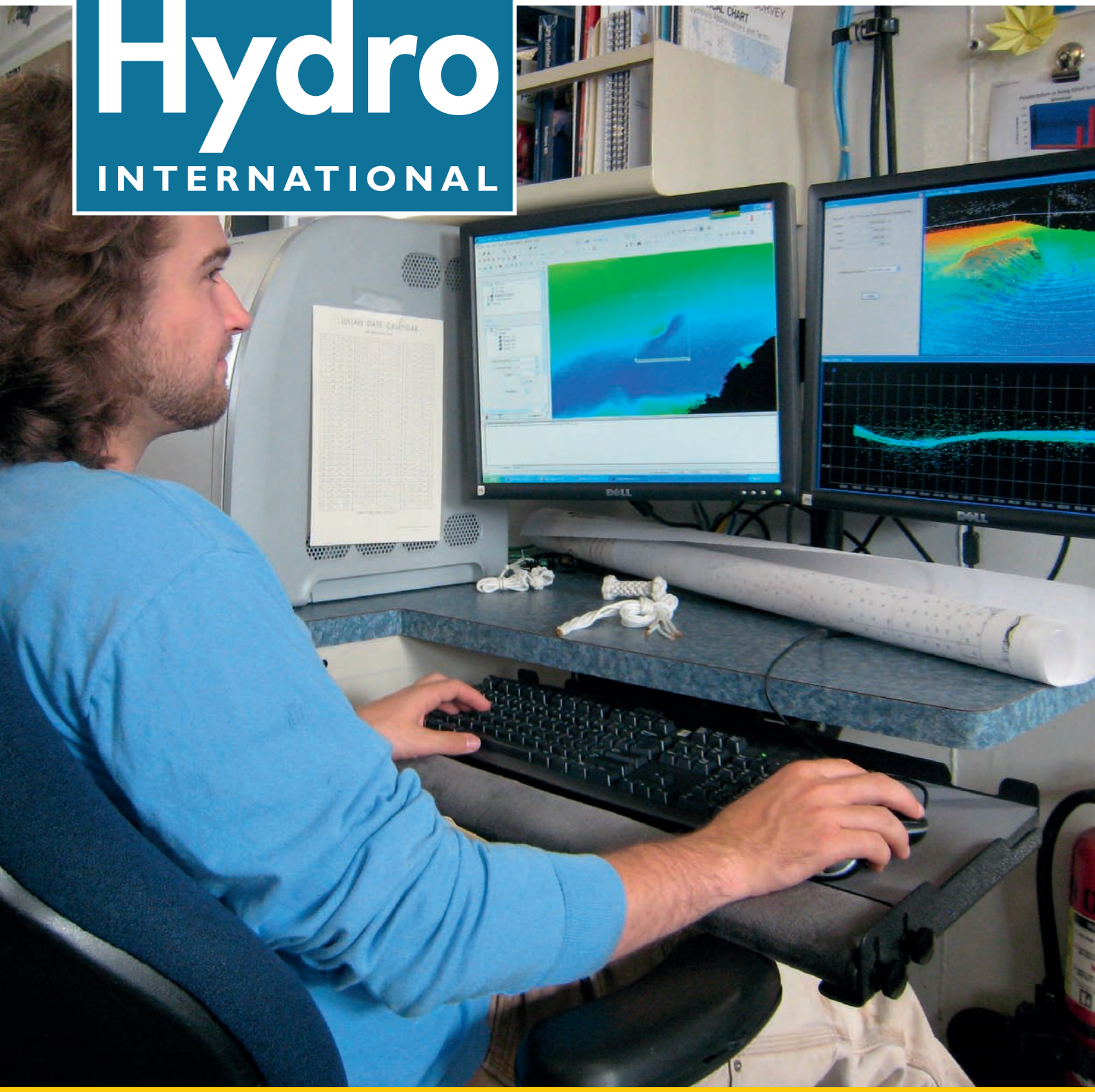
MARCH 2013 > VOLUME 17 > NUMBER 2 > WWW.HYDRO-INTERNATIONAL.COM

Hydro INTERNATIONAL



Pioneer for Space Geodesy

Hydro International Interviews Reiner Rummel

OpenSeaMap – the Free Nautical Chart

Biggest Worldwide Geodatabase, Made by the Crowd

Solution for Cameron's Deepsea Challenge

Communications to the Deepest Point on Earth

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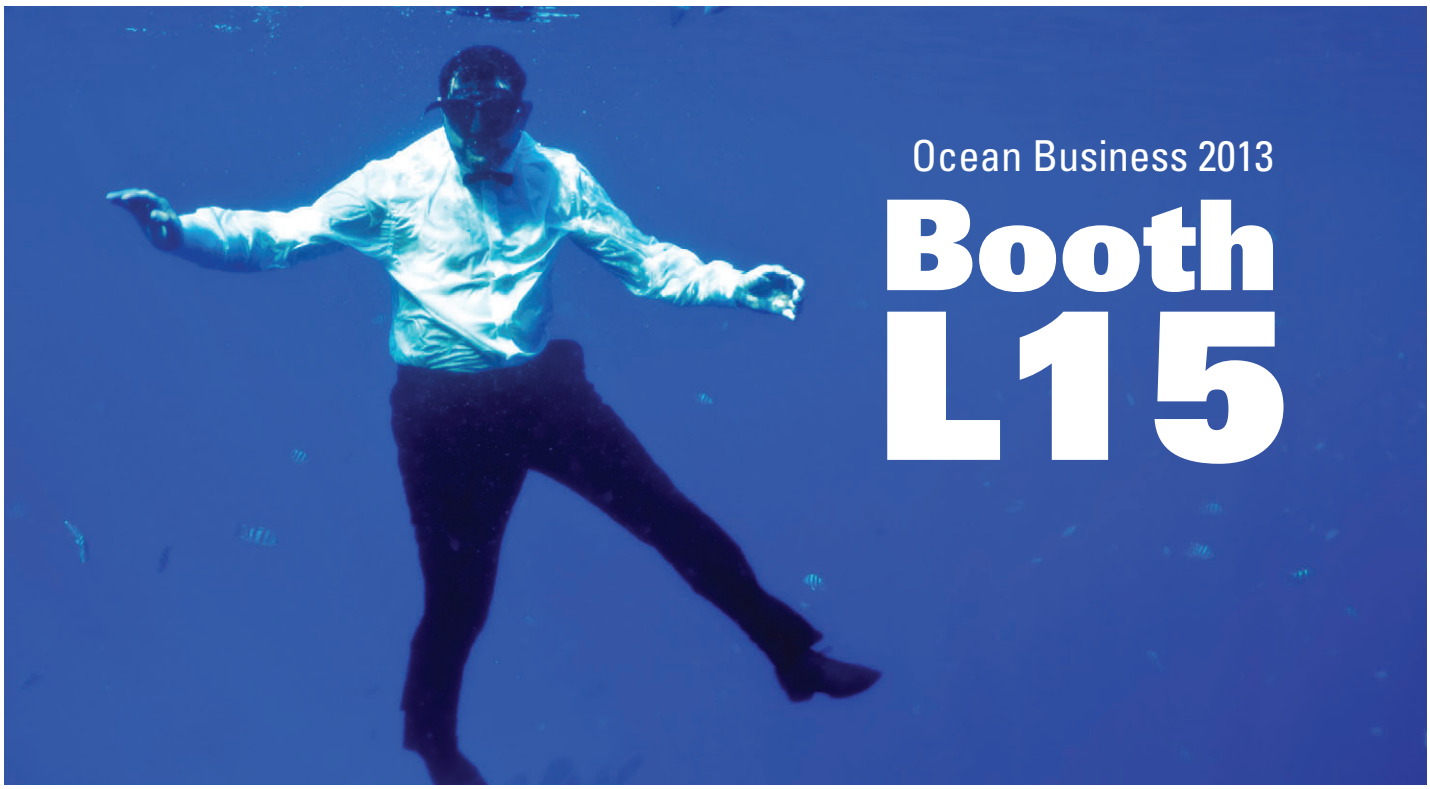
RESON

Underwater acoustic solutions



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SeaBat

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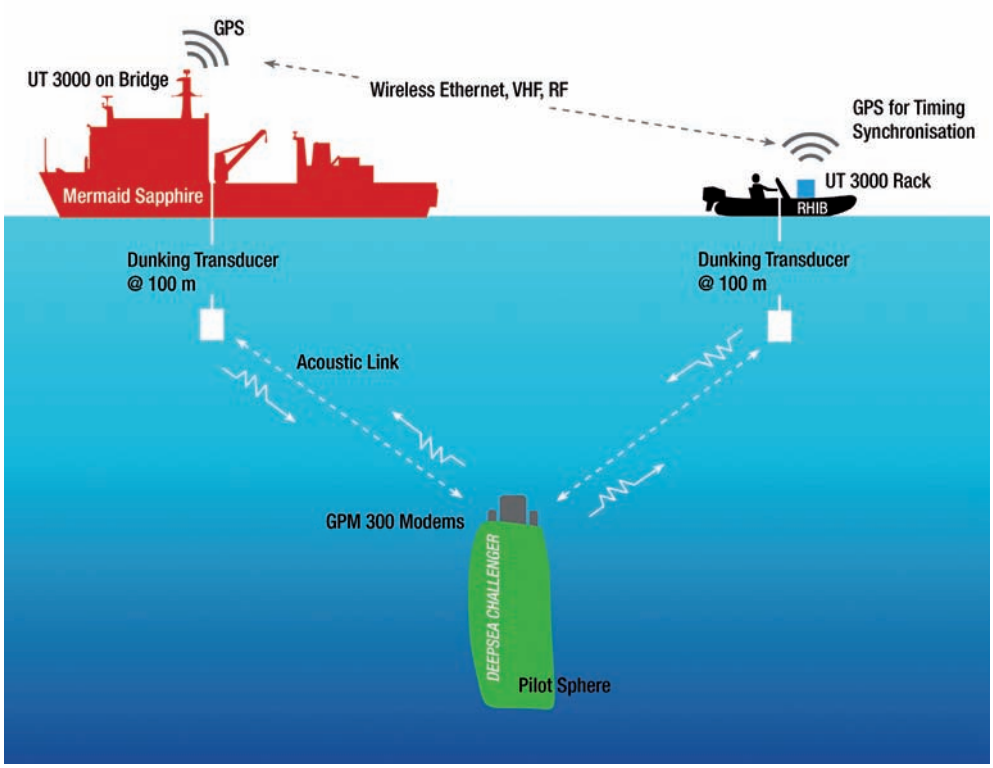

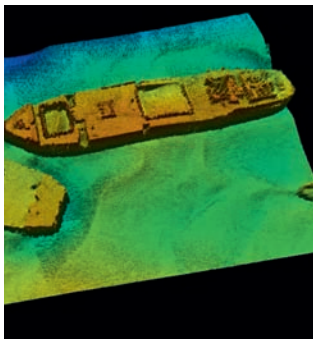

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NOAA scientists analyse multi-beam data and study navigational obstructions on Alaska's Kachemak Bay's bottom. Image courtesy: NOAA.

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Photography: Arie Bruinsma (www.ariebruinsma.nl)

Connecting

Durk Haarsma
durk.haarsma@geomares.nl

'Connecting hydrography' is a theme that is likely to become significant in the coming years and I would like to briefly explore why it is important to stay abreast. I put connecting hydrography in brackets because it could have two, three or even more meanings.

The first way of looking at connecting hydrography could be as a glue between different, adjacent fields: offshore oil & gas, geophysics, engineering, e-navigation and shipping. 'Connecting hydrography' is then seen as a concept that is in the middle of all kinds of maritime techniques, with a small contribution to all techniques making it necessary in all of them.

Secondly, I would like to explore the connection between hydrography and real-time information, for instance, on currents or weather data on board of a ship – or think ahead with me – near real-time hydrography through satellite imagery? Let's also think about connecting hydrography across borders, between maritime states, for instance, or to the surveyors on land.

The last two 'connections' are particularly interesting, but still need to take place within the profession, within the boundaries of the field and probably also within the boundaries of knowledge. The first concept explores a more hypothetical, hitherto unknown situation, which could bring opportunities that we have as yet not thought of. Such a concept would be good for the business and the profession: it places the hydrographic surveyor in the middle of many processes in the maritime environment and yes, the blue economy. Therefore, I think it is vital to search for the potential to connect with hydrography. Without this potential the whole concept is deemed to fail. It requires an open mind from both hydrographic surveyors and companies alike. It requires a pioneering attitude in times when work is sometimes scarce and jobs are no longer for life. It requires business leaders who dare to steer away from the vision. Over the years I've met a lot of these open-minded, pioneering and inquisitive hydrographic professionals – stand alone or those searching for new ventures for their companies. But there are also many professionals out there who are happy just doing what they have done for years: it is safe, there will always be a need for hydrographic data and why change things if they are working as they are? But remember it is vital to develop a vision and think across borders to ensure that the field of hydrography is kept alive and that it counts as the bridging technique: once again as the connection!

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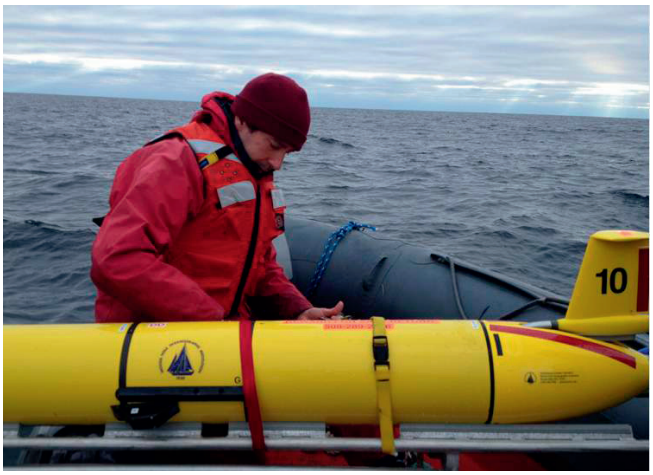
Delay for Third Leg of *Polarstern* Expedition

Due to technical problems with the front crane, the German oceanographic research vessel *Polarstern* did not start its third leg to Antarctica on 19 January 2013. Since an important part of the crane's hydraulic system was broken, and could not be fixed using the tools on board, the crew was unable to complete loading in the port of Punta Arenas, Chile.
http://su.pr/1LWiCq

SV *Polarstern*. (Image courtesy: Folke Mehrtens, Alfred-Wegener-Institut).

Gliders Detect Endangered Whales



Chief scientist Mark Baumgartner secures a glider (with its wings removed) after it was recovered on 4 December from its three-week mission. (Image Courtesy: Nadine Lysiak, Woods Hole Oceanographic Institution).

Two gliders equipped with instruments designed to 'listen' for the calls of baleen whales detected nine endangered North Atlantic right whales in the Gulf of Maine, USA, in December 2012. The robots reported the detections to shore-based researchers within hours of hearing the whales (i.e. in real time), demonstrating a new and powerful tool for managing interactions between whales and human activities. The team of researchers, led by Woods Hole Oceanographic Institution (WHOI, USA) scientists Mark Baumgartner and Dave Fratantoni, reported their sightings to the USA-based NOAA, which is responsible for enforcing the Marine Mammal Protection Act.
http://su.pr/3Vziqv

GPS Intellectual Property Issue Resolved

The governments of the United Kingdom and the United States of America have reached a common understanding of intellectual property rights related to the Global Positioning System (GPS), and will work together to address broader global navigation satellite systems' intellectual property issues.

This understanding is part of a broader shared effort to advance compatibility and interoperability among civil satellite navigation systems and transparency in civil service provision. The two governments affirmed their joint commitment to ensuring that GPS civil signals will remain free and openly available for users worldwide.
http://su.pr/A0CANq

GPS Satellite. (Image courtesy: GPS.gov).

Round 3 Windfarm Metocean Data Delivery

UK-based Cefas has signed a major contract with East Anglia Offshore Wind Ltd (EAOW) to provide metocean data that will support the development of the East Anglia Zone in the North Sea. The three-year project will involve the deployment, operation and servicing of directional waverider buoys and seabed 'mini-landers' at a number of sites across the East Anglia Zone.
http://su.pr/4rDuSR

Sandy Island Solved by SHOM in 1979

The ghost island Sandy Island is back in the spotlight these days, despite the fact that its mystery was definitively solved in 1979, which should be before the Australian Hydrographic Service did so in 1985.

During a survey of the tectonic evolution of the Coral Sea, the Australian research vessel *Southern Surveyor* found no land mass in the presumed position of Sandy Island. The opposite would have been surprising, because in 1979, to put an end to the many doubts surrounding the existence of this island, SHOM commissioned several aerial reconnaissance missions with a Maritime Patrol Aircraft (Neptune P2H) of the Naval Air Force in New Caledonia, which concluded that this island did not exist. The island was deleted from nautical publications via a notice to mariners in March 1979.
http://su.pr/3vDiMT

Extrait groupe d'avis aux navigateurs (mars 1979)
– 16 –

★ 79 13 42. NOUVELLE-CALÉDONIE. Récifs de Chesterfield. – Dangers.
(Mission Océanographique du Pacifique, 79-351 R4).
– Instructions K 8, 5.1.1.3.
– Cartos

5978 (14) cartouche *Rbcits Bampton Chesterfield Bullona*

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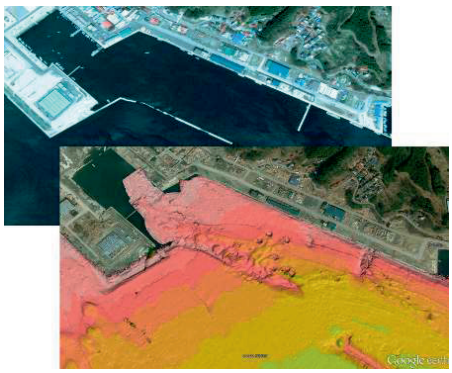
Extract of the Notice to Mariners, to erase the mentioning of Sandy Island, made in 1979.

