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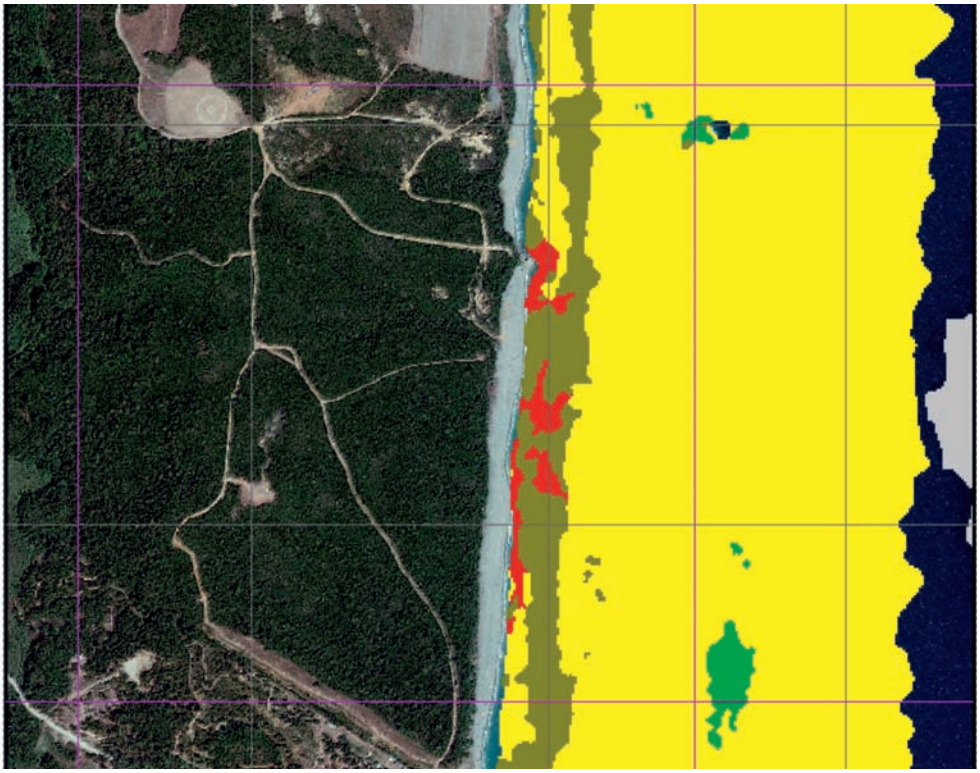

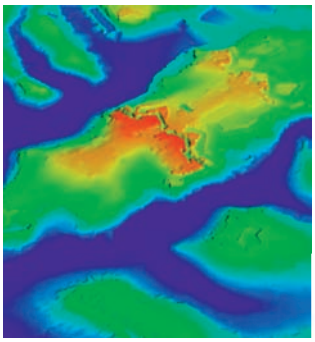

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WorldView-2 high-resolution satellite imagery can be used for the calculation of satellite-derived bathymetry , seabed classification and marine habitat mapping, providing high-resolution data and global coverage for hydrographic and terrestrial applications. (Image courtesy: DigitalGlobe).

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Hydro INTERNATIONAL

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The Buyer's Guide features Company Profiles, Contact Details and an online directory with a categorised overview of suppliers. The Buyer's Guide is distributed among subscribers of Hydro INTERNATIONAL, visitors to international trade shows throughout the year and is available from www.hydro-international.com/buyersguide – thus it is a valuable information source to consult regularly throughout the year. For further information, please contact herma.lenten@geomares.nl

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Photography: Arie Bruinsma

Look up!

Durk Haarsma
durk.haarsma@geomares.nl

The development of all the new and rapidly evolving techniques almost makes you want to predict a little of the future that lies ahead for hydrographic professionals in particular or for the field in general. This is often quite natural at this time of the year, especially in the first issue of the year, which this is for Hydro INTERNATIONAL. But I am inclined to steer clear of looking to the stars, because things usually move in a different direction – or move faster or more slowly than expected or predicted. But then again, it might not be completely unwise to look up, at least in the direction of the stars, instead of looking down, to keep track of the hydrography of the future. To be more precise, we should look up at the devices that are looking down on us.

In this very first issue of 2013 we are bringing you two feature articles that describe good examples of bathymetry from the sky. The first is the article *Image-derived Bathymetry and Seabed Classifications Validated* on page 14 of this issue of Hydro INTERNATIONAL by Helen Needham, Graham Mimpriss and Knut Hartman. The authors describe the outcome of a pilot, carried out by a partnership formed by Proteus, EOMAP, and Digital Globe and sponsored by the UKHO. It is a pilot in which two project sites in the Mediterranean were identified and WorldView 2 satellite imagery was processed to determine depth and seabed classification. Conclusion was that considerable areas can be surveyed in a much faster and more cost-effective way. In the article *No More Spatial Misinterpretation* on page 18 author Saviour Formosa describes the country-wide hydrographic survey of the island state of Malta. Lidar bathymetry played a crucial role in the whole project that took place over the course of last year. Both articles give a glimpse of the future in which the above-mentioned techniques are likely to be combined more often with the accurate techniques on board. There's much more in this first issue of 2013 of course, and we will bring you lots more interesting articles throughout the year.

I would also like to invite you to visit *www.geo-matching.com*, a comparative website developed by Geomares Publishing and launched at the end of last year. New hydrographic product surveys have been added, such as multi-beam echo sounders and inertial navigation systems (INS), and acoustic Doppler current profilers had already been included. Let us know what you think of the website, leave product reviews for your peers or just browse and compare.

Last, but not least, I would like to wish all readers a healthy and successful New Year. Have a great 2013!

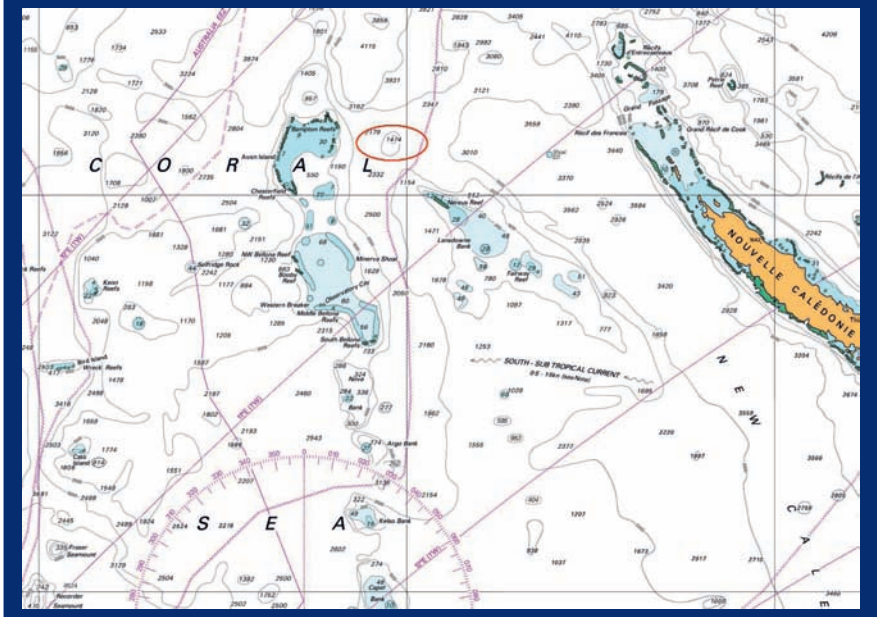
Hydrography and Cartography Training Course in Ivory Coast

The International Maritime Organization (IMO), in collaboration with the International Hydrographic Organization (IHO) and the French Hydrographic Office (SHOM), organised a two-week training course in Ivory Coast on hydrography and nautical charting for French speaking African countries, from 19 November to 1 December 2012.
http://su.pr/7DVzSR

Impressions of the training in Ivory Coast.

It's on the Map – But does it Exist?

In a reversal of the centuries-old tradition of explorers undertaking ocean voyages of discovery with the hope of finding new land, a scientific party from the University of Sydney, Australia, has done the complete opposite. They have solved a mystery regarding the existence of a supposed island in the Southwest Pacific. The Australian Hydrographic Service has added a further explanation of the phenomenon.
http://su.pr/7hOQCq



AHS Chart of the Region AUS04602. Image courtesy: Australian Hydrographic Service.

Phoenix Recovers US Air Force F-16

Underwater survey company Phoenix International, based in the USA, has successfully completed a search and recovery of a US Air Force F-16 aircraft from over 16,400 feet of sea water (fsw). Underwater search operations commenced using the Navy's 20,000fsw depth search system, ORION. After searching the initial planned search area spanning a 2x4 nautical mile area, search operations shifted to another high-probability area and the suspected F-16 debris field was quickly identified.
http://su.pr/1MEtTh

Deployment of the CURV21 ROV.

APEX Deep Profiling Float Descends to 4,000 Metres

A new version of Teledyne Webb Research's Autonomous Profiling Explorer (APEX) set a record on 30 and 31 October 2012 by diving below 4,000 metres off the coast of Hawaii's Big Island. The standard APEX, which makes up over two thirds of the 3,500-float international ARGO fleet, has a maximum depth rating of 2,000 metres. The new APEX Deep has been completely redesigned to bring the deep oceans within reach of oceanographers with a working depth of 6,000 metres.
http://su.pr/1mM1zV

An APEX Deep device.

Geomarine Taken Over by UTEC

UTEC, with its headquarters in Houston, USA, has acquired Geomarine Ltd which is headquartered in Newcastle-upon-Tyne, UK, with operational offices in Bath, UK, and Singapore. The move will capitalise on a natural and complementary fit between the two companies, providing an opportunity to enhance and increase the range of services offered.
http://su.pr/2xXEuK

New Officials for IFHS Board

Holger Klindt, head of strategy & product management for Signalis in France and Germany, has been elected chairman of the International Federation of Hydrographic Societies (IFHS) in succession to Aubrey Price, executive director of C&C Technologies (South Africa). Furthermore Rob van Ree, senior lecturer on hydrography at the Maritime Institute Willem Barentsz, the Netherlands, and treasurer of Hydrographic Society Benelux, has been elected vice-chairman.
http://su.pr/22etmI

The new and the old IFHS board.

Award for Erosion Behaviour of a Draghead Paper

Mr Verschelde (left) receives the IADC Award for the best paper by a Young Author from IADC's secretary general René Kolman at the CEDA Dredging Days in Abu Dhabi on 13 December 2012. Image Courtesy: IADC.

During the CEDA Dredging Days, which were held from 12 to 13 December 2012 in Abu Dhabi (UAE), the International Association of Dredging Companies (IADC) presented its 28th Best Paper Award for a Young Author to Mr Arnaud Verschelde for his paper entitled *Erosion Behaviour of a Draghead.*
http://su.pr/1utaek

OI Looking Forward to 2014

Like-for-like sales of exhibition space for Oceanology International 2014, which is set to take place at the ExCeL Centre in London, UK, from 11 to 13 March 2014, are currently 27% up on Oceanology International 2012. Currently over 6,500m^2 of the available 8,150m^2 of floor space at Oceanology International 2014 has been sold. It has been announced that Spill 2014 will run alongside Oceanology International 2014, and prior to this, Oceanology International China 2013 will be held in Shanghai from 3 to 5 September 2013.
http://su.pr/1cWNA6

Impression of the OI2012 show floor.

YOUMARES to Continue

After a successful edition in 2012, a fourth YOUMARES conference is scheduled from 11 to 13 September 2013 in Oldenburg (Germany). The slogan of this year's event is 'From coast to deep sea: multi-scale approaches to marine sciences'. YOUMARES is an international conference of young marine researchers and engineers organised by the study group of the German Society for Marine Research (DGM). Session leaders are called to apply. This event addresses all young marine scientists and engineers from all disciplines of fundamental and applied research, industry and other relevant fields coming from Germany and the rest of the world.
http://su.pr/27sPP3

Most Shared

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

1. Surveying Z-Boat Visible in Google Earth - http://su.pr/2PDBFF
2. Costa Concordia Rock Not Charted or Erroneous Navigation - http://su.pr/1LMzVE
3. Five-year Offshore Contract - http://su.pr/66K7Cu
4. High-frequency Side-scan Sonar - http://su.pr/5A3NtF
5. HUGIN AUV System for FUGRO Survey - http://su.pr/3uPbQj

Mapping and Monitoring French Coastal Stretches

Blom's Italian-French subsidiary has signed a contract with the Finistère Department and the Provence-Alpes-Côtes d'Azur Region to map and monitor stretches of the Atlantic and Mediterranean shores in France to produce a seamless DTM. Blom will use bathymetric and topographic laser scanners to collect accurate data simultaneously from both land and seabed terrain, delivering the response that 21st-century decision-makers need. The contract is in the scope of the Litto3D project. Litto3D, a SHOM (Hydrographic and Oceanographic Service of the Navy) and IGN (National Geographic Institute) programme, aims to produce a seamless digital terrain model of the entire French coast, covering more than 5,500km in length, and will feature at the core of all integrated coastal management projects.
http://su.pr/8y4beL

Mapping the French Mediterranean coastline.

Met-ocean Equipment Takeover

MIROS AS, Norway, has acquired Muir Matheson in Aberdeen, UK. Muir Matheson, which has been in the marketplace for almost three decades, has a well-known brand and has delivered met-ocean systems all over the world. Both companies are seeing an increased demand for weather stations, meteorological and oceanographic systems able to operate in harsh weather conditions in offshore projects.
http://su.pr/2twzaw

Youth Forum Considers Ideas for Baltic Blue Growth

Thirty students from nine countries of the Baltic Sea catchment area gathered to discuss ideas on blue growth and green limits in the HELCOM Youth Forum 2012 in Rostock, Germany. The potential decision-makers and top scientists of the future had the chance to interact with high-level professionals and a Resolution was adapted. The three-day event was organised by the Baltic Sea Forum and the University of Rostock.
http://su.pr/18kJRY

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

Marine Institutes Co-operate to Improve Ocean Knowledge

Hydro International interviews Peter Harris

Peter Harris outlines how hydrography contributes to marine science. Seafloor mapping forms the basis for almost all marine research programmes. Mapping of the seafloor assists science in designing a seafloor sampling programme, understanding processes like sediment transport and tectonics and in identifying benthic habitats. The education of hydrographic technologies should therefore also play a larger role within scientific education. As a marine expert, Peter Harris has worked with a multi-disciplinary team to design Australia's national representative system of marine protected areas and is currently working on the United Nations World Ocean Assessment that is scheduled to be completed by 2014. The oceans are our future in many respects and while we depend upon ocean resources there still remains much to explore and understand to enable us to derive the maximum benefits for humanity while protecting our oceans.

Mark Pronk
Technical Editor,
Hydro International

Do mapping agencies have environmental aspects on their agenda?
Since the beginning of modern oceanographic exploration about 150 years ago we have learned much about the oceans, but there is still much more to learn. It has been said many times; 'we know more about the surface of the moon or of Mars than we know of our own oceans' and that statement is true. Given the importance of the oceans for humanity, this gap in our knowledge is a concern and so the environmental aspects of the oceans should be on everyone's agenda!
As the president of IHO mentioned during his keynote address during the conference Hydro12, the survey fleet worldwide is decreasing and thus we have to become even more efficient with the available survey programmes in order to optimise the use of data collected. Hydrography provides an essential framework for marine science. Without an accurate bathymetric map of the seafloor, it is impossible to design a sampling programme or to know where to place an oceanographic mooring. Therefore, it would be beneficial to integrate marine science and hydrographic survey programmes as much as possible. I think mapping agencies will need to involve themselves more in multi-disciplinary surveys, that include oceanographic, environmental and hydrographic data collection, integrated into one programme.

Will there be a closer focus of hydrography for benthic mappers?
The key is to map once and use the data in many different ways. The collection of data at sea is quite costly and many organisations active in the marine industry still use the collected information only for their own specific purpose; the collected data stays within the organisation itself. Benthic habitat mapping is only one of the many possible applications hydrographic data could be used for; think of defence, wave and

tide computer modelling, fisheries and the oil and gas industry. The converse of this point is that bathymetric data collected for scientific purposes could (and should) be collected at a standard acceptable for hydrographic purposes whenever possible. Collecting the data to the highest possible standard means that it can be used by others for the benefit of society.

