

Robert Ballard: Exploring Human History Lost Beneath the Sea



Manned and unmanned underwater vehicles have been used for many years to explore the hidden features of the deep ocean. Dr Robert D. Ballard is an oceanographer most noted for his deep-ocean explorations for underwater archaeology. Ballard is best known for his discovery of the legendary Titanic and underwater explorations of the Bismarck, Lusitania and Britannic. Hydrointernational asks him about his experience and best practices when setting up explorations for human history lost beneath the sea.

Please introduce yourself to our readers.

I am an oceanographer who spent 30 years at the Woods Hole Oceanographic Institution (WHOI) where I studied 'Plate tectonics and the volcanic, tectonic and hydrothermal processes of the mid-ocean ridge'. After our discovery of the RMS Titanic, German battleship Bismarck and the aircraft carrier Yorktown, I turned my attention to human history lost beneath the sea. I am presently the Director of the Institute for Archaeological Oceanography at the University of Rhode Island's (URI's) Graduate School of Oceanography (GSO). While at both institutions (the WHOI and URI/GSO), I pioneered the development of deep submergence technology including the manned submersible Alvin, the remotely operated vehicles (ROVs) Jason and Hercules, and tele-presence technology linking ROVs to shore-based science teams. I am presently working with National Oceanic and Atmospheric Administration (NOAA) Office of Ocean Exploration and their new ship of exploration, the Okeanos Explorer. I also am President of the Institute for Exploration, that studies deep-sea archaeology and deep-sea geology.

Somewhere it is written that Jules Verne inspired you with his novel *Twenty Thousand Leagues under the Sea*. Have you ever thought about Homer's poem *Odysseus* (Ulysses) and the anxiety of that mythological hero to discover what there was over the horizon?

Yes, in fact, I have named all of my undersea vehicles after Jason and his Argonauts who went in search of the Golden Fleece including Jason, Hercules, Hylas, Atalanta, etc.

Your deep-sea research inevitably needs a lot of planning and desk research. How do you set up such a project and what method do you use when searching for wrecks?

I am constantly thinking about my next expedition and at any one time have several underway. It takes about 2–3 years to plan and execute an expedition, 10–15 years to plan and execute a series of expeditions that have a central theme or focus, and 20–25 years to implement a new exploration paradigm such as tele-presence. Note from the Editor: Dr Ballard uses Internet2 and a high-bandwidth satellite link to let scientists work on the ocean floor from the comfort of their university laboratory. This real-time networking capability coupled with two underwater vehicles outfitted with high-definition video cameras and a two-way audio link to shore greatly increased the number of scientists able to participate in the research programme during the project. Dr Ballard calls this 'tele-presence'.

The most important thing for me in planning an expedition is logistical support (distance between location and ports), information about where the ship might have been when it was sunk, as well as the terrain in which it is thought to be located.

Do you use information from hydrographic and geophysical surveys in this planning? If so, what difficulties do you encounter?

I always use bathymetric data to plan my expeditions; hopefully high-resolution multi-narrow beam data. I am always interested in sedimentation rates, visibility, oxygen content, sound velocity, sea states, wind velocity, surface currents, etc. I always use the series of International Bathymetric Charts that are published under the aegis of the Intergovernmental Oceanographic Commission (IOC) and the International Hydrographic Organization (IHO). However, most of the search efforts we conducted for ships such as the Titanic, Bismarck and Yorktown were done in areas with poor bathymetric maps.

No doubt you make use of many information sources and use various sensors as well: do you use data-fusion techniques and GIS? If so, can you elaborate on this?

Yes, we always use GIS techniques, as well as software we have developed to help integrate our various databases. We need to 'zoom' in on the undersea terrain, starting at scales of 1:1,000,000 down to 1:25,000 down to micro-topography with contour intervals of centimetres without 'getting lost' along the way. We need to be able to fuse our high-resolution digital visual mosaics over our high-resolution bathymetric maps.

Are you involved in technological research and development?

Always. We develop most of our own vehicle systems including towed acoustic vehicles, towed visual imaging vehicles (Argus), ROVs (Little Herc and Hercules) and AUVs (Atalanta). We are also very much involved in the development of tele-presence technology needed to link our towed vehicles and ROVs to scientific users ashore in real-time.

What are and will be, in your opinion, the most important developments of today and tomorrow??

I believe that important developments will be related to online visualisation. Technologies such as Internet2 (which will need fibre optics for data transmission), AUVs, 4K imaging cameras, high-resolution TV projectors – these will give integrated tele-presence technology.

During your scientific career you have seen changes in the means for submarine feature detection and data evaluation. Which have been, in your opinion, the most helpful technological enhancements?

Clearly, the development of multi-narrow beam sonar systems such as those pioneered by the US Navy during the Cold War and deployed on the USNS Bowditch and USNS Dutton was critical.

How do you evaluate your period in the US Navy? Did it have any particular significance for you?

My 30 years in the Navy was a very fulfilling phase of my life. I only had fond and proud moments of working with a great organisation and great people during a critical phase of the Cold War.??

You are involved in many deep-sea underwater projects. Do you carry out these operations taking into account the UNESCO 2001 Convention on the Protection of the Underwater Cultural Heritage??

Absolutely. Our team of archaeologists, anthropologists and maritime historians make sure we follow those protocols to the highest level of compliance.

When planning and executing research at sea, do you find it useful to create international co-operation? Can you mention the institutions of other nations with which you have co-operated?

We are always working with international colleagues. Over the years, they have come from the French Research Institute for Exploitation of the Sea (IFREMER), Japan Agency for Marine-Earth Science and Technology (JAMSTEC), as well as various marine institutions in Greece, Turkey, Ukraine, Israel and Bulgaria.

Do you consider your research at sea as complying with part XII (Protection and Preservation of the Marine Environment), XIII (Marine Scientific Research) and XIV (Development and Transfer of Marine Technology) of the United Nations Convention on the Law of the Sea (UNCLOS)? How does your research contribute to these three specific areas?

Our major contribution at this point in time deals with establishing the new field of Archaeological Oceanography and working with our partner nations to develop various protocols involved in search, mapping and excavation of ancient shipwrecks in the deep sea including the establishment of undersea museums.

Do you have the feeling that interest towards oceanography is increasing?

Yes, I do and I hope that NOAA's new programme in ocean exploration and its first dedicated ship of exploration, the Okeanos Explorer , will greatly increase public awareness of the importance of the oceans of the world to the survival of the human race. I believe that young people have positive job perspectives nowadays. The most important thing that needs to be done is to reach young people between the ages of 10 and 14 when they are still dreaming big dreams. Educational outreach programmes I have founded such as the JASON Project (web reference 1) and Immersion Presents (web reference 2) reach millions of young people each year.

Do you have the impression that national administrations and international organisations such as the UN, IOC and IHO sometimes overlook aspects that affect your work? If yes, do you have a message you would like to convey to them?

Yes, they need to realise that we are only now on the threshold of many important discoveries in the world's oceans that will have an important and positive impact on the human race and that ocean exploration needs to be accelerated.