

# DEEP ROVER SUBMERSIBLES



**CO-OWNED AND OPERATED BY DEEP OCEAN EXPEDITIONS LLC**

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# DEEP OCEAN EXPEDITIONS

- In the past Deep Ocean Expeditions (DOE) has chartered a variety of manned deep submersibles from around the world to conduct its diving expeditions.
- In addition to partnering with the PP Shirshov Institute of the Russian Academy of Sciences in the operation of the 6,000-metre rated MIR submersibles, Deep Ocean Expeditions also own the 600 metre (2000 feet) rated Dual Deep Worker and co-own the two (2) 1,000 metre (3300 feet) rated Deep Rover 1002 submersibles.
- The company's diving expeditions range from unique seafloor natural history sites to historical wrecks. Sites dived on to date include the wrecks of the RMS Titanic, the first manned submersible dives to the wreck of the German battleship Bismarck and exploratory diving on an unknown wreck located in 5,182 metres (17,000 feet) in the Caribbean. Our clients have also dived to the hydrothermal vents in the Atlantic and Pacific Ocean and also to ancient wrecks in the Mediterranean.



- DOE clients have made dives to depths as shallow as 100 m (328 feet) and as deep as 5,180 metres (17,000 feet). This is approximately half the greatest depth in the world ocean.

- The founding principles of Deep Ocean Expeditions are simple: offer unique expedition experiences for the adventurer; educate lay people about the world's deep oceans, help support scientific research and support documentary film making. In addition, the company upholds the highest marine conservation standards during its operations. Nothing is disturbed, touched or removed other than for approved scientific or archaeological sampling.



- To support scientific investigation at its operating sites, DOE invites marine scientists to participate in its expeditions wherever possible. In this way, the company can help contribute to our knowledge of the world's oceans.
- The company is actively planning an array of exciting expeditions in 2004 and beyond. Underlying this expansion of the project base is consistent attention to the founding principles: education, science and adventure.

**DEEP OCEAN EXPEDITIONS : INNOVATORS  
IN ADVENTURE DIVING WITH SUBMERSIBLES**



# THE DEEP ROVER SUBMERSIBLES

The Deep Rover 1002 submersibles were designed and built by Deep Ocean Engineering in 1994. In 2002 they were purchased by Deep Ocean Expeditions and a partner. The two-person Deep Rover submersibles have recently undergone a complete rebuild and are now available for charter to interested parties.

Prior to being purchased by Deep Ocean Expeditions the Deep Rovers were owned by Aqua +, a subsidiary of the French media company Canal +. They were used primarily for filming projects in the Mediterranean.



The Deep Rovers offer a significant change to historical submersible ocean exploration; The Deep Rovers are safe, reliable and comfortable while offering occupants an unprecedented view through their entirely transparent acrylic pressure hull, (you might consider deleting this last sentence) from which they will be able to explore, inspect, scientifically sample and film the wonders of the deep.

The 1000 metre (3,280 feet) depth rating gives the Deep Rovers access to a staggering 40 % of the ocean floor. Viewing for the occupants of the Deep Rovers is exceptional and has been likened to flying a helicopter underwater.

A series of dives were made on the Mid Atlantic Ridge (MAR) hydrothermal vents in July 2003 capturing incredible volcanic activity and marine life. In addition to capturing the scene on camera the Deep Rovers were also able to return a variety of geological and biological samples to the surface, collected using their two (2) manipulator arms.

The Deep Rovers will continue to explore the world's oceans, support science, and film underwater features, both natural and manmade over the coming years.

Further these unique submersibles will be actively used to introduce interested members of the general public to the wonders of the oceans below scuba depths. The Deep Rover operation is one of only two in the world that includes a two submersible fleet that can be dived together or separate. The availability of two submersibles adds exceptional flexibility and advantages.



# **DEEP ROVER SUBMERSIBLE FEATURES**

- **Full Visibility**

The pressure hull of the Deep Rover 1002 submersibles consists of a transparent acrylic sphere, which offers an unprecedented 320-degree view of the outside environment. Traditionally, deep diving submersibles have only been able to offer pilots and observers limited visibility through small viewing ports. The Deep Rovers acrylic pressure hull configuration ensures the occupants can see both the submersibles' external equipment and their surrounding environment.



- **Comfort**

The pilot and the observer sit comfortably upright on regular seating while cabin pressure is maintained at one atmosphere using a traditional metabolic make up life support system. Cabin temperature and humidity is maintained at a comfortable level by the submersibles air-conditioning system and all life support related parameters are monitored by the pilot, using sophisticated atmospheric sensors and sampling equipment.