Should hydrographic data become freely available as well?
A lot of the data collected by national hydrographic services are under the control of the military. Such data are often classified and not made public. Private industry also owns enormous amounts of marine information, including bathymetry that is not publicly available for commercial reasons. Science would greatly benefit from having access to such hydrographic data, even if the data were only released at a lower resolution that would not conflict with confidential industry or military applications. For example, my agency Geoscience Australia, has an agreement with the Royal Australian Navy Hydrographic Service to use their data to produce a national bathymetric model at 250m grid resolution. This resolution is useful for most oceanographic modelling purposes and assists scientists in better understanding our oceans and contributes to better government decision-making for ocean management, but does not conflict with military uses.

In what way could the commercial marine mining industry further contribute to marine research?
Mining industries, such as the oil and gas and aggregate mining industry are already collaborating with marine scientists in many countries through different programmes. Examples from the oil and gas industry include the international SEA-SERPENT programme that gives scientists access to industry-owned remotely operated vehicles (ROVs) to conduct research and in the UK, 3D seismic data is shared to derive bathymetry for scientific research purposes. The marine aggregate mining industry in the UK has funded research into the recovery rates of disturbed habitats, providing valuable information on ecological succession processes. I think these examples of collaboration between science and industry should be encouraged and expanded as much as possible.

The key is to map once and use the data in many different ways

Which international body should regulate and monitor our oceans?
Decision-making for the oceans starts at local level and extends to the global level. If we take beach littering, for example, decisions need to be made at certain levels of the government (eg. local to state levels). Fisheries management might involve different levels of government. International agreements are needed to regulate human activities on the high seas. The point is that no single organisation can manage all ocean issues. Assessing the condition and health of the oceans also takes place at different scales and involves different organisations. The United Nations is in the process of conducting a World Ocean Assessment, involving several hundred marine experts, that will attempt to pull together many of the existing national and regional assessments to produce a global synthesis by 2014.

What role does hydrography play for educational programmes for marine scientists worldwide?
Multi-beam sonar mapping is to the marine scientist what satellite remote sensing is to the terrestrial scientist. Acoustic technology provides us with the means to map and image the ocean floor accurately over a range of spatial scales and resolutions. Multi-beam systems have become standard equipment used by marine industries and research scientists. Therefore, education and training in marine science and engineering now includes training on how to operate multi-beam systems and how to interpret multi-beam data using software that is itself undergoing rapid development. The science of hydrography, I think, is a natural, essential part of such training.

Peter delivering a keynote address during Hydro12 in Rotterdam. (Image Courtesy: Holger Klindt).

Peter Harris is a senior marine science advisor for Geoscience Australia in the Environmental Geoscience Division. He is currently seconded by the Australian government to UNEP/GRID, based in Arendal, Norway. He is leading the development of a web page and creating a new global seafloor geomorphology map to support the United Nations World Ocean Assessment. In his 30-year career he has worked in three main research area's; coastal and shelf oceanography and sedimentology; Antarctic palaeoenvironments; and seabed mapping applications to biodiversity conservation and marine zone management. He is a founding member of the international GeoHab organisation (www.geohab.org) and has edited a book on seabed habitat mapping: *Seafloor Geomorphology as Benthic Habitat*, published by Elsevier.

What current emerging hydrographic technologies are of great use for benthic mappers at the moment?
Although there are many interesting new and emerging technologies, autonomous underwater vehicles (AUVs) is one technology that is currently under rapid development. Improvements in navigating AUVs plus onboard systems like high-frequency multi-beam sonar and video systems, together with object recognition algorithms and other analytical tools, have been rapid and impressive in the last decade. AUVs can perform repetitive surveys over the exact same patch of seabed to accurately measure changes in species and monitor changes in ecosystem health. This means we now have a tool that can be used to measure and monitor the performance of conservation measures taken by governments, to determine whether or not an MPA meets expectations and so forth. I think we are entering an exciting period of new technologies for hydrography and marine management.

What about water column visualisation?
This is a relatively new application of multi-beam sonar technology that is very interesting as it allows us to image features in the water column, for example, gas escape features. We can then study, in combination with other survey information, the life around gas seeps and vents. Other life in the water column can now also be visualised, although some species might not be detected, such as, for example, jelly fish. This topic raises the point about what data to record, since I think some mapping agencies do not record backscatter data, for example, while conducting bathymetric surveys. All data that is recorded by multi-beam systems should be stored, if possible, because it is difficult to predict what uses we may find for it in the future.

What kind of technological challenges is the benthic industry still facing at the moment?
There are currently several issues that are challenges for us. One of them is having technology available to be able to share marine spatial information, such as bathymetry. Huge file sizes combined with varying equipment formats, different gridded products having undergone varying degrees of QC, in different projections using different base levels makes for a confusing mix when one attempts to design a data sharing system. This so-called 'interoperability' issue is related to interagency agreements on standards and protocols, but it involves hydrographers' knowledge and experience too.


Peter Harris in Norway.

Related to this is also the challenge of how to handle the decreasing number of government survey and research vessels around the world, coupled with the need to train the next generation of marine scientists and technologists. Australia is currently building a new 90m research vessel to meet the needs of our government, education and marine research organisations. It will be a challenge to attract the right mix of proposals that will make optimal use of the vessel's capabilities, combining multi-disciplinary research with teaching to meet national science goals.

What message would you give to our younger generation?
Twelve people have set foot on the moon, but only three have been to the Mariana Trench, the deepest part of the ocean (the third visitor to the Mariana Trench, James Cameron, made his visit in March 2012). The oceans, for the most part, are yet to be explored and there are huge opportunities for new discoveries and exciting new science using technologies that are yet to be invented. These discoveries await the next generation who will live in what perhaps will be the most exciting times for ocean research.

Multi-beam sonar mapping is to the marine scientist what satellite remote sensing is to the terrestrial scientist

Imagery-derived Bathymetry and Seabed Classification Validated

UKHO Sponsors Pilot for Satellite Imagery-based Survey in Mediterranean

Proteus FZC, EOMAP and DigitalGlobe have formed a partnership to bring satellite-derived bathymetry and seabed classification to the hydrographic community. A pilot conducted by UKHO in the Mediterranean confirms that the satellite-based process yields depth and seafloor information faster and more safely than traditional hydrographic survey methods in the shallow-water environment.

Helen Needham, Hydrographic director, Proteus FZC, UAE

Dr. Knut Hartmann, Project manager, EOMAP, Germany

Graham Mimpriss, United Kingdom Hydrographic Office, United Kingdom

IN SUMMER 2012, THE UNITED Kingdom Hydrographic Office (UKHO) contracted the Proteus-led team in a pilot trial of satellite-derived bathymetry and seabed classification to assess the quality and the potential for satellite-derived bathymetry as a data gathering technique in the very shallow-water or nearshore environment. The UKHO are interested in using new techniques to enable them to update charts in remote areas more frequently and more efficiently than solely relying on waterborne methods.

Two project sites, one comprising a 50-km stretch of coastline (Area A) and another about half that size (Area B) were identified in the Mediterranean for the pilot. Per instructions from UKHO, the Proteus team was required to work entirely remotely with no access to horizontal and vertical ground truthing data and to achieve depths from the zero contour or surf zone to the maximum depth possible.

Coastal Blue Band Makes the Difference

This project and the process tested were made possible by the launch of DigitalGlobe's WorldView 2 satellite. This high-resolution satellite captures eight multispectral bands of imagery, and most notably includes the coastal blue band, see Figure 1. All bands are utilised for bathymetry and determining seabed type through seabed classification extraction, however, the introduction of the coastal blue band starting at 400nm has significantly improved this technology and brought this methodology as an alternative solution to the hydrographic sector.

DigitalGlobe has a vast library of multispectral imagery providing global coverage to the hydrographer. For this project, participants decided to task the satellite by capturing a new image for the two survey areas. Dedicated tasking parameters were calculated and assigned to the project. The angle of the satellite camera is an important variable when capturing an image for bathymetry applications, so team members tasked the satellite to acquire images with a maximum incidence angle of 30° from nadir.

Suitable imagery was captured for the areas with minimal cloud cover and favourable environmental conditions. For this type of application, desired conditions include little or no wind so as to minimise turbidity in the shallow waters near the shore. The satellite images a total coastline length of over 100 kilometres with a survey time of less than 10 seconds.

New Processing Technique

Imagery was downloaded from the satellite within 6-24 hours of capture and delivered to EOMAP for processing. The imagery was quickly assessed for quality and suitability for hydrographic purposes. In this instance, excess cloud cover obscured the northern section of Area A which required acquisition of another image.

The UKHO chose to apply tidal corrections itself using tidal gauge data available over the internet. This required the project technicians to deliver bathymetric results for the time collected. This actual tidal data improved the vertical accuracy of the measurements.

EOMAP has developed an in-house processing suite called the Modular Inversion and Processing system, or MIP. This proprietary program extracts seafloor reflectance and converts this into water depth and seabed classification measurements. MIP is designed for the physical based recovery of hydro-biological parameters from

multi- and hyperspectral remote sensing data and used for environmental mapping of aquatic shallow and deep water of inland waters, coastal zones and wetlands.

The architecture of the program binds a set of general and transferable computational schemes in a chain, connecting bio-physical parameters with the measured sensor radiances. The schemes include a number of algorithms to extract the depth information from the imagery. Atmospheric, sun glitter, water surface and underwater bidirectional effects of the underwater light field are all accounted for, as depicted on Figure 2.

The flow line incorporates a number of correction factors. The multispectral signals are subject to refraction and absorption through the atmosphere and water column. These need to be accounted for to establish seafloor reflectance value before converting reflectance into depth and seabed classification data.

The bathymetry processing flow line is sensor independent, allowing different hyperspectral and multi spectral imagery to be used. WorldView-2 multispectral imagery has a resolution of 2m and the eight-band multispectral bands provide better vertical accuracy and depth penetration than previously seen.
The seabed classification processing line is based on either supervised or unsupervised classification methods. For this project no ground truth data was made available for either bathymetry or seabed classification, and hence extraction was undertaken on an unsupervised basis.
In contrast to the land classification, the satellite input image was not only corrected to atmospheric influences, but also to the effects of sun reflectance on the sea surface and the effects of the water column. This unique semi-automatic approach was developed and maintained by EOMAP and implemented in MIP. The program processed radiance satellite imagery and outputs a bottom reflectance image, which represent the reflectance of the sea-surface bottom without the effects of water column and atmosphere, see Figure 3.

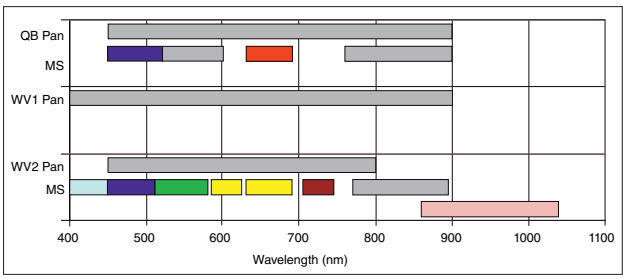


Figure 1: DigitalGlobe's Quickbird, WorldView-1 and WorldView-2 multispectral and comparison.

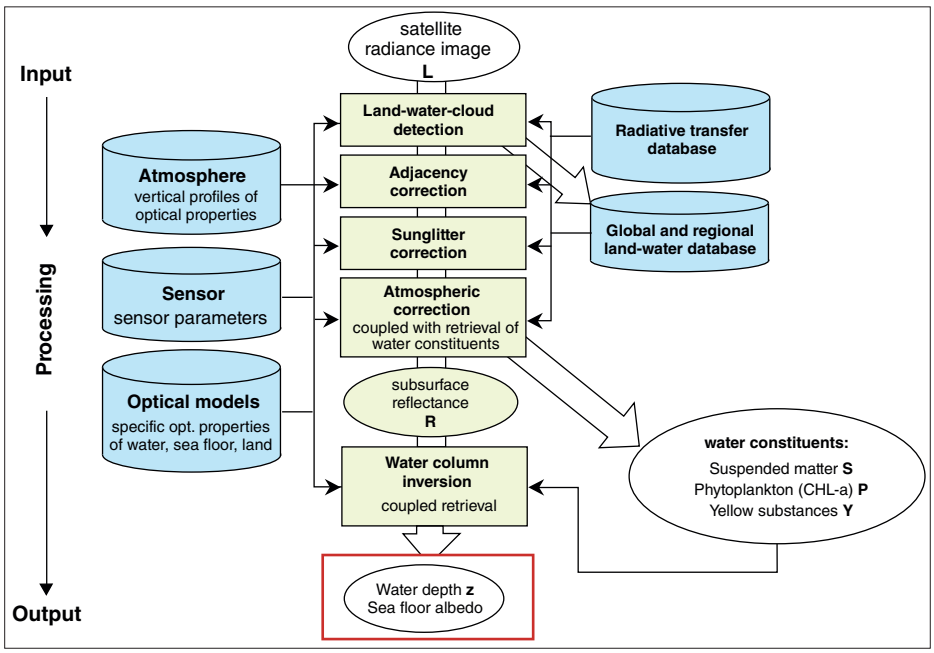


Figure 2: Scheme of the Modular and Inversion Program. Input: Satellite radiance image; Output: Water depth information and seafloor/bottom reflectance.

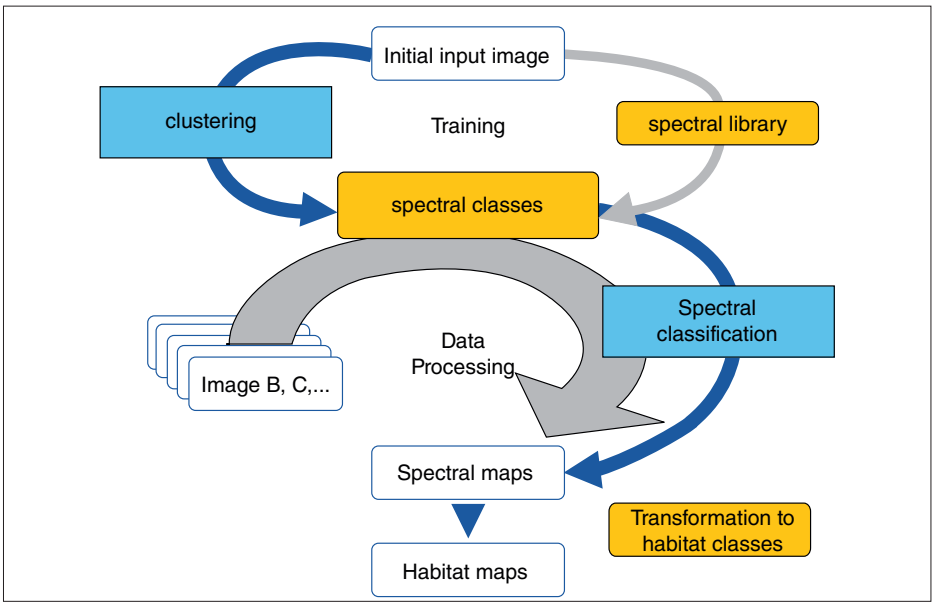
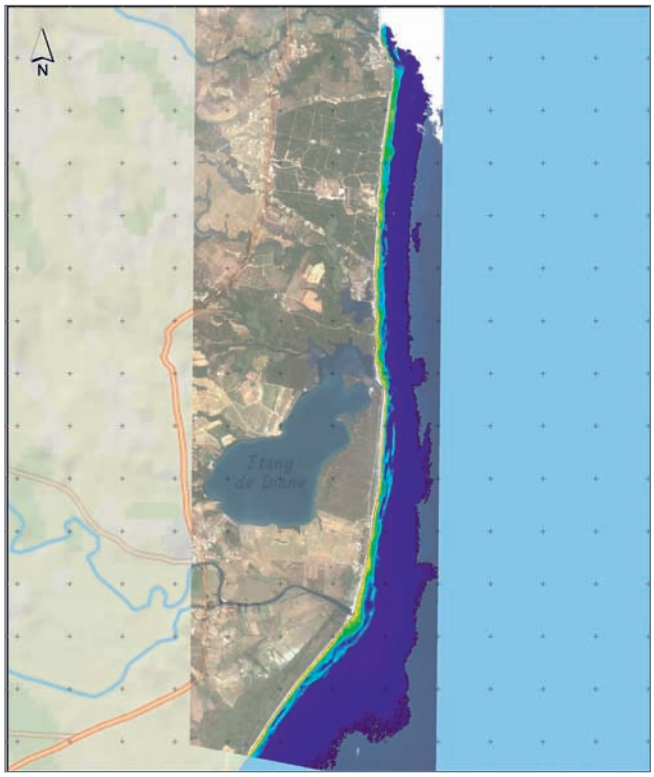


Figure 3: Scheme of the unsupervised classification method. Input image: Seafloor/bottom reflectance.

