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Cover Story: Breaking the surface

By Jim Kirk, business development manager,
OceanServer Technology, Inc., Massachusetts, USA

Iver2 AUV used by archaeologists to examine Roman ruins during BTS 2012 conference

OceanServer Technology, Inc. (OTI) recently participated in the fourth annual international interdisciplinary field training of marine robotics and applications, Breaking the Surface 2012 (BTS 2012), which took place in October 2012 on the island of Murter in Croatia. It was hosted by the University of Zagreb and involved a wide variety of researchers, including representatives from France, Greece, Germany, Portugal, the USA and several other countries.

The conference brought together four related disciplines: marine robotics, marine biology/ecology, maritime archaeology and maritime security. For eight days, BTS 2012 offered multidisciplinary field training where researchers from the aforementioned disciplines were able to join forces and use existing and recently available technologies to address their specific problems. The crystal clear waters of the Adriatic Sea presented these researchers with the perfect setting to update their knowledge base and operate a number of modern subsea systems, including AUVs, ROVs and other robotic platforms.

On the marine robotics front, conference attendees had the opportunity to attend classes/lectures and participate in field demonstrations of robotic equipment. OTI conducted classroom training and in-field operations addressing the latest advances in mission planning and mission execution, including launch and recovery. OTI provided its most recent product, the Iver2 system with an L-3 Klein, USA, 3500 high-resolution sidescan sonar, for use by the conference attendees. At Podvrške Bay, users planned missions to locate and identify targets such as construction equipment and a sunken barrel. The AUV, equipped with the Klein 3500, allows users to sweep large survey areas at a constant height above the seafloor, while simultaneously collecting both high and low frequency images. This provides for maximum image efficiency and the best possible coverage. During the trials images were generated using a variety of different range settings to cover from 30- to 100-metre swaths on either side of the AUV for the



Iver2 AUV returns from
Podvrške Bay sweep
mission



OTI provided its Iver2 system with an L-3 Klein 3500 high-resolution sidescan sonar for use by the conference attendees



Church of Our Lady



Mosaic image using SonarWiz from Colentum Site



Pipeline image

most efficient and highest resolution imaging of the bottom features. The capability and operability of this ‘game changing’ technology is expected to contribute to significant and affordable improvements in areas such as harbour security and mine countermeasures.

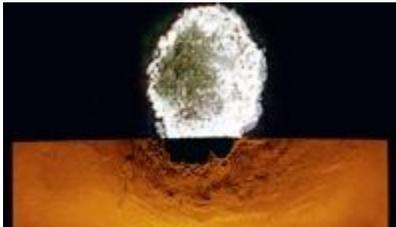
A bonus at the event was an opportunity for this multi-disciplinary team of archaeologists and researchers to operate an Iver2 AUV with Klein 3500 high-resolution sonar system at two exciting historical sites. These included Roman ruins in the cove of Hramina, Murter, and the Gnali Island shipwreck (<http://inadiscover.com/blogs/gnalic-project>). Conference attendees led by Krunoslav Zubcic from the Croatian Conservation Institute visited shoreside at the Roman ruins from the ancient settlement of Colentum, known as the island of Murter today. These submerged and hillside remains sit next to the 17th century Church of Our Lady which overlooks the cove of Hramina just outside the main harbour of Murter. In previous trips to the Colentum site, AUVs equipped with lower resolution sidescan sonars were used to image the shallow-water ruins and stitch together mosaic images of the entire area.

The Colentum site was discovered more than 300 years ago. The dramatic rise of the Adriatic Sea when compared to Roman times makes the subsurface analysis of the shoreline component an important area to image. Professor Zdenko Brusi carried out an extensive investigation of the submerged portion of the Colentum site in 1970. In recent years, the University of Zagreb used its Iver2 AUV, equipped with an Imagenex, Canada, YellowFin sidescan sonar and HD cameras, to locate sunken remains of the harbour walls and also piles of ballast stones. These missions consisted of box grid sweeps with five-metre spacing to collect geo-reference HD camera images and sonar images consistent with an archaeological survey. The end product was a sonar mosaic image of the bottom near-shore area along with HD camera images collected once per second where piles of ballast stones and wall remains were suspected.

At the October BTS 2012 event two AUVs were employed to better cover the site area and expand the imaging to new locations. The Iver2 AUV provided by OTI focused on large area sweeps with very high-resolution imaging (Klein 3500). The Iver vehicle completed two rectangular box grid sweeps around the middle of the bay covering an area just under 500,000 square metres in approximately two hours. SonarWiz (a proprietary post-processing software tool licensed by Chesapeake Technologies, USA) was used to mosaic the Klein 3500 images, which were then placed on the local area satellite image used to plan the mission. Several targets were identified including typical marine debris, modern pipeline structures and several previously unidentified mounds which will be the subject of future investigations. The conference also included an expedition to a small rocky island called Gnalic. In the 1960s amateur divers discovered the wreck of a Venetian merchant ship, the *Gagiana*, near the island. Records indicate that the ship sank in 80 feet (24 metres) of water during a storm in 1583. The ship’s cargo consisted of a wide assortment of glass vessels, mirrors, window panes, brass chandeliers, silk, cotton shirts, shaving razors, pins, needles, candle snuffers, brass bells, spectacles and raw materials such as cinnabar, lead carbonate, mercury, antimony, sulphur, brass wire and brass sheet. For hundreds of years the Eastern Adriatic coastline has been an important route for ships and the *Gagiana* wreck sheds light on commerce routes in the eastern Mediterranean world in the late 16th century.



Gnalic Island. The wreck of the *Gagiana*, a Venetian merchant ship, was discovered close to the island by amateur divers in the 1960s.



Gnalic Island Klein sonar image

On this expedition two AUVs imaged the bottom around the island while divers took the opportunity to check the state of the wreck. One of the archaeologists did collect a few samples for analysis including a brass candle holder or part of a chandelier. The sonar images show very little of the actual wreck, which is mostly below the seabed or decayed at this point. Another objective of the survey was to identify an anchor from the ship in the surrounding areas after reviewing the high-resolution sonar images. Below is a satellite image with one of the Klein images overlaid which provides a look at the slope approaching the island.

Dr Matko Barisic of the University of Zagreb summed up the technology aspects of the conference in a note to the author. He says: “All of the above leads us to reach a conclusion much in line with the summary provided by the final section of this year’s BTS 2012 event – the round table open-floor discussion, attended by the myriad marine robotics and ocean science experts. It is evident that portable, easy-to-use underwater technology, including small form-factor AUVs like the Iver, are already a cornerstone technology, in essence a *sine qua non* for efficient, pervasive and constant presence in the littoral. Many key locations around the world, both from the standpoint of as-yet-uneearthed submerged cultural heritage and of large bio-indicative/proxy habitats for the state of the ecosphere in general, or of significant carbon sink capacities (such as *Posidonia oceanica*), are in the littoral depth range.

“Efforts must be combined from the R&D community, the end-user (ocean science) side and the commercial suppliers to make this technology financially approachable by the public and non-government sectors, readily available, easy to use and supplemented with round-the-world and round-the-clock tech support, as well as with ever-increasing measures of operational safety and telemetry of deployed systems.”

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For further information on the Iver2 AUV please contact: Jim Kirk, business development manager, OceanServer Technology, kirk@ocean-server.com