining family. For such occasions the pilot is external and tours guests in shallow SCUBA depths. The private yacht is flagged with the Cayman Islands and requires the submersible operation to be fully CISR certified. Training of the crew is scheduled for early 2011.</p> <p>SEAmagine No. 9 is a sister vessel equipped with a fly-out ROV. The ROV is based on a SEAbotix LBV 300 which integrates a full 1080i Hi-Def camera, a simple grabber arm with selectable end effectors and a line cutter. This enables the pilot to fly the ROV from the cabin with a maximum tether of 20m. The distance is effective for filming in tight locations, allows self filming at depth, and the line cutter tool provides a unique self rescue capability to cut potential entangled lines. SEAmagine No. 9 has performed a total of 50 dives to date with an expedition in August 2010 diving around Catalina Island, in California. The submersible is scheduled a 130 ft catamaran mothership.</p> <div data-bbox="841 625 1528 1136" data-label="Image"> </div> <p data-bbox="841 1136 1528 1192">SEAmagine No. 8 – Two Person Ocean Pearl Model</p> <p>In 2010, SEAmagine also completed a research &amp; development contract for the US Coast Guard through Marine Pollution Control, in Detroit, Michigan. The project developed new methods for submerged oil recovery on the sea floor, an issue of growing concern to the US Coast Guard, even before the disaster of the HORIZON platform explosion. The system uses a submersible and a robotic manipulator to replace the work performed by a commercial diver with a suction wand. The work is difficult to automate as it requires a great deal of human feedback to sense the recovery success, yet it is highly limited by underwater conditions that are very harsh on the divers. A specially developed sensing system is integrated to the submersible robotic manipulator to provide full feedback of sight, sounds and feel to the wand operator. The increased bottom time will provide direct productivity gains. The success of the Phase 1 results encouraged the USCG to proceed with a phase 2 contract to test the system at the OHMSETT test facility in New Jersey in 2011.</p>			





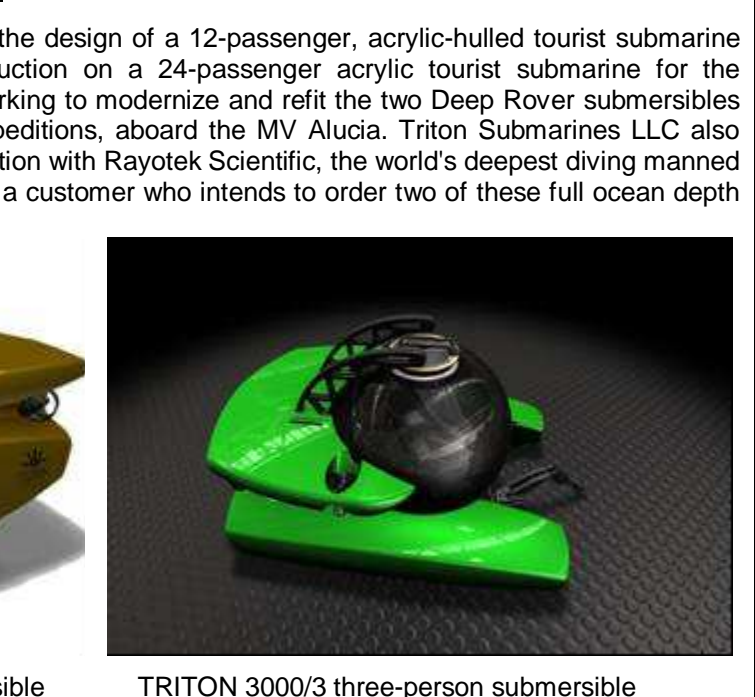




SEAmagine No. 9 Submersible ABS Classed to 1100 ft with Fly-Out ROV system & HD Cam