Faster, Safer Results

Proteus delivered bathymetry and seabed classification mapping, high-resolution satellite imagery, quality mapping, metadata and technical reporting to the UKHO where they undertook a comprehensive review of the results. The UKHO used historical single beam data from acoustic devices to compare the results.

Bathymetry covered nearly 100% seafloor coverage, with the exception of surface objects e.g. vessels and navigation marks. Objects with the size



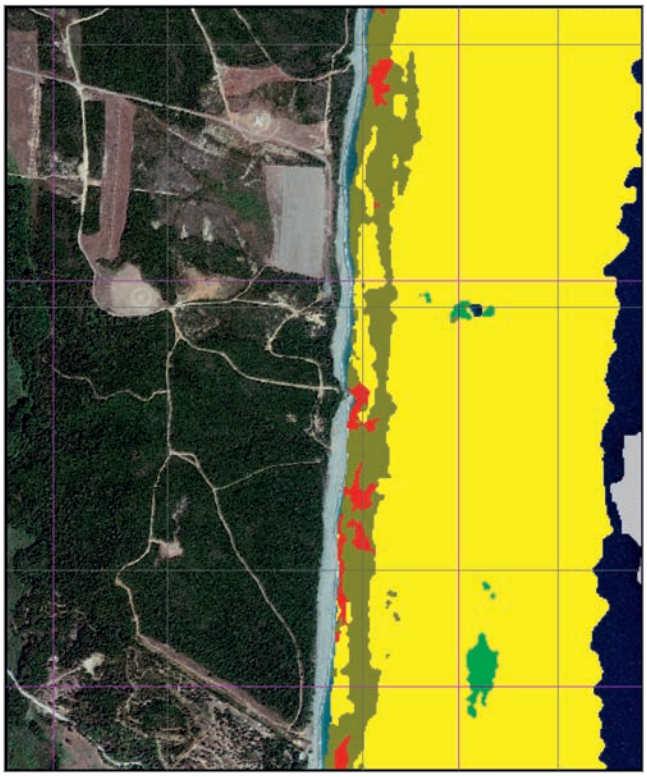


Figure 4: Bathymetry for subsection of area A, with detailed bathymetry.

Figure 5: Detailed high-resolution seafloor classification for Area A.

of greater than 4m were detected and mapped. Despite the no ground control restrictions required by the UKHO vertical accuracies achieved were 10 – 15% of water depth and a positional accuracy of 10m CEP 90% were seen. However, a small amount of ground truthing data would have comfortably seen an accuracy improvement to 10% of depth and 6.5m 90% CEP would have been achievable. Seabed classification was also successful, with four seabed types being identified; sand, rock/debris, vegetation and mixed seafloor (mainly vegetation). The 2m resolution seafloor mapping supported and corresponded with the bathymetry and provided essential information for hydrography, scientific or engineering applications.

Figure 4 shows the bathymetry results, with depths ranging from 0.1m to 10m, after 10m the turbidity of the water column slightly reduced the overall accuracy, but still provided results acceptable for this application. Figure 5 shows the seafloor classification for the same area. With four seabed types being identified and mapped to a high resolution, these being sand, rock/debris, vegetation and mixed seafloor (mainly vegetation).

In areas where the turbidity exceeded the tolerances of the processing system the depths recorded aired on the side of safety. When the satellite depths were compromised by the environmental conditions then the system reported shoal depths, thus erring on the side of safety.

A crucial metric used in judging the pilot's success was timeliness. The entire project, even with re-acquisition of some imagery, was completed in eight weeks. The same project would have taken months if it had been undertaken with traditional acoustic hydrographic surveys, which have inherent dangers operating in the shallow, near-shore environment of the Mediterranean.

Bathymetry covered nearly 100% of the seafloor

Lessons Learned

Project participants learned several lessons during the course of this pilot in the Mediterranean.

- Using multiple satellite images would increase the point density and enable a shoal bias product to be created. This would increase the cost of the product; however, it would also increase the safety element for survey or engineering applications. An average depth value is suitable for environmental/engineering and marine resources planning applications, however, for some advanced applications a shoal depth is required.
- Stationary surface objects provide valuable information for this application, however, moving objects e.g. vessels would prefer to be removed from the bathymetry and reported separately on their characteristics, size; direction and speed of vessel.

Satellite tasking parameters are location and time dependent. They are important for survey planning and considered when trying to produce the highest degree of vertical accuracy.

Conclusion

Without the use of ground control data for horizontal and vertical referencing – as dictated by the project guidelines – the results are reliable and consistent to 10-11m water depths throughout all of the areas of interest where environmental conditions have allowed. Quality mapping is an essential deliverable for users when viewing and working with the deliverables.

For the purpose of survey reconnaissance and survey planning, this technique has delivered results good enough for serious consideration as a rapid, cost effective alternative to airborne and waterborne survey techniques in many environments. Being able to survey considerable volume areas quickly and remotely is a cost-effective and safe solution.

DigitalGlobe's archive of recent imagery, EOMAP's technology and Proteus's expertise enables bathymetry and seabed classification data to be produced within weeks. In the event of tasking the satellite for new imagery, the project life cycle is extended, but this process is still faster and has considerable advantages over traditional methods.

The same project would have taken months with traditional acoustic hydrographic surveys

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The Authors

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No More Spatial Misinterpretation

Capturing an Entire Maltese Islands' Territory

Malta, the smallest European Union state, has carried out a country-wide hydrographic survey which was initiated in Q1 2012 and completed in Q4 of the same year. Aimed at acquiring baseline information that satisfies a number of key National and European Directives including the Water Framework Directive, the central Mediterranean state took the ambitious step of employing different technologies within one project in order to ensure compliance.

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AN INABILITY TO COLLECT BASE physical data on which to build reliable thematic environmental data would not only make Malta more exposed to various environmental pressures due to poorly informed policy decisions, but also subjects the Islands to heavy economic penalties for non-compliance with EU reporting obligations. As part of the process to implement the EU legislative framework in the fields of air, water, noise, soil and radiation, Malta sought to enhance the quality of the environmental data and its interpretation. This depends to a large extent on the underlying spatial base data, as this underpins the operation of environmental monitoring programmes and is essential to the analytical and decision-making processes. This was deemed true for both terrestrial and bathymetric data acquisition related to environmental monitoring.

Data Dearths

A base study identified that whilst some basic bathymetric data was available from legacy nautical charts, such data needed to be updated to higher resolutions so as to be suitable for environmental modelling and EU reporting purposes. This was also the case for terrestrial high-definition data which were both lacking and where available in low resolution and dated currency. No comprehensive and detailed terrestrial and bathymetric 3D surveys have ever been carried out in Malta. The resulting lack of high-quality 3D spatial data was hindering land use planning, environmental monitoring and management processes that rely on such data. The target to address this lacuna was actuated through the delivery of high-resolution 3D terrestrial data coverage for the Maltese Islands using a

Nautical charts can now be created in high definition

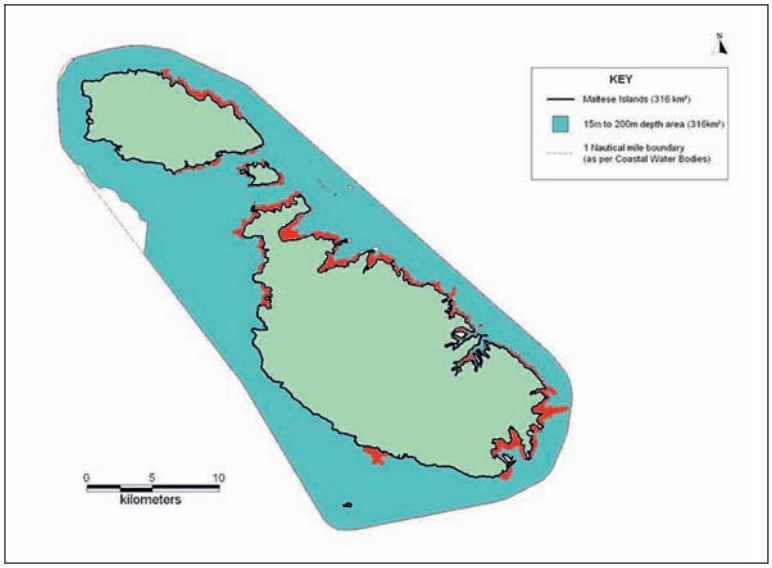

Figure 1: Areas under study. The Blue area depicts the bathymetric side-scan zone, the brown depicts the bathymetric Lidar zone and the green depicts the terrestrial Lidar zone.

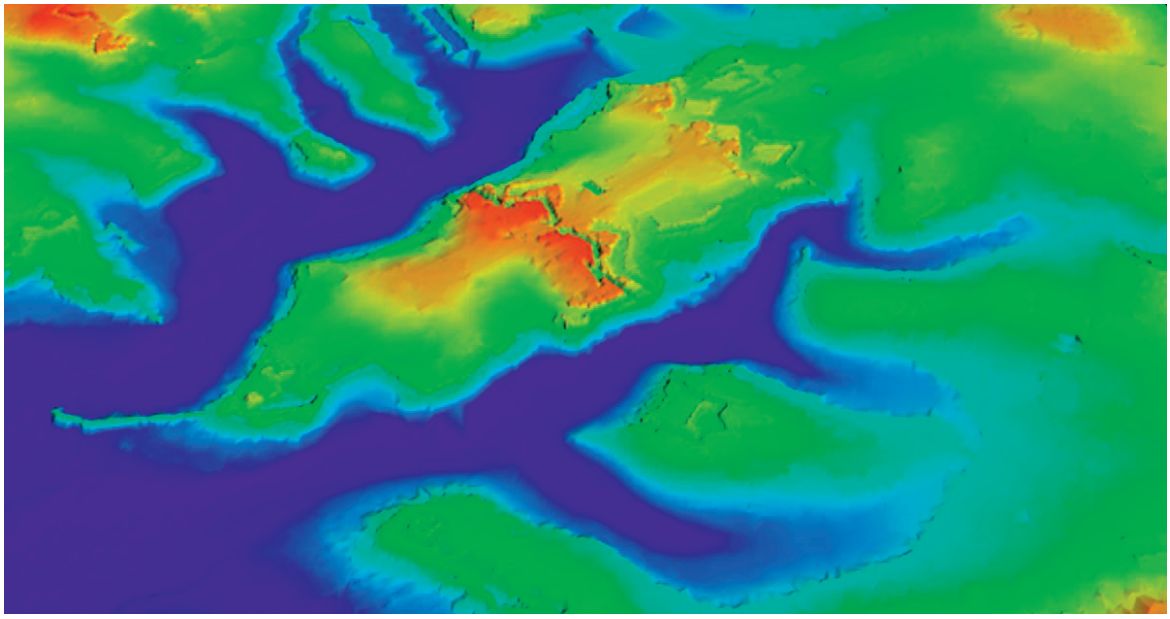

Figure 2: Terrestrial Lidar (Grand Harbour) – Image courtesy: Terraimaging.

combination of Light Detection and Ranging (Lidar) data and oblique aerial imagery, as well as through a bathymetric survey of coastal waters within 1 nautical mile (nm) radius off the coastline, using a combination of aerial Lidar surveys, acoustic scans and a physical grab sampling survey (Figure 1).

Acquisition Vehicle

This was made possible by implementing a EUR 4.6 million project, entitled Developing National Environmental Monitoring Infrastructure and Capacity, a project co-financed by the European Regional Development Fund, which provides 85% of the project's funding and the Government of Malta, which finances the remainder under Operational Programme 1 - Cohesion Policy 2007-2013 - Investing in Competitiveness for a Better Quality of Life. Whilst the project focused on strategies in the different environmental domains, the scans played a major role in acquiring the main baselines.

Aerial Conveyors

The four main activities emanating from this project were entrusted to Terraimaging, with subcontractors Pelydryn (UK) and AquaBioTech Group. The main acquisitions pertaining to the geo-information were comprised of 4 activities. Activities 1 and 2 targeted a terrestrial Lidar survey and imagery in addition to oblique imagery which rendered high-resolution data for land cover and land use analysis for forward planning. The Lidar exercise resulted in a DSM and DTM aimed at a 1 points/m^2 but actually resulted in a surprising 4.3 points/m^2 and a height accuracy >5cm (Figure 2). This was enhanced by an image acquisition employing an IGI DigiCam with a GSD of 16cm, whilst the oblique imagery had a spatial resolution of 15cm and employed a VisionMap A3 camera.

The integration of a huge dataset into a single system that spans multi-domains

Bathymetric Conveyors

Activity 3 comprised a bathymetric Lidar survey which was deemed necessary to ensure that the data lacunae experienced in the nether zone between the coast and the deeper sea as reached by boat-based surveys is captured. The requirements stipulated a minimum 5m overlap between bathymetric airborne Lidar and the swath bathymetric survey for quality assurance purposes as well as delivery of post-processed data in fulfilment of the IHO requirements.

The technology used was based on HawkEye IIb (AHAB) that operated at 1Khz frequency for the bathymetric area and 8Khz for the topographic zones. Interestingly, what was originally requested up to a depth of 15m resulted in a 50m depth return with a post spacing of 2 x 2m (Figure 3). Data was delivered in ASCII XYZ format file and a DSM. The final activity consisted of an acoustic and bathymetric survey from a sea-going vessel. The main aim being the Water Framework Directive specifying studies within 1 nautical mile from the Maltese

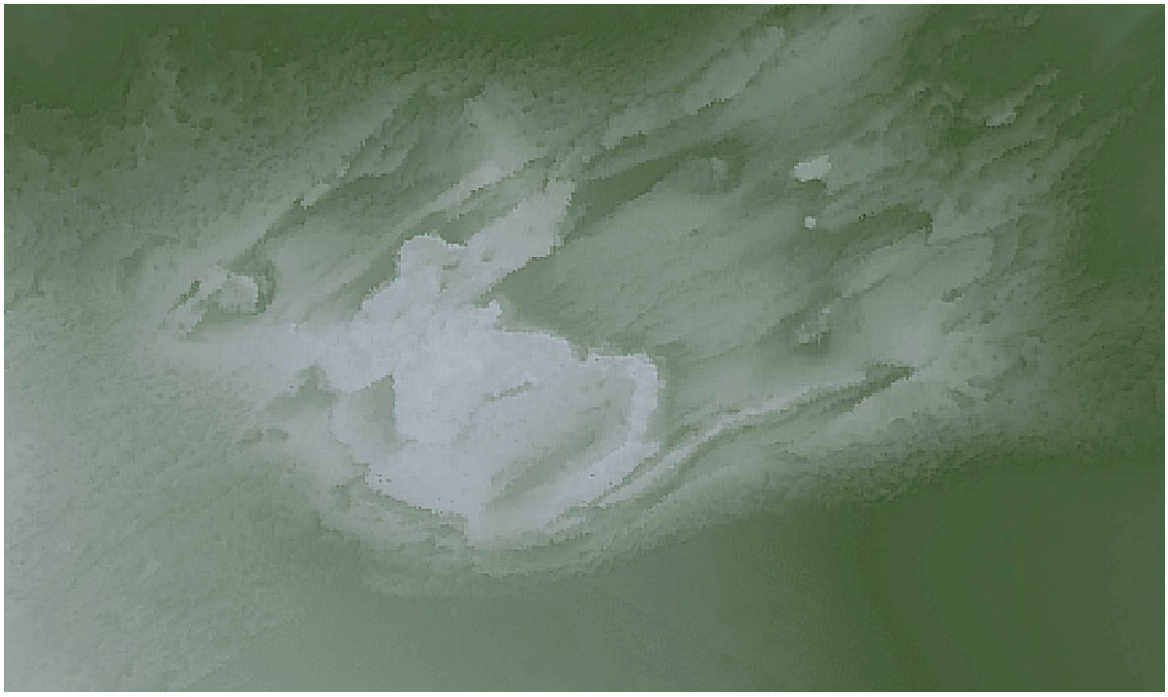

Figure 3: Bathymetric Lidar: Rock formations.

Predictive planning and scenario building within the environmental domain was made possible

baseline coastline, resulted in the need for a survey of the coastal water at 15m to 200m depths. The technology used was side sonar with ground truthing carried out to determine the type of sea bottom as well as grab samples being taken where the ground changes. This was required to ensure the collection and on-site visual analysis of the sediment samples.

