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Hydro INTERNATIONAL

Quality Control of Survey Data

A Continuous Process?

Space-borne Technologies for the O&G Sector

Challenges Facing the Data Managers/Owners

Expanding the Use of Survey Data to the Wider Business Community

geomares

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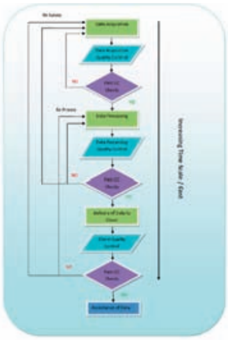

SEPTEMBER 2013
VOLUME17 > NUMBER6

A Saab Seaeye Falcon ROV is attached to a crane for deployment to an offshore job. This issue of Hydro INTERNATIONAL features a variety of offshore survey aspects, mainly related to data collection and quality control of the data.

No. 3350

Hydro INTERNATIONAL

Hydro INTERNATIONAL is an independent international magazine published 8 times a year by Geomares Publishing. The magazine and related e-newsletter inform worldwide professional, industrial and governmental readers of the latest news and developments in the hydrographic, surveying, marine cartographic and geomatics world. Hydro INTERNATIONAL encompasses all aspects, activities and equipment related to the acquisition, processing, presentation, control and management of hydrographic and surveying-related activities.

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Unprecedented Growth

Durk Haarsma
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The offshore - oil & gas and renewables - industry is still very much growing, the outlook is still bearish and will be for the coming years. The fact is that new oil fields are being discovered – the Dutch government recently announced the possible discovery of oil & gas in the most northern part of the Dutch EEZ of the North Sea worth billions of euros, while at the same time a huge offshore wind farm is being built in the IJsselmeer, near the former island of Urk, with 86 huge wind turbines with a tip height of between 150 and 200 metres. Some 30 kilometres to the west, at the Enclosure Dam, which closes off the former Zuiderzee (now IJsselmeer) from the North Sea , experiments with tidal energy power are in preparation, whereas even further north west, at the Orkney islands on the Scottish coast, tidal energy is already being generated. Hydrography has played a role in all of these projects. Enough reason to pay special attention in this issue of Hydro INTERNATIONAL to the offshore industry at large and the role hydrography plays in supporting it. Magnus Wettle, Knut Hartmann and Thomas Heege describe the use of satellite-derived mapping and monitoring technologies for the oil & gas sector in their article Space-borne technologies for the O&G sector on page 24 and we interviewed Jim Davis, senior vice president of Teledyne Technologies, one of the biggest players in the world, building environmental monitoring systems, marine sensors and autonomous underwater vehicles (see page 12). According to Davis, hydrography is vital in creating economic growth in the marine domain: "The offshore oil and gas industry is expected to double its expenditure on subsea hardware over the next five years. The building of off-coast LNG terminals for liquefaction and regasification is accelerating. Offshore renewable energy projects are growing at an unprecedented rate as renewables are expected to surpass gas-based power generation by 2016." These developments are not just taking place in the North Sea and surrounding estuaries, as described above. No, more and more coastal states all over the globe seek to exploit their offshore resources, whether that be hydrocarbons or minerals, and everywhere hydrography comes into play to define what is beneath a nation's territorial waters and to chart their exclusive economic zones and continental shelf extensions over which jurisdiction is claimed in accordance with the UN's Law of the Sea. It's good to know that chances for hydrography will be plentiful in the coming years, irrespective of whether carbon fuels will continue to dominate the market or new, alternative energy sources will be found – because either way it looks like the solution for the world's craving for energy will come from offshore sources.

Life offers enough complications. Why waste mental energy on instrument availability, sensor-range requirements, or recalibration dates when you don't need to?