- **Reliability**

The two Deep Rovers have each logged over 200 successful dives each since their launch in 1994. Their predecessor Deep Rover 001, the first acrylic sphere submersible, has also safely made hundreds of dives.

- **Simultaneous two Sub operation**

The two submersible Deep Rover operation is one of only two such multi-submersible operations in the world. The Deep Rovers can operate simultaneously or independently. They are able to mutually assist and guide one another yet they do not rely on one another. This two-sub operation is a feature that strongly appeals to those involved in filming related operations.

- **Ease of Handling / Thrusters**

Each Deep Rover 1002 is fitted with four (4) five (5) horsepower thrusters controlled by a single joystick from inside the acrylic sphere. The pilot or the observer, with only minimal training, can easily control all the movements of the submersible, because of the intuitive nature of the controls. The compact size and weight of the Deep Rover 1002 submersibles compared with thruster power available results in an incredibly manoeuvrable craft with a high power to weight ratio. The generously sized 30 kWh battery ensures 8-hour missions are achievable, depending on the dive profile.



- **Safety**

The Deep Rover 1002 submersibles have been pressure tested to 1.25 times their maximum diving depth (1,250 meters or 4,100 feet) with a designed safety factor of four times and a theoretical crush depth of over 4,000 metres (13,120 feet).

The three main safety concerns for passengers in submersibles are entanglement, fire and flooding. The Deep Rover 1002 design mitigates these potential risks as follows:

\* Entanglement - The manoeuvrability and superb visibility reduce the chance of entanglement to a minimum while the feature of diving two submersibles also offers the ability to give assistance should an entanglement situation arise.

\* Fire – The principal cause of fire in a submerged vehicle is associated with electrical faults. The risk of fire has been diminished in the Deep Rovers by keeping all high current circuits outside of the pressure

hull. Only small currents required to both power the internal equipment and control the external equipment are used within the hull. In addition, all equipment within the personnel sphere is halogen free, non-smoke producing and self-extinguishing. The Deep Rovers are also equipped with both a built in breathing system and self-contained oxygen generating re-breather units, which offer the occupants over 100 minutes of self contained life support.

\* **Flooding** - The Deep Rovers are accessed through a bottom hatch. Flooding incidents typically occur at the surface in submersibles when the access hatch is opened prematurely allowing water to enter the pressure hull. Configuring the Deep Rovers with a bottom hatch eliminates this problem.

- **Life Support**

In the event an extended stay on bottom is required, the Deep Rover 1002 submersibles are equipped with 72 hours of emergency life support per person including carbon dioxide absorbent, food, water, basic first aid, waste disposal facilities, atmospheric sampling equipment and sufficient power for any communications that may be required.

- **Tracking**

An optional Track Point II system can be used to monitor the position of the Deep Rover submersibles relative to the ship while they are dived. In this case, each submersible would be fitted with an underwater beacon that interfaces with the system, which is monitored by the base station aboard the mothership. This system allows the support ship to both follow and plot the position of the submersibles during a dive.

- **Manipulators**

Each Deep Rover is equipped with two (2) six (6) function, rate-controlled, Hawke sensory manipulators. These manipulators can either be operated by the pilot or the observer, with minimal training, because of the intuitive nature of the joystick controls used.

- **Sonar**

Each Deep Rover 1002 submersible is fitted with a state of the art Simrad MS900 colour imaging sonar system.

- **Launch and Retrievals**

The compact size and relatively small tonnage of the Deep Rovers make them less cumbersome than their predecessors. They can be launched and retrieved from small ships of opportunity in average to moderate sea conditions.

- **Lighting**

Any combination of lighting packages can be installed on the Deep Rovers. Lights available include 1200-Watt, 600-Watt, 400-Watt and 200-Watt HMI lights.

- **Filmmaking**

Camera and lighting packages can be fitted to the Deep Rovers to facilitate filmmaking. An optional High Definition video system and specialised deep water housing is available extra at additional cost. An electric pan and tilt system is currently being designed and manufactured to further enhance documentary filming. Internal monitors are installed inside the pressure sphere along with interior Ikegami high definition cameras. The best feature of the double submersible operation is the ability to use one vessel for lighting and the second vehicle for filming.

- **Pilots and Sub Crew**

Our team of 4-6 submersible pilots and engineers have spent thousands of hours working on a variety of submersibles and their combined experience is our client's best guarantee that operations will be run in a safe, professional and courteous manner.