Applications

The integration of the datasets and imagery into a homogenous spatial infrastructure can now allow for analysis and policy making in the realms

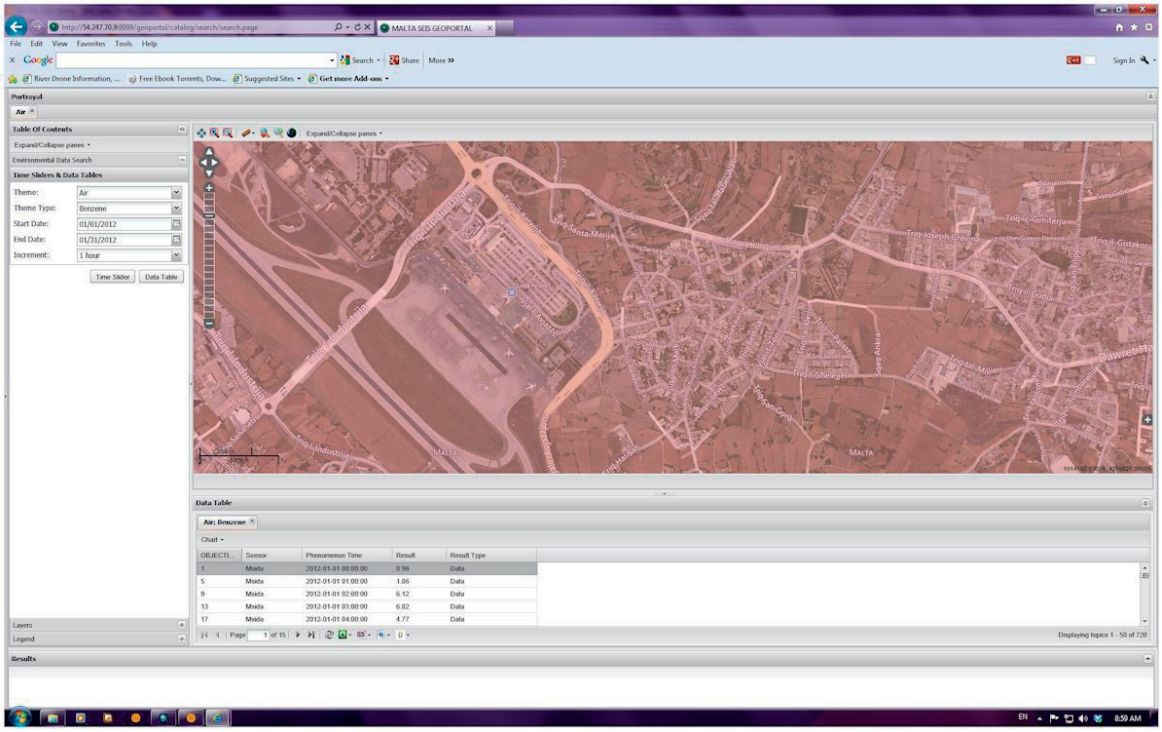

Figure 4: Shared Environmental Information System Interface.

of spatial planning and environmental protection due to its potential to create valley networks, watersheds, view sheds, line of sight, risk maps and a plethora of other outputs as well as aid in the planning of major projects such as offshore wind farms, wave energy generators and potentially land reclamation. In addition, nautical charts can now be created in high definition. Predictive planning and scenario building within the environmental domain is made possible through the integration of data on noise, air pollution and water runoff. The data will be disseminated free of charge post Q3 2013 on project closure through a Shared Environmental Information System (Figure 4).

Lessons Learnt

Lessons learnt from this project predominantly focus on the rapid changes experienced by technological change from project drafting to conclusion, to the client's benefit, and the potential for the integration of a huge dataset into a single system that spans multi-domains (physical-environmental-social, amongst others). Of course, one cannot ignore the difficulties encountered in managing a multi-thematic project that spans technologies and detailed requirements that few companies may be able to provide. The latter may result in project loss although the main positive aspect pertains to the potential for consortia to be set up, as effectively happened in Malta.

Planning the Next Steps

The next steps include a drive to rerun the bathymetric and terrestrial scan to enable change analysis, the commissioning of a street-level terrestrial Lidar scan in full colour as well as the commissioning of a ground-penetrating radar scan of the Maltese Islands which would ensure the completion of a full structural dataset covering the entire territory.

The Author

Saviour Formosa is a senior lecturer at the University of Malta. His main area of research is in spatio-temporal analysis of social and physical relationships using spatial information systems. His expertise lies in the implementation of cross-thematic approaches and uses to the data cycle with emphasis in the thematic and spatial data structures, visualisation, modelling, web-mapping, and dataflow management. He has led projects on Aarhus, INSPIRE, ERDF, ISEC, ESPON and serves as contact point for various international fora. Dr. Formosa has a PhD in spatio-temporal environmental criminology (University of Huddersfield 2007), having previously obtained an MSc in GIS.

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Fluid Mud and Determining Nautical Depth

A Case Study

Ships are getting larger, dredging costs for maintenance are increasing and permits for disposing harbour sludge are increasingly difficult to obtain. An objective evaluation of harbour maintenance practices is therefore justified. Siltation of harbour basins decreases the nautical depth and maintenance is required to ensure safe shipping. The present techniques usually consist of dredging or other methods for removing sediments. Scientific research over the past decades and experience in seaports in the north of the Netherlands, Belgium and Germany have shown that a different approach, based on physical characteristics of mud layers, innovative surveying tools and strategies is feasible. This article presents an approach for determining the nautical depth for a sea harbour with fluid mud and or a muddy bottom layer which can be successfully related to a 'Keep Sediments Navigable' strategy of the PIANC Report 102 'Minimising Harbour Siltation'.

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IN MANY PARTS OF THE WORLD fluid-mud suspensions occur above the bottom of shipping routes creating difficulties in defining the navigational depth. When lead lines were used, the depth was recorded to the fairly solid bottom and any overlying mud layer was usually not detected. By introducing echo sounders, the water-mud interface was not always clearly defined. The interface shown on the records may depend on the instrument and the frequency used. The lack of a clearly defined water-mud interface can cause unnecessary depth restriction and possibly excessive dredging.

During the 25th PIANC Congress in Edinburgh, in May 1981, a working group was formed under the auspices of the Permanent Technical Committee II to prepare a short report which was to include: A definition of the term Nautical Depth, Methods of measuring the characteristics of bottom layers and a description of the effect of muddy layers on the manoeuvrability of ships. The results were presented in 1983 (Navigation in muddy areas, *Supplement to Bulletin no. 43*, PTC2 report of WG 03 - 1983 issue, MarCom Working Group 03).

Safe navigation depends on a combination of ship characteristics, harbour lay-out, flow and wind conditions as well as thickness and the rheological characteristics of the fluid mud layer.

Since 1983, a substantial amount of scientific research has been carried out by institutes in Belgium, Germany and the Netherlands to gain more insight into the behaviour and physical characteristics of fluid mud. Emden Harbour in Germany has 25 years of practical experience in conditioning fluid mud, a process whereby they radically changed the harbour maintenance from dredging and disposing to keeping mud navigable. Of great importance is also the scientific research carried out by Ghent University (Belgium) and Flanders Hydraulics Research (Belgium) on ship manoeuvrability in relation to fluid mud. This resulted in a validated computer model for ship simulations that allows harbour pilots to practice with the effects of different fluid mud conditions in a realistic virtual environment of their harbour.

Case study

The case study was carried out in the Dutch harbour of Delfzijl. The harbour is located in the north of the Netherlands close to the eastern German border, and bordering on an important marine nature reserve and World Heritage area, the Wadden Sea. The harbour board, Groningen Seaports, wants to optimise harbour maintenance. One of the aspects to be covered is to define and prove the optimal nautical depth. The following paragraphs present the approach chosen and the results. A word of caution based on experience; for acceptance of results of this kind of studies and for swift implementation of changes, open communication and participation of other stakeholders is required.

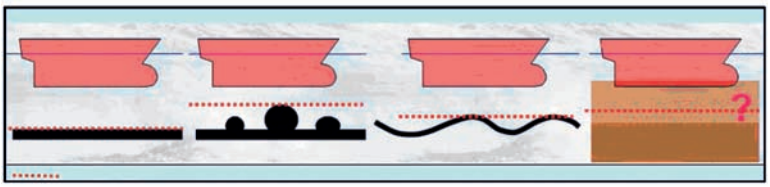

Figure 1: Definition nautical depth for different types of situations (Source: PIANC 1983).

Figure 2: Location harbour Delfzijl and lay-out (source: Groningen Seaports).

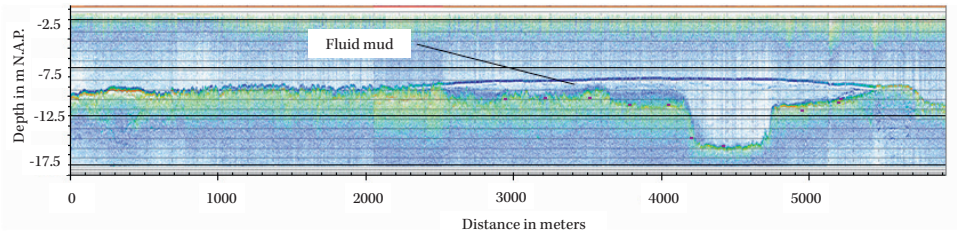

Figure 3: Parametric echo profile outer harbour showing the fluid mud body.

The harbour of Delfzijl

The harbour of Delfzijl consists of an outer part subdivided into three sections and an inner part linked by sea locks. The total surface is approximately 1,500 hectares, the depth of the seaports is 9m, the depth of the inner harbour is 5m. The outer harbour is parallel to the shore and has a length of approximately 5.5km. The range between low tide and high tide is approximately 3m.

Nautical Depth

According to PIANC (1997) the nautical depth can be defined as 'the level where physical characteristics of the bottom reach a critical limit beyond which contact with a ship's keel causes either damage or unacceptable effects on controllability and manoeuvrability.' Accordingly, nautical depth can be defined as: the instantaneous and local vertical distance between the nautical bottom and the undisturbed free water surface.

Within the muddy bottom layer the physical properties such as density and apparent viscosity increase with depth. At a certain depth a transition between the 'liquid' and 'solid' can be established. This transition, associated with specific critical density, could be considered as the nautical bottom. Density is the most practical measurable parameter for indicating the position of the nautical depth, however, not the most relevant. Investigations (Vantorre, 1994) have shown that the nautical depth was found in mud layers with densities varying between 1.15kg/l and 1.24kg/l to 1.3kg/l and that not density is decisive, but viscosity is a measure for the nautical depth. Investigations in the German harbour of Emden (Greiser and Wurpts) also conclude that the critical density is not the best parameter to define the nautical depth. According to the latest investigations, the nautical depth can best be defined by a physical parameter as the yield point (yield stress). At present, fluid mud agitation in the Emden harbour must be carried out when the following criteria are exceeded: maximum yield point 100Pa, maximum fluidisation viscosity 100Pa.s, Newtonian behaviour at shear stresses of maximum 500Pa.s.

Field survey

Over a period of approximately one year regular measurements were carried out in the outer harbour of Delfzijl. The measurements consisted of surveys (parametric echo sounder+dual frequency single beam (201kc and 33kc) and vertical profiling (Multisampler for turbidity+EC+Ph, DRDP for density and dynamic penetrometer measurements).

The dark blue line clearly shows the top of the fluid mud layer in the harbour entrance. Near the entrance is a mud trap. In the harbour entrance a sand bar is present before the bottom layer descends into the deeper entrance channel.

During each survey at predefined locations undisturbed samples were taken for laboratory analyses. For this purpose a dedicated piston sampler was developed with an air operated tube valve at the bottom. The maximum sample length was 2m. Based on the coupled density measurements and depth, sensor samples can be taken at various depth intervals. During the field investigations 10 surveys were carried out and approximately 1000 samples were collected for further laboratory analyses.

Laboratory tests

A large number of tests were carried

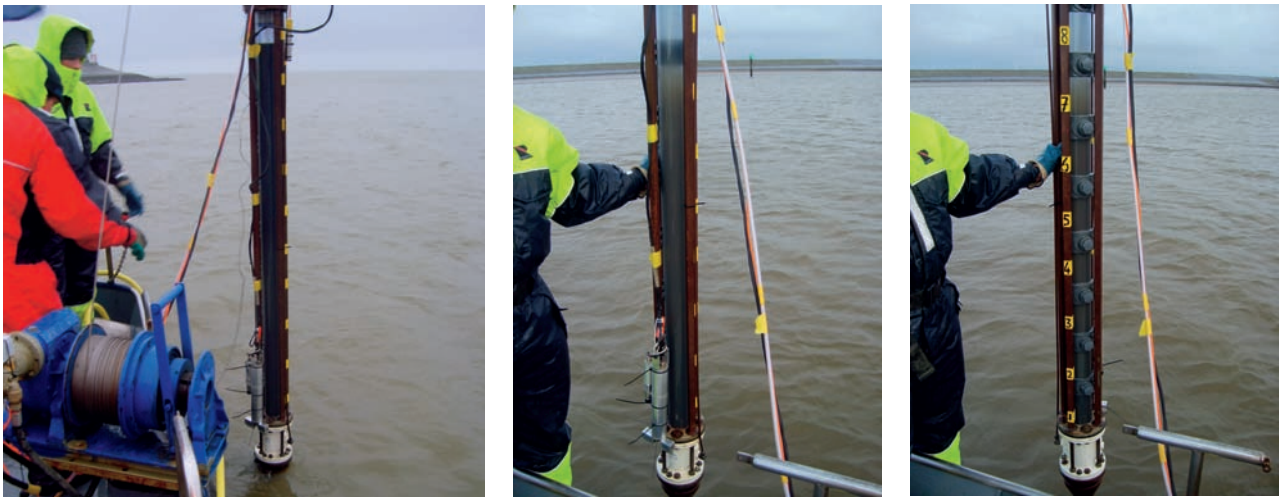

Figure 4: Fluid Mud sampling and simultaneous density profiling.

out on the collected samples. These consisted both of regular tests such as grain size distribution, water content, organic content, density, and specific weight but also rheological tests to determine the characteristics of the fluid mud.

The mud layer in the harbour of Delfzijl can be considered as fluid mud. The characteristics of the material are suitable for a 'Keep Sludge Navigable' maintenance dredging approach. The present characteristics of the fluid mud layer have not changed significantly during the investigation although no significant maintenance work was carried out further inland from the sand trap near the harbours entrance.

Simulation study

The presence of a mud layer in the port of Delfzijl in the Netherlands implicates a major restriction to the nautical accessibility of the port. At present, the maximum drafts for shipping traffic to Delfzijl are limited by a minimum under keel clearance with respect to the top of the mud layer. Laboratory tests indicated that a KSN approach should be possible. Simulator studies with local pilots were carried out to confirm these findings.

In 2008, a new consolidated mathematical model was implemented in the simulators of Flanders Hydraulics Research institute enabling the simulation of a vessel's behaviour above and in contact with any realistic mud layer. As a result of the availability of this model, Flanders Hydraulics Research was asked to investigate the influence of sailing at very low and even negative under keel clearances with respect to the mud layer on the inbound and outbound route to and from the port of Delfzijl. In addition, the mud layer characteristics (thickness, density and viscosity) were varied systematically. In order to perform the simulations as realistically as possible, local pilots experienced with the port of Delfzijl, participated in the study.

Simulations were carried out with a 1700 TEU vessel for which the mathematical manoeuvring models have been derived from comprehensive captive model tests performed in the towing tank for manoeuvring in shallow and confined waters (co-operation Ghent University and Flanders Hydraulics Research). During this experimental programme (2001-2004) the ship behaviour above and in contact with several mud layers was measured. The mud layers were simulated using paraffin's characterised by layer thickness, density and viscosity.