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LAS Domain Profile Facilitates Topo-bathy Lidar

Thanks to a recent initiative of the ASPRS Lidar Division, different segments of the Lidar mapping community now have the ability to customise the LAS file format to meet their application-specific needs. The new mechanism that makes this possible is the LAS Domain Profile, which is a derivative of the base LAS v1.4 specification that adds (but does not remove or alter existing) point classes and attributes. It also supports topographic-bathymetric Lidar.
http://tw.gs/R7r6Za

Five-year Indonesian Positioning Contract

Global GNSS positioning specialist Veripos has been awarded a five-year contract to supply precision services by Bintang Subsea, an independent survey organisation providing offshore inspection, survey and dredging support services on behalf of a wide range of users in the Asia Pacific Region.
http://tw.gs/Q5x502

Creation of Backscatter Working Group

Geohab is putting together a Working Group on Backscatter Data Acquisition and Processing. This was one of the main recommendations of the workshop on 'Multibeam Backscatter – State of Technology, Tools and Techniques' which was held on 5 May 2013 in Rome, Italy. During this workshop, the need for the standardisation of the acquisition and processing of backscatter obtained by multibeam echo sounders was expressed.
http://tw.gs/R7r7i1

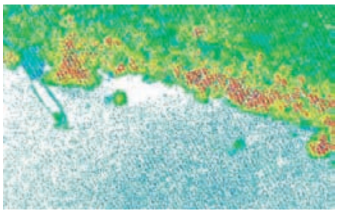
Backscatter is the subject of a new Geohab working group

LINZ Launches App for Reporting Sea Hazards

A smartphone app that streamlines the reporting process for hazards at sea is now available for download thanks to a collaboration between IT company Datacom and Land Information New Zealand (LINZ). 'Hydrographic Notes' – or 'HNotes' – allows users to photograph hazards at sea, note the location and send the information to the New Zealand Hydrographic Authority (NZHA) at LINZ so that it can be reported to the maritime community.
http://tw.gs/R7r6bY

3D Mapping Technology to Locate Sunken Vessels

A team of shipwreck hunters have turned to advanced 3D mapping technology to locate sunken vessels along the South Australian coastline without getting their feet wet. A group of shipwreck hunters are aiming to uncover these long-forgotten hulks by using GIS technology from partners Esri Australia to create digital 3D reconstructions of the ocean floor.
http://tw.gs/R7r6cy



The Lidar image used to find the hulls.

Most Shared

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

1. Creation of Backscatter Working Group - http://tw.gs/R7r7i1
2. Fate of *Titanic* Linked to Lunar Event - http://tw.gs/R7r7aW
3. Hydrographic Airborne Scanner Integrated in UAV - http://tw.gs/R7r7bw
4. Port of Rotterdam Saves EUR150,000 Using Sonar - http://tw.gs/R7r60y
5. Acoustic Positioning for De Beers Marine - http://tw.gs/R7r6gX

Workshop Success Influences Future of Dynamic Positioning

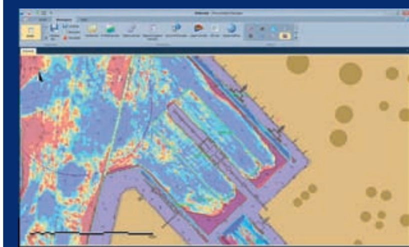
Sonardyne International, in conjunction with Guidance Navigation and Veripos, UK, recently held a one-day user workshop focusing on the latest advances in Dynamic Positioning (DP) reference sensor technologies. More than 50 industry experts from a wide selection of companies gathered in Houston, USA, to review current Position Monitoring Equipment (PME) solutions and to discuss the industry's future requirements.
http://tw.gs/R7r6A3

Terrestrial/Marine LULC Classification Mapping of Abu Dhabi

Proteus, headquartered in the UAE, has been contracted by Environment Agency – Abu Dhabi (EAD) to deliver fine-scale terrestrial and marine land use/land cover (LULC) and habitat maps for the entire Emirate of Abu Dhabi. The multi-million dollar project will include 60,000 square kilometres of land area and the coastal marine environment down to the 15m contour.
http://tw.gs/R7r6BZ

Port of Rotterdam Saves EUR150,000 Using Sonar

The Port of Rotterdam, The Netherlands, is an open deepwater port in the river estuary Maas. The location of the port in an estuarine environment necessitates maintenance dredging due to siltation 'attacks' from both tidal current and river discharge. Daily hydrographic surveys control the dredging. An operation to make this more efficient resulted in a reduction by about half a survey vessel, representing a cost saving of approximately EUR150,000 per year; partly due to the upgrade of the multibeam systems to the Teledyne RESON 7101 and 7125.
http://tw.gs/R7r60y



MBES post-processing image of the Port of Rotterdam.