Chart S-4 Adapts After-disaster Survey Marking



The IHO Chart Standardization and Paper Chart Working Group (CSPCWG) has considered a proposal to advise the IHO on a suggestion put forward by the Japanese Hydrographic and Oceanographic Department, namely that a magenta dotted line should be adopted for international use to indicate clearly on charts those areas that have been surveyed since a natural disaster such as a tsunami.
http://su.pr/8ILk2u

Image: Otsuchi harbour, Iwate Prefecture, Japan, before and after the Tohoku earthquake and tsunami that occurred one year ago on Friday 11 March 2011. The bathymetry data, acquired with Kongsberg GeoAcoustics GeoSwath Plus, show the damage to the infrastructure and large amounts of debris. Data source: Dr. Teruhisa KOMATSU. Atmosphere and Ocean Research Institute, The University of Tokyo, Japan.

Permanent Tide Station for Dubai

Unique System FZE, a Unique Maritime Group Company, UAE, together with the Geodesy and Hydrographic Survey Section of Dubai Municipality has established a permanent tidal station at Al Mamzaar. The purpose of the project is to collect precise tide data continuously for a period of 19 years to calculate mean sea level and annual sea level rise and to provide precise tide and tide-related meteorological data to various users, as well as to define and update a precise vertical datum for Dubai Emirate.
http://su.pr/2e5tXK

The tide meter in operation.

Teledyne Technologies to Acquire RESON

Teledyne Technologies, USA, and the shareholders of RESON, Denmark, have entered into a definitive agreement for the acquisition of RESON by a wholly owned subsidiary of Teledyne. RESON, headquartered in Slangerup, Denmark, provides high-resolution marine acoustic imaging and measurement solutions. Terms of the transaction were not disclosed. The closing of the transaction, which is subject to customary conditions, is anticipated to occur in the first quarter of 2013.
http://su.pr/1m8Lkw

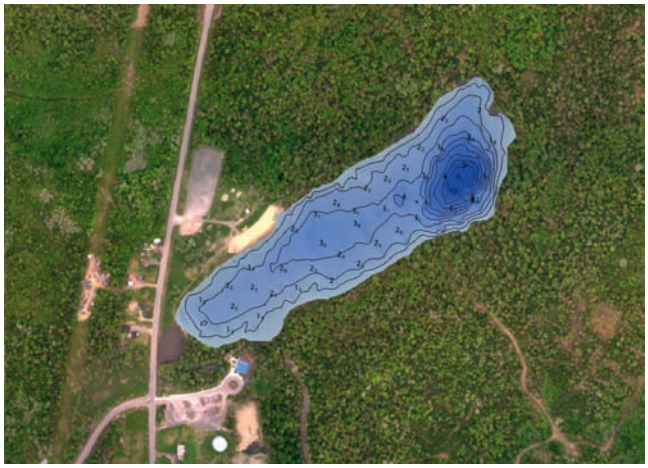
Most Shared

Most shared during the last month from www.hydro-international.com

1. 3D Sonar Map Reveals Details of Civil War Wreck - http://su.pr/1GNWCk
2. Imagery-derived Bathymetry and Seabed Classification Validated - http://su.pr/1wjXpP
3. Stop Using DGPS! - http://su.pr/7rZHNT
4. Prizes for Plymouth University Students - http://su.pr/17xGkU
5. USS *Guardian* Investigation to Include Faulty Chart Data - http://su.pr/916DmQ

Taking Bathymetry Using a Kayak

As a geomatics professional and avid kayaker, Matthew Gudger decided to assemble a simple and easy-to-use kayak-mounted bathymetric mapping system which could help to create simple bottom terrain maps of local lakes. The original concept was conceived by Paul Illsley, a geomatics instructor based in Nova Scotia, Canada. A bathymetric survey was conducted off Killarney Lake in Fredericton, New Brunswick. The survey was completed using a prototype sounding system consisting of a 10-foot open-cockpit kayak, Humminbird 788ci HD depth sounder and a 12V power supply. A series of 2,100 soundings were collected during the two-hour survey which were used in the creation of a depth model and selected soundings for the lake.
http://su.pr/261p29



The bathymetry of Killarney Lake.

EIVA Sponsors Benthic Mapping Programme

EIVA, Denmark, has entered into a partnership with the College of Charleston and University of Washington, USA, on the benthic acoustic mapping and survey (BEAMS) programme. This joint journey will centre around knowledge-sharing and training across the Atlantic Ocean, concerned with matters below the water's surface.

When EIVA learned of the BEAMS programme, the opportunity of establishing a partnership focusing on knowledge-sharing was an obvious ship to board.

The partnership revolves around internships at EIVA's headquarters in Denmark and an annual 3-day training workshop, taught by EIVA instructors, where the EIVA software suite is put to use at both the College of Charleston and University of Washington.
http://su.pr/3BBP0t

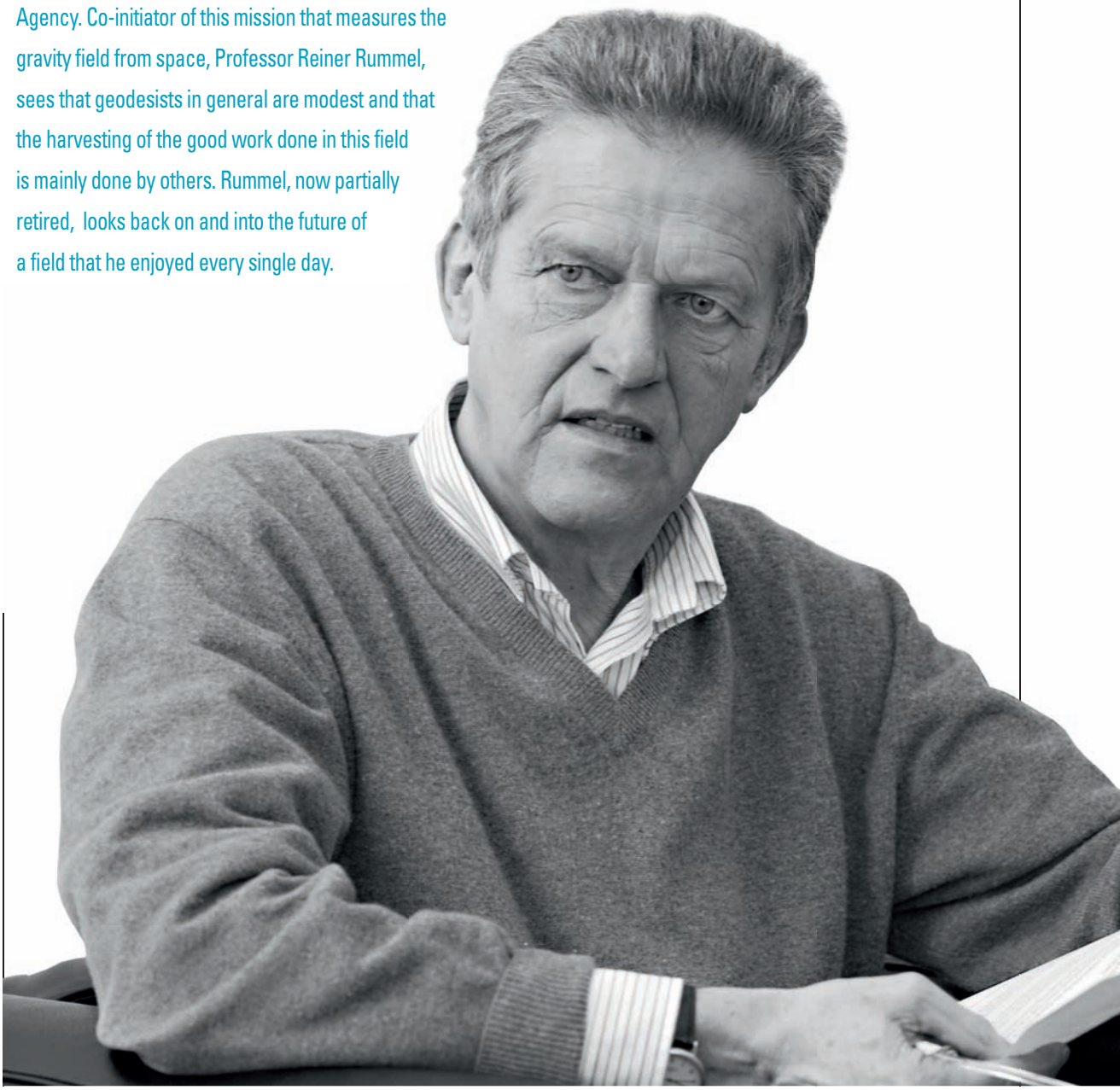
More news
www.hydro-international.com/news/news.php

Pioneer for Space Geodesy

Hydro International interviews Reiner Rummel

The field of geodesy is undergoing a revolutionary change. The developments of the last few decades have altered the views and work of professional surveyors, researchers and developers immensely, think of GPS, INSAR but also the Gravity and steady-state Ocean Circulation Explorer (GOCE) mission carried out by the European Space Agency. Co-initiator of this mission that measures the gravity field from space, Professor Reiner Rummel, sees that geodesists in general are modest and that the harvesting of the good work done in this field is mainly done by others. Rummel, now partially retired, looks back on and into the future of a field that he enjoyed every single day.

Durk Haarsma
Publishing director,
Hydro International



What is your biggest contribution to the science of geodesy?
That's difficult. I think my contribution to the Gravity and steady-state Ocean Circulation Explorer (GOCE) satellite mission would probably count as the biggest. I was one of the initiators of this project and I am still responsible for the level-2 processing of the data. The mission itself is a great success. But… if you would look into my heart it's probably the education of many young people over the years that I consider my greatest contribution. It gives me great pleasure seeing them successfully contributing to our field.

What is your strength in both your scientific work and your teaching?
If I have a strength, it would probably be the ability to translate sometimes rather complex issues into much simpler words. For teaching as well as for the work related to the GOCE satellite mission it is vital to be able to rephrase and simplify, because sometimes it's easy to drown in the complexity.

Can you explain in a few sentences what GOCE does and what it means?
GOCE measures the gravity field of the earth in the greatest possible detail. It is the first time we have done this from space using the principle of gradiometry and with the data collected a new geoid was derived and first unveiled in 2009. We are still in the process of improving this geoid by collecting additional data to make it more accurate.

What difficulties did you encounter?
To measure the gravity field from space – that is, from satellite altitude – you have to build in a few tricks, because gravity is strongly attenuated at satellite height. Gradiometry is used as the measurement principle to counteract this damping effect. This is therefore the first time that gradiometry is being used from space, which is not easy.

Can you already name an effect of the outcomes of GOCE on hydrography?
One of the projects we carry out for the European Space Agency is the unification of the height systems of many countries into a single system. The height systems in each country now refer to a benchmark or tide gauge, for instance, in the Netherlands it is the Amsterdam Ordnance Datum (NPA). This datum has been adopted by several other countries, but there were also countries setting their own standard. Usually 'mean sea level' at a tide gauge is adopted as height reference, but mean sea level varies from place to place. We can bring them into one system using GOCE. Large-scale leveling has become history thanks to GOCE. In Germany, for instance, first-order levelling has probably been carried out for the last time, and in the United States and Canada GOCE results are already used.

Geodesy is riding a wave of success due to all these technological advancements

Were there any interesting findings in unifying these height systems?
Yes, we carried out an interesting exercise with colleagues from Liverpool to check the American height system in order to try and settle an interesting historical dispute between geodesists and oceanographers. When oceanographers calculate the slope of the sea level along the East coast the sea level bulges towards the equator, while geodetic levelling shows the opposite: an increase towards northern latitudes. We have now used the new data and the discrepancy has gone. Outcome: the geodesists were wrong, the oceanographers were right!

Are there other practical uses of GOCE outcomes?
Yes, you can now convert GPS height to physical height much more precisely than in the past. This will make life much easier in construction projects like building bridges between two countries separated by sea, etc. Especially in the lesser developed world, Africa or Southeast Asia, it could stimulate economies, while building in areas with many islands or areas where the height system was simply not accurate becomes much easier.

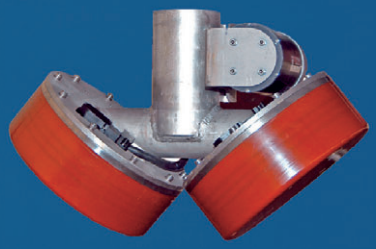
Can you share early conclusions from GOCE related to oceanography?
What I find sensational is that we are now able to compare the Pacific and the Atlantic Ocean easily. Another major leap, is research in the ocean circulation patterns of the Antarctic region, without the need for in-situ drifter or ship data, but based only on data collected by GOCE and satellite altimetry.

Reinhard (Reiner) Rummel earned a degree in surveying at the Technical University in Munich, Germany (TUM) and then did his doctorate at the Technical University Darmstadt, Germany in 1974. From 1993 to 2011, he was professor of astronomical and physical geodesy at the TUM. From 1980 to 1993, he was professor of physical geodesy at the Technical University of Delft, the Netherlands. Rummel is co-initiator and principal investigator of the Gravity field and steady-state Ocean Circulation Explorer (GOCE) satellite mission of the European Space Agency. Rummel is a member of both the Bavarian Academy for Sciences, the German Academy of Science Leopoldina and the Dutch Academy for Sciences.

KONGSBERG

The end of data cleaning

High resolution soundings with new EM 2040C



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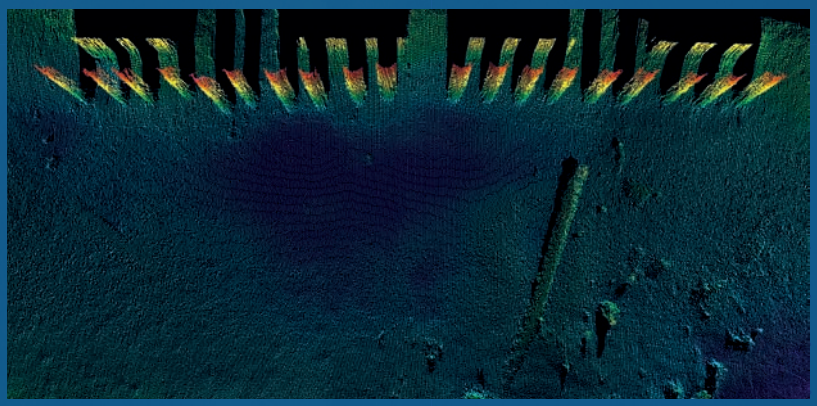

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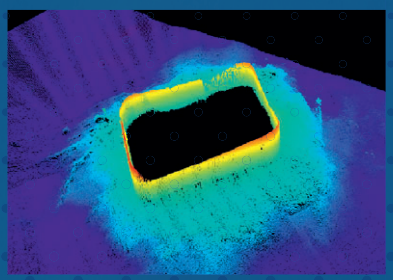

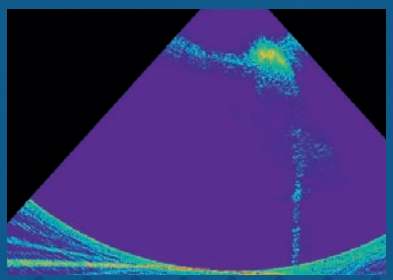

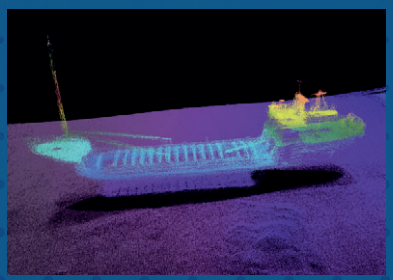

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It makes it possible to study the circumpolar current in the Antarctic. Even more important is that we have created a standard, a baseline-measurement, on which we can base any changes in the future. It is just very important basic material.

Will GOCE eventually change our profession dramatically?
There is a revolution going on in the whole field. This revolution is not just related to gravity and thus to GOCE, but to GPS, INSAR and GRACE as well. We are talking about millimetre accuracy and we are now even able to see temporal changes. This is important, because for the first time geodesy is now able to contribute to issues such as climate change, to tectonic changes but also to changes due to planning. And for the first time in history sea level rise can now be divided into its contribution due to thermal expansion and that of melting water of the ice shields, for the first time we can quantify how much ice is melting in Greenland or Antarctica, and for the first time we can quantify changes in ground water on the continents. This is in itself really sensational!

How do you see the future of geodesy?
I see that we are penetrating many more fields that we did not touch before, like hydrology, oceanography and hydrography and geophysics, but also land management and disaster management. The key word for me is the Global Geodetic Observing System, previously extensively described in this magazine, but it is good to note again that one global reference system on a millimetre scale on an Earth that is wobbling and bobbling is a major accomplishment. We extensively pushed this idea because it is a precondition for further progress in geodesy. First of all, because this connects satellite and terrestrial work and secondly because it provides for a global system. Geodesists are coming out of their shells and showing the world their good work while almost by definition geodesists do their work in silence and modesty. In geodesy we have the tendency to say - this is no longer our field of experience so let hydrographers or oceanographers do the application based on our geodetic data; other fields are less hesitant to practice geodesy.

Is it expected to affect the work of an oceanographer?
GOCE stands for Gravity and steady-state Ocean Circulation Explorer. The main scientific application of the mission is oceanography. Without data having to be collected at sea we can now, for instance, measure the level of the Gulf stream and its deviation from the geoid. We derive ocean velocity from the mountains and valleys on the ocean measured by GOCE, so we can now measure transport of mass or heat which is extremely important for climate change.

Should oceanographers and geodesists look towards each other more?
Of course oceanography is a very difficult field, and joint scientific programmes and meetings are helping to exchange information for the good of terrestrial geodesy and oceanography. At TUM we work together with the National Oceanographic Center in Liverpool, UK and the Alfred Wegener Institute in Bremerhaven, Germany. It sometimes takes a while to find a common language, but eventually both sides benefit enormously. So I would definitely advise working together.