The simulator study revealed the possibility of working with a nautical bottom that is at a lower level than the top of the mud layer. This opens up the possibility for the port of Delfzijl to receive vessels with a larger draft in the future without the requirement of extra dredging efforts. In order to validate the conclusions from the simulator study, full scale testing was organised on site in the second half of

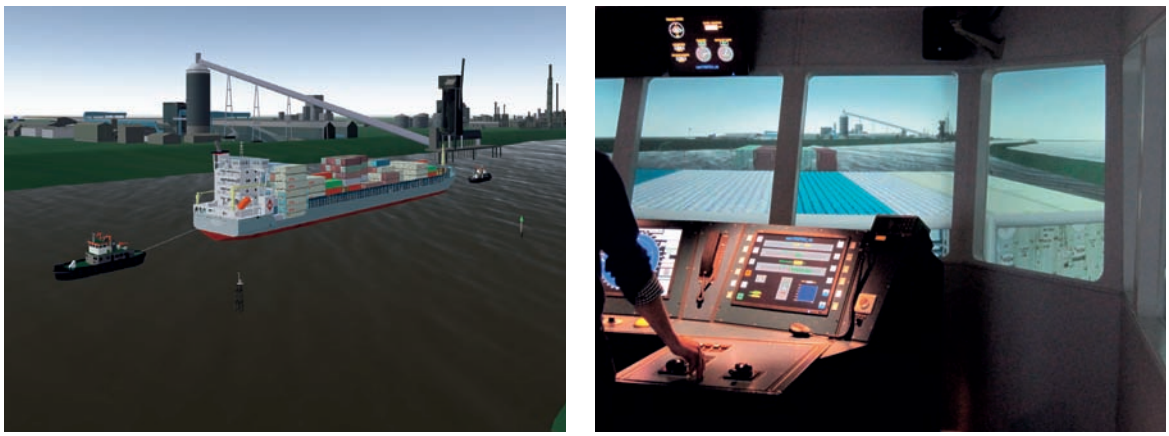

Figure 5: Impression simulation study.

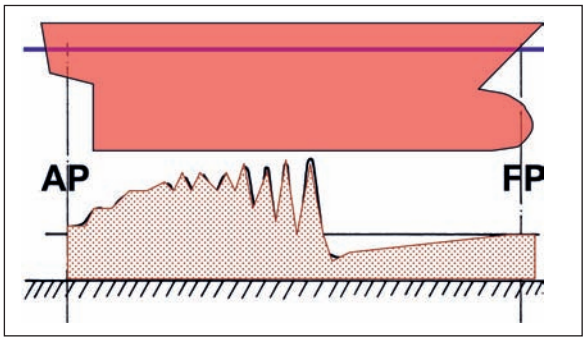

Figure 6: Interface motions: second speed range.

2012. Flanders Hydraulics Research were also be involved in this study.

Conclusions

Based on the results so far, definition of a lower nautical bottom and optimising harbour maintenance is possible in the harbour of Delfzijl as well as for other muddy ports. Due to the different aspects involved this requires a multi-disciplinary team as well as the early involvement of stakeholders. As safety is a primary concern for the harbour board, Groningen Seaports, full scale field tests will be carried out for validation, and after being successful, an optimised harbour maintenance schedule will be implemented.

Acknowledgement

The authors are most grateful to M. Vantorre from Ghent University, N. Greiser of Greiser und Partner, C. Laban of Deltares and C.J van der Made for their valuable contributions during the investigation and in the revision of this article.

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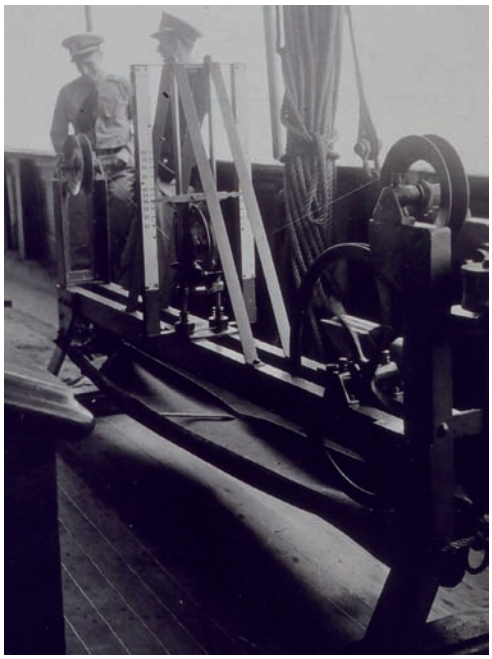
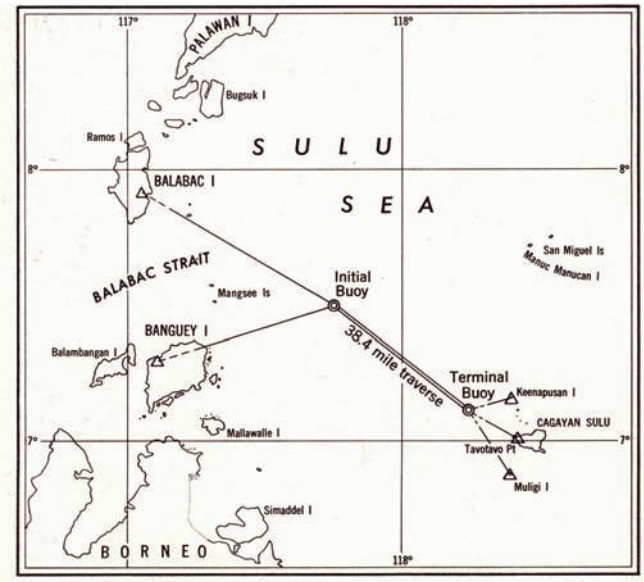
Taut-wire machine





TAUT-WIRE SUN-AZIMUTH TRAVERSE
A taut-wire sun-azimuth traverse, 38.4 miles long, was run in the Sulu Sea for locating Cagayan Sulu and for establishing hydrographic control.

Cagayan Sulu taut-wire diagram.

Locating Cagayan Sulu

The Last Taut-Wire Sun-Azimuth Traverse

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

A glance at a map of the Philippine Islands shows that the Sulu Sea is nearly an enclosed body of water: the Sulu Archipelago on the southeast; Palawan to the northwest; the main body of the Philippine Islands to the northeast; and Borneo on the southwest. Far in the southern reaches of the Sulu Sea, located almost midway between the Sulu Archipelago and Palawan and northeast of Borneo, are a small group of islands, the largest of which was known as Cagayan Sulu, today called Mapun. These small islands were among the most remote of the Philippine Islands and determining an accurate position of these islands for charting purposes was problematic. The position relied upon in the late 1930s was astronomically determined by British surveyors in 1889 but local navigators felt this position to be in error.

IN 1939, THE CHARTING AGENCY for the Philippines was the United States Coast and Geodetic Survey (USC&GS). The Survey had been working in the Philippine Islands for nearly 40 years at this time and had completed the triangulation of the main islands on the north, through the Sulu Archipelago on the east and down the spine of Palawan, across Balabac Strait, to Balabac Island on the west. Thus three sides of a great polygon enclosing the Sulu Sea had been completed. What remained was for the British to complete the triangulation of northern Borneo to enclose the Sulu Sea in a great trigonometric figure and allow for the adjustment of the total triangulation network of the southern Philippine Islands and northern Borneo.

Not coincidentally, completion of the triangulation of northern Borneo would have allowed a relatively easy tie to Cagayan Sulu. Accordingly, a request was made to the British Admiralty to complete the northern Borneo triangulation which was gladly agreed to. Orders were issued for the East Indies survey ship HMS *Scarborough* to execute this work. However, World War II intervened, and more important issues than the triangulation of northern Borneo determined that the ship and its crew would return to the Atlantic for convoy escort duty. This left the C&GS with the need to improvise, as not only were they planning on completing the polygon enclosing the Sulu Sea, but they also wished to better position Cagayan Sulu for control of hydrographic surveys in the southern Sulu Sea. An accurate geodetic position would have to wait until after the war, but a sufficiently accurate method to determine the position of these small islands for hydrographic surveying purposes was within the realm of possibility. This method was the taut-wire sun-azimuth method of measuring distance and direction between anchored survey buoys.

The taut-wire machine was invented by the English firm Telegraph

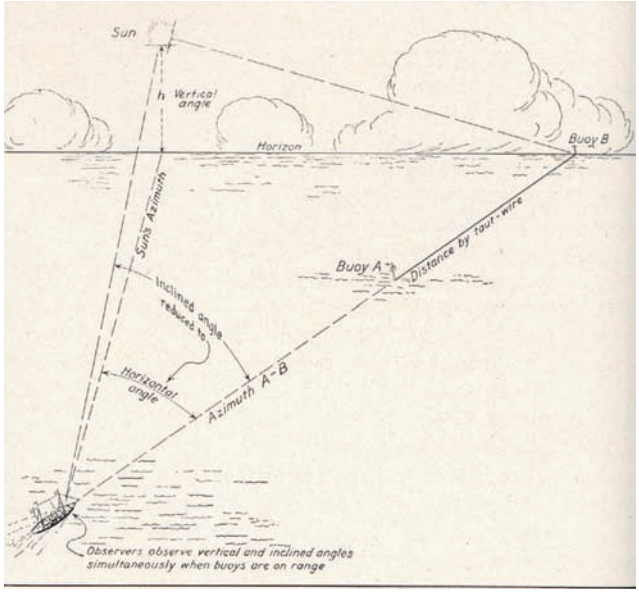
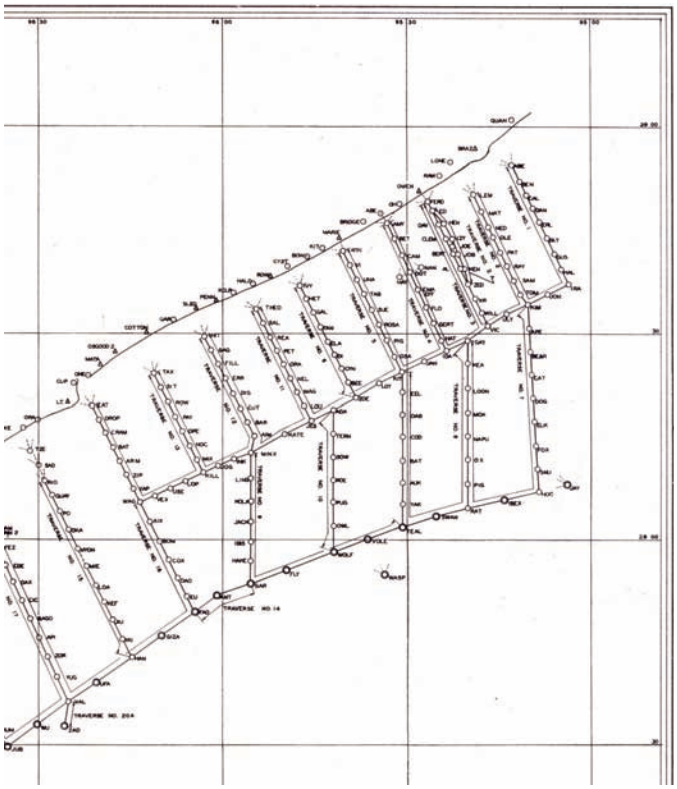


Diagram of a taut-wire sun azimuth controlled survey. This baseline measurement and triangulation allowed for positioning of buoys for visual, and RAR surveys far offshore.



Example of taut-wire buoy array established on the Texas coast in 1938. Over 250 buoys were established in this area for visual control of surveys on the continental shelf while radio-acoustic-ranging buoys were established past the shelf break for deepwater operations.

Construction and Maintenance Company and it was first used by British hydrographers in 1921. The machine was originally used to determine the geographic positions of buoys that would provide visual control for surveys far offshore. Conceptually, the method was quite simple: a wire measured the distance between buoys and sextant observed sun azimuths provided azimuth control for determining position. In practice, this was a relatively complicated operation involving a high degree of teamwork. While conning the ship to stay on range with two buoys of an array, the sun's altitude was observed simultaneously with the inclined angle between the sun and a two-buoy range to obtain the direction between the buoys. In practice, this involved many personnel including an officer-in-charge conning the ship to stay on range between buoys, an assistant on the bridge recording various associated data, observers reading and checking the taut-wire sheave, the inclined angle observer measuring the angle between sun and buoys on range, vertical angle observer measuring altitude of sun, angle recorder, pelorus attendant reading directions of on-range buoys off compass stand (for a gross check on observed sun azimuth), a helmsman, and a fathometer attendant for recording depths.

As practiced in the United States during the 1930s, taut-wire surveys were used extensively to establish buoy locations for visual control of surveys along the mid-Atlantic coast and Gulf coast of the United States. These were areas of wide continental shelf with low coastlines that made it impossible to carry traditional land-based visual control to the edge of the shelf. Radio acoustic ranging was also infeasible as the acoustic signal generally dissipated in the shallow water. The buoy arrays established in these areas were quite extensive. One array on the Texas coast had over 250 buoys planted in 1938 during the course of a survey season. When reaching the edge of the continental shelf, radio-acoustic ranging sono-buoys would then be placed for surveying in the deeper offshore waters.

The first step in implementing a taut-wire survey in the southern Sulu Sea was to purchase and install on the ship *Research* (formerly the *Pathfinder*) a taut-wire device and two reels of wire, each reel containing 140 nautical miles of piano-wire. Two plans were considered for positioning an 'initial' buoy. The first of these considered placing it in a location where a three-point sextant fix could be observed between triangulated peaks on Palawan, Balabac, and Banguey islands. A second plan was developed to position the initial buoy somewhere on the line of position determined by measuring the single angle between the peaks on Balabac and Banguey islands near the limit of their visibility and measuring a sun azimuth to one or both of these peaks from the location of the initial buoy. This plan had the advantage of shorter traverse length coupled with a belief that this shorter length would afford greater overall accuracy. The first plan had the following disadvantages:

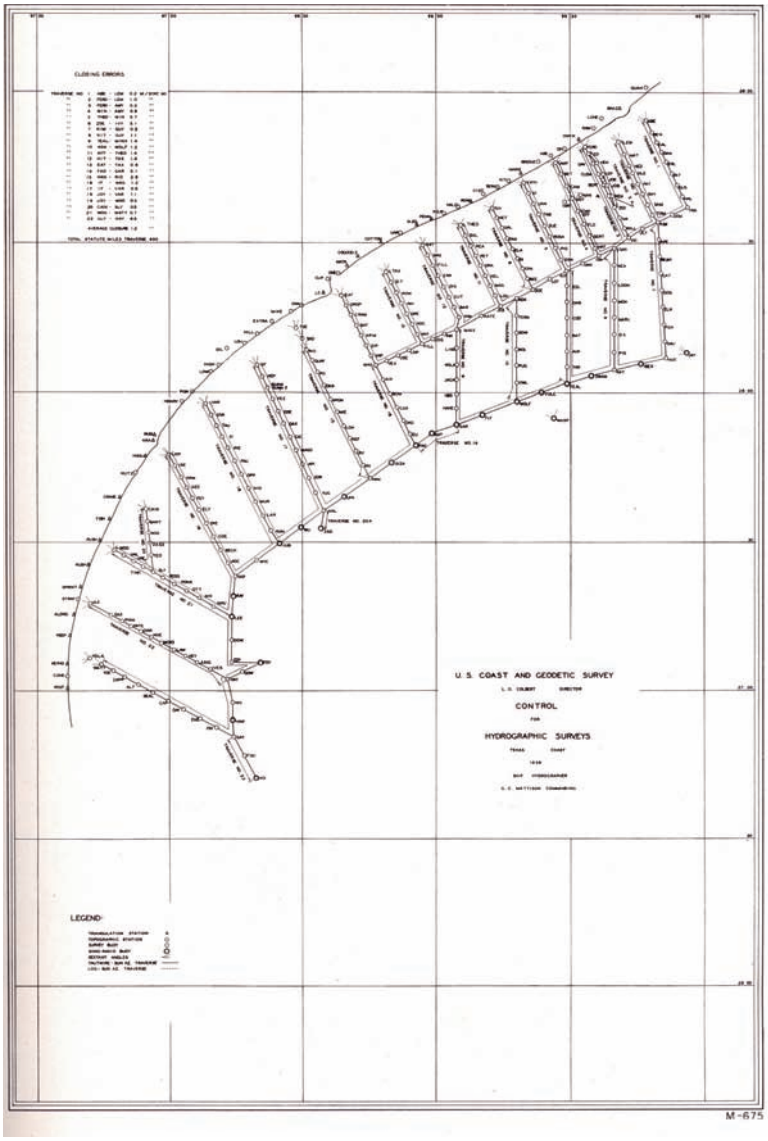
1. because of clouds shrouding its high peaks, there would be an uncertain wait for observing the high Palawan peaks;
2. use of the Palawan peaks would necessitate placing the initial

buoy much farther north than was desired;

3. the further north position would lengthen the line of intermediate buoys and would also reduce the availability of observing on Balabac and Banguey; and
4. conservation of wire was imperative. Thus selection of the second plan was dictated by the circumstances of the project.