International Maritime Prize for Former ITLOS President

Dr Thomas A. Mensah.

The IMO Council has unanimously agreed to award the International Maritime Prize for 2012 to Dr Thomas A. Mensah of Ghana, former president of the International Tribunal for the Law of the Sea and assistant secretary-general and director of the Legal Affairs and External Relations Division at the International Maritime Organization (IMO), for his contribution to the work and objectives of the IMO.
http://tw.gs/R7r6f5

Survey vessel *Borda.*

Survey Updates Bathymetry Offshore French Guyana

Survey vessel *Borda* left Brest, France, on 31 July 2013 for a hydrographic survey mission to French Guyana. The mission focuses on general bathymetric, tidal and current surveys for SHOM in order to update nautical charts to improve safety of navigation. The surveys will be conducted in areas that have not been surveyed but which are interesting for the states of the sea, pilots and the Navy of French Guyana. The data will also be applied to hydrodynamic models. The mission is expected to last until November 2013. The cruise also leads the *Borda* past Suriname and Brazil, already visited in 2002 by the *Borda* when sailing the last survey campaign of the SHOM in French Guyana.
http://tw.gs/R7r6b2

Acoustic Positioning for De Beers Marine

Acoustic positioning technology from Sonardyne International, UK, has been selected by De Beers Marine from South Africa to assist in the search for diamonds buried off Namibia and South Africa. The Ranger 2 GyroUSBL system, supplied through Sonardyne's South African agent Underwater Surveys, will be used to track the position of De Beers Marine's two Autonomous Underwater Vehicles (AUVs) as they undertake geophysical surveys in water depths of up to 200 metres.
http://tw.gs/R7r6gX


Launch of an AUV by De Beers Marine.

Maritime Information Gaining Importance

The third session of the UN Committee of Experts on Global Geospatial Information Management (UN-GGIM) took place in Cambridge, UK, from 24 to 26 July 2013. Over 70 UN Member States were represented at the third session of UN-GGIM together with representatives from nearly 20 international organisations, including the IHO. President Robert Ward represented the IHO. A number of the agenda items generated discussions that were of relevance to IHO Member States, particularly those that are planning or are already contributing hydrographic data and services to their national spatial data infrastructure. Issues were IHO standards that are well adopted worldwide, a lack of underlying geospatial information in the ocean, seas and coastal waters, a status report on remote sensing and increasing sustainable development.
http://tw.gs/R7r5DV

Quantum GeoServices Takeover Agreed

Dolphin Geophysical (Norway) has reached exclusive agreement to take over Quantum GeoServices (Asia Pacific) Pte Ltd. The agreement is subject to due diligence and is expected to be completed in early August 2013. Based in Singapore, Quantum provides seismic data-processing services including multi-component, multi-client products and training for data processing within the Asia Pacific region. Quantum GeoServices' name is to be transferred to Dolpin in the process.
http://tw.gs/Qav3Cv

Navigation and Survey Support for Windmill Installation

Parker Maritime, Norway, provided the Seajacks team with navigation services, survey support during installation of the monopiles and transition pieces (TP), and crane monitoring services during monopile upending. Parker utilised its ParkerPMS computer and software technology for data collection and presentation. ParkerPMS was the platform for the radio link of data between the TP and Bridge. Other technologies used were: iXBlue Octans for heading and motion, GPS for heading control of the TP and positioning of the monopiles, MRU for motion and Leica Total stations for the inclination of the monopiles.
http://tw.gs/Qbs7E1


Constructing monopiles with a jack-up vessel.

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

Continuously Evolve Solutions as a Strategy

Hydro International Interviews Jim Davis of Teledyne

Teledyne has quickly become one of the biggest players in the hydrographic market. Through attractive acquisitions and internal growth the 'Teledyne Marine' platform grew to USD418M in revenues at the close of 2012. Hydro International interviews Jim Davis, senior vice president of Teledyne Technologies on strategy and future outlook for the business as well as on AUVs and multibeam and single beam echo sounders and more.