- **Locations**

It is anticipated that the Deep Rovers will operate in the Pacific and Indian Oceans in the next 12-18 months and will begin diving on various locations of both man-made historical significance as well as features of natural wonder and beauty. The Deep Rovers can easily be shipped or air freighted to locations around the world, complete with their own workshop container.

- **Additional features**

Deep Ocean Expeditions LLC is open to ideas for use of the Deep Rovers. Additional science sampling equipment or filming equipment can be mounted on the vehicles at the request of clients. Presently a sophisticated suite of scientific sampling equipment is being designed for each submersible.

# DEEP ROVER TECHNICAL SPECIFICATIONS

- **SIZE**

LENGTH	3.3 METRES / 11.0 FEET
WIDTH	2.5 METRES / 8.0 FEET
HEIGHT	2.5 METRES / 8.0 FEET
  
- **WEIGHT** 6.3 TONNES (with crew and equipment) / 13,900 LBS
  
- **SERVICE DEPTH** 1,000 METRES / 3,280 FEET
  
- **CREW** 1 PILOT, 1 OBSERVER
  
- **PRESSURE HULL** ACRYLIC TRANSPARENT SPHERE,  
UNOBSTRUCTED 320° VIEW
 

Service Depth	: 1,000 metres / 3,280 feet
Theoretical Collapse Depth	: 4,000 metres / 13,120 feet
Inside Diameter	: 1.48 metres / 5 feet
Outside Diameter	: 1.75 metres / 5 ½ feet
Hull Thickness	: 13.5 cm / 5 ¼ inch
Service life of pressure hull	: 20 years
  
- **MANOEUVRING** 4 THRUSTERS / 5 HP EACH  
Manoeuvring of the submersibles by intuitive control of all thrusters via one joystick
  
- **CONTROL** 2 AXIAL THRUSTERS WITH AN ANGLE OF 15°  
CLOSING ASTERN  
All thrusters are independently activated, bi-directional, variable speed, proportionally controlled and with limited energy requirements.  
Intuitive control of the two manipulators controlled by two joysticks
  
- **POWER SOURCE** LEAD ACID BATTERIES
 

120 volt	140 AH / i.e. 30 KWH
24 volt interior and exterior by DC/DC converter	
12 volt	140 AH for video
24 volt emergency	12.5 AH
  
- **BALLAST** MAIN BALLAST (MBT) 114KGS / 252 lbs BUOYANCY  
WEIGHT BALLAST (VBT) 114KGS / 252 lbs BUOYANCY
  
- **LIFE SUPPORT**

MAIN BREATHABLE AIR CAPACITY	6 bottles - 9 litres each at 310 bar (4500 PSI)
EMERGENCY BREATHABLE AIR CAPACITY	6 bottles - 9 litres each at 310 bar (4500 PSI)

 (EMERGENCY LIFE SUPPORT 120 HOURS / TWO PERSONS)
  
- **CARBON DIOXIDE REMOVAL SYSTEM**

NORMAL	SODASORB (Sofnolime 812)
EMERGENCY	LITHIUM HYDROXIDE ANHYDROUS (LIOH)

 2 X 120 MAN HRS
  
- **TRIM WEIGHT/EMERGENCY DROPWEIGHT**

TRIM WEIGHT:	AIR:	110 KGS / 243 lbs
	WATER:	98 KGS / 217 lbs
EMERGENCY DROPWEIGHT:		114 KGS / 252 lbs

- **MANIPULATORS**

TWO HAWK SENSORY MANIPULATORS	
LIFTING CAPACITY IN EXTENSION	45 KGS / 99.5 lbs
YAM TIGHTENING	89 DAN
JAW ROTATION TECHNIQUE	9.5 DAN/MTR

- **LIGHTING**

3 X 450 WATTS HMI (DAY LIGHT)  
 4 X 150 WATTS HALOGEN  
 XENON FLASH  
 Plus ability to add additional lighting packages.

- **OTHER EQUIPMENT FEATURES**

- Underwater tracking by Trac Point II system
- Complete atmosphere control unit: O<sub>2</sub>, CO<sub>2</sub>, pressure, temperature and humidity
- Atmosphere cooling element, dehumidification
- Central computer for thruster commands, diving data, function conditions, alarms
- Magnetic compass, fluxgate
- Immersion control, immersion manometer
- Panoramic sonar
- Underwater acoustic telephone communication system - 10 kHz and 27 kHz
- Altimeter, depth sounder to 150 meters (490 feet)
- Marine VHF unit for surface communications equipped with GPS data stream