Because the two ends of the traverse were not inter-visible, a final step was to establish a string of buoys placed at 5 to 7 mile intervals between the initial buoy and a 'terminal' buoy at the southeast end of the traverse. The terminal buoy was located by simultaneously observing theodolite angles from three triangulation stations on Cagayan Sulu and two small outlying islands. The total traverse length was 38.4 nautical miles and was taut-wired in both directions. The two measures allowed treatment of the traverse as a closed loop. Extra care was taken in calibrating the taut-wire sheave (in this instance, the calibrated value was 1.86737 metres per revolution of the sheave) and accounting for eccentricities of intermediate buoys which were moored in an average depth of 40 fathoms. Also, reciprocal sun azimuths were measured between buoy pairs in each direction, and the distance between initial buoy and terminal buoy was measured as a continuous run in each direction without break. All of these precautions resulted in an overall closing accuracy of 0.6 metre per nautical mile (approximately 1 part in 3,000), a result more than adequate for the follow-on hydrography that was to be conducted. As a result of this traverse, the position of Cagayan Sulu was shifted 1,150 metres southward in latitude and 2,500 metres westward in longitude. This confirmed the suspicions of mariners navigating these waters that the islands were not charted in the proper location.

In retrospect, the technologies and methods used to determine positions for hydrographic control far offshore prior to the era of electronic navigation systems and today's GPS seem almost heroic. The skill level, knowledge required, seamanship, and teamwork of hydrographers using this methodology was impressive. However, this was the last taut-wire sun-azimuth survey ever run by C&GS hydrographers and marked the end of an era. As with their British counterparts, the United States would soon be drawn into World War II. Early in 1942, the *Research* was lost to a Japanese bombing raid ending a career of 40 years in the islands. Lieutenant Commander Carl Egner, the commanding officer of the *Research* during the taut-wire survey described above, remained in the Philippines and was incarcerated at Santo Tomas prison during the Japanese occupation of the islands. However, C&GS charts, geodetic positioning, and tide predictions were used by US forces in the liberation of the Philippine Islands. New technologies such as electronic navigation methods and electronic distance measuring devices made far offshore visual surveys unnecessary and taut-wire surveys obsolete. The Philippine Islands attained their independence following the war and USC&GS officers returned to assist in training a new organisation, the Philippine Bureau of Coast and Geodetic Surveys. Today the functions of that agency have been incorporated into the Philippine National Mapping and Resource Information Authority (NAMRIA).



Section of taut-wire buoy array established on the Texas coast in 1938. Over 250 buoys were established in this area for visual control of surveys on the continental shelf while radio-acoustic-ranging buoys were established past the shelf break for deepwater operations.

Further Reading

Egner, C. A. 1950. Taut-Wire Sun-Azimuth Traverse in the Sulu Sea, 1940. In: The Journal: Coast and Geodetic Survey. Number 3. US Department of Commerce. pp. 95-97.

Adams, K. T. 1942. Hydrographic Manual. Special Publication No. 143. Numerous sections devoted to taut-wire traverses.

Borden, Frank S. 1938. Taut-Wire Sun-Azimuth Traverses. In: Field Engineers Bulletin: US Coast and Geodetic Survey. No. 12. pp. 71-80

Survey Talk on a Cruise Vessel

The hydrographic conference Hydro12 took place from 13 to 15 November 2012 on board the permanently moored former cruise vessel SS *Rotterdam* in Rotterdam, the Netherlands. This venue proved to offer a great environment for the conference, networking, demos in the Port of Rotterdam and more. The conference attracted over 400 delegates and the trade show had more than 40 companies exhibiting technical developments in the hydrographic market.

IHO president Robert Ward gave the opening address. (Image courtesy: Holger Klindt)

IN HIS OPENING ADDRESS, the president of the IHO, Robert Ward, reached out to the hydrographic community. The IHO should represent all hydrographic activities, not just those of the national hydrographic offices. He invited everyone interested to contribute to the work of the IHO by participating in its working groups.

Keynote speakers Peter Harris of Geoscience Australia and Terje Thorsnes of the Geological Survey of Norway illustrated the theme 'Taking care of the sea', by showing the central role of hydrography in large-scale multi-disciplinary projects about the state of the marine environment.

Keynote speakers Steve Shipman and Mark Heine of Fugro showed an inspiring contrast between hydrography one generation ago, and hydrography one generation into the future. This made the audience aware of the amazing speed of progress in our profession, which will not stop in the years to come.

There were many contributions about marine geophysics, an important topic in the North Sea region. Examples include access to the port of Antwerp, and extension of a port in the Jade-Weser estuary. The first paper, presented by Yves Plancke of the Antwerp Maritime Academy, won the best presentation award, and the second paper, presented by Ruggero Capperucci of the German Senckenberg am Meer institute, was given the best student presentation award.

Hydrographic companies welcomed people in over forty booths throughout the ship. Alongside the conference and trade show, the programme offered tutorials, poster presentations, open meetings, ship demonstrations, a conference dinner, a wine tasting, and musical entertainment.

But perhaps the most admired aspect of the conference was the venue itself, as the steam ship *Rotterdam* triggered the imagination of historic nautical adventures.

Holger Klindt, the new IFHS chairman, adds that with the IFHS's perspective the HYDRO series in general and HYDRO 2012 in particular has to be seen in a much wider context.

On-water demos gave substantial insight into the actual use of equipment. (Image courtesy: Camiel Hinderink).

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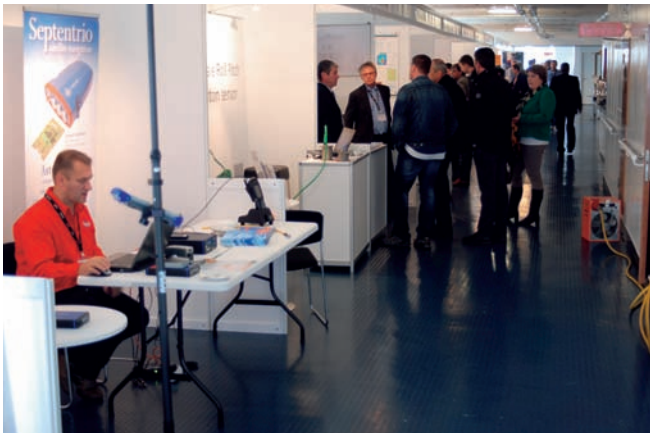
By MacArtney

No. 3265

"In a world of an exponentially growing economy, with a breathtaking increase in demands for energy and commodities the oceans have come into focus as the basis for nations' future development and well-being. Today a multitude of different users and applications are seeking for the continuous provision of precise, reliable and just-in-time ocean data and nautical information - not only for the safety of maritime traffic. Hydrography therefore has to reconsider its role and position in the wider maritime community. Added to safe navigation, other disciplines like the offshore oil and gas industry, deep-sea mining activities, global fisheries, offshore energy production and the tourism and leisure industry compete for maritime space and are therefore in urgent need of hydrographic services."

Mr Klindt continues by stating that in recognition of developments, also within major international institutions like the International Maritime Organisation (IMO), the International Hydrographic Organisation (IHO) and the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA), the International Federation of Hydrographic Societies (IFHS) must take a more prominent role in contributing to and driving such initiatives. Promotion of the community's interests must address this challenge on a truly global basis with a clear focus on both public charting and the survey industry perspective. And it is for this reason that the HYDRO conference and exhibition series has been created for the specialists' community, as well as for the wider benefit of the maritime industry. This serves as the platform to exchange, discuss and shape our common views and positions on ocean policies, economics, science and technology in close dialogue with the current and future users of IFHS services.



Trade show in the Glass Enclosed Promenade of the SS *Rotterdam* emphasised the character of the vessel. (Image courtesy: Camiel Hinderink).

Leendert Dorst,
Hydro INTERNATIONAL

Holger Klindt,
International Federation of Hydrographic Societies

www.hydro12.com

Stop Using DGPS!

I have just read Mike Brissette's interesting article 'Stop Using DGPS' in the Oct 2012 issue of Hydro INTERNATIONAL and, although I fully agree with many of the points made by Mike I feel that his inference that the current IHO S-44 special order maximum Total Horizontal Uncertainty (THU) is too lax should be not be taken at face value.

The IHO S-44 standard is explicitly aimed at 'hydrographic surveys for the collection of data which will primarily be used to compile navigational charts to be used for the safety of surface navigation and the protection of the marine environment.' (Introduction to IHO S-44 5th edition). For this use, I firmly believe that the minimum 2m THU required to achieve the special order accuracy remains valid.

Although modern precise positioning can certainly achieve better THUs, there is little point in doing so for charting use only because a) the symbolisation of the feature on charts will be much larger than the 2m on the ground THU and b) navigators of ships will not be interested in positioning themselves so close to charted dangers that the 2m THU becomes an issue. Indeed, as was discussed at length during the S-44 work, a single beam/side-scan survey is perfectly adequate for navigational use! S-44 is a minimum standard which, if met, will produce data that can be safely used in chart production. This does not in any way imply that organisations who specify surveys should limit their requirements to those detailed in S-44 and surveyors can be directed to use tighter THUs in part or all of the survey area if such a difference will allow the data to be used for other purposes. With ever decreasing resources and budgets the maxim of 'survey once, use many times' needs to be constantly in mind.

What I think Mike is actually stating is that the IHO S-44 special order is inadequate for hydrographic surveys intended for the large-scale visualisation of seafloor features and I would fully agree with this since features sampled on multiple lines each with a potential 2m THU can, and do, look blurred. Also, any deformation survey will be of little use if the expected deformation is smaller than the THU of the survey attempting to measure it. In all cases, users must implement standards that are applicable to their task and if large scale visualisation is required then tighter THUs must be specified.

I agree with his assertion that high accuracy x/y is equally applicable to surveys as z and that the x/y has largely been subservient to the z. However, improvements in charting surveys are probably best served by improving object detection rather than maximum THU since undetected tall thin features rising from the seafloor present a much greater danger to surface navigation than do detected features that are 2m away from their true position and this topic will be considered carefully in the future development of the IHO survey standards.

In conclusion, therefore, I suggest that even for high-resolution shallow-water surveys where feature detection is a priority (which is true for S-44 special order) DGPS remains a viable positioning method providing it is detection and not visualisation of the feature that is the aim. The high-resolution equipment ensures feature detection while the uncertainties in position are not an issue normally for navigational surveys. If the desire is to visually inspect the feature and hence the high-resolution data is for visualisation and multiple passes will be required (either to cover the feature or to give a time series) then a more precise form of positioning must be used.

The views of Hydro INTERNATIONAL readership on whether the time has come to reconsider broadening the scope of S-44 to non-navigational applications are welcome. Meanwhile, there are legitimate applications of shallow-water MBES surveys for which DGPS is perfectly suitable. HOs should not be discouraged to use this cost-effective combination.

Chris Howlett,
Chairman of the former IHO Working
Group which created S-44 edition 5.

Fluvial Hydrography Workshop in Peru

The 2nd Fluvial Hydrography Workshop, organised and hosted by the Peru Hydrographic Service for Navigation of the Amazon (SHNA), was held in Iquitos, Peru, from 12 to 13 November 2012. Moderated by CDR Hugo Montoro (Commander, SHNA), this was a follow-on to the 1st Workshop which was held in Iquitos in November 2007.

OVER 45 PEOPLE ATTENDED the workshop including representatives from hydrographic offices, inland waterway transportation agencies and companies who conduct inland/river hydrographic surveys. Attendees included people from Hydrographic Offices of Brazil, Ecuador and Peru, and representatives from commercial companies in Canada, Peru and the United States. There were also observers from the Inland ENC Harmonization Group (IEHG) which met in Iquitos later that week.

The workshop included a series of seminars and on-water demonstrations aimed at increasing the level of knowledge on the hydro-dynamic processes that influence dynamic changes in South American river systems. Presentations by Dr Jorge Abad (University of Pittsburgh, Pennsylvania, USA) explained how parameters such as volume and velocity of water flow, sediment transport, and river bed composition/morphology are the primary factors. He also provided examples of complex river meander shapes and fluctuations that occur in Peru and Brazil. Another series of presentations by Mr Kevin Oberg (US Geological Survey) provided both a theoretical background and practical advice on the use of Acoustic Doppler Current Profilers (ADCPs).

This workshop had several take-home messages related to conducting fluvial hydrographic surveys. In addition to using satellite images to monitor changes in river configuration, there is also a need to rely on field observations, experimental measurements, and numerical modelling in order to better predict changes in river configuration that continually occur. When conducting fluvial hydro surveys, various types of equipment and procedures are required that are not often used when conducting hydrographic surveys in ocean and coastal regions. In this regard, it was recommended that there may be a need to review existing IHO standards on hydrographic surveying in terms of their application and adequacy for conducting hydrographic surveys in dynamic, river systems. In particular, this includes IHO Standards for Hydrographic Surveys (S-44) and the Manual on Hydrography (C-13).

Lee Alexander

The workshop attendees.

Gilles Dandec and Frederick Clement.

Going International

Cadden

Frederick Clement
Export sales manager, Cadden, France

Based in Nantes, France, Cadden specialises in electronic solutions for geopositioning and hydrography. As a full-service integrator, distributor and designer, the company's global vision has become its trademark. This French SME is now entering a new growth phase.

IN 1999, GILLES DANDEC, FORMER sales executive with Thales Navigation, formed Cadden in Nantes, France. Initially a distributor of GPS systems and inertial measurement units for the maritime sector, the company continued to expand its range of products and services. Its steady growth was marked by two key events:

1. In mid-2010, Cadden developed and introduced Geod, a range of smart GPS antennas, and
2. In late 2011, they created their Export department.

"After a series of successes outside France, we wanted to move away from simply responding to opportunities and instead develop a real international strategy," explains Cadden's director Mr. Gilles Dandec.

A Solution for Every Need

Since its inception, Cadden's mission statement has remained the same: to provide customers with the most advanced technologies and customised technical solutions tailored to any situation in the field. Its products now cover a broad spectrum of specialised sensors, available for sale or lease, alone or as integrated solutions, with or without support services.

Internally, the company cultivates a culture of teamwork and innovation. Its workforce of nine people is divided among the France Sales/Export department, R & D, technical support and administration. For the year 2011/2012, the company posted sales of EUR 3.8 million , with a 14% export share.

Export: a Turning Point for the Company

Within the river and maritime community, Cadden's customer base is diverse and constantly expanding: engineering companies, scientific organisations, major seaports, offshore service companies, shipyards, territorial authorities and more.

While continuing its growth in France, Cadden is pursuing a strong export policy. The company is aiming for 30% of its sales outside France within two years, doubling the current export share. To achieve this progress, the French integrator will rely on two strengths:

Cadden Geod BALI bathymetric system, suited for small survey vessels. (Image Courtesy: IGN France International).

Cadden Geod PPU on board.

1. Its range of products and services for international markets:
   - The Geod range of smart antennas, featuring the PPU, Bali and Tracking units. The new Pilotstar system proposed by Fugro to help tankers dock alongside an FPSO (Floating Production Storage and Offloading) is also built around the Geod PPU.
   - The Integrated Hydro Pack is a turnkey solution for hydrographic survey vessels built by shipyards.
   - Cadden also offers equipment rentals - single or multi-beam echo sounders, 3D Lidar sensors, inertial measurement units, etc.- as well as integration services as needed for specific projects.

2. The experienced export sales manager, hired in late 2011, whose primary mission is to establish a network of distributors. Europe and Africa are already covered, and India should follow soon.

"In just twelve years, Cadden has become a key player on the French hydrography market as an integrator and distributor of high-tech solutions. Our goal for the future is to extend this recognition beyond our borders," says Cadden's director.

A Promising Future

The hydrography market, and more generally the maritime sector, is shaped by three basic trends.

The first is technological. The systems are becoming increasingly sophisticated and integration requires more and more expertise. Customers need specialists they can count on to build complete, reliable operational solutions, and demand for these services will surely increase. In this regard, Cadden is in an excellent position.

The second trend involves overall market demand. Customer needs are becoming more complex and specific. For these niche markets, sales volumes are low, and large companies are not organised to bid on small projects. This provides very interesting perspectives for Cadden, whose mission is precisely to develop such solutions.

The third trend relates more particularly to the European market, where the renewable maritime energy sector is booming. Ocean currents, offshore wind energy and ocean thermal energy offer a huge potential, and Cadden is already experiencing the positive effects of the 'green wave' in France.

Consistent with its approach, Cadden is already preparing solutions for tomorrow. In the near-term, they are developing a 'portable' version of their Integrated Hydro Pack solution: a compact system on a pole, consisting of a multi-beam echo sounder, an inertial measurement unit and a GPS (early 2013).