Durk Haarsma
Publishing director, Hydro International

Recently we saw activities of Teledyne Benthos being merged with Teledyne Odom. Are there plans to further integrate business units with each other?
The rearrangement you refer to involving the transfer of certain hydrographic and geophysical product lines from Teledyne Benthos to Teledyne Odom Hydrographic is merely a realignment of products and technologies to allow both organisations to focus on their primary markets with their respective core capabilities. Benthos will transfer its geophysical sonar portfolio to Odom which includes a sub-bottom profiler, an interferometric sonar and a side-scan sonar.

What cross-benefits are there between the various Teledyne groups, for example oceanography and digital imaging or avionics?
First of all, we are able to share best practices in terms of business processes involving demand generation and demand fulfillment methodologies, product development and design practices for harsh environment applications, innovative promotional campaigns and productivity or efficiency improvement initiatives. These activities are enabled because business leaders get together face-to-face every quarter. Additionally, we are able to take a core technology from one group and re-adapt it for deployment into another group's market space. Signal processing designed for optical imagery can, in many cases, be applied to acoustic imagery and algorithms specific to Lidar point-cloud data and can be useful in bathymetric sonar processing. From a customer standpoint, enabling the simple

fusing of multiple datasets from disparate sensors into a single synoptic view provides extreme value to an end-user who is trying to make scientific assessment or engineering decisions. Finally, all groups have access to the corporation's R&D centre to solve very difficult technical issues as well as access leading edge technologies. This type of centralised resource is very rare in today's corporate organisational structures.

Teledyne is active in markets that 'have high barriers to entry and are not likely to be commoditised'. Will Teledyne keep activities that have easier competitive accessibility or will these companies or technologies be divested?

By design, we have built a corporation focused on highly engineered products and services. So, although very unusual for us, the odd opportunity may come about to spin out business activities or assets that have difficulty reaching our internal performance goals or which have limited value-creation upside. Some years ago, for example, we sold our piston engine business.

What do you currently see as a new product group to incorporate, especially in the marine sector?

We have a broad array of interests. Our spectrum of interests ranges from sensors to systems, products to services, and data collection and processing capabilities to critical information delivery solutions. Teledyne always has new sensors under development, either to broach new areas of capability or push the performance envelope of existing technologies. An obvious opportunity, again focusing on customer benefit, is to make our sensors work better together and enable them to integrate more easily on survey platforms. Beyond that, we are looking at ways to extend the usefulness of our sensor data so that our customers can get more value from our systems.

Your companies are working for government organisations and science institutions. Especially in the United States and Europe, the budgets are tightening. Is this affecting Teledyne and if so, how are you anticipating this potential loss of revenues?

You bring up an excellent point and an important concern. Indeed, since we have been operating in uncertain times over the past several years, we have been anticipating the scenario you describe. Therefore, being cognisant of this threat, we engage our business leaders in periodic strategic roadmapping exercises to ensure that we diversify our activities and spread our business endeavours across counter-cyclical industries, markets, geographies, applications and customers.

How would you describe the job market at the moment?

If your question is from a marine industries perspective, then I can comment that offshore oil and gas as well as offshore renewables are robust. Businesses that support the aforementioned activities are enjoying excellent prospects. Other marine sectors may be under stress somewhat but not for long. An emerging growth thesis is the entire infrastructure covering the liquefaction, transportation and regasification of natural gas across the oceans.

What are the plans after the recent take-over of multibeam manufacturer Reson together with the solutions from Teledyne Odom?

We have created a Marine Acoustic Imaging Group where Teledyne Reson, Teledyne Odom Hydrographic and Teledyne BlueView work together under a unified and coordinated market-facing structure. Again, the focus must be on the customer and how best we can bring our technologies and products to bear on best serving their needs.

In the multibeam market there seems to be a trend of going to smaller devices. Are you seeing a similar trend with other Teledyne marine sensors, for example, INS?

