

Buckle up, we're getting wired

He started developing underwater vehicles when he was in college in 1962, which is a fairly long time ago, says Dr Robert Ballard. 'We bid unsuccessfully for the construction of *Alvin* at North American Aviation and then I went into the Navy during the Vietnam War and I was assigned to Woods Hole and to the Alvin programme in 1967. I then stayed at Woods Hole for about 30 years until I moved on to this new programme with the University of Rhode Island where I'm bringing together oceanography, archaeology and engineering in this new oceanography/archaeology programme, which is a lot of fun.'

He is still very much involved in the development of underwater vehicles. At this point he directs me towards The Institute for Archaeological Oceanography's website set up at the University of Rhode Island Graduate School of Oceanography under the direction of Ballard as an academic home for his scientific and engineering endeavours, including oceanographic exploration programmes, underwater archaeology projects, and marine technology development. The institute has designed a number of its own unmanned underwater vehicles, all built within the last two years.

'We are now building two AUV systems to complement our ROV systems,' he explains. The institute is constantly involved in the development of new technology, but 'has certainly shifted the emphasis to the shore-based systems.' He told *The JOT*: 'We have put a lot of energy into production studios, networking and command centres.'



Dr Robert Ballard, famous for finding the Titanic is now hunting for Minoan shipwrecks in the Sea of Crete

Ancient exploration

When *The JOT* spoke to Dr Ballard he was about to board a flight to Greece to meet up with the *Endeavor*. The ship is currently on a two month expedition that has three different components to it.

The first was in the Black Sea, which it has just completed. 'We are interested in the Black Sea because of its unique anoxic conditions and we are also interested in it because it is an area of ancient maritime trade that goes back to the Bronze Age,' explains Ballard. 'In fact, the story of Jason and the Argonauts was a story from the Black Sea.'

When *The JOT* spoke to Ballard, the *Endeavor* had recently left the Bosphorus and arrived off the eastern side of Santorini where he was to meet it. The expedition is interested in Santorini for two reasons:

- Its geological history. Santorini has a violent history being the second largest historical explosion in the Bronze Age.
- Because it buried the city of Aquateria, which is Minoan city,'

Ballard explains, 'we are particularly interested in the Minoan period because it is where science and mythology meet, much like Heinrich Schliemann's work, which proved the existence of Troy and later he went on to find Agamemnon.

'Schliemann didn't find Agamemnon's golden mask but he did find the Mycenaean culture on the Peloponnese peninsula and then Arthur Evans went on to find the palace at Knossos, so turning myth into fact.'

'We are trying to do the same thing by trying to locate Minoan shipwrecks in the

Sea of Crete. We have been there earlier and have found a number of targets and that is what I'm going back for.'

The expedition is part of a joint programme with the Hellenic Centre for Marine Research, which is Greece's major oceanographic research institution.

Advanced technology

The ship will not only focus on the geology of Santorini but will be providing an educational outreach programme. The vessel is equipped with a satellite system that makes it possible to carry out video streaming directly from ROVs on the seabed. 'Essential to our technology is the ability to create a tele-presence ashore,' he explains. Command centres built ashore are identical to the command centre on the ship allowing experts ashore to be called in to view discoveries in real time. Perhaps this is technology that the offshore sector could use in light of the fact there is a huge skills shortage in the industry.

'We now have five of the consoles across the US — one at the university in New Hampshire, because they are doing a lot of our sonar processing. There are other ones at the University of Rhode Island, one at Mystic and two at NOAA's facilities.'

He told The JOT: 'They are all connected via the new high bandwidth pipeline — we call Internet 2. It gives you 10Gb of bandwidth, so you are then able to network your experts as you need them.'

The system is the forerunner of the system being fitted to NOAA's (National Oceanic & Atmospheric Administration's) new ship exploration ship, *Okeanos Explorer*, which is currently in drydock at Todd Shipyard being outfitted with the latest exploration technology. The ship will come online later next year.