The hydrography market is shaped by three basic trends

In parallel, the company intends to pursue the commercial development of the Geod range, including Geod Survey, a small autonomous catamaran equipped with multiple sensors, which will successfully serve light hydrographic applications.

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International Hydrographic Organization

The Hydrographic Services and Standards Committee

The Hydrographic Services and Standards Committee (HSSC) is the steering committee for the IHO technical programme. All IHO Members States can be represented on this Committee. In addition, international organisations accredited to the IHO as Observers provide stakeholder views and input. The role of the HSSC is to oversee the IHO technical programme and to make recommendations to the IHO Member States.

The delegates of the Hydrographic Services and Standards Committee.

This could be to undertake significant new technical tasks or to adopt new or revised new technical standards, specifications and guidelines covering hydrography, hydrographic data and nautical charting services. The Committee establishes specialist working groups to undertake the various tasks in the technical programme. The role of the HSSC, which meets annually, was mainly undertaken by the Committee on Hydrographic Requirements and Information Systems (CHRIS) until four years ago.

The fourth and most recent meeting of the HSSC took place in Taunton, United Kingdom, hosted by the UK Hydrographic Office in September last year. The meeting, chaired by Dr Mathias Jonas, the national hydrographer of Germany, was attended by 60 delegates representing 24 Member States together with delegates representing six of the international Observer organisations. They were joined for part of the meeting by 46 representatives from 39 different groups for an IHO Stakeholders' Forum *Realising the full potential of ECDIS, ENCs and digital hydrographic data*.

The HSSC reviewed the activities, proposals, and work plans of its subordinate working groups, with particular attention being paid to critical areas. Two revised editions of IHO publications (edition 3.1.0 of S-57 - Appendix B1 - Annex A - *Use of the Object Catalogue for ENC*, and draft edition 1.1.0 of S-99 - *Operational Procedures for the Organisation and Management of the S-100 Geospatial Information Registry*) were endorsed and passed to IHO Member States for formal approval. The development of the S-100 Universal Hydrographic Data Model and associated Product Specifications ware also discussed. The Committee tasked the working groups concerned to prepare a master plan document for framing these ongoing developments. Besides the first edition of the S-101 ENC product specification, which is nearing completion, the Committee established a new working group to develop an S-100 based surface current product specification. It also directed that the future work of the Standardisation of Nautical Publications Working Group should be to develop S-100 based data models and product contents. Other subjects considered by the Committee included further work on developing better chart reliability indicators for ENCs such as the eventual replacement of the current CATZOC - Category of Zones of Confidence method, e-navigation, marine spatial data infrastructures, tidal and water levels issues, and IHO publication S-32 - *The Hydrographic Dictionary*.

The IHO Stakeholders' Forum provided some twenty presentations given by speakers from the IHB, IHO Member States and IHO stakeholders including industry and mariners. They addressed a variety of issues such as the global status of surveys, ENC coverage issues, GIS and cloud-based services, and S-100 related developments.

The Committee elected Dr Mathias Jonas as chair, and Mr Mike Prince (Australia) as vice-chair for the next five year period. The next HSSC meeting will be held in Shanghai, China in early November 2013. The next IHO Stakeholders' Forum will be held in conjunction with Hydro13, the International Federation of Hydrographic Societies (IFHS) Annual Conference in Copenhagen later in the same month.
The records of the meeting and the papers presented at the meeting and the Forum are available at: 1.

Robert Ward
President, IHO, Monaco


The meeting discussed standards and data models.

1. *http://www.iho.int/mtg_docs/com_wg/HSSC/HSSC4/HSSC-4Docs.htm*

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.
http://su.pr/9Z3d0B

The Kingfisher M200 Remote Survey System.

High-frequency Side-scan Sonar

JW Fishers, USA, has added a new high-frequency side-scan system to its line. The 1,200kHz sonar produces detailed images of even small and soft targets such as old wooden wrecks, areas of scattered debris or a victim of drowning. The new sonar is available as a single-frequency system or a dual-frequency side scan with two sets of transducers in one towfish.
http://su.pr/5A3NtF

The high-frequency side-scan sonar. Inset: the sonar image of a bike. (Image Courtesy: JW Fischers).

Falcon Explores Mountain

The ocean conservation organisation Oceana, headquartered in the USA, has explored a number of undersea mountains in the Atlantic and Mediterranean using the small, deep-swimming Falcon DR ROV. The 1,000 metre-rated Saab Seaeye ROV enabled the organisation to record many species and habitats needing protection and conservation, ranging from carnivorous sponges to lobsters and sharks.
http://su.pr/5M4yiD

ROV control room. (Image courtesy: Saab Seaeye).

HUGIN AUV System for FUGRO Survey

UK-based FUGRO Survey has ordered a HUGIN AUV to augment its existing fleet of survey vehicles. The new HUGIN 1000 AUV has depth rating of 3,000 metres and includes lithium polymer batteries. The batteries are packaged into modules, which are stacked in the centre section of the AUV.
http://su.pr/3uPbQj

A HUGIN AUV in operation. (Image Courtesy: Kongsberg Maritime).

Hydrographic Airborne Scanner Integrated in UAV

Schiebel and RIEGL Laser Measurement Systems, Austria, have successfully integrated the Schiebel CAMCOPTER S-100 Unmanned Air System (UAS) together with the RIEGL VQ-820-GU Hydrographic Airborne Sensor. The integration marks the first time that this new airborne sensor was flown on board of a UAV. The S-100 helicopter UAS carried a special Schiebel-made composite pod containing the sensor, the IMU-GNSS unit, the data recording and transfer unit as well as a digital camera, during the flight tests in Grossmittel, Austria, which were carried out this month. This fully integrated system thus enables acquisition of high-accuracy hydrographic and topographic data, even in critical operational areas.
http://su.pr/1maUWS

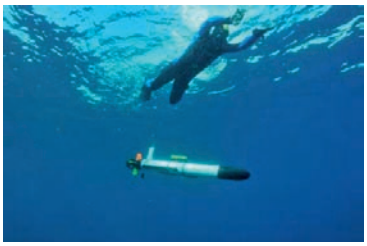
The airborne hydrographic survey platform.

CARIS and EIVA Partner for Offshore Surveys

Software developers CARIS (Canada) and EIVA (Denmark) have signed a Memorandum of Understanding (MoU) to collaborate on providing offshore survey organisations with an integrated and streamlined solution. The two organisations join forces to provide a solution for offshore survey projects including the acquisition and processing of survey data through to managing and manipulating the data in an enterprise GIS environment.
http://su.pr/4rW61y

OceanServer Iver2 AUV with EdgeTech 2205

OceanServer Technology, USA, continues to deliver superior AUV-based acoustic imaging with the qualification and release of the new EdgeTech 2205 high-resolution side-scan sonar. The 2205, designed specifically for use on AUVs, has been specifically optimised for the demanding size and power constraints present in a small platform footprint.
http://su.pr/2j8eNI



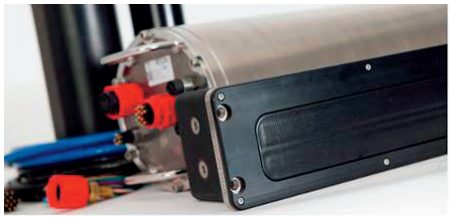
The OceanServer Iver2 in action.

ADCP in Moored Profiler

McLane Research Laboratories (USA) has integrated and tested a Nortek acoustic Doppler current meter for the Mclane Moored Profiler (MMP), a wire-crawling profiler. In collaboration with NortekUSA, successful tests of the Nortek Aquadopp Profiler mounted to the MMP were expanded in fully integrating the current meter into the MMP data control and acquisition system for seamless deployment configuration and data collection.
http://su.pr/3wzATP

SeaBat Fleet Expansion

Seatronics, UK, has recently purchased four RESON SeaBat 7125-ROV2s, six ROV2 upgrades with G5 processors and two SeaBat 7101s. This order emphasises Seatronics' position as rental supplier of 7125-ROV2 solutions with the world's largest fleet of SeaBat solutions. Seatronics now owns 28 ROV2 systems, 10 of which have a G5 processor prepared for X-Range and Full Rate Dual Head.
http://su.pr/1HtPyZ



RESON sensors for Seatronics.

GNSS Receiver for Mobile Hydrographic Package

Geometius, Trimble's Marine distributor in the Netherlands, has delivered the first Trimble SPS855 GNSS receiver to the Hydrographic Service of the Royal Netherlands Navy. The new GNSS positioning receiver will be part of the Royal Netherlands Navy Mobile Hydrographic package. It is used by the Rapid Environmental Assessment (REA) team consisting of two hydrographers, two meteorologists and a GEO specialist.
http://su.pr/5kFXsU

(From left to right): Lt Cdr. John Loog (Hydrographic Service), Lt. Niels Nijhuis (member of the REA team), Lt. Laura Veerman (member of the REA team), Martin de Kievit (sales manager EAMA, Trimble Europe), Sander Terwee (sales engineer, Geometius).

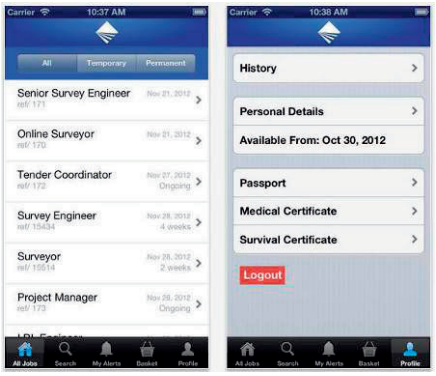
200th USBL System Sale

Applied Acoustic Engineering (AAE, UK), recently sold its 200th USBL system to rental company Sonar Equipment Services (SES, UK). The sale was celebrated with a short ceremony and presentation by AAE's sales advisor Julian Rickards to SES's managing director, Scott Johnstone. The system bought was the Spread Spectrum rack-mount Easytrak Nexus USBL, the fifth purchased by the company, destined for its rental pool.
http://su.pr/8lrVy3

Presentation of the 200th Applied Acoustics USBL.

Mobile App for Hydrographic Contractors

A mobile application for Marine and Hydrographic contractors across the iPhone, Android and BlackBerry Playbook platforms has been launched by G.O.S.S. Consultants, UK. This recruitment application adds another level of functionality to the website that features real-time vacancies. The app will enable contractors to keep up to date with roles that match their expertise and availability. Their member profiles can be updated from the app, the job applications will be tracked and the aim is for contractors to be informed immediately of the vacancy. This should result in a higher level of success being achieved in notifying people of suitable vacancies.
http://su.pr/1IPwBR



Screen images of the app.

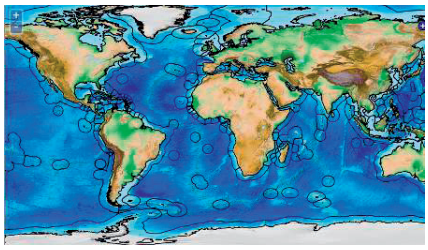
Mohican ROV for Geophysical Survey

MMT, headquartered in Sweden, has conducted seabed surveys for BKK Nett AS, Norway. This was the first time MMT used its Mohican ROV fully equipped for geophysical survey to produce a detailed design for the submarine cable route between Modalen and Kollsnes via Mongstad.
http://su.pr/32g55X

Deployment of the Mohican ROV.

Maritime Boundaries Database Now Online

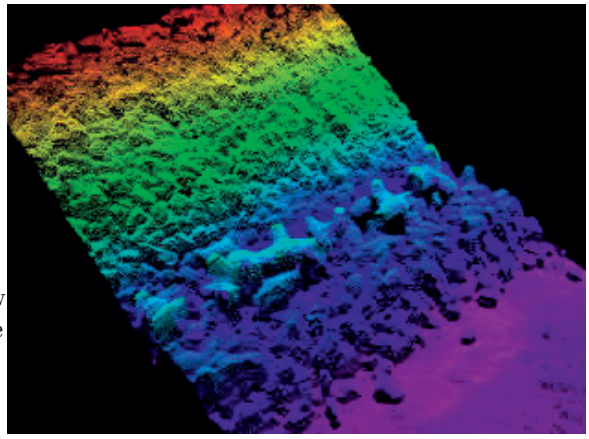
Marine Regions, an online standard list of georeferenced marine place names, areas, regions, marine and maritime boundaries, has been launched. It is an integration of the VLIMAR Gazetteer and the VLIZ Maritime Boundaries Geodatabase. Marine Regions is managed by the Flanders Marine Institute.
http://su.pr/9tS51x



Overview of the maritime boundaries mapped.

Underwater Sonar for Breakwater System

RESON will provide a SeaBat 7125 sonar system for a new breakwater mapping system GEOSUB 3DTM developed by the company MESURIS in France. It is a high-resolution 3D real-time bathymetric and topographic system designed to provide marine engineering data both above and below the water's surface, deployable either from a land or barge crane.
http://su.pr/26U0u7



The multi-beam image of the breakwater.

Real-time Current Measurement Systems

Metocean Services International (MSI, Australia) has completed the installation of three real-time current profile monitoring buoys offshore Curtis Island at Gladstone in Queensland, Australia, for Arrow Energy as part of a 3-year monitoring programme. With a tidal range at site in the order of 4m and currents in excess of 2 knots already observed in the first week, the buoys will provide important real-time current profile data to assist with future planning as well as current vessel operations.
http://su.pr/30sx2O

Light Construction and Survey Services Contract

Norway-headquartered DeepOcean has been awarded a call-off order under the current long-term frame agreement for offshore light construction and survey services for Statoil. The estimated contract value is more than NOK 100 million. The frame agreement includes services covering light construction services, seabed mapping with hull-mounted Multibeam Echo sounder (MBE) and ROV-based construction support, seabed mapping and pipeline inspection services.
http://su.pr/1n0pc8

QPS Bundles Esri Technology

Quality Positioning Services (QPS, The Netherlands) has signed an original equipment manufacturer (OEM) agreement with Esri, USA, to bundle its QINSy and Fledermaus products with Esri software and provide a complete hydrographic survey, data management and charting solution. QPS will incorporate two of Esri's ArcGIS applications into an end-to-end hydrographic package, QINSy Premium. One application is ArcGIS for Maritime: Bathymetry, which indexes, searches, and models bathymetric data. The other is ArcGIS for Maritime: Charting, which facilitates the capturing, maintaining and managing of nautical data in a centralised database.
http://su.pr/1HsBFO

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

Monitoring Environmental Concerns in Lake Victoria

UK-based OSIL recently completed the installation of two data buoys along Lake Victoria in Kenya to help manage the local environment. The buoys will be used to monitor various environmental concerns including hyacinth menace and contamination of the lake water. In addition to monitoring atmospheric components of the lake, such as moisture, oxygen levels and temperature, the sensors on the data buoys will also measure wind direction and levels of potentially harmful chemicals in the lake.
http://su.pr/2JOYCf

The data monitoring buoy in Lake Victoria.

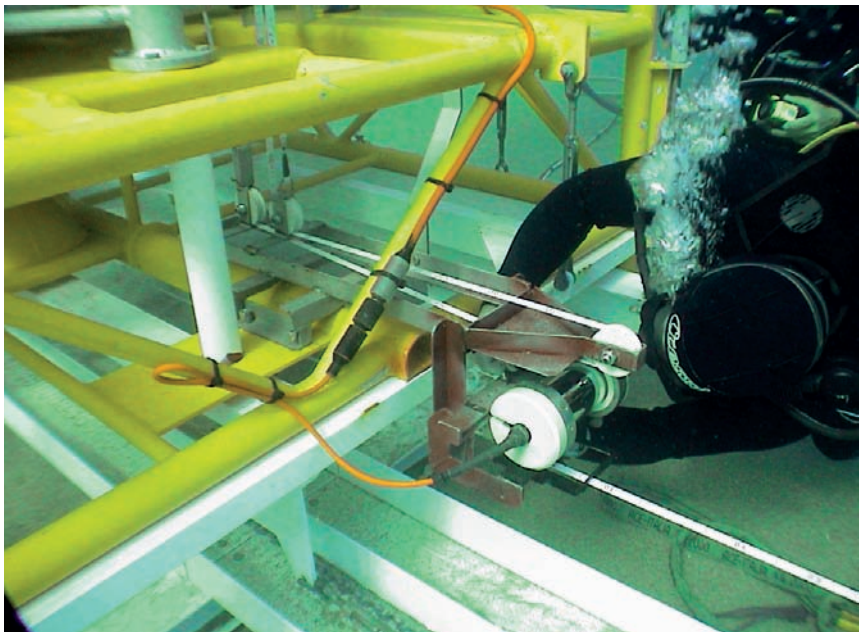


Figure 1: Mounting a mobile platform with different marine sensors.