Geodesists were wrong, the oceanographers were right!

You are now partially retired, but still active. If you had 25 more years of research ahead of you, what would be your absolute priority in research and development?
It is difficult - at my age you start looking back rather than ahead. I had the privilege of working in this field in a particularly interesting time. Over the last 40 years, technology has advanced at an enormous pace. I predict that this growth could still go on for a few more decades. I expect height to be measured with clocks, I expect new types of gravimeters based on atomic interferometry, I expect time to play a very prominent role in the future of geodesy, I also expects clouds of small satellites to carry out measurements and I expect an explosion in the use of unmanned aerial vehicles. The link between terrestrial and airborne data and space data is of highest priority for the next decade. We can do so much from space now that we have an enormous problem in between. In my field of research we are lacking detail in spatial and temporal detail. I see a number of companies investing in airborne instrumentation products of a much better quality. It is with great pleasure that I see this happening and if I had time this would really be a field in which I would like to be active.

Multi-beam Echo Sounders

New Technology, New Capabilities and New Markets

The evolution of multi-beam echo sounders (MBES) is leading to systems with enhanced capabilities in their traditional markets, but also provides features to allow the expansion of their use into new areas and applications. This short review highlights some of the features of the latest generation of systems. The attributes of an MBES system are traditionally described by technical specifications, such as operating frequency, pulse length, beamwidth, number of beams and coverage. These technical parameters define the nature of the system, but the fundamental characteristics of greatest interest to the user may be broadly summarised in terms of quality, quantity and cost.

Dave Mann, head of Geomatics, Gardline Survey, UK.

JUST AS TECHNOLOGICAL advances mean there are potential new market areas in what may be described as the higher end of the market, it is also apparent that potentially cost-effective systems are now available to users who may previously have only considered a single beam echo sounder (SBES) solution.

A further design influence for MBES systems is a requirement for compact systems with lower power consumption for installation on remotely operated or autonomous vehicles (ROV or AUV).

Multi-frequency

The quest for higher quality systems is primarily realised by increases in system resolution. These advances are largely achieved by producing systems of smaller beamwidths and reduced pulse lengths. Thus, it is now quite common to find systems with half-degree beamwidths, and beams of 0.3 and 0.4 degrees are available.

These specifications are to be found in systems catering for the shallow-water markets, which operate in the higher frequency range. Naturally, there is a trade-off between frequency and range. In order to achieve the highest resolution, a high frequency is necessary but useable range will then be compromised. Manufacturers are overcoming range limitations by introducing a frequency modulated (FM) sweep, in addition to the traditional continuous wave (CW) pulse. This feature allows greater energy in the pulse, providing enhanced range.

In order to allow some flexibility in operations, systems are now available that allow a selection of frequencies, typically in the 200 – 400kHz range for shallow-water operations, although at least one manufacturer has a system available with the additional option of 700kHz. At this frequency, the systems are approaching the same band occupied by scanners and imaging sonar systems, and it is evident that the technologies are converging around certain applications in the survey and inspection markets. In the medium and deepwater sectors various manufacturers also offer dual frequency capability.

Multi-transmission

As the MBES systems have been developed to offer narrower beamwidths, there has also been

Systems are approaching the same band occupied by scanners and imaging sonar systems

Figure 1: Odom MB1 low cost yet high-performance swath sounder.

Figure 2: RESON 7125 multi-beam echo sounder on a Tetra Tech vessel (Image courtesy Seaview Systems).

Systems now deliver impressively clean datasets even in traditionally challenging environments

a complementary increase in the number of beams provided. This development has become necessary in order to retain the ability for full ensonification of the seabed. Although this term is no longer recommended for use in hydrographic standards, the implicit principle remains valid in specifications that are described in terms of size of detectable features.

Other enhancements have been made to improve the density of data provided by MBES. In a dual-head configuration systems are able to provide simultaneous 'pings' on both heads, rather than alternate transmissions. This has the obvious benefit of doubling the density of collected soundings. Further, systems are now available that provide the option of dual-swathe, which simultaneously provides two transmissions at each ping, even when operating in a dual-head configuration. The purpose of this facility is to provide double the along-track density of soundings, thus the second swathe is positioned slightly ahead of the first swathe. This feature complements the increase in (across-track) number of beams, but also has the advantage of allowing greater survey speeds for a given ping spacing, thus potentially increasing the efficiency of acquisition.

Beams or Soundings

Applying some numbers to this scenario quantifies the tremendous increase in the quantity of soundings that can now be acquired. Older generations of MBES may have typically produced between 100 and 200 soundings per ping. Modern systems may produce up to 400 or 500 soundings for a single head. Systems operating in a dual-head configuration and with dual-swathe capability may produce more than 1500 soundings per ping.

Progress in the provision of greater numbers of soundings has been allied to advances in beam-forming technology, so the user has much greater control over the distribution and application of those soundings. Beam-forming has advanced from the traditional equal-angle geometry, whereby most soundings were compressed within the centre of the swathe, and equal-distance beam spacing now provides soundings with an even distribution on the seabed, frequently available as a user-selectable alternative. Further, it is also possible to reduce the angular swathe coverage and maintain the same number of soundings, thus increasing the density further (at the expense of coverage). Alternatively some systems allow the

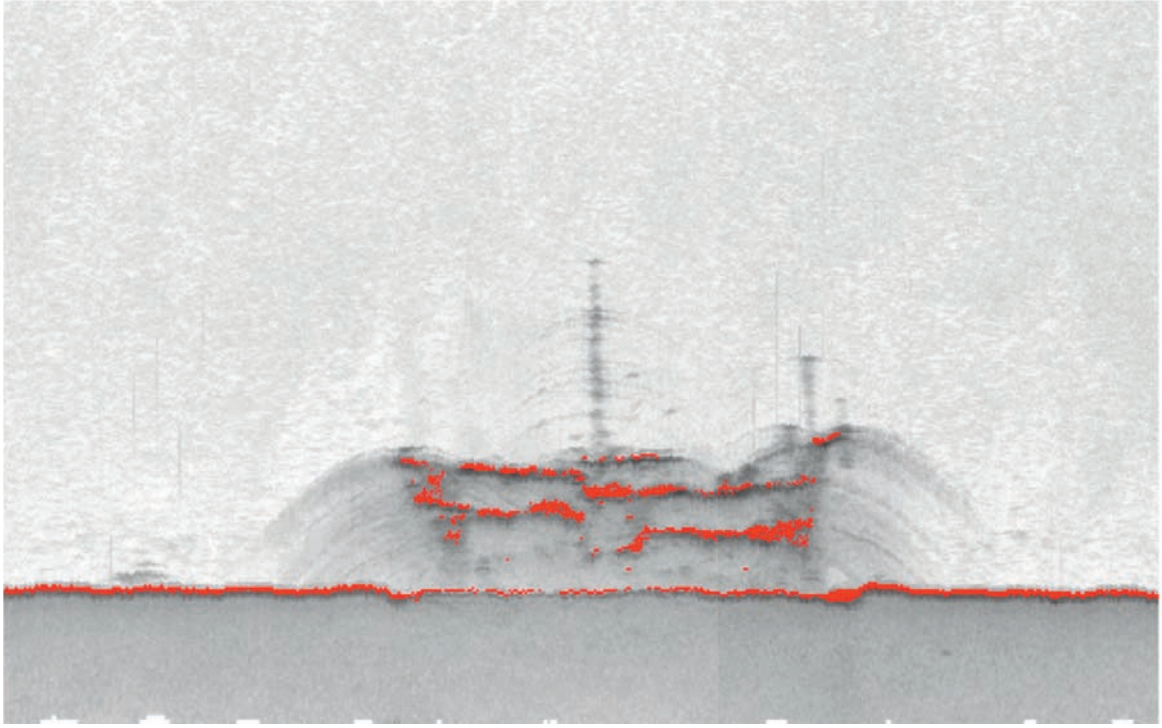


Figure 3: Water-column display of a wreck.

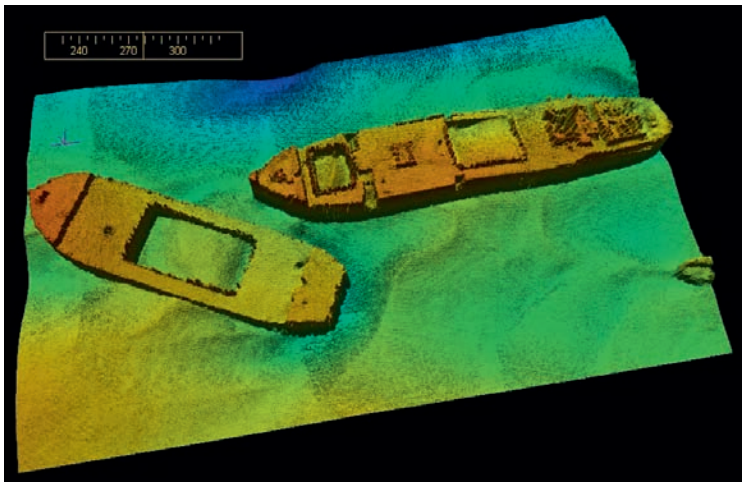


Figure 4: Curtin Artificial Reef, Moreton Bay, Australia surveyed with R2Sonic Sonic 2024 400kHz sonar and processed using QPS QLoud.

swathe to be steered to one side or the other, which is a feature particularly useful for inspection work.

Other innovations allow for hybrid settings, whereby a specified sector of interest may retain a high density of soundings whilst the rest of the swathe is relatively low density, but still provides good coverage. This feature is aimed particularly at the pipeline inspection market and similar fields.

It should also be noted that the traditional association between number of beams and soundings is becoming less distinct. Some systems are capable of producing more than one sounding from a beam, and retain independence of the soundings by using a limited subset of samples within the beam.

Beam-forming technology is also better able to fully compensate for vessel motion, not just to correctly locate a sounding, but to ensure an even coverage is maintained regardless of sea state. Increasingly, systems are able to apply pitch compensation on transmission, thus providing constant along-track spacing, and roll compensation on receive to ensure constant coverage to port and starboard. Some medium and deepwater systems also use multi-sector transmissions to additionally compensate for vessel yaw.

Enhancements have been made to improve the density of data provided by MBES

Bottom Detection

Much of the progress that has been made in the development of MBES systems has been enabled through general advancements in computer processor technology. This technology provides the raw power to enable more sophisticated processing of the sonar data. The benefit of this is most evident in the improvement of bottom detection algorithms. Systems now deliver impressively clean datasets even in traditionally challenging environments around structures and quay headings.

As development of MBES systems continues to deliver greater quantities of raw soundings, the ability to process and manage such datasets becomes a concern - during survey acquisition and subsequently during the processing, delivery and archiving of data. The ability to provide cleaner datasets, minimising the processing stage, is of great benefit.

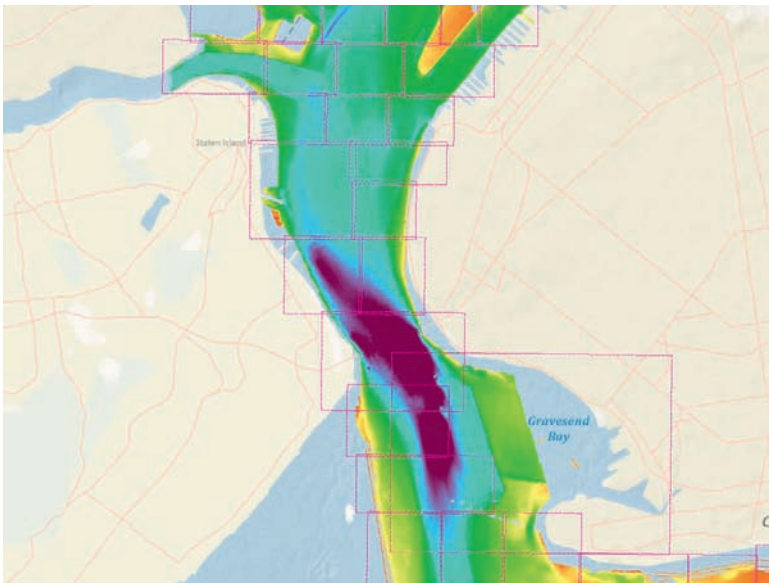


Figure 5: Seamless bathymetric surfaces on the fly from the original with ArcGIS for Maritime.

Echo sounder and processing software integration allows real-time bathymetry surface generation

In conjunction with these developments, MBES manufacturers and software developers are investigating the integration of echo sounder and processing software, allowing the real-time generation of bathymetry surfaces (within the processing software) as the survey progresses.

Backscatter and Water-Column

Discussion thus far has focused on the bathymetric capability of the echo sounder, but increasingly the ability to supply backscatter imagery and water-column data is of importance. The delivery of spatially registered backscatter from the beam-forming process has been an enhancement to the multi-beam in recent years. Improvement in the resolution of the MBES bathymetry has resulted in similar developments in the quality of the delivered backscatter.

Much research has been devoted to the analysis of MBES backscatter, with the goal of improving the ability to use this information in automated or semi-automated processes for the classification of seabed sediments and habitats. The ability to produce high-resolution, clean, calibrated and geo-referenced backscatter is essential to further this research.

There is interest in the acquisition of water-column (also referred to as mid-water) data for further analysis - recent research and development has focused on this data to assist in reporting the least depths above wrecks and other hazards to shipping. Another application is the detection of seeps and gases from existing infrastructure or natural features. There are many other potential applications related to the nature of the water mass and anomalies within it.

Many MBES systems are able to deliver the raw data for analysis. Further development is ongoing as the quality of the product is strongly influenced by ambient noise in the water, particularly outside the central sector.

The presentation and exchange of water-column information is an area which remains largely unregulated by any standards. No longer is the interest confined to a surface, whether portrayed in 2D or 3D, but we are potentially modelling the 3D volume. A volume is impossible to render as a single static view, unlike the traditional bathymetry or backscatter chart. Sections through the volume along a plane of interest are useful snapshots, however new techniques and procedures are sought to fully exploit the potential of this data.

The hydrographic and offshore surveying community is moving closer to integrating and delivering products in a GIS environment, with raw data available for re-use in a range of other applications. The challenge of delivering new types of information presents an exciting opportunity for the developers and integrators.

The Author
Dave Mann is a graduate of the University of Nottingham with a Masters degree in Geodesy. For most of his career he has been employed by Gardline, initially as a field surveyor, later as assistant chief surveyor, survey support manager, and now head of Geomatics, with responsibility for survey, vessel, and IT systems.

http://www.geo-matching.com/category/id54-multibeam-echosounders.html

Communications to the Deepest Point on Earth

Underwater Communication Solution for James Cameron's Deepsea Challenge

In March 2012, filmmaker and explorer James Cameron successfully completed his one-man dive to the bottom of the Mariana Trench. The dive was the centrepiece of the Deepsea Challenge expedition, a joint scientific project by Cameron, the National Geographic Society and Rolex to conduct deep ocean research and exploration. A range of technological innovations were required for the venture, one of which was a reliable method for sending voice and data between the *Deepsea Challenger* submarine and its support vessels on the surface. At a depth of almost 11km, the Mariana Trench is the most remote and isolated place on Earth.

Paul Roberts, electronics/software engineer, L-3 Oceania, Australia

Michael Sieger, electronics/software engineer, L-3 ELAC Nautik, Germany

Ulrike Schulte-Rahde, marketing and public relations manager, L-3 ELAC Nautik, Germany

IN 2011, ONLY SIX MONTHS before the expedition, the Australian company L-3 Oceania (formerly L-3 Nautronix) was tasked with providing a technical solution that would enable James Cameron to remain in contact with the surface at all times. In addition to underwater communications conveying voice and text for status updates, mission support and co-ordination, it was also very important to monitor vital signs like the submarine's oxygen and battery levels, depth, speed and range position from the surface.

Facing the Challenge

Two significant challenges were quickly identified. Firstly, a technical solution had to be found to ensure reliable underwater communication over such an immense distance. Secondly, the expedition schedule was extremely tight and offered a very limited period for building, installing and integrating the system into the submarine and the support vessels *Mermaid Sapphire* and *Prime RHIB* (Rigid Hulled Inflatable Boat).

Long-range hydroacoustic communication is a very challenging task due to limited bandwidth, slow propagation time, multi-path and inter-symbol interference, ray bending and frequency dependent attenuation. The low carrier frequencies required by underwater acoustic signals are influenced by Doppler shift arising from movements of the sender or receiver. Noise levels in particular, influenced by sea conditions, weather and noise from the supporting surface vessels with their equipment generating acoustic and structure-borne noise, have a significant impact on the quality of communications. Very faint signals received from a long distance will be masked by this noise. Acoustic system designers must take all these factors into account as well as assure the quality of the installation and eliminate interference from nearby equipment to provide good communication performance.

Engineering the Solution

The underwater communication solution that was engineered for the expedition was based on well-proven

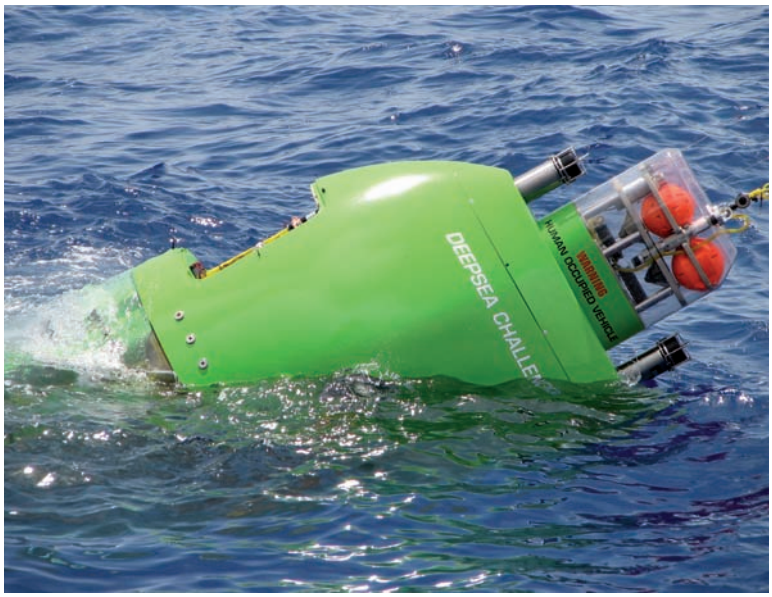


Figure 1: *Deepsea Challenger* with GPM modems.