<b>SHINKAI 6500</b>	JAMSTEC	Japan	<a href="http://www.jamstec.go.jp/e/about/equipment/ships/shinkai6500.html">www.jamstec.go.jp/e/about/equipment/ships/shinkai6500.html</a>
<p>2010-2011 Summary of Shinkai6500</p> <p>The SHINKAI 6500 followed its regular yearly maintenance and inspection schedule which is carried out until March. Submersible operations started in April with Shinkai diving in the North Philippine Sea, West Pacific and the Mariana Trough. The submersible performed 63 dives in 2010, and has reached a total of 1240 dives so far.</p> <p>In the last yearly maintenance of 2009, the hybrid electro-optics connector was installed on the submersible. Soundness of the design was successfully tested through the sea trial. Because the fiber-optic circuit was already built up, integration of HDTV camera was much easier and the development of the entire HDTV system for SHINKA was accelerated. This includes the decision to design a new camera head and a detailed design and production unit was ordered.</p> <p>An analog output became unnecessary in the spec of the new camera, so the structure of that became very simple. Finally, there were 2 CCD cameras on the submersible, and these cameras were replaced to HDTV cameras in last summer.</p> <p>The recording system is using the tape media with HDV format. Therefore the video converter (HD-SDI to HDV) is necessary in this method. However, we could use HD-SDI signal easily by the fiber-optic circuit, so we considered replacing this recording system to tapeless system using digital devices. New recording system which used HDD was built, and we began an actual test operation in parallel with current system from last summer. The result of this test operation, we found some little problems, but these were cleared in this yearly maintenance, therefore current system will be taken off completely and new system will be alone from next cruise.</p> <p>Replacement of thrusters: This project was begun in 2008, then such as DC motors, drivers and the control unit were prepared so far. The next overhaul and periodic inspection will carry out in next winter. At that time, all current thrusters which are equipped on the submersible will be replaced to new ones. Moreover the horizontal thruster will be added on the stern of the submersible. This replacing construction will be completed in March 2012, then we are working on a plan of the sea trial cruise after that.</p>			



<p><b>THETIS</b></p>	<p>Hellenic Center for Marine Research</p>	<p>Greece</p>	<p><a href="http://www.hcmr.gr">www.hcmr.gr</a></p>
<p>The 1,000m rated, two person acrylic submersible launched in 1997 remains operational in Greece. Built by Comex, the submersible is Classed by the Bureau Veritas of France. The submersible remains active and is operated from its mothership the R/V AEGAEO.</p>			
			
<p>HMCR R/V AEGAEO Mothership</p>		<p>Thetis, 1000m rated 2-Person Sub</p>	
<p><b>TRITON</b></p>	<p>US Submarines</p>	<p>USA</p>	<p><a href="http://www.tritonsubs.com">www.tritonsubs.com</a></p>
<p>U.S. Submarines, Inc. and TRITON Submarines LLC have designed and built a number of two and three person acrylic hull submersibles, rated to depths of 1000 and 3000ft, and classed by ABS. The company is completing two new 3-passenger, 1000-meter capable Tritons and two 20 meter support catamarans. It is also commencing a contract for four Triton 1000/3s for Poseidon Undersea Resorts, a subsidiary company specializing in the design and construction of underwater habitats. US Submarines plans to bring acrylic hull manufacturing capacity in-house.</p> <p>Other development projects include the design of a 12-passenger, acrylic-hulled tourist submarine for a major cruise line and construction on a 24-passenger acrylic tourist submarine for the Galapagos. The company is also working to modernize and refit the two Deep Rover submersibles that are owned by Deep Ocean Expeditions, aboard the MV Alucia. Triton Submarines LLC also announced it is designing, in conjunction with Rayotek Scientific, the world's deepest diving manned submersible, the Triton 36,000/3, for a customer who intends to order two of these full ocean depth units.</p>			
		<p>U.S. Submarines, Inc. and TRITON Submarines LLC have designed and built a number of two and three person acrylic hull submersibles, rated to depths of 1000 and 3000ft, and classed by ABS. The company is completing two new 3-passenger, 1000-meter capable Tritons and two 20 meter support catamarans. It is also commencing a contract for four Triton 1000/3s for Poseidon Undersea Resorts, a subsidiary company specializing in the design and construction of underwater habitats. US Submarines plans to bring acrylic hull manufacturing capacity in-house.</p>	
			
<p>TRITON 36,000/3 Person submersible</p>		<p>TRITON 3000/3 three-person submersible</p>	

<b>VAS 525</b>	GSE Trieste	Italy	<a href="http://www.gsesubs.com">www.gsesubs.com</a>
<p>GSE trieste in Italy completed the second VAS diver lockout submersible in 2009, scheduled for integration onto a new 74 meter superyacht. The VAS 525 is five-person submersible, rated to a depth of 525 ft and classed to both the Italian RINA code and the Cayman Island Shipping Registry. The GSE VAS 525 is the civil version of a Special Operations Minisub. The submersible's batteries can be recharged while afloat, and the craft can be transited, even on tow, at speeds up to 16 kt. The VAS 1578 (Veicolo Autonomo Sottomarino) has a pressure hull of 48 in, length of 25 ft and can carry a crew of four, three of them passengers or scuba divers. The VAS is equipped with a lock-in lock-out compartment for scuba divers egress and re-enter, and can bear two additional side view ports of 2 ft diameter. The VAS is available in both an ER (Exploration and Retrieval) and the SL (Scuba Lockout) model which is equipped with either one or two airlocks.</p>			
			