Figure 2: Cruise to measure the different parameters for coastal engineering; sediment transport, currents, waves, CTD typical data, etc. The main purpose of the cruise was to calibrate several numerical models for coastal engineering.

Faculty of Marine Sciences of Las Palmas de Gran Canaria University

Jesús Cisneros Aguirre

Established in 1982, it is the first faculty of marine studies in Spain. The experience gained since its creation, coupled with the strategic location of the Canary Islands, make the School of Marine Sciences at the University of Las Palmas de Gran Canaria a reference centre, and an example in the development of teaching marine sciences in Spain and Europe.

THE SCHOOL OF MARINE Sciences at the University of Las Palmas de Gran Canaria offers undergraduate, graduate and postgraduate programmes. Specifically, it offers Bachelor degrees in Marine Science and Marine Science Graduate courses including master's degrees in Marine Aquaculture, Coastal Master in Management, Master in Sustainable Management Fisheries and Oceanography-University Master, Expertise Course in Coastal and Harbour Engineering (in collaboration with the Civil Engineering School and the Port Authority of Las Palmas) as well as PhD degrees in Coastal Management, PhD in Sustainable Management of Fisheries and Oceanography PhD.

The School of Marine Sciences at the University of Las Palmas de Gran Canaria has the materials and human resources to offer students training and quality services. The extensive experience and recognised qualifications of the faculty make them fully prepared to offer students quality training. The administrative and service staff is also well-trained and experienced to ensure that students receive adequate attention.

The quality of training and services offered in the School of Marine Sciences at the University of Las Palmas de Gran Canaria has been proven by regional and national monitoring processes.

The involvement of the faculty of the School of Marine Sciences at the University of Las Palmas de Gran Canaria in research, development and innovation is undoubtedly outstanding. In the ranking of journals showing the impact of marine sciences in Spain, this faculty is among the top ten centres in the country, at levels comparable to those of the institutes of the National Research Council (CSIC) and the Spanish Institute of oceanography (IEO). The benefit reported for the School and its students in this important research activity is remarkable.

The faculty of the School of Marine

Figure 4: Cruise to Canary Islands with the Box Corer Dredge, Saturday 15 December 2012; sampling sediments.

Figure 3: Marine instrumentation platform; this is the moment when the pop-up leaves the platform for the surface to send the data.

Sciences at the University of Las Palmas de Gran Canaria develop their research work in the field of research groups, including Applied Marine and Fisheries Ecology, Applied Marine Physics and Remote Sensing, Observation and modelling of geophysical phenomena and Marine Processes (with research areas: Mixing and boundary layer; Ocean circulation and coastal upwelling; Applied Geophysics; Circulation and Coastal and Estuarine Pollution – the latter led by the author of this article); Biological Oceanography, and Physical Oceanography and Satellite Oceanography (with research areas Marine and Coastal Meteorology Physics Applied, Applied Remote Sensing).

One of the research projects has been published in the journal *Scientific Reports*, part of the prestigious *Nature*. It included the first scientific results of the effects of the volcanic eruption on the Canary island of El Hierro, conducted by researchers from the Spanish Institute of Oceanography (IEO) and the Faculty of Marine Sciences (ULPGC) aboard the research vessel *Ramon Margalef*. Researchers from the FCM are assigned to the Institute of Oceanography and Global Change, IOCAG, and the Spanish Bank of Algae, BEA.

The study shows a warming, acidification and very significant oxygen depletion in waters affected by volcanic emissions. Specifically, the water temperature rose to 18.8° C, the pH decreased to 3-equivalent units of acid at a concentration 1,000 times higher than normal values and down-dissolved oxygen concentration up to 90-100%. These extreme environmental changes caused different responses in marine organisms: from the selection of phytoplankton species adapted to living in high temperatures and high concentrations of copper, which significantly increased their populations, to massive fish kills.

The Spanish Institute of Oceanography, co-operating with the Commission for Coordination and Monitoring of Activities of Research Vessels (COCSABO) has given permission to degree, bachelor and master of oceanography students to use the new research vessel *Alvariño Angeles* for 10 days in April 2013 to carry out field work.

1. www.fcm.ulpgc.es

Australasian Hydrographic Society

The AHS 2012 AGM was held on 27 September 2012 with the following office bearers being voted in:

President: Alec Millett
Secretary: Ron Furness
Treasurer: Steve Duffield

East Australian Region

The AHS/EAR 2012 AGM was also held on 27 September 2012 with the following office bearers being voted in:

Chairman: John Maschke
Secretary: Dave Garforth
Treasurer: Roger Harvey

The EAR met on 13 November with ongoing discussions on the re-establishment of Cat A/B hydrographic training courses in Australia and/or New Zealand.

West Australia Region

The WAR has been busy with regular meetings, the last being held on 8 November with presentations from Sonardyne on 'Improving USBL & LBL positioning performance through Integration to subsea INS'; Ixsea Blue, 'ComMet, the iXBlue combined acoustic and inertial metrology method' and Acoustic Imaging 'Opening Marine Software for User Customisation: the QPS Example'.

Congratulations to the new and continuing office bearers for their continued support of the AHS.

Hydrographic Society Russia

50 Years in the Arctic

On 22 October 2012, members of the Russian Geographical Society (RGS) met with HSR members to mark the 50th anniversary of the beginning of regular mapping of the Arctic basin with a session by the RGS Commission on geographical and mathematical cartography.

The session was opened by rear admiral (ret.), corresponding member of the Russian Academy of Science, professor, and deserved HSR member Aleksandr I. Sorokin. One of the last chiefs of the Northern Hydrographic Expedition (NHE), Nikolay A. Zamyatin, gave the first report. He reminded everyone that research at the Arctic pole from ice was carried out earlier. But it was only the single drifting stations and the data received from them that allowed the presentation of a general picture of the bottom relief. The first dimensional research on bottom relief, sediment structure, gravitational and magnetic fields using modern devices and exact measurements began in 1961. This research was carried out by NHE specialists in co-operation with experts from the Scientific Research Institute of Arctic Geology. These expeditions would certainly have been impossible without the participation of pilots and technicians of the Soviet, and the Russian polar aircraft.

Figure 1: Co-chairmen of assembly: academic Aleksandr Sorokin (on the left) and HSR president Nikolay Neronov.

The lecturer explained about structure of the NHE and illuminated the contribution of the predecessors – the chiefs of the expedition, including Leonid I. Senchura, Serguey K. Nemilov, Vladimir A. Baranov, Semen A. Fridman, Nikolay K. Timoshenko and Aleksandr P. Makorta. They were responsible for the very difficult organisation of research at high-altitudes .

Former general director of the Hydrographic Enterprise (St. Petersburg Transport Ministry), Viktor I. Medvedev, explained the achievements of its employees in the Arctic regions being studied.

Aleksandr I. Sorokin, in turn, noted the major contributions by experts from the Arctic and Antarctic Institute (St. Petersburg) and the polar pilots. Prof. Stanislav G. Mikavtadze (Navy Academy, St. Petersburg) emphasised the outstanding contribution to science by hydrographers in the Arctic regions. He also reminded everyone of the assignment of the USSR State premium to a number of experts, including Aleksandr I. Sorokin.

An employee of the Cartographic division, Valentina Agerova, mentioned the long-term work

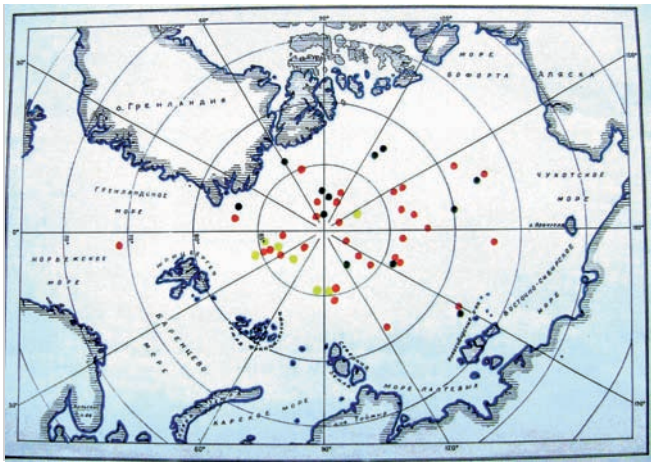


Figure 2: The map of underwater objects named in honour of the Russian researchers of the Arctic region (red: from the Hydrographic service, black: from other organisations)

on assigning names of the Soviet and Russian hydrographers to underwater objects in the Arctic regions and showed a map detailing the positions of such objects.

At the end of the session A.I. Sorokin suggested starting a petition for the establishment of a memorial board in St. Petersburg, where the outstanding Soviet geodesist, astronomer and cartographer rear admiral Vladimir V. Kavraysky lived, in connection with the 130th anniversary of his birthday (2014). Participants unanimously supported this initiative. After the session ended, some veteran participants of the Arctic research expeditions shared memoirs of the work in difficult polar conditions. Thus the amusing moments of a life were also not forgotten. Participant of the 1962 Arctic expedition, Viktor Rybin, recounted that besides necessary tools and books he also brought along his ice skates. During the rare free time he had, he cleared away a small surface of the ice and 'wrote' simple figures on the ice. This tiny skating rink which he named 'Polar pleasure', was at that time probably the most northern rink in the world (latitude 87° N) and could be recorded in the Guinness Book of Records.

Figure 3: Hydrographer A. Karbasov on the Wrangel island 1967.

Hydrographic Society Benelux

Workshop on Vessels and Multi-beam Echo Sounders

The presenters of the HSB workshop, from left to right: Huib-Jan Lekkerkerk, Albert Keijzer, Thorsten Döscher, Niels Winke and Holger Klindt.

Over forty hydrographic professionals attended the workshop on Survey Vessels and Multi-beam Echo Sounders, which was held on 12 December 2012 in Delfzijl, the Netherlands. Amongst the delegates were members of the Deutsche Hydrografischen Gesellschaft (DHyG) who were invited to contribute.

Speakers were Albert Keijzer (No Limit Ships on Workboats, multi or single role); Niels Winke (Geo Plus on MBES & Laser Scanning data, progress on processing challenges); Thorsten Döscher (chief surveyor at bremenports on Multi-beam Surveys along the Container Terminal Bremerhaven); Huibert-Jan Lekkerkerk (piLot Survey Services on Determining Rock and Rock quantities using MBES with results from the Maasvlakte 2 and Rijkswaterstaat) and Holger Klindt (Signalis, as well as chairman of the DHyG and the IFHS; with background information on the DHyG and the IFHS).

After the presentations, No Limit Ships and Geo Plus kindly contributed to the social by offering drinks and snacks.

A date for your Diary: Workshop at Meyer Werft

The atmosphere was great and proposals were made to organise a joint HSB-DHyG workshop in 2013 together, this time in Germany. The Old Wharf in Papenburg was named as venue and topics will focus on hydrographic aspects of the enormous vessels being built in Meyer Werft. At this moment, the new research vessel for German universities is under construction by the company. The workshop has been planned for the last week of May 2013.

Overview of Workshops in 2013

Please mark your diaries for the dates, some tentative, and subjects of the workshops in the new year.

- 6 February - Reference Levels in the North Sea
- 27 March - Cleaning and Dredging of the Vecht River
- Last week of May - Joint Workshop with the DHyG, Meyer Werft, Papenburg
- 21 June - WHD/Blue Economy
- 18 September - Offshore Positioning, Renewables
- 6 November - Europort
- 11 December - Simulators

The final dates, themes and presenters will be announced on the website of the Hydrographic Society Benelux. You will then also be able to register.

hydrographicsocietybenelux.eu

Hydro Agenda

JANUARY

EIVA Navipac Offline
Aberdeen, UK
→ 21-25 January
For more information:
E: kmoffat@atlasservicesgroup.com
W: www.atlasservicesgroup.com/seismic-hydrographic

Multi-beam Survey Training Course
Vizag, India
→ 28 January-01 February
For more information:
E: shekhar.murthy@iictechnologies.com

Underwater Intervention 2013
New Orleans, LA, USA
→ 29-31 January
For more information:
W: www.underwaterintervention.com.

FEBRUARY

Euromaritime 2013
Paris, France
→ 05-07 February
For more information:
W: www.euromaritime.fr

Seabed Mapping and Inspection 2013
Geilo, Norway
→ 06-08 February
For more information:
E: lise.olaussen@tekna.no
W: http://bit.ly/O4zG3V

International Lidar Mapping Forum
Denver, CO, USA
→ 11-13 February
For more information:
E: info@lidarmap.org
W: www.lidarmap.org/ILMF.aspx

VLIZ Young Marine Scientists' Day
Bruges, Belgium
→ 15 February
For more information:
W: http://www.vliz.be/EN/Intro/&p=show&id=3250

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

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/

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

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

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
→ 05-07 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

Establishment of a National Hydrographic Committee

The establishment of a National Hydrographic Committee (NHC) can play a vital role in ensuring the hydrographic industry is relevant to the current technologies and surveying requirements. An NHC provides a medium to discuss essential aspects such as industrial collaboration, national data and training standards, hydrographic surveyor and nautical cartographer competencies, and annual marine and hydrographic activities.

IT HAS BEEN PROPOSED THAT maritime nations should consider establishing an NHC to co-operate in the development and sustainability of marine and hydrographic industries. The members of an NHC are comprised of agencies and education institutions related to these industries. The National Hydrographic Office (NHO) should be appointed as chairman of the NHC, responsible as the representative of the committee to preside the meetings or any other activities. The annual meetings of NHCs can be conducted twice a year. Members of an NHC are encouraged to report their hydrographic activities during the meeting. Such reporting includes the updating of nautical charts and information on new hydrographic survey projects that have been carried out since the last NHC meeting. Any consequential issues in marine and hydrographic matters can be addressed and discussed during the meeting.

NHC members are expected to provide the solution and give their recommendation with regard to the hydrographic and marine issues. Example of such an issue is the data sharing among agencies. Perhaps, a sub-committee can be set up to look at this specific issue and any other related issues such as national datum standardisation. Any findings by the sub-committee will be reported to the NHC who will then decide whether a working group should be set up to further investigate the issue and produce a standard, guideline, circular, report, etc. NHC can play a role in enabling data sharing, exchange of information and consultation between the hydrographic services especially for the development of marine geospatial data infrastructure. In addition, the NHC can serve as the authority to ensure the hydrographic survey fees are standardised to reflect the professional service accomplished.

Collaboration between the NHC and educational institutions can benefit the industry. The co-operation between NHC and education institutions is necessary to ensure the hydrographic education provides comprehensive knowledge in line with hydrographic development and requirements. For instance, NHC can provide the input to the syllabus and training of hydrographic education to meet the criteria and the requirements of the hydrographic industry in order to produce competent hydrographic surveyors and nautical cartographers. Furthermore, the NHC can support and assist the education institutions by providing expertise as an advisor and in the placement of industrial training for the students. In addition to providing education and training, most educational institutions also conduct research and development. The NHC can support and assist the education institutions in providing the facilities and resources available such as survey vessels for research expeditions.

The communication among members of the NHC can establish a strong interconnection and networking for the marine and hydrographic industries that provide positive benefits to the country. Hence, the establishment of a National Hydrographic Committee should be seen as a way of gathering all the related agencies and education institutions in marine and hydrographic industries so as to provide a significant contribution to the country.

Prof. Dr. Mohd Razali Mahmud,
Universiti Teknologi Malaysia

VALEPORT
in our element

Tide Gauges

VRS-20 Radar Level Sensor

a new approach to tide and water level measurement

- Non-contact measurement of water level
- Direct interface to TideMaster tide gauge
- Use with own logger or PC via digital outputs
- Direct output via GPRS to internet

The VRS-20 is a 25 GHz pulsed k-band radar level sensor developed by Valeport to work seamlessly with the TideMaster tide logger, operate standalone with optional integrated GPRS telemetry or interface to a third party data logger. Communication is conducted via three standard methods, RS232, RS485 and SDI 12. With a wide range 9 - 28v DC power supply, integrated spirit bubbles for levelling and a bar fixing for GPS antenna use, the VRS-20 is both versatile and simple to install. The VRS-20 addresses a number of the issues traditionally associated with water level measurement through non-contact technology which removes the installation, corrosion & fouling issues of submerged sensors, while simplifying datum control. Accuracy and performance are unaffected by changes in water density and atmospheric conditions.

Tel: +44 (0) 1803 869292 • sales@valeport.co.uk

www.valeport.co.uk

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