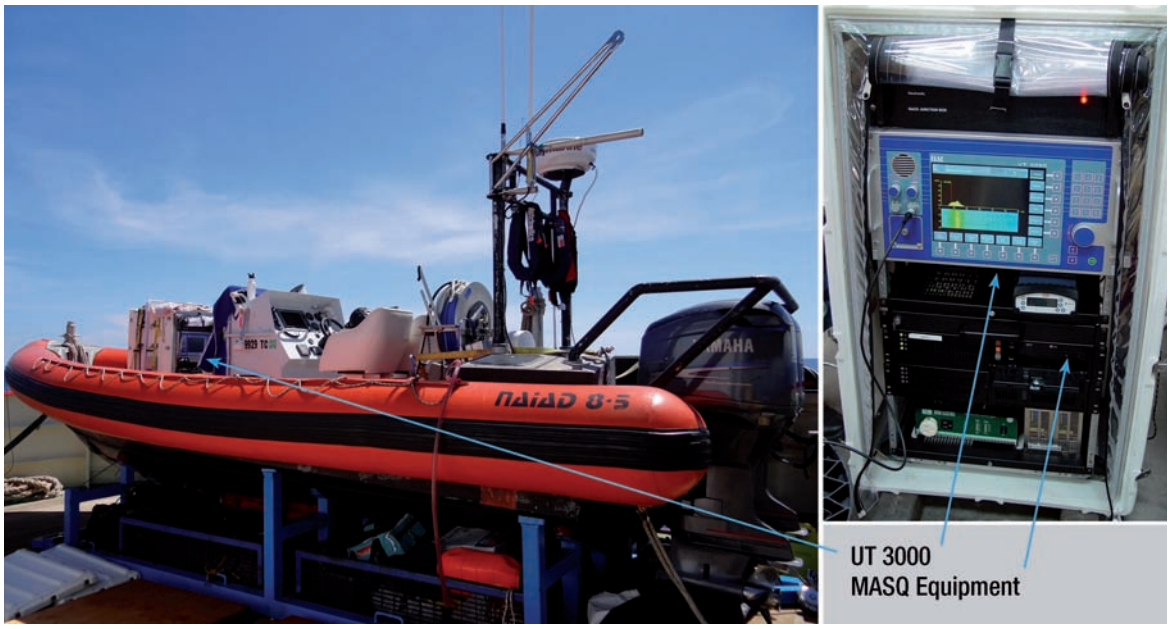


Figure 2: RHIB communications rack with UT 3000 MASQ.

components: L-3 Oceania's GPM 300 modem with electronics, transducer assembly and a full ocean depth housing along with the German sister company L-3 ELAC Nautik's UT 3000 underwater communication system. Analogue communications for voice and digital communications for data were supported. Analogue communications used normal underwater telephone (STANAG 1074) modulation, and digital communications used the latest L-3 underwater spread spectrum signalling known as MASQ. Each MASQ digital data packet is time-referenced so that time of flight and thus range can be computed – a capability that was used to assist in locating the submarine.

The GPM 300 modem with its full ocean depth housing was installed on the exterior of the submarine, outside of the small (43-inch diameter) pressure sphere housing the pilot, saving precious space inside the highly restricted living space. For analogue voice communication, the modem was attached to an audio interface and speaker box allowing it to be operated by the pilot using only a small, lightweight ear-mounted microphone. Digital text messages were received and sent by a tablet PC with a touch screen, whereas vital status information (such as CO2 level, temperature and battery levels) was automatically retrieved and sent out from the sphere control system. A second modem was installed as an autonomous backup with its own power supply and the ability to independently monitor depth. The second modem could also be controlled from the surface to trigger devices such as lights and an emergency weight release.

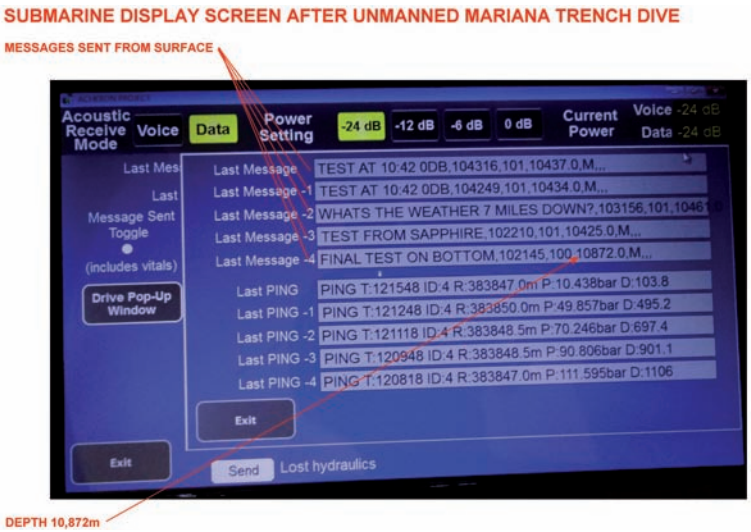


Figure 3: Submarine display screen with messages.

Communication with the Underwater Telephone UT 3000

The underwater telephone UT 3000 that was installed on the two surface vessels combines analogue communication modes such as telephony, telegraphy or pinger mode with digital communication capabilities based on Multiple Frequency Shift Keying (MFSK) techniques. Similar to a mobile phone, the UT 3000 allows SMS messages to be sent using a small built-in keyboard or, for convenience, using an external USB keyboard. On the receiver side, SMS reception automatically opens an SMS viewer. A binary file transfer mode allows the selection of a file from a USB memory stick or an Ethernet Network File System (NFS) server connected to the UT 3000. On the receiving side, files are automatically stored on an attached USB memory stick or an NFS server.

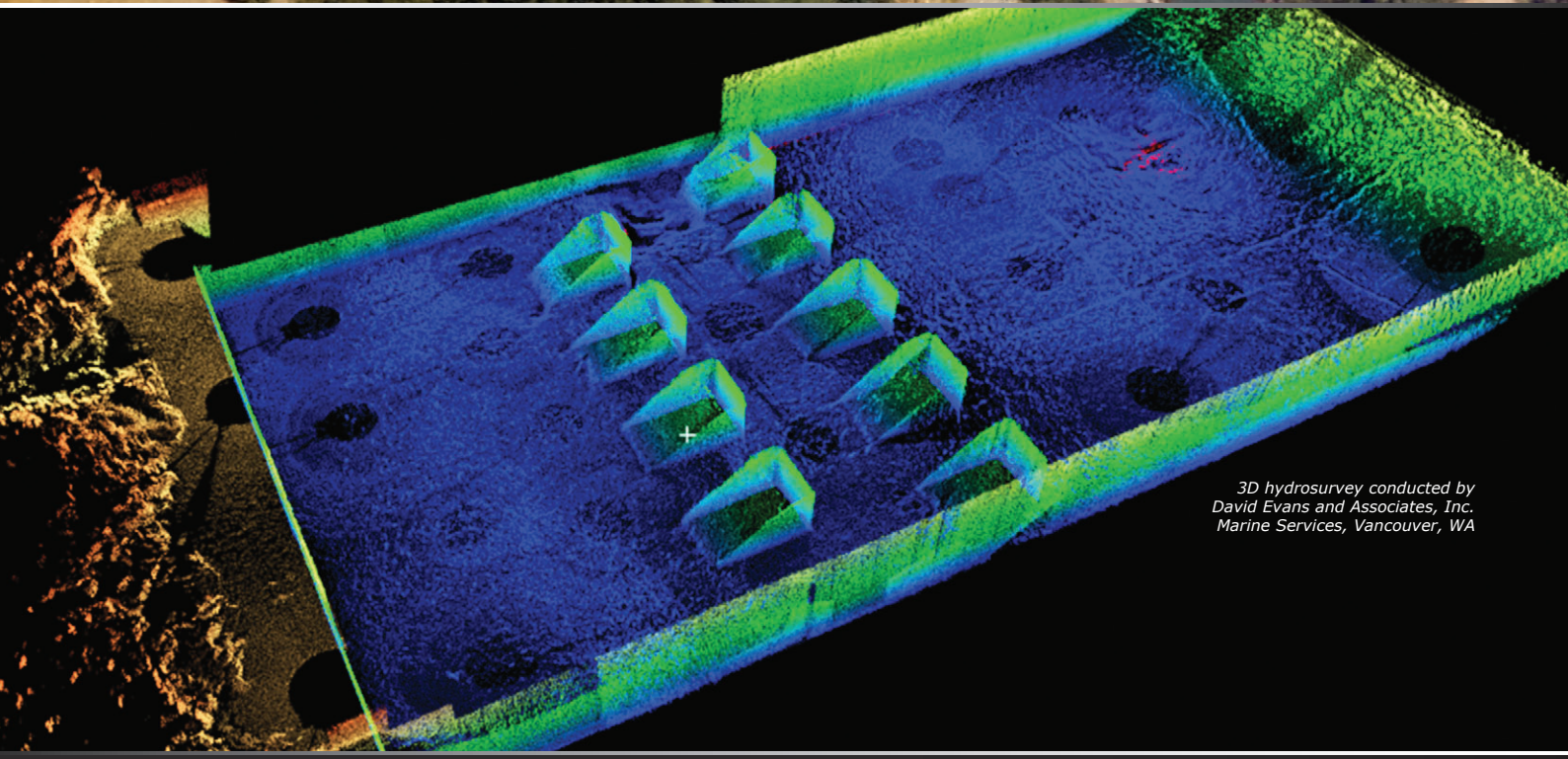
The baud rate for digital underwater communication is not comparable to Ethernet-based LAN or WLAN networking. The underlying mechanism is similar to old-fashioned acoustic couplers where digital data is converted to acoustic signals. Travelling through water, sound waves are compromised by the aforementioned factors, calling for data recovery and forward error correction information to be included in the data stream. This guarding information is used

Accurate Underwater Measurements

Making Impossible Jobs Possible

The limited access and confined workspace of the Green Peter Dam in Oregon made the hydrosurvey of the stilling basin impossible for a traditional survey boat. A small ROV equipped with a BlueView BV5000 3D Multibeam Scanner was the solution. The full 3D hydrosurvey captured early stages of erosional damage, which was measured and analyzed for remediation planning. The BV5000 3D Mechanical Scanner is centimeter level accurate, providing the highest degree of hydrosurvey confidence. First time. Every time. Any condition.

Image courtesy of US Army Corps of Engineers



3D hydrosurvey conducted by David Evans and Associates, Inc. Marine Services, Vancouver, WA

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by the receiver for data reconstruction. Besides the slow signal propagation speed in water, the amount of forward error correction information included reduces effective baud rates to less than 4,000bps. A typical trade-off between data reliability and transmission time results in a baud rate of approximately 1,000bps. Most data transfers include readable ASCII-based messages and can be interpreted even when they include corrupted characters. In any case, low transmission speed practically restricts underwater file transfers to files of a couple of kilobytes, which despite their small size are still suitable for underwater tasks.

The UT 3000 system was designed in a modular manner, allowing the unit to be tailored to customer-specific needs. Benefits include the capability to expand processing power for signal processing algorithms, and also the support of different transducer configurations. L-3 ELAC Nautik supplies a range of transducers for various underwater tasks, including transducers especially designed for underwater communication. These transducers cover different frequency bands and installation aspects for installation on surface vessels or submarines.

The standard UT 3000 system includes two Digital Signal Processor (DSP) boards each equipped with five multi-core DSPs. These boards are dedicated to analogue and digital communication modes.

Digital Communication via MASQ

The UT 3000 allows the addition of extra DSP boards for signal processing enhancements. This capability was exploited with the development of the sophisticated MASQ spread spectrum digital signal processing in an inter-company development between L-3 ELAC and L-3 Oceania. MASQ is supported on the UT 3000 by adding an extra DSP board to run the spread spectrum communication algorithms.

Underwater spread spectrum technology was first introduced to the world by L-3 Oceania in the 1990s to provide reliable and discreet communications where other systems failed.

Figure 4: WB 54 transducer mounted on the RHIB during sea trials.

The spread spectrum techniques used in MASQ include multi-channel direct sequence spread spectrum and forward error correction which make it highly resistant to the problems posed by the underwater channel. Signals can still be decoded in highly reverberant environments with low signal-to-noise ratios and reception levels well below the background noise.

For the Deepsea Challenge project, the transfer of data to and from external systems such as the submarine control system was vital and so the MASQ Graphical User Interface (GUI), resembling a kind of email client, was run on a PC at each end. In addition, both vessels were connected via a TCP/IP network that ran over wireless Ethernet, which meant that all data could be collated in the communications centre on the primary dive support vessel, the *Mermaid Sapphire*.

Dealing with the Environment

The transducer initially selected for the Deepsea Challenge was the WB 54, a small omni-directional transducer. The WB 54 is a circular, barrel-shaped array, primarily designed for installation under the hull of surface vessels (typically covered by a sonar dome for acoustical improvement and mechanical protection) or onto a hoisting gear for retraction into the ship's envelope in case of transit.

The WB 54 was chosen for the expedition as a trade-off between size, performance and lead time. The small size allowed it to be lowered below the hull of the *Mermaid Sapphire* using a moon pool. A second WB 54 was installed on the *Prime RHIB*.

The test dives performed during the Deepsea Challenge expedition showed that intelligible and reliable underwater communication could be established between both the *Deepsea Challenger* and *Prime RHIB* equipped with the WB 54 down to a depth of approximately 8,200 metres. Unfortunately the noise from the *Mermaid Sapphire*'s own dynamic positioning system inhibited the use of the WB 54 from that platform, with the *Prime RHIB* proving a more suitable platform for receiving the quiet underwater sound signals.

To counter the impact of ship noise, an external, mobile transducer was used, equipped with a long cable which allowed it to be dropped overboard. The configuration

QINSy

The modular design, user friendly user interface, comprehensive help and support of international standards and exchange formats, mean QINSy is equally well suited to less complex bathymetric surveys as it is to highly complex multi-vessel and multi-sensor offshore construction projects.

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Fledermaus is the industry leading interactive 4D geospatial processing and analysis tool. The intuitive user interface allows users to rapidly gain insight and extract more information from their data, that in turn promotes data processing efficiency, quality control accuracy, and data analysis completeness.

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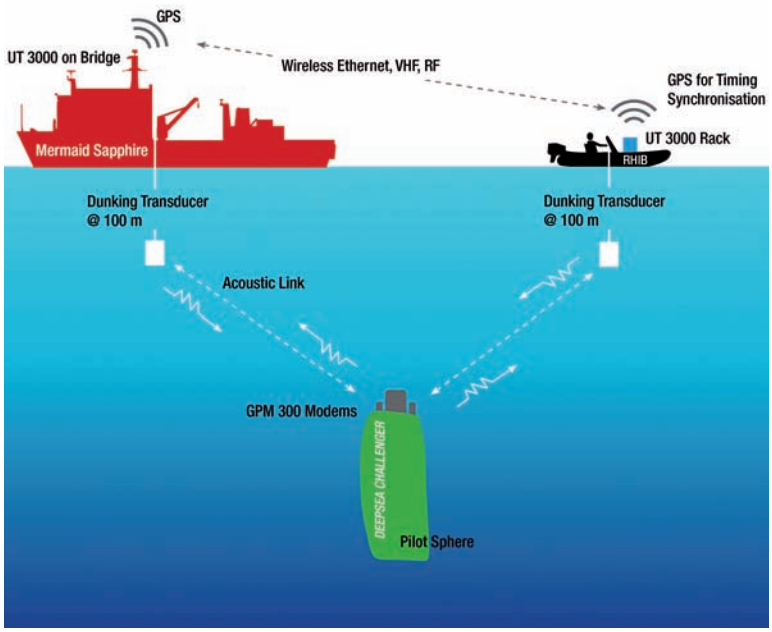

Figure 5: Schematic overview of technical set-up.

mechanically decoupled the transducer from the ship, reducing direct acoustic interference and increasing penetration of the acoustic layers below the surface. An external dunking transducer with 125m of cable and a matching transformer was connected, and lowered approximately 100m below the surface. This allowed communications from the *Mermaid Sapphire* to be carried out by the dunking transducer, whereas the *Prime RHIB* system used both the WB 54 and a dunking transducer.

At maximum depth, the noise of the *Mermaid Sapphire* still prevented the reliable use of the dunking transducer for reception, masking the low level receive signals. Primary reception was therefore carried out by the *Prime RHIB*, drifting with disengaged engines. The voice signals received by the *Prime RHIB* system were relayed to the *Mermaid Sapphire* by RF transmission and the data relayed by wireless Ethernet. In effect, most communications at full ocean depth were carried out downwards from the *Mermaid Sapphire* to the *Deepsea Challenger* and then upwards from *Deepsea Challenger* to the *Prime RHIB* and onto the *Mermaid Sapphire* via RF link.

Historic Dive

At 7:52 a.m. on 26 March 2012, James Cameron touched down at a depth of 10,911 metres and was able to answer to a voice message sent down by his wife who was on the *Mermaid Sapphire* as well as relay the world's first tweet from the deepest part of the ocean. The use of standard voice communications also made it possible for Paul Allen, who was present at the dive location on board the *Octopus* yacht, to follow the whole communication with another underwater telephone, the L-3 ELAC Nautik UT 2000, and to share updates about the dive on Twitter.