Absolutely. We are definitely seeing the trend toward smaller multibeam and inertial navigation packages. With the increased adoption rate by the marine markets of unmanned underwater vehicles, both tethered and untethered, smaller sensor footprints are being demanded to accommodate the reduced platform volumes and limited power budgets. This is especially true for autonomous underwater vehicles missions that carry a large number of sensors, or wish to operate for extended periods of time.

Do you still see a future for single beam echo sounders?

Yes. Even though single beam echo sounders are being displaced by multibeam echo sounders, there are still applications where single beam sounders offer strong advantages. Single beam sounders are lower in cost and much easier to set up than multibeam systems. This enables a less experienced surveyor to accomplish a successful survey with less risk. Not only is a single beam echo sounder lower in cost but the other sensors required for a single beam survey are also lower in cost. This makes the equipment required for a single beam survey much more affordable for small engineering and construction firms. If a survey does not require 100% coverage of the bottom, a single beam survey is generally much quicker and less costly to complete. Most dredging companies still require a single beam sounder on a survey boat because there are dredging projects where multibeam sounders will not detect the dredge depth. After a dredge has completed dredging in a particular area, suspended dredging solids will sink to the bottom. If the area is surveyed with a typical multibeam, the top of the suspended material will trigger bottom detects. However, a dual frequency single beam sounder with a lower frequency channel will generally show the dredger the hard bottom and if there is material settled over the dredge depth. In some

Mr. Davis is a senior vice president of Teledyne Technologies. He joined Teledyne eleven years ago and has successfully integrated fifteen acquisitions into the Instrumentation Segment with the more recent ones being in the marine space. Mr. Davis holds an undergraduate degree in chemical engineering and a graduate degree in business administration. He is a transnational executive with 29 years of general management experience leading technology- based manufacturers of electronic instrumentation, industrial process controls, laboratory analysers, medical & diagnostic devices, environmental monitoring systems, marine sensors and autonomous underwater vehicles.

areas it is possible for vessels to sail through the settled material. Single beam sounders and signal processing software are used to determine the navigable depth in these areas. This is generally not possible with multibeam sounders. All ships have single beam sounders on board for navigation purposes and for recording water depth during transit. In areas with turbulent waters, single beam sounders are more successful than multibeam sounders. This would include surf zones and areas with rapids.

How do you see the AUV market and AUV usage developing further?
As mentioned earlier, the AUV market is definitely growing. We know this through direct experience. For one, we manufacture and sell several types of autonomous underwater vehicles. On the other hand, we ship a broad portfolio of underwater sensors, instruments and interconnect devices to manufacturers of large displacement and small displacement AUVs. As the capabilities of AUVs and the associated sensors grow, so will the breadth of the missions and functions required of AUVs.

Will there ever be long endurance AUVs on the market capable of surveying for months?
The answer is a resounding 'yes'; however, the 'when' is not clear to me. There are many active programmes funded by industry, academia and navies around the globe that are making solid strides in the development of long endurance AUVs. As mentioned earlier, reducing the size and mass of the hydrographic system as well as of other sensor suites is critical. Efficient system design is paramount. The AUV's hydrodynamics, propulsion system, energy bank, power management and mission specific autonomy algorithms are just a few of the design elements that need to be perfected in order to achieve the optimal combination of payload capacity, range and endurance.

Does Teledyne think there is enough focus from governments on the marine market?
It is certainly and undeniably gaining more traction and attention. With the unrelenting growth of the world's population, future food and energy concerns are occupying more of government's attention. Similarly, disasters caused by destructive climate events force government action to fund solutions to predict and anticipate weather calamities. In both cases, the oceans are the main protagonist. The oceans can feed, provide energy and dictate climatologic behaviour. Scientists are also pressuring governments by pointing out that we have more detailed understanding of our Moon and Mars than of our own oceans.

What do you see as biggest developments in hydrography and oceanography in the coming years? Technically or policy wise?
I would say the development of 'enablers', technologies that connect different sensing and measurement capabilities that provide a global picture of conditions and trends, contributing to a thorough and total understanding of our ocean ecosystem and maritime expanses. The ability to measure, monitor and visualise in real time every corner of our oceans as well as model ocean behaviour and its association with surface and land-based dynamics.