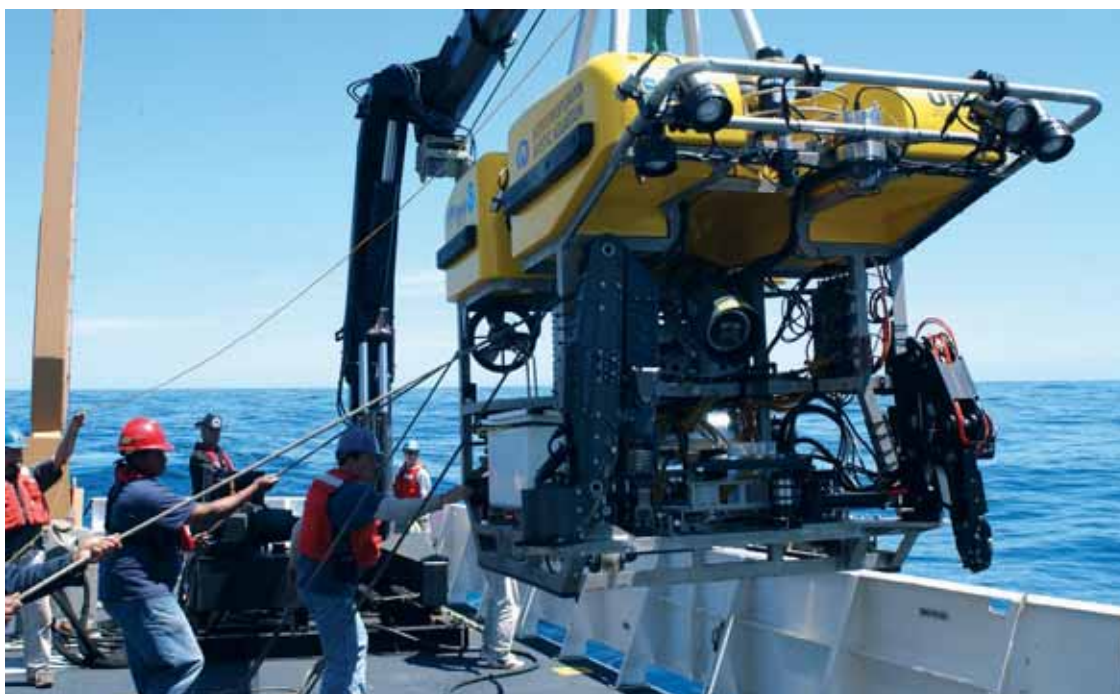
'This ship's mission is to quote: "to go where no one has ever gone before" on planet Earth, says Ballard. The ship will go out and explore not knowing what it will find. 'So, it is ludicrous to think that you are going to stack this ship with scientists who are sitting around waiting because it could be a biological discovery, or it could be a geological discovery.' The current expedition is getting ready technologically for the new ship, 'so that we are propagating these command centres.'

The final phase of the expedition will be to go into the Sea of Crete where the ship will be searching the ancient trade routes that connected Knossos, the Minoan centre of culture on Crete, to its colonies to the north and the Cyclades islands of Milos and Santorini to see if they can find a Minoan ship.

The project involves the building of what Ballard calls an 'inner space centre' at the University of Rhode Island to support the *Okeanos Explorer* once it is delivered as it will spend most of its time at sea. 'The US\$14M building will have a telecommunications centre that will look a lot like the control room at Houston for the support of the space programme,' says Ballard.

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The Endeavor is a test bed for the technologies being installed on NOAA's new ship Okeanos Explorer



The idea is that the ship will work 24hrs a day and it will be connected 24hrs a day to a team of engineers. In fact, the team at sea will switch out on a regular basis with the team in the inner space centre, so it is really one team. 'It is very much like the way we run our ballistic missile submarines, called the gold team and the blue team. You don't want the submarine to come in – you just switch out the crews.'

Engineers will operate a watch system so that the moment a discovery is made it is seen at the inner space centre and their job is to find an expert to respond to a discovery and then to network them immediately aboard the ship so that they can take over the mission for a day or so. Then the ship will return to its original plan. 'That's what it is all about and it's working,' says Ballard.

Remote viewing

He explains that after having spent a lifetime in submarines, 'this is far better in all aspects. People fantasise about what it is like to be in a deep dive submarine but it is miserable – you can't go to the bathroom and your bladder is killing you and you are looking out of a little peephole and you can only stay down for a short period of time before you have to run back to the surface, so it is like holding your breath.' He told *The JOT*: 'With these ROVs you have high definition screens which are the equivalent of big bay windows and you can stay down almost indefinitely and, more importantly, you can converse with others.'

He explains, 'If you think that when you send a person down that they are going to know everything – well they're not. So they miss 90% of the important stuff because they are specialists and they only see what they want to see.' The new system allows anybody to view what is being seen by the ROVs on the seabed 'I expect to have one of these command centres in my home by next year – it is the last mile for the Internet 2 connection.'

Ballard believes that what they are doing is reflective of electronic travel (see Editor's Choice). 'I have a big lab at the university and I have the exhibit centre at Mystic [Aquarium & Institute for Exploration] and they are 45 minutes apart and it is a pain to constantly drive back and forth.'

He says, 'we have purchased a technology called Pepper's Ghost, which was devel-



Dr Robert Ballard is still very much involved in the development of under water vehicles, such as Hercules seen here being launched

oped by Disney for the haunted house. In the haunted house ghosts are created by projecting images on sloped glass. They have now commercialised that technology and although it is not holography, it gives a 3D effect, which is crystal clear and the person is looking at you straight in the eye. I had it demonstrated to me and I purchased it that moment because it was just so impressive.'

He told *The JOT*: 'I am standing in my study talking to you but I could easily be teleconferencing around the world or using Pepper's Ghost to talk to my staff – that is where technology is headed. The difficulty is going to be adjusting to it – how do we restructure our society. The technology is out of control – the world is going to be wired – there are whole states going wireless, so buckle up!'

JOT

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