Throughout his three-hour stay on the bottom of the Mariana Trench and while taking 3D film footage and scientific samples, James Cameron remained in constant contact with the surface. Cameron later commended the L-3 communications solution, saying "We were pleased to have solid voice comms to full-ocean-depth using the L-3 system. It was amazing to talk to my wife Suzy from the deepest point in the world's oceans."

Conclusion

Thanks to the close co-operation of the engineers working on the submarine and the flexibility of the UT 3000, a sophisticated communications solution was developed in a comparatively short amount of time. This solution has successfully proved that reliable two-way voice and data communication to the deepest part of the ocean is possible.

Acknowledgements

The L-3 team wishes to thank James Cameron, Ron Allum, Tim Bulman and the other members of the Deepsea Challenge team as well the expedition sponsors, National Geographic and Rolex, for the opportunity to have participated in this historic event.

Reliable two-way voice and data communication to the deepest part of the ocean is possible

The Authors

Paul Roberts is an electronics/software engineer and project manager with more than 25 years' experience in engineering projects. He joined L-3 Oceania in 2001 and has worked on a range of underwater communication and positioning systems for defence and commercial customers. He managed the development of the Deepsea Challenge acoustic communications solution, commissioned the systems and participated in the expedition.

Michael Sieger is an electronics/software engineer and joined L-3 ELAC Nautik in 1989. After designing and working on echo sounders, sonar systems and the new-generation UT 3000, he is now the technical lead for L-3 ELAC Nautik's underwater communication systems. On site, he supported the L-3 Oceania team and their customers during system integration and by providing on-the-job training.

Ulrike Schulte-Rahde has been marketing and public relations manager at L-3 ELAC Nautik since 2008. Besides managing all marketing activities including the organisation of exhibitions, she is dedicated to presenting the company's technical developments and products to a broad professional audience.

http://deepseachallenge.com/

OpenSeaMap – the Free Nautical Chart

The biggest worldwide geodatabase, made by the crowd

Nautical charts are expensive, and in many countries data are not always up to date. OpenSeaMap is an alternative solution which is free for anybody to use worldwide. Following the example of Wikipedia, the data are collected by volunteers and are visible on the chart within just a few minutes. OpenSeaMap involves experienced mariners, programmers and thousands of data collectors, all of whom are working to produce a nautical chart with comprehensive, relevant and up-to-date data for water sports which is open to everyone and free of charge.

Markus Bärlocher, initiator of OpenSeaMap

OPENSEAMAP – THE FREE nautical chart – covers oceans and inland waterways worldwide. OpenSeaMap works like Wikipedia, the up-to-date, competent and most comprehensive encyclopaedia in the world. Thousands of skippers, divers, kayakers, and other water-sports enthusiasts compile information they consider important and useful for a nautical chart and save them in a spatial database.

Making use of crowdsourcing, OpenSeaMap is:

- Up to date – every change is visible online immediately
- Specialised – every user enters data that they consider important
- Precise and detailed – continuously optimised by thousands of people
- Comprehensive – information for everyone involved in water sports.

OpenSeaMap is the fastest chart in the world. Items such as buoys that have been moved, a new harbour or the harbour master's new telephone number can be found online within just a few minutes, instead of one year later in the next edition of a common harbour pilot book.

Oceans, rivers and topography

OpenSeaMap is versatile. It contains information on oceans, rivers and topography. The chart does not end at the coastline but instead also shows details of the harbour, the infrastructure of various places, traffic routes and much more. The river chart shows inland waters including inland waterways as well as wild-water stretches for kayakers.

OpenSeaMap is part of OpenStreetMap. The collection of free spatial data works just the same. There are three sources of data:

1. One million amateur cartographers collect spatial data using GPS devices, at home and abroad. They update the map with these data with a very keen eye for detail.
2. Authorities and organisations that are increasingly embracing the idea of OpenData provide data voluntarily.
3. Aerial photographs with partly excellent resolution obtained from Bing, Microsoft, local authorities and organisations are rendered manually into vector data of spatial information.

OpenData culture

OpenData means all databases that, in the interest of the public, can be freely accessed. OpenData is intended to initiate developments that are profitable for the overall economy: by giving everybody access, open data can be used to create synergies and thus innovative products and services. It is crucial that the information can be re-used, worked with and propagated freely by everyone. Spatial information is required to become OpenData as well.

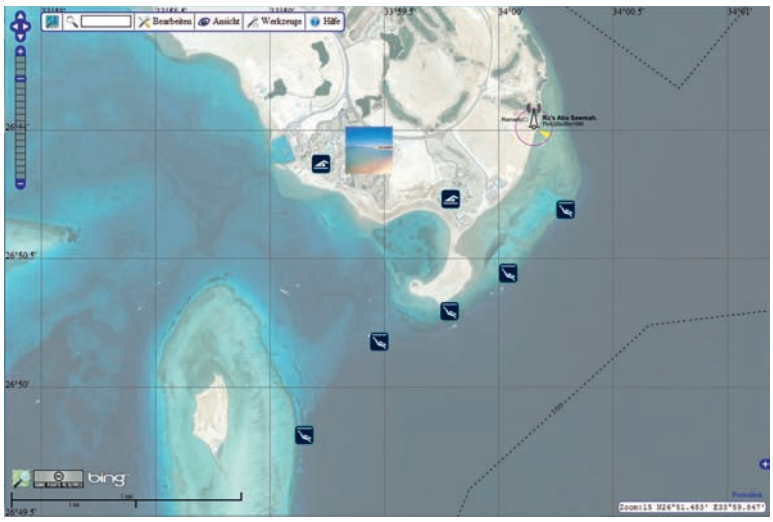

Figure 1: Diving spots.

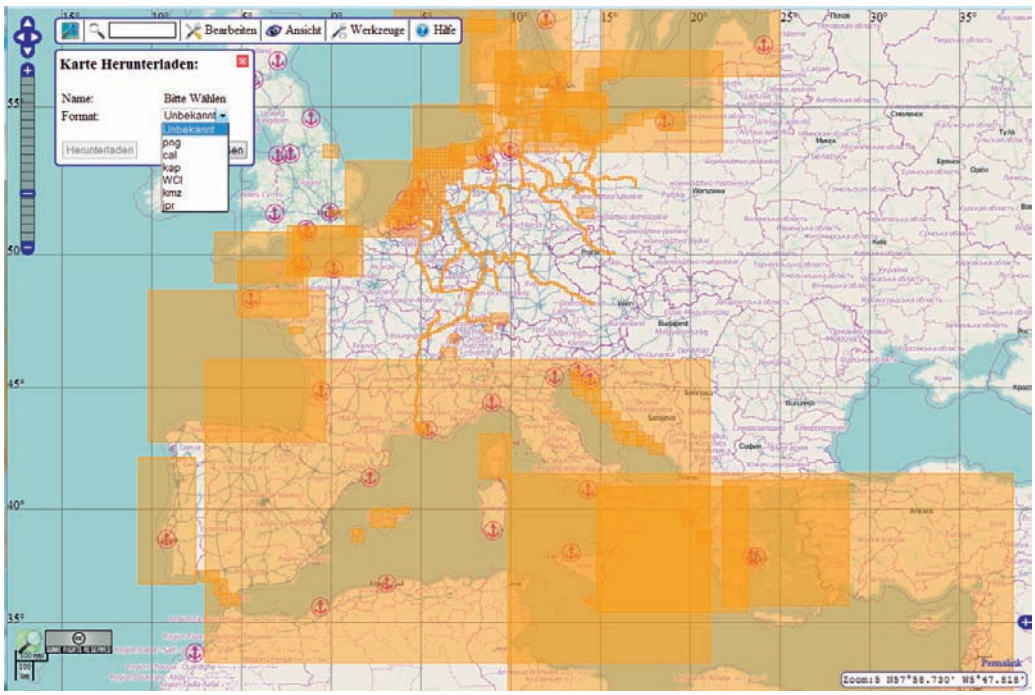

Figure 2: Offline charts in various formats.

The spatial data relevant for OpenSeaMap are virtual data such as details of protection zones, data relating to what lies beneath the water's surface or concerning objects far out at sea. Capturing these data is not as easy as collecting data about the countryside. The information is already there but most nations treat it rather proprietarily. The OpenData community hopes that the OpenData culture will increasingly spread amongst marine authorities. For example, OpenSeaMap is allowed to use water level information and tidal information from Germany, Austria, and Switzerland. Germany in particular shares quite a lot of country-specific data, and the German Bundesamt für Seeschifffahrt und Hydrographie (BSH) has also offered to share quite significant data.

Collecting data

Anyone can collect spatial data: amateur cartographers and watersports enthusiasts as well as nautical and bathymetry specialists, geographers and hydraulic engineers. All objects relevant for nautical purposes that are described in the international IHO standards INT-1, S-57 and S-100 can be entered. There is simply no limit to the variety of objects. OpenSeaMap shows anything from complex sector lights and traffic separation areas to shops for yachting equipment and bakeries. The exact forms, positions and descriptions of these objects are fine-tuned iteratively using nautical know-how and local knowledge.

A user-friendly graphical editor can be used to enter more detailed descriptions. It was specially developed for nautical data so that watersports objects can be depicted that are not usually included on traditional nautical charts. The editor translates the collected object details into a data schema according to IHO S-57 and S-100. The data are then saved in a central spatial database.

Finally, the chart is rendered from the entered data and made available both through the web browser and as an offline chart.

Offline charts

Offline charts are available for use en route. They can currently be loaded onto iPad or Garmin Plotter. As yet, there is no application for Android and OpenSeaMap is still looking for Android developers. OpenSeaMap offers hundreds of offline charts for download from the website.

Vector charts are the future because they support head-up and true motion view. OpenSeaMap already provides vector charts for use on Garmin devices. However, most of the navigational software programs still work with raster charts, meaning that it is necessary to modify these navigation programs so that they can handle vector charts instead.

All-in-one workplace

Leisure-sailing skippers need a modern, integrated system; instead of using dozens of charts and manuals, the information must be contained in one single chart. This has already been realised on the web-based full-screen chart.

Selecting the menu option 'View' provides access to a wealth of information depicted in layers on the base map. The 'navigational aids' layer contains typical features of a nautical chart. It has 18 zoom levels that range from a view of the world to detailed harbour plans in 1:2000 scale. The most advantageous combinations of objects are depicted for each particular zoom level. The 'harbour' layer shows 6,000 harbours, thousands of marinas, and anchorages. Clicking on the symbol opens the harbour pilot which can be updated by users with detailed descriptions and images of the harbours. The 'weather' layer comprises weather maps of the world including parameters such as wind direction and wind force, air pressure, temperature, precipitation and the height of waves. Also included is a three-day weather forecast. The 'water depth' layer shows the deep-water bathymetry by GEBCO. The

'ship tracking' layer shows the AIS positions in real time. The 'water gauge' layer shows dynamic water levels of coasts and rivers. The 'aerial photograph' layer was provided by Bing. The aerial photographs can be used to receive spatial data by digitising them. The 'Wikipedia' layer has direct links to 2.5 million Wikipedia articles. This co-operation between OpenSeaMap and Wikipedia is aimed at benefiting from synergy effects and hence making a cultural contribution.

Of course, it is intended that all these layers will soon be available on offline charts too, so that skippers can check and monitor all nautical data and the onboard instruments via their smartphone or tablet computer from anywhere on the ship.

Chart for water-sports enthusiasts

OpenSeaMap is interested in everything that is 'blue' in the world – from oceans to rivers and streams; after all, 70% of our planet's surface is covered in water. Until now, users of the navigational charts have usually been skippers and motorboat operators. However, growing numbers of divers, surfers, kayakers, anglers and other water-sports enthusiasts are keen to benefit from OpenSeaMap too, and they are catered for by the 'sports' layer. Among other things, this shows great diving spots, diving schools and places for filling up or renting scuba tanks. Kayaking routes are marked with different colours depending on their degree of difficulty, and entry and exit points plus obstacles and spots where kayaks need to be carried are clearly indicated.

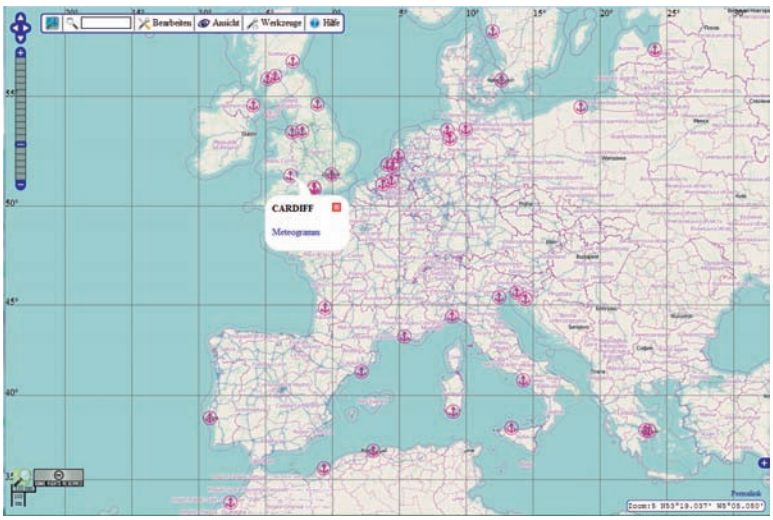

Figure 3: European harbours.

Added value for organisations

In addition to skippers and water sports enthusiasts, OpenSeaMap is increasingly being used by communities and tourist organisations that want to offer a great service to guests and tourists. Thanks to the free license, any organisations can easily integrate OpenSeaMap into their website free of charge.

The same goes for commercial use for ship owners, charter companies, organisations for the protection of the environment, oceanologists, schools and universities. Furthermore, users can add layers of their own such as images of protection zones, construction projects, wind turbines, distribution of fish species or other information.

Shallow water depths

A chart without water depths is rather useless, but unfortunately depth information is difficult to obtain from countries. That is why OpenSeaMap wants to measure the seacoasts worldwide using crowdsourcing. In this way, everybody can contribute and collect depth data. Most ships are equipped with GPS and sonar systems, which makes data collection easy. The devices can write the data via an NMEA string format. An NMEA data logger, which was developed specifically for OpenSeaMap, then stores the data on a USB stick. Contributors can transfer the collected data from any computer with internet access to the central server. The raw data can be corrected (fed with heel and tide data) and calculated to create a terrain model. From this, depth contours will be derived and shown in the chart.

TeamSurv and ARGUS recently explained in HYDRO INTERNATIONAL that finding contributors for crowdsourcing is quite a challenge. The OpenSeaMap community is large and spread all over the world, so the chances of this ambitious project succeeding are rather good. However, there are other challenges such as feeding the system with tide and wave information data. It is therefore important to have bathymetry specialists contributing to OpenSeaMap. And of course it would be especially valuable to benefit from the experience of TeamSurv and ARGUS.

Our practical tests so far have proved quite successful. Extensive data collection will be starting in the sailing season 2013; however, any bathymetry already collected can be submitted to OpenSeaMap immediately.

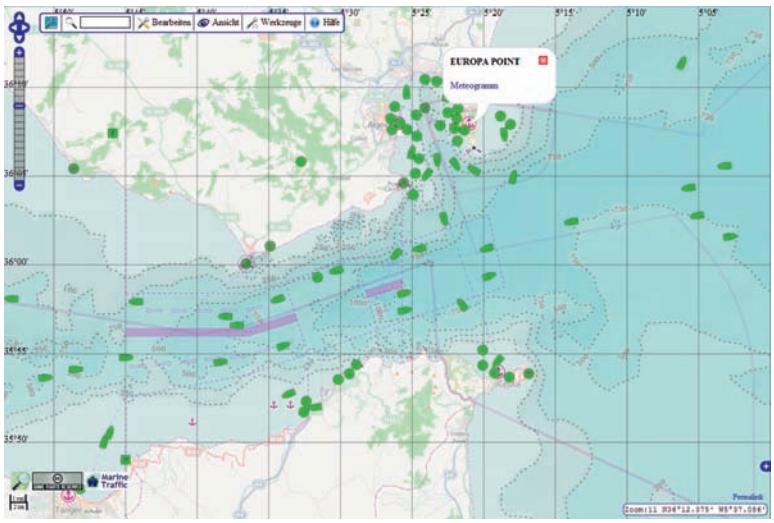

Figure 4: GEBCO water depths in the Strait of Gibraltar.

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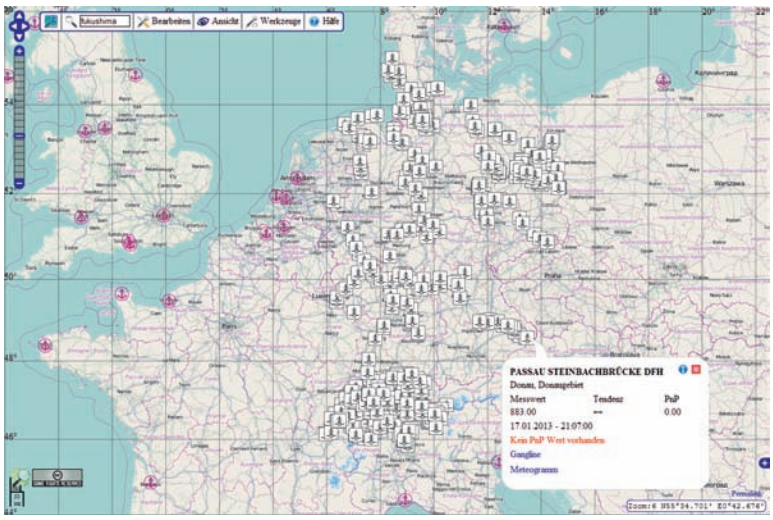


Figure 5: Gauges in real time.