A lot of high profile people, for instance Robert Ward within IHO, are pointing out the importance of putting hydrography at work for the 'blue economy'. Is this something you would underline?
Yes, I would. Hydrography is vital in creating economic growth in the marine domain. Ports, canals and waterways need to be upgraded to handle the next generation of giant cargo ships, the Triple-E. The offshore oil and gas industry is expected to double its expenditure on subsea hardware over the next five years. The building of off-coast LNG terminals for liquefaction and regasification is accelerating. Deployment of submarine pipelines and telecommunication cable networks is expanding. Offshore renewable energy projects are growing to an unprecedented rate as renewables are expected to surpass gas-based power generation by 2016. As more and more countries seek to exploit their offshore resources, whether hydrocarbons or minerals, hydrography comes into play to define what is beneath a nation's territorial waters as well as chart their exclusive economic zones and continental shelf extensions over which jurisdiction is claimed in accordance with the UN's Law of the Sea.

Is reaching out to other branches necessary for hydrography and oceanography?
If by other branches you mean aside from the traditional commercial or 'white ship' fleet, 'necessary' may not be the correct word. I believe it to be more of an 'eventuality'. Clearly, there is always a defence component that is present; however, there are always population-based drivers. 7 billion people live on our planet, and they live predominately near water… a beach, a river, a lake. Smaller governmental entities such as local municipalities certainly have increased interest in their submerged real estate; whether responders or the municipality's infrastructure management. Commercial examples are developers of shore property and the civil engineering companies tasked with survey.

Does industry focus enough on 'looking outside' and 'thinking out of the box'?
There is always room for fresh and creative thinking in any industry. Nevertheless, given the particular challenges of the marine environment and the demands of a very savvy customer base, 'thinking out of the box' is the norm rather than the exception. Our strategic roadmapping processes mentioned previously are designed to nurture and capture fresh ideas and new technologies. We push this philosophy down through all levels of development, involving our scientists, engineers, sales and marketing professionals… and especially our customers.
The marine industry was built by individuals and companies who conceived and developed unique and creative solutions, supporting adventurers with visions of greater understanding of the unknown. Some of these companies are no longer with us, which is natural. To stay in this business, we have to continuously evolve our solutions set to meet ever changing requirements.

Expanding the Use of Survey Data to the Wider Business Community

Challenges Facing the Data Managers/Owners

The combination of technical advances in survey sensors, combined with the use of Geographic Information Systems (GIS) and centralised data storage, has revolutionised the way in which digital survey data is acquired and managed. The result of these changes is the availability of the data to an entirely new set of users. The ease in which datasets can be selected, combined and displayed together has added genuine value to our data and when we consider the additional decisions and business benefits that can be made from a single set of marine survey data, it has in one sense reduced the overall cost of data acquisition.

John Kelly, Hydro Projects, UK

WHILE THE BENEFITS OF THIS are clear, a new set of problems for both the modern surveyor and data manager is also brought into play. This is because while the GIS application allows the user to combine datasets it does not guarantee compatibility in a geodetic sense or guarantee that the data is being displayed at a scale or manner that is appropriate for the decisions being made. This paper looks at some of the challenges we need to overcome to allow all users to utilise the data correctly, as well as some of the potential errors that can be made when not considering fundamental survey principles.

Mapping Techniques

The processing power of the standard user's desktop PC means that the corporate dataset is now more widely accessible, thus where charts or maps used to be produced by qualified surveyors for use by other disciplines, these drawings can now be produced 'on-the-fly' by the majority of users, often with very little knowledge or understanding of survey practices and techniques.

Figure 1 shows the type of map that can be easily produced with a free-to-download GIS application that allows the import of freely available data from the UK Government online data store. The GIS application itself cannot be faulted as it allows 'on-the-fly' transformations which are necessary, as even from a common data store, the data had been recorded with different Geodetic parameters. While the application correctly warned the user that a transformation was required when importing a specific dataset, the user simply had to press 'Yes' to allow the data import process to be completed. No obvious indication was provided as to what the