Current challenge

You can help us by telling people about this project and asking your friends to update the chart with spatial information about their place of residence or home country. Tell the people at your sailing club about OpenSeaMap. Ask skippers to record water depths and upload them. Researchers and scientists can help OpenSeaMap feed the system with depth data. We are looking for tide models, waves, wave travel times, ship movements, etc. Professors and students alike can find exciting topics for diploma theses or internship reports.

There are many more ideas for OpenSeaMap and together we can accomplish them. If you are a developer, you are welcome to join OpenSeaMap – we could use your experience in various fields such as servers, databases, rendering, hardware, microcontroller, web programming, app programming, graphics, web design, data transformation, statistics, geodesy, bathymetry, cartography, translations and more. Let's build the chart together!

Acknowledgements

Many thanks to all our diligent amateur cartographers and of course our programmers. Together, they all help to create OpenSeaMap.

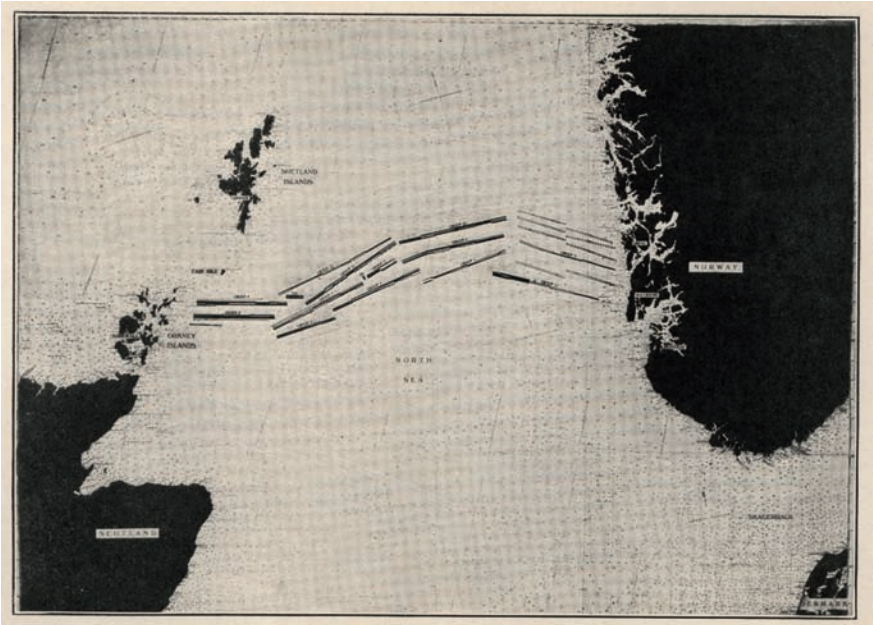
The Author

Markus Bärlocher is an experienced skipper and sailing instructor. He is the initiator of OpenSeaMap. He sails worldwide and has crossed the Atlantic Ocean W-E. Professionally he is an organisation developer. For OpenSeaMap, he had to learn a lot about bathymetry, cartography and computing, and he is grateful to all the experts involved for their helpful conversations.

project@openseamap.org

1. *http://openseamap.org/*
2. *http://map.openseamap.org/map/*
3. *http://depth.openseamap.org/*

An overview of the Northern Barrage.



The North Sea mine barrage consisting of 56,611 American and 13,652 British mines. The dotted lines indicate British mine fields.

The Northern Barrage

Albert E. Theberge Jr.,
Contributing editor,
Hydro INTERNATIONAL

Historically, perhaps the naval discipline most related to the work and skills of the hydrographer is naval mine warfare. Successful implementation requires knowledge of the configuration of the bottom in the area to be mined, local tides and currents, and relatively precise navigation to position mines, identify mine fields, and ultimately remove mines. The laying and subsequent sweeping of the great mine field known as the 'Northern Barrage' during World War I is a nearly forgotten story that encompassed cutting edge technology, evolution of hydrographic techniques, and significant courage.

WHEN THE UNITED STATES entered World War I in April 1917, the German U-boat campaign was at its height. In December 1916, Germany began sinking merchant vessels without warning and two months later announced unrestricted submarine warfare. By April, Germany was sinking ships bound for English and French ports at the rate of 800,000 tons per month. If allowed to continue indefinitely, such a rate would potentially starve Great Britain into submission. In May 1917, the United States entered the war. To counter the submarine threat, Great Britain and the United States developed a convoy system that was partially effective in stemming the losses, but they still amounted to 450,000 tons per month. This was an unsustainable loss rate and would ultimately doom the Allied war effort if allowed to continue. Other anti-submarine measures were also instituted including arming merchant vessels, formation of squadrons of submarine hunters equipped with 'listening devices', aerial patrol by seaplanes and blimps armed with depth charges, arming of destroyers and other craft with virtually unlimited supplies of depth charges, and mining of waters habitually traversed by enemy submarines. This last measure is of great interest to hydrographers as the greatest combat mining operation up to that time in history was completed over the next year. With the cessation of hostilities in November 1918, the problem of removing a vast number of mines and opening sea lanes to the ships of the world became of paramount importance.

Developing a Plan

Early on, the concept of confining German submarines to the North Sea was suggested between the British Admiralty and the United States Navy. This would require either mines, nets, or a combination of mines and nets, extending from Scotland to Norway on the north, the minimal distance being 230 miles, and a mine field extending across the English Channel on the south. The British had already had unsatisfactory experience with nets so it was decided to use only mines for blockading the exits to the Atlantic Ocean from the North Sea. At the time the decision was made, the United States was developing a firing device for mines that would activate when a submarine was within 100 feet of a mine. This compared to British mines that required contact for activation. The difference was significant as the number of mines required

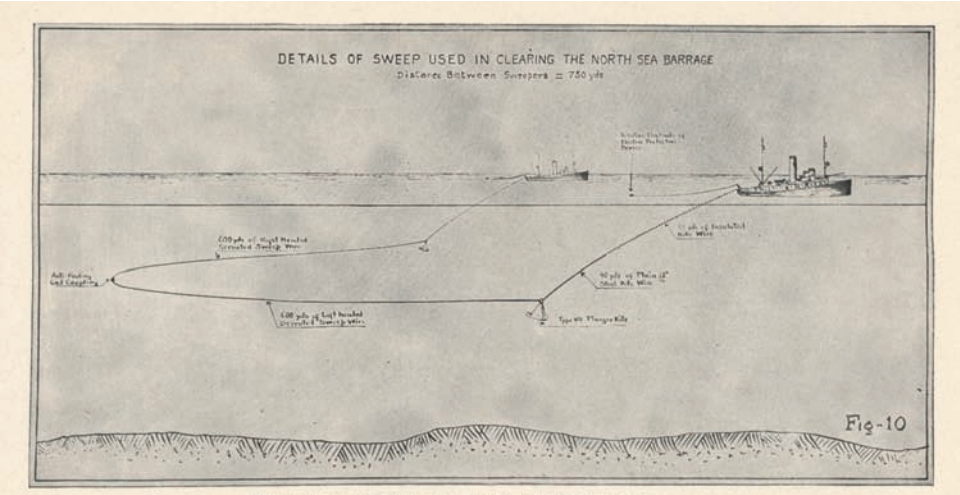


Chart showing details of sweep used in clearing the North Sea barrage.

Mine sweeping in the North Sea.

Three explosions between the Lapwing and Penguin.

Three explosions between the *Lapwing* and the *Penguin*.

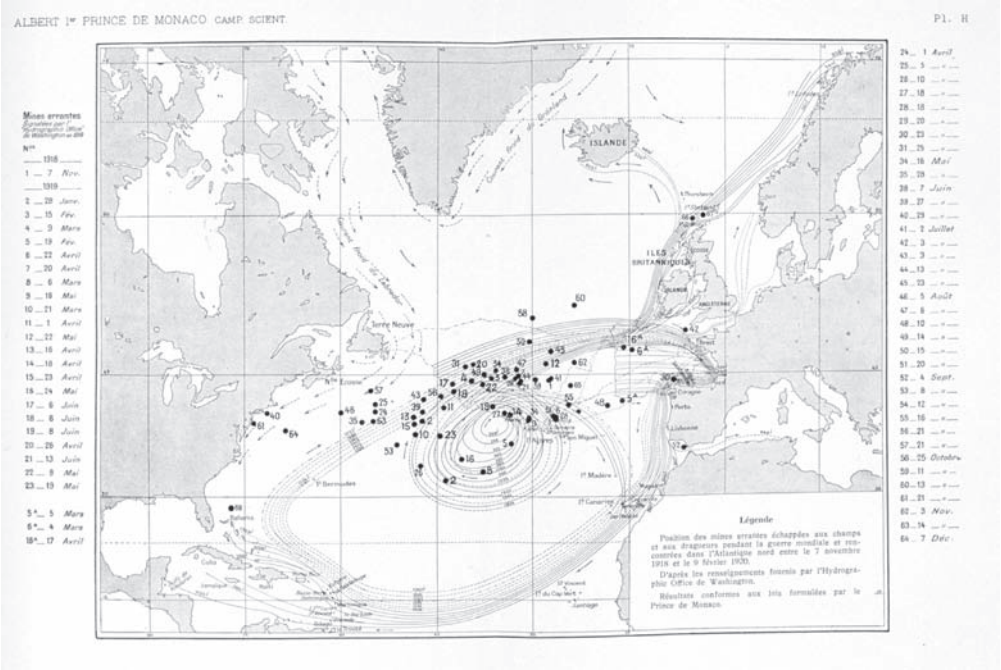
with the American system would be approximately 1/3 that required with the British system to establish a truly effective barrier. It was this difference that made the concept feasible. The decision was made to produce 100,000 American mines with the new firing mechanism although it had never been combat tested. The plan was to have these mines ready for planting by the spring of 1918. To implement this plan separate mine components were assembled by over 500 manufacturing facilities such that no one plant or individual would understand the end product. Additionally, 80,000,000 feet of wire rope and 30,000 tons of anchor material would have to be produced. Besides this industrial effort, a fleet of twenty-four small cargo vessels was dedicated to transporting the mine components from the US to Scotland for final assembly, ten ships were modified for laying the mines, and, looking ahead to peace, a fleet of 34 specially designed minesweepers would have to be built as rapidly as possible starting in July 1917. During the whole operation, only one of the twenty-four cargo vessels transporting mines across the North Atlantic was lost to submarine attack with 41 men lost.

Laying the Barrage

The US mine squadron consisting of two old cruisers and eight converted merchantmen began arriving in Scotland in May 1918. Mines had still to be assembled at the Scottish bases, but by 7 June, 3400 had been assembled and the mine layers proceeded out to lay the first row of mines – 47 miles long with mines at three different levels. Locating the mine fields both prior to laying of mines and during recovery operations was done by laying out buoy arrays that were positioned using taut-wire apparatus for measuring distance from known shore points and sextant observations of celestial bodies for latitude. Taut-wire use for horizontal positioning of mine fields is an example of technology modified and used by hydrographic surveyors following the war. By October 1918, the Northern Barrage, as it came to be called, was finished. Captain Reginald Belknap, the mine squadron commander, recalled: "A barrier of high explosives across the North Sea – 10,000 tons of TNT -, 150 shiploads of it, spread across an area 230 miles long by 25 miles wide and reaching from near the surface to 240 feet below – 70,000 anchored mines each containing 300 pounds of explosive, sensitive to a touch, barring the passage of German submarines between the Orkneys and Norway – this was the final five months' contribution of the American and British mining forces towards bringing the war to a close."

Sweeping the Barrage – The Greatest Wire-drag Operation

The sensitive firing device and novel construction of the American mines, the attributes that dictated their use in the barrage, now made sweeping a dangerous proposition at best. Technical problems associated with steel vessels sweeping the field were solved in the winter of 1918-1919 which made it feasible to use the new American minesweepers. In addition, as related by the US Navy history of this operation, "The water was deep, beyond all the customary estimates for mine operations; the winds were strong; the seas were rough; the atmospheric conditions were such as to make vision, for the greater part of the time, difficult if not impossible." The method used to sweep the minefields was wire-drag - a method first used as a hydrographic tool. Initially developed as a drifting rope-sweep by the French hydrographer Joseph Renaud in 1882, modified by engineers of the US Lake Survey for sweeping with a line attached between boats in 1903, and then adopted and further modified by the US Coast and Geodetic Survey in a system that became known as wire-drag, the method consisted of towing a line between two vessels by means of an arrangement of buoys, kites, and weights to maintain a pre-set depth.



Prince Albert's map of the observed location of drifting mines following the clearing of the North Sea Barrage.

As practiced in hydrographic surveying, the depth of sweep was set at a level that would allow safe passage of deepest draft shipping assumed to occur in the swept area. Buoys attached to the sweep wire were observed by the sweeping boats and when an obstruction was encountered, the buoys would align in a V-shaped pattern as the sweeping boats proceeded ahead. The apex of the V would indicate the location of the obstruction which would be carefully sounded out for least depth.

To safely sweep the mines of the Northern Barrage, a system was developed where three pairs of sweeping vessels would run down a single line of mines. The first pair would have its sweep set to cut the antennas of the near-surface mines and explode them; the second and third pairs would have their sweeps set such that they would cut mine mooring cables and set adrift any mines not exploded by the first pair. The mines set adrift were detonated by rifle fire from a small vessel (a sub chaser) that followed behind the sweeping vessels. The work was exceedingly dangerous as random mines exploded on a regular basis, often for no apparent reason. Occasionally, the explosion of one mine would activate a second, termed 'countermining' in the official history. Sometimes these explosions would occur in the vicinity of a sweeping vessel. Mines were also fouled in the sweeping wire and the associated kites causing explosions close aboard while retrieving wire. Damage to minesweepers occurred on a regular basis. A Flower class British minesweeper was sunk by mines with the loss of 40 men while they were sweeping their segment of the barrage. American losses were less severe – less than ten men and only one small vessel sunk during five months of sweeping. However, one sweeper was permanently disabled and another had six months of shipyard repairs following a close explosion.

The work was exceedingly dangerous as random mines exploded on a regular basis

Results of the Sweeping Effort

After five months of sweeping, between May and September 1919, the American commander on-site declared the sweeping job completed. This operation involved relatively new technologies – a form of wire-drag used by the sweepers from hydrographic technology and taut-wire horizontal distance measurement which passed from the minesweeping community to the hydrographic community following the war. A disturbing statistic is that of the 56,611 mines laid in areas swept by US minesweepers, 4,392 exploded prematurely, and only 21,295 were accounted for during sweeping operations leaving over half unaccounted for. Over the next three years, 64 mines were found in the North Atlantic and plotted on the accompanying map by Prince Albert of Monaco. How many vessels encountered mines in the years following World War I is unknown. A 2009 publication by the United States Navy Program Executive Office Littoral and Mine Warfare and the Expeditionary Warfare Directorate stated that "mine countermeasures vessels participating in … the Kattegat and North Sea find and destroy World War I and II-era mines." Twenty-five years after World War II an estimated 2,000 sensitive influence mines still remained in the Pacific. Given the nature of mine warfare and the state of world politics, it would not be surprising if many of the hydrographers reading this today spend part of their career engaged in some form of mine neutralisation activities be it for an on-going war or clearing shipping lanes after the cessation of warfare. As a final note, by various counts between four and thirteen U-boats were sunk by the barrage, a factor contributing to the end of the World War I.

Xulio Fernandez at work.

Innovation in Coastal Water Monitoring

HCTECH Technology

Sonia Lamas, Wouter Vogel, Vanesa Duran, Carlos Duran, HCTECH

HCTECH is a technology-based company that started as a spin-off of CIS (Centro de Investigaciones Submarinas SL) in Santiago de Compostela (NW Spain). It was founded to improve the management and to further develop the technical know-how gathered during 10 years of R & D in CIS. The company is dedicated to the designing and manufacturing of water quality monitoring systems and other marine technologies.

CIS (CENTRE FOR SUBMARINE Investigations), founded in 1987, is an environmental consulting company, specialised in the marine environment. For over a decade, CIS maintained a research, development and innovation department that generated techniques to prospect and investigate marine ecosystems. As part of a second line of business, the company entered the coastal signage market (beacon buoys and lanterns).

Since 2009, the company has focused on the development of a system for monitoring water quality and oceanographic parameters, directly linked to the environmental impact studies CIS used to work in. The company started to offer services to monitor the water quality upwards and downwards of the entire water column using buoys: turbidity, pH, temperature and dissolved oxygen. The monitoring is carried out in areas affected by marine civil works, thus assessing the impact of these activities real time.

The company also integrated sensors for monitoring meteorological and oceanographic parameters using these buoys. These parameters, such as current direction and speed, wave frequency and height and wind speed and direction, are of the highest interest for port authorities and civil engineering enterprises.

In 2011, the CIS partners valued the technology product portfolio as an asset that deserved to be managed by an independent and autonomous company. Thus the R & D department was separated from CIS and continued as HCTECH.

HCTECH is a spin-off created for better management, operation and further development of the technological achievements made by CIS. These technological achievements are the result of collaborative projects with universities and technology centres, aimed at the better protection of the seas and marine

ecosystems. HCTECH is convinced that the best way to preserve water quality is through knowledge and through reliable environmental data, which is precisely what our technologies are looking for. We are designers, manufacturers and marketers of technological products capable of real-time measurement of the physical-chemical characteristics of water and the physical oceanographic conditions. We transmit this information to a control centre via radio, GPRS or satellite. The main competitive characteristics of our system are the protection of the sensors against corrosion (antifouling) and monitoring of the entire water column.

HCTECH remains commercially linked to CIS, with three partners: Carlos Duran, principal promoter, Manuel D. Lago, former head of R & D at CIS, and Xulio Fernández Hermida, co-inventor of HidroBoya (autonomous sampling system for water quality monitoring).
The participation of three partners in the project provides multiple disciplines and skills. The main promoter is Carlos Duran, graduate in Biology at the University of Santiago de Compostela (USC), with 30 years experience as business promoter, commercial agent and innovator. Manuel D. Lago, telecommunications engineer, was primarily responsible for the development of HidroBoya and other equipment and software in CIS. Xulio Fernandez has a telecommunications degree from the School of Telecommunications Engineering of Barcelona and a PhD in Telecommunications Engineering from the University of Vigo.

The company's main market is the geo-referenced monitoring of water and coastal areas by automatic reading and data transmission in real time. Our project is especially focused on compliance with the Water Framework Directive (WFD). This requires managers and water administrations across Europe to have a network of this type of monitoring systems in each Hydrographic Department. Compliance with the Framework Directive on European Marine Strategy and the MARPOL/OSPAR conventions, which apply to seaports, are also business areas of interest for our technologies. There is far more interest in security issues rather than purely environmental concerns, and therefore we are working on the integration of image recording, processing and transmitting.

Hidroboya mooring.

The strategic agendas from the water sector technology platforms have established real-time monitoring and development of sensors for remote monitoring of water quality as one of the priorities for action for 2020. Between the technical and market objectives of the cluster Aqueau Blue Book II a roadmap can be found, and it includes a specific demand for water management that comprises our activities.

Based on its Blue Growth Study, the European Commission has established a comprehensive picture of the economic size and employment of marine and maritime sectors in Europe and is looking at the direction in which these sectors could realistically be heading in the coming years, focussing at particular potential for innovation. The coastal and maritime tourism is the biggest maritime sector in terms of gross value added and employment, expected to grow by 2 to 3% towards 2020. As the worldwide ocean energy installed capacity is expected to double yearly in the near future, the commercialisation of wave and tidal technologies will be enhanced through a reduction in technology costs. HCTECH services and technologies are directly linked to these business sectors, as we provide information critical for decision making.
We feel confident about our growth perspectives as we are working in a


Hercules lantern.

market continually in need of new developments and innovations. Though our core business area is mainly comprised of water quality monitoring, HCTECH was created as an intensive R&D dedicated company, offering services to develop tailor-made devices for hydrological studies or monitoring. We also are in the course of integrating or adapting existing hydrology technologies to new services. The near future for HCTECH is quite promising from this point of view, as we are starting new projects in Chile for a tsunami alert system, measuring wave height and frequency. In Portugal we will start aquaculture surveillance, including video recording and image processing. All of these needs demand the know-how and technologies that we have already developed for other markets. Sea level rise, extreme meteorological events, and other coastal threats are leading the market for coastal security and surveillance of littoral environmental conditions. HCTECH currently participates in R&D projects aimed at improving the environmental performance of harbour dredging (Ecodraga Project, *www.ecodraga.es*), in co-operation with another three companies and four R&D public centres. HCTECH participates by integrating its monitoring systems in the dredging vessel. The aim of the project is to achieve a vessel design that minimises the dispersion of pollutants in the water column during dredging and depositing of the dredged material. Our company focuses on monitoring the turbidity real time, and on integrating a broad hardware-software system on board. This system will offer real-time, on-line, geo-referenced information about the sea bottom topography during the dredging process, based on interferometry. The objective is to increase the efficiency of the dredging process by making the sediment volume calculations and the dredged area information available quickly and accurately.

www.hctech.eu

Side-scan System for Indian New-build Survey Vessel

In August 2012, Kongsberg GeoAcoustics, UK, delivered a full side-scan sonar system to Hyundai Heavy Industries, Korea. The sonar system is part of a suite that will see the Geological Survey of India (GSI) take charge of a new-build survey vessel during 2013. The package included the side-scan system itself, a winch, complete acquisition and processing software and all the necessary peripherals for seabed sonar surveys as part of the Kongsberg 'Full Picture' supply initiative.
http://su.pr/20CNxz

Remote Survey System

Clearpath Robotics from Canada has unveiled the Kingfisher M200 Remote Survey System, providing environmental professionals with an agile, customisable platform for remote sensing and environmental monitoring. Applications range from hydrology staples such as bathymetric data collection, shore erosion monitoring, sediment mapping and flow rate measurements to dam inspection and harbour safety.

The newly refined features include semi-planing hulls for increased speed with less draw on power, a compact design, and electric jet thrusters that allow the Kingfisher M200 to traverse fast-moving water with ease.
http://su.pr/9Z3d0B

The Kingfisher M200 Remote Survey System in operation.

TerraStar Positioning for Dredging Operations

DEME, Belgium, has commissioned TerraStar GNSS's TerraStar-D Precise Point Positioning (PPP) service to support the worldwide nearshore operations of its multifunctional fleet of dredgers and auxiliary vessels.

Operating in conjunction with Septentrio AsteRx2eL GNSS positioning and AsteRx2eH heading receivers, the TerraStar-D service will provide DEME's vessel fleet with seamless high-precision decimetre-level accuracies using a combination of GPS and Glonass satellites to ensure faster levels of convergence and high update rates in the most demanding environments.
http://su.pr/1IYXC7

SMD Improves Survey Capabilities of Work-class ROVs

Soil Machine Dynamics Limited (SMD) and SeeByte have successfully integrated SeeTrack CoPilot into SMD's work-class ROV system. The vehicle is now better equipped to carry out successful surveys, field development and pre & post lay operations as well as a range of other applications. The integration and trials, which took place in Fort William, Scotland, in mid-January 2013, saw SeeByte's SeeTrack CoPilot Software system for dynamic positioning and real-time monitoring of work-class ROVs, successfully carry out a number of survey missions using the software's easy-to-use, point-and-click interface.
http://su.pr/2nMUsk

StarFish Software Update

The full range of the TriTech StarFish 450 series can be interfaced directly to HYPACK after application of the latest software interfaces; this includes the original 450F system, the hull-mounted 450H option and the higher-frequency 452F system. The high-resolution StarFish 990F system, popular with Search and Rescue (SAR) operations and close inspection surveys, is also supported.

HydroSupport's mosaicing software application, WinProfile Sharp now also supports the full range of StarFish systems, offering complete real-time processing. Designed for a Windows operating system, WinProfile has been developed by specialists in hydrographic survey.
http://su.pr/1Cuw9m

New Options Added to Mini M Sonar Series

Teledyne BlueView, USA, has added two options to its Mini M Series of 2D multi-beam imaging sonar: lightweight and built-in 10° down-angle. The new lightweight model reduces the M Series' weight by 30% to 3.4lbs in air with near-neutral buoyancy in water. The lightweight and 10° down-angle options are engineered for micro-ROV and diver handheld platforms.
http://su.pr/31Y525

GML Encoding for UKHO S-100-based Product

Snowflake Software, UK, has been awarded a contract by the United Kingdom Hydrographic Office (UKHO) to provide an open standard Geography Markup Language (GML) encoding and profile for a basic route specification S-100-based maritime data specification.

This work builds on Snowflake's leading role implementing the International Organization for Standardization (ISO) Model Driven Approach to managed GML application schema design and optimisation for use in practical applications and web services.
http://su.pr/3o8rmr

High-accuracy Inertial Systems

SBG Systems, France, has announced the Ekinox Series, a family of MEMS-based Tactical Grade Inertial Systems. This series consists of two ITAR Free models: the Ekinox AHRS which provides 0.05° 3D attitude and 5cm heave, and the Ekinox INS which delivers additional 2cm position.
http://su.pr/2EYtHT

The Ekinox INS systems from SBG Systems.

SeeTrack Military Compatible with Sea Scan HDS

SeeByte, UK, has made its SeeTrack Military software systems compatible with Marine Sonic Technology's high-resolution Sea Scan HDS side-scan sonar system. Seebyte users operating the Marine Sonic Sea Scan HDS sonar can now visualise and process data from the newest side-scan sonar using SeeTrack Military.
http://su.pr/2JKqmJ

Multi-beam Echo Sounder for Medium to Deep Water

The RESON SeaBat 7160 multi-beam echo sounder has been developed for marine exploration, seafloor habitat mapping and hydrographic charting in medium to deep water (3 to 3,000m). Equipped with X-Range, it provides improved system immunity to external noise.
http://su.pr/2lyFd9

Multi-client BroadSeis Seismic Programme

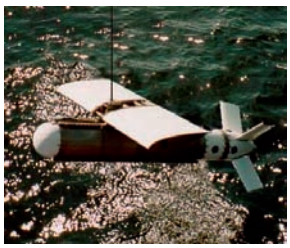
CGG, headquartered in France, has commenced data capture in a new, highly pre-funded 3D multi-client programme in the Central North Sea (CNS). Quad 30 Phase 7 of CGG's Cornerstone CNS dataset covers over 5,500 square kilometres in the Q29, 30 and 38 areas, and data is being collected by the CGG Oceanic Phoenix operating with a 10x100x6,000m long-offset streamer configuration.
http://su.pr/1FPzGF

Obstacle Avoidance Sonar

Sonardyne International, UK, has announced the launch of its new Navigation and Obstacle Avoidance Sonar, NOAS, at NAVDEX 2013 in Abu Dhabi. Designed for use on submersible vehicles, NOAS enables faster, safer and more efficient navigation by detecting and classifying potentially hazardous underwater obstacles in its path. Unveiled on the first day of the event, NOAS provides a unique combination of very long range 2D navigation performance, 3D object detection and class-leading intruder detection in a single compact sonar.
http://su.pr/2YFi3j

The Sonardyne NOAS.

Royal Canadian Navy to Use Aurora Towfish



Aurora Towfish.

International Submarine Engineering Ltd is to provide two commercial off-the-shelf, high-speed Aurora Towfish, which will be used to support mine detection missions and route survey operations for the Royal Canadian Navy's maritime coastal defence vessels. The Aurora Towfish will include modifications to integrate new sensors and navigation equipment, including an L3 Klein side-scan sonar, and an R2Sonic bathymetric multibeam echosounder. The modular design of the vehicle makes it easy to exchange sonar payloads.
http://su.pr/AqMzIr

Introduction of UXO Marine Software

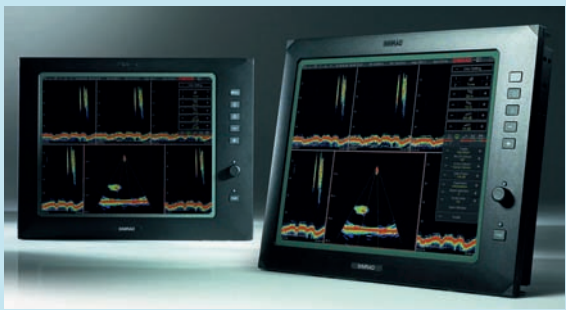
Geosoft, headquartered in Canada, will introduce the new UXO Marine software at Ocean Business 13, running from 9 to 11 April 2013 in Southampton, UK. The software provides marine surveyors with a purpose-built workflow and set of tools for processing and managing marine magnetic data for site investigation surveys.

Offered as an extension to Geosoft Oasis montaj, UXO Marine is a comprehensive system for processing, detecting and analysing munitions and related underwater site investigation work using Transverse Gradient (TVG) as well as single-sensor and multi-sensor magnetic arrays.
http://su.pr/1RmHzN

More product news
www.hydro-international.com/news/productnews.php

Scientific Multibeam Echo Sounder Updates

Simrad, Norway, has released a significant update for its ME70 scientific multibeam echo sounder. A new software and hardware configuration improves accuracy and operating range while reducing maintenance costs and improving system reliability. With the new Simrad ME70 software 1.2.5, all beam forming is carried out on a powerful operator computer processor, meaning the system can run on a single computer.
http://su.pr/3uuAui



Simrad's ME70 Multibeam echosounder received a significant update

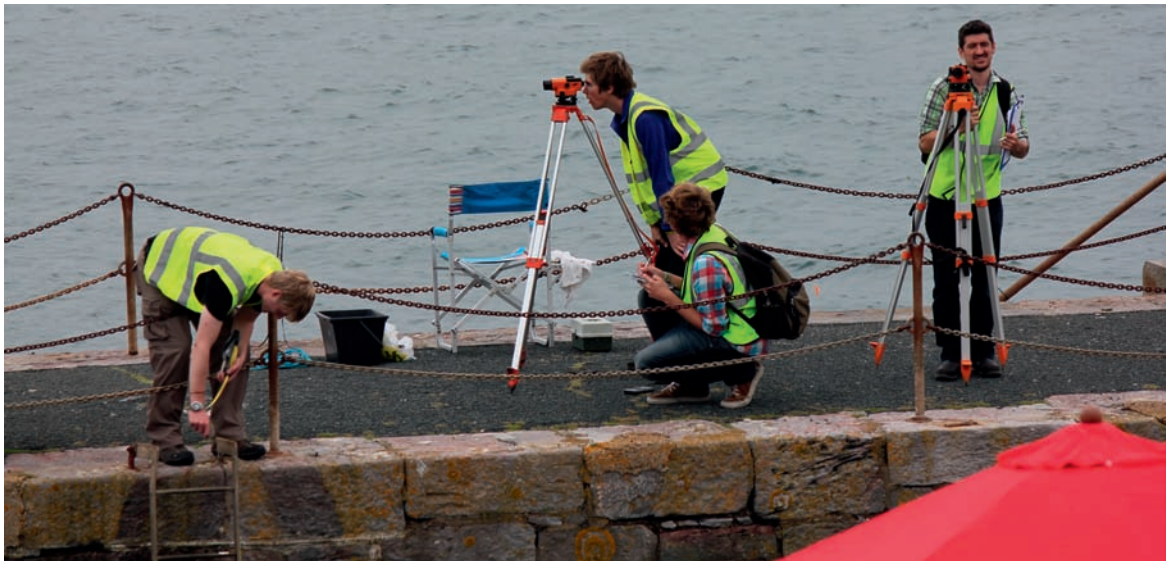


Figure 1: Students surveying in Plymouth.

Taking your University to Work

Hydrographic Academy with Plymouth University

Dr Richard Thain, director, Hydrographic Academy, UK.

Solving issues with the future supply of hydrographic surveyors, the retention of existing staff, and the limited number of surveyors working within the industry who are formally qualified and professionally accredited to do their job requires training and education. The Hydrographic Academy takes studying with Plymouth University offshore.

THE OFFSHORE INDUSTRY IS facing an increasing threat to its success. Despite a relentless advance in technology and a globally buoyant market place, there are insufficient hydrographic surveyors being supplied from universities to satisfy demand. Historically, surveyors entered the industry once they had completed training and service in the Navy or had completed one of a handful of recognised higher education courses worldwide; the majority of the latter being targeted at a relatively small number of eligible postgraduates. There are very few undergraduate level courses which are professionally recognised apart from Plymouth University's three year full-time BSc (Hons) Ocean Exploration, which is an IHO Cat A course, whilst several well respected university hydrographic survey programmes around the world have closed over the last few years.

Qualifications

The issue is exacerbated further as many personnel currently working as hydrographic surveyors are doing so on the basis of experience alone, or have often completed a university course in an allied subject such as geomatics or marine science. There are, therefore, relatively few surveyors within the workforce who have completed an accredited IHO Cat A and Cat B programme. In today's increasingly litigious world, higher education level qualifications and professional body approval as a measure of fitness to work are becoming important.

Plymouth University has undertaken a programme of educational development to address these issues, and formed the Hydrographic Academy in 2011. The Hydrographic Academy has developed a fully integrated part-time e-learning solution to train and educate hydrographic surveyors in the workplace. Clearly, in such a high-value, short-staffed industry it is not normally viable for companies to release their personnel for, say, 12 months for full-time study to gain a postgraduate qualification and appropriate professional body recognition; so the option of part-time blended learning, whereby students study distance e-learning modules and then attend short, intensive residential practical sessions, is enabling many who would otherwise have no opportunity to engage with a university course.

Undergraduate and Postgraduate

The Hydrographic Academy offers both postgraduate and undergraduate programmes of study, the latter facilitating a route for school leavers into the industry. Organisations such as the IHO, IMarEST, CICES and RICS are fully engaged in advanced discussions regarding professional recognition, and Fugro and the Royal Navy are acting as industrial advisers and representatives to the Hydrographic Academy's programme design and development. In this way, students and employers

Figure 2: The USB stick for the Hydrographic Academy.

Figure 3: Survey vessel *Falcon Spirit*.

alike can be assured that the teaching and learning materials are relevant to today's working environment. For example, as well as gaining practical and applied knowledge in typical subjects such as geodesy, positioning and acoustics, a student's skill set is broadened with elements of management and leadership training, facilitating career development opportunities within the industry.

Total Learning Package

Delivery of the Hydrographic Academy's teaching and learning materials has been designed carefully by the learning technology team at Plymouth University to provide an easily navigable route through the subject matter. The Total Learning Package (TLP) is supplied on a USB memory stick, and presents the student with a familiar HTML-type, web browser environment making it second nature for anyone familiar with the internet to navigate. Seamless integration with online materials can be achieved as and when an internet connection is available, but critically, the TLP is designed to work effectively offline and does not require students to have an internet connection. An important aspect of the overall teaching and learning design, this means that a student can be deployed offshore for extended periods and still continue their studies effectively, as all the lecture and support materials are contained within the TLP. Full personal tutor support is provided to each student, with regular contact through e-mail, video conferencing or telephone as appropriate.

It is critical that teaching and learning design for distance learning students pays due regard to the mode of delivery. It is thus wholly inappropriate and ineffectual to merely repackage existing lecture material from full-time residential courses. All learning materials have to meet the learning styles and preferences of different types of students, be able to be used by students across platforms and differing levels of technology, be portable, maintain rigorous academic standards and encourage discussion, debate and critical thinking. A typical distance learning module within the Hydrographic Academy programme would require between 100-300 hours of study. During this time a student would experience a variety of modes of learning, including listening to a series of short, narrated PowerPoint lectures of typically less than 20 minutes each, completing a selection of challenging self-test formative questions, conducting some directed background reading which may be supplied as part of the TLP or may have to be downloaded when internet connection allows, completing practical exercises, and research for the production of an essay or report on a subject related to a lecture or series of lectures.

E-Learning and Residential Elements

Clearly, an effective hydrographic surveyor cannot be trained through distance education alone, and the Hydrographic Academy's programmes each include two intensive residential practical sessions of two weeks' duration. These enable students to hone their practical surveying skills using cutting edge equipment, as well as undertake classroom-based learning in subjects such as advanced mathematics. Formal written examinations and skills-based assessments are also completed during these sessions.

The requirement for more training and education in hydrography, including to facilitate capacity building, is gaining wider recognition, and recent themes promoted within the industry such as 'Taking Care of the Sea' and 'The Blue Economy' are providing a much needed focus on important issues separate to those related solely to technological developments. Ensuring that those working within the industry are appropriately trained, educated and certified; making sure the next generation of employees are able to access the education they need, when and where they need it, are all critical. The Hydrographic Academy provides an opportunity for employers and employees to engage with higher education, and address these issues. Uptake from sponsored and self-funding students on the Hydrographic Academy's programmes has been very encouraging to date, and already nearly 100 students are underway on their journey towards full qualification and accreditation.

www.plymouth.ac.uk/hydro

Australasian Hydrographic Society

AHS Awards

The 2013 AHS Awards are now open for nominations. This scheme celebrates hydrography and is for the AHS to recognise those who contribute to improving the profession and enhancing community understanding.

The schedule is:

- Call for nominations: end of January 2013
- Nominations close: 30 April 2013
- Awardees notified: 28 May 2013
- Awards presented: World Hydrography Day 20 June 2013 or AHS AGM

Details about the awards as well as nomination forms are available from the AHS website: *www.ahs.asn.au/awards.html*

East Australian Region

The next meeting of the EAR is to be held on 12 February and will also include a farewell dinner for Commodore Rod Nairn AM RAN who retires mid-January as the Australian Hydrographer. Rod has been an active member of the AHS and his leadership chairing the accreditation panel for hydrographic surveyors has been influential in shaping this capability. The AHS wishes Rod all the very best in his retirement.

Gary and Trimble Navigation New Zealand are long-standing members of the Society and have been enthusiastic supporters of hydrography in New Zealand for many years.

West Australia Region

The WAR is planning several technical meetings over the next few months. Two meetings are scheduled for 19 February (Multi-beam) and 20 March (Tides). The organising committee is spreading their influence amongst the offshore and underwater technology community resulting in increased numbers attending the meetings.

New Zealand Region

When Trimble Navigation New Zealand's offices were devastated by fire in May 2011, so too were senior product manager Gary Chisholm's prized Australian Hydrographic Society (AHS) Awards. The earthquake and fire destroyed the building along with much of the company's equipment. Forty firefighters in 10 fire trucks were able to contain the blaze after several hours. Three firefighters were injured.

Gary's AHS Award for Scientific and Technological Achievement awarded in 2008 and his AHS Presidents Letter of Appreciation awarded in 2003 were replaced along with new wooden frames.

The awards were recently presented to Gary by Maurice Perwick from the AHS New Zealand Branch committee at a small function in Christchurch.

Hydrographic Society Russia

The Centre's Anniversary

On 18 December 2012, an extensive session of the HSR Council took place at the State Research Navigation-Hydrographic Institute (SRNHI). The session was devoted to the 40th anniversary of the SRNHI Research Oceanographic Centre.

Since being founded in 1972, the Centre has been involved in the collection, processing and storage of global ocean data and its scientists have researched the information collected, including a definition of the Russian continental shelf border in Arctic regions.

The Centre's employees were invited to the session. Also present were all the heads of the Centre from the past 40 years: Nikolay Kolyshev, Sergey Balyasnikov, and Konstantin Stavrov. Unfortunately, due to poor health the first head of the Centre rear admiral (retired) Aleksandr Sorokin could not attend. Also absent was Aleksandr Oparin, who passed away tragically in 2008.

All former heads discussed the difficulties encountered in creating and developing the

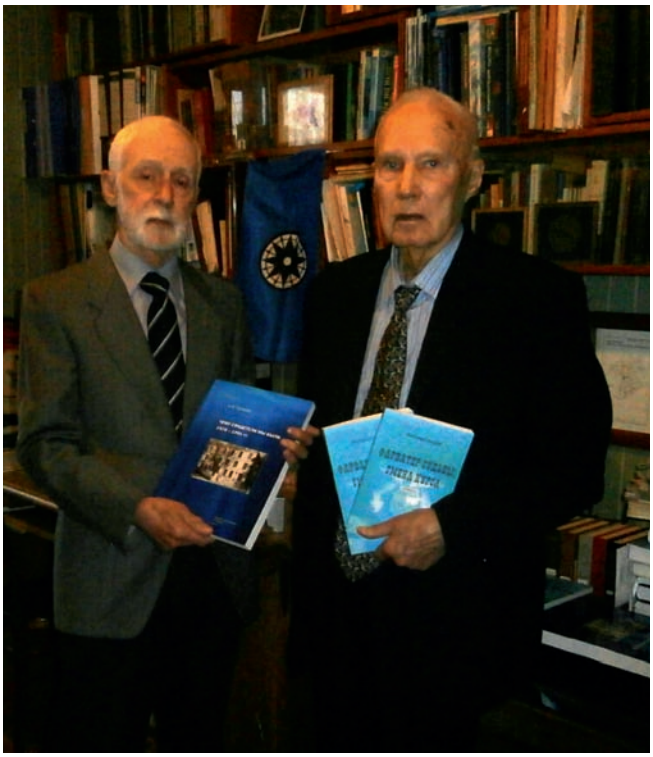


Figure 1: Aleksandr Gruzdev (right) presents his books to HSR council member Viktor Rybin.

Figure 2: Heads of the Centre from left Konstantin Stavrov, Serguey Balyasnikov, HSR vice president Nikolay Nesterov, HSR president Nikolay Neronov, Nikolay Kolyshev.

Figure 3: Serguey Balyasnikov takes to the floor.

Centre. A. Sorokin's statement was read by HSR vice president Nikolay Nesterov.

After the official part of the session there was a buffet for all participants.

Gift to the Society

On 11 January 2013, HSR member, 1st rank captain (ret.) Aleksandr Gruzdev met with HSR Council member Viktor Rybin and handed him a gift for the HSR Council, namely two books: *To that witnesses we were. 1978 - 1991* and *The Waterway of destiny: change of a course. Records from a diary. (1990 - 2011)* .

In these books he recorded the results from his diaries on the work which he conducted for many years. These detailed records include not only his work in the Hydrographic service of the Pacific fleet, but also his public work. The books not only include data and documents on historical events that took place in the USSR and Russia, but also on events in the Far East and Pacific fleet.

Particular attention should be paid to the carefulness and detail with which the data has been recorded, resulting in official documents.

Hydrographic Society Benelux

Successful Workshop in Antwerp Harbour

The workshop themed 'Reference Frames and Geodesy in the North Sea' attracted nearly 70 members of the Hydrographic Society Benelux who headed for the small town of Lillo near Antwerp, a historical green oasis surrounded by the industrial area of the harbours of Antwerp. Alain de Wulf managed to create a varied programme of presentations on Wednesday 6 February 2013.

Cornelis Slobbe from Delft University of Technology started the sessions by explaining the 'Roadmap to a mutually consistent set of offshore vertical reference frames'. He introduced the participants to various reference frames and their relationships. Hans Poppe, Project Engineer Tide and Currents, Flemish Hydrography, emphasised the Belgian reference frames and the renewed atlas of the Port of Zeebrugge. He discussed matters from a Belgian perspective and talked about the history of reference frames.

After a break, Dr. Leendert Louis Dorst, marine geodesist for the Dutch government, chairman of the Resurvey Working Group at North Sea Hydrograpic Committee and vice-chairman of the International Hydrographic Organization's Data Quality Working Group, gave an insight into the geodetic infrastructure of organisations and their positions and duties in the national and international hydrographic and geodetic professions. The last contribution, 'Geodesy: the Reality!', was presented by Pedro De Roose, senior surveyor at DEME Survey Department. He brought together the theory and the dilemmas faced in daily practice.

The meeting was concluded with drinks hosted by DEME, which were welcomed by all delegates before taking to the road again.

AGM and workshop on Cleaning the Vecht River

The next workshop has been scheduled for 27 March 2013. Subject will be the cleaning and dredging of the River Vecht from Muiden to Utrecht in the Netherlands. Emphasis will be on the first section in the north, reaching towards Nigtevecht. The work to be carried out shows quite some innovation and promises to be very interesting! Details of the programme will follow at the beginning of March on the Hydrographic Society Benelux website.
The AGM will also be held on this day as well as the traditional award presentation for the best Student Paper.

www.hydrographicsociety-benelux.eu

Joint Workshop with DHyG

The Hydrographic Society Benelux is involved in the joint organisation of a workshop with the Deutsche Hydrografische Gesellschaft (DHyG). The Hydrographentag 2013 is to take place on 28 and 29 May 2013 in Hotel Alte Werft in Papenburg, Germany. The programme, prepared by the DHyG, includes 5 German and 5 Dutch presentations. On the evening of 28 May, there will be an excursion to the Meyerwerft where the new German research vessel *Sonne* is currently being built.
The conference language will be English. Companies are invited to contribute to the event to extend their reach. There will be a fee of around EUR100 (excluding travel and accommodation). For more information, please see *www.hydrographicsociety-benelux.eu*.

Hydro Agenda

MARCH

EIVA Navipac Online
Singapore
→ 04-08 March
For more information:
E: kmoffat@atlasservicesgroup.com
W: www.atlasservicesgroup.com/seismic-hydrographic

Black Sea Oil and Gas Forum 2013
Sofia, Bulgaria
→ 05-07 March
For more information:
E: laurenceallen@dmgevents.com
W: www.blackseaoilgas.com

Marine Geoscience Leadership Symposium
Washington, DC, USA
→ 11-15 March
For more information:
W: www.oceanleadership.org/mgls

Europort Istanbul 2013
Istanbul, Turkey
→ 20-23 March
For more information:
E: info@europort-istanbul.com
W: www.europort-istanbul.com

Coastal GeoTools 2013
Myrtle Beach, South Carolina, USA
→ 25-28 March
For more information:
E: csc.info@noaa.gov
W: http://geotools.csc.noaa.gov/default.aspx

US Hydro 2013
New Orleans, LA, USA
→ 25-28 March
For more information:
E: info@ushydro2013.com
W: www.thsoa.org

APRIL

Fundamentals of Subsea Engineering
Distance Learning
→ 04 April – 04 July
For more information:
E: ibc-academy@informa.com
W: www.ibc-academy.com/FLR2382HI

Sea Asia 2013
Singapore
→ 09-11 April
For more information:
E: lwhelan@rina.org.uk
W: www.rina.org.uk/sea_asia_2013.html

Ocean Business 2013
Southampton, UK
→ 09-11 April
For more information:
E: sophie.potten@intelligentexhibitions.com
W: www.oceanbusiness.com

Offshore Survey
Southampton, UK
→ 10-11 April
For more information:
E: cheri.arvonio@intelligentexhibitions.com
W: www.oceanbusiness.com/en/conference/

International Seminar on Dredging and Reclamation
Buzios, Brazil
→ 15-19 April
For more information:
W: www.iadc-dredging.com

Practical Multi-beam Training Course
Southampton, UK
→ 15-19 April
For more information:
E: chloe.tidy@swathe-services.com

FEMME 2013
Boston, MA, USA
→ 16-19 April
For more information:
E: km.femme.2013@kongsberg.com
W: www.km.kongsberg.com/

MAY

FIG Working Week
Abuja, Nigeria
→ 06-10 May
For more information:
W: www.fig.net/fig2013

Hydroacoustic Workshop 2013
Seattle, WA, USA
→ 21-23 May
For more information:
W: www.biosonicsinc.com/services-training.asp

All-Energy Exhibition & Conference
→ 22-23 May
For more information:
E: all-energy@reedexpo.co.uk
W: www.all-energy.co.uk

SEE Congress & Exhibition on Energy Efficiency & Renewable Energy (EE&RE)
Sofia, Bulgaria
→ 29-31 May
For more information:
E: office@viaexpo.com
W: www.eeandres.viaexpo.com/en/exhibition

JUNE

WODCON XX
Brussels, Belgium
→ 03-07 June
For more information:
W: www.wodcon.org

OCEANS 13 MTS/IEEE BERGEN
Bergen, Norway
→ 10-13 June
For more information:
W: www.oceans13mtsieee-bergen.org/

EAGE
London, UK
→ 10-13 June
For more information:
W: www.eage.org/events/index.php?eventid=755

Brasil Offshore
Masaé, Brasil
→ 11-14 June
For more information:
W: www.brasiloffshore.com

TransNav 2013
Gdynia, Poland
→ 19-21 June
For more information:
E: transnav@am.gdynia.pl
W: http://transnav2013.am.gdynia.pl

Underwater Technology Conference
Bergen, Norway
→ 19-20 June
For more information:
E: stale.eiken@possibility.no
W: www.utc.no

Seawork International
Southampton, UK
→ 25-27 June
For more information:
W: www.seawork.com

AUGUST

33rd Annual Western Hemisphere Dredging Conference
Honolulu, HI, USA
→ 25-28 August
For more information:
E: weda@comcast.net
W: www.westerndredging.org

International Cartographic Conference
Dresden, Germany
→ 25-30 August 2013
For more information:
W: www.icc2013.org

SEPTEMBER

Offshore Europe 2013
Aberdeen, UK
→ 03-06 September
For more information:
E: natalie.booth@reedexpo.co.uk
W: www.offshore-europe.co.uk

Oceanology International China
Shanghai, China
→ 03-05 September
For more information:
W: www.oceanologyinternational.com/china

YOUMARES 4
Oldenburg, Germany
→ 11-13 September
E: info@youmares.net
W: www.youmares.net

OCEANS MTS/IEEE 2013 San Diego, CA, USA
→ 23-26 September
For more information:
W: www.oceans13mtsieee-sandiego.org

OCTOBER

Offshore Energy 2013
Amsterdam, The Netherlands
→ 15-16 October
For more information:
E: oe@offshore-energy.biz
W: www.offshore-energy.biz

DECEMBER

IHO Hydrographic Commission on Antarctica (HCA)
Cadiz, Spain
→ 03-05 December
For more information:
W: http://bit.ly/UkkGOE

Calendar Notices
Please send notices at least 3 months before the event date to: Trea Fledderus, marketing assistant
E: trea.fledderus@geomares.nl
For extended information on the shows mentioned on this page, see our website: www.hydro-international.com

Hydro Alphabetical list of advertisers

Ocean Bathymetry; Step-child of Hydrography

Although 71% of Earth is covered by oceans, only some 11% has been mapped in detail. In relation to SOLAS and safe marine transport, marine surveys are making giant steps forward. However, lack of knowledge about the deep ocean floor limits our ability to foresee future impacts on society.

This column comes just 50 years after my introduction to ocean bathymetry as a young marine geophysicist standing PGR echo sounder watches aboard WHOI's R/V *Chain* in the midst of the Cuban missile crisis. This was followed by six years at Lamont and a PhD from working up nine years of Arctic geophysical drifting station data. Marriage to an Israeli brought me to Jerusalem where over four decades have been spent mapping the 'puddles' around the Arabian Plate, and long-time involvement in the IBCM and GEBCO compilations.

Recently, cancellation of US 'Man in the Sea' programmes has raised questions about our abandoning the 99.9% of the oceans not yet observed. What is lost in these arguments is the fact that every detailed survey of the ocean floor offers new insights into a world where two-thirds of the species are still unknown, and where powerful geological and tectonic processes are at work posing far-reaching threats to society.

Unfortunately, worldwide compilation of detailed bathymetry is not sexy. The 30" marine grids available from GEBCO, Scripps, Lamont and others are the life's work of a handful of 'get a life' diehards, but accurately mapped areas still remain a small patchwork.

However, I suspect that seafloor mapping will progress, under the radar so to speak, just as land topography did 13 years ago. Then, in just 10 days, NASA's STM-99 Shuttle Radar Topographic Mission (SRTM) made a coherent and relatively accurate mapping of 82% of the continents, the basis for more detailed mapping that has greatly benefited society. The developments in airborne Lidar and GPS precision have corrected faulty topography that could not foresee flooding and geological hazards.

The bathymetric mapping community has greatly benefited from the many UNCLOS Article 76 surveys and their detailed coverage, which increased public awareness of the value of the seabed for mineral and petroleum exploration, and fisheries habitat. Ships with multi-beam sonar have proliferated, as the sonar costs decrease relative to that of the ships and their fuel, and as systems' bathymetry, backscatter analysis, and water column capabilities improve. Working well below the keel depth (50m) of the largest vessels or the maximum dive depths of submarines, the offshore petroleum industry is surveying prospective offshore fields to 2,000m depth. And often AUVs are making the near-bottom surveys at engineering quality for future oil or gas field infrastructure.

Over the past few years, the human cost from tsunamis (Sumatra, Japan) and rising sea levels (Sandy, Katrina) has far eclipsed what hydrographers generally deal with. Is a SRTM-like effort with government support likely (SRTM's cost totalled USD142 million)? NOAA has recently put a cost benefit on improved geodesy (1). Is a deeper understanding of sea level rise, ocean warming, and tectonic and slump sources of tsunamis cost effective? Is increasing ocean acidification and its effect on the marine food chain and ultimately the fish stocks worth a global mapping programme? In light of these recent wake-up calls, the posited USD8-16 billion cost of a 20 year GOMaP-like project (2) would seem to be a no-brainer.

Dr. John K. Hall Geological Survey of Israel (Israel)

1. *http://dels.nas.edu/resources/static-assets/materials-based-on-reports/reports-in-brief/GeodeticInfrastructure-ReportBrief-Final.pdf (accessed 21 Jan 2013).*
2. *http://mp-www.nrl.navy.mil/marine_physics_branch/thsoa_paper.pdf (accessed 21 Jan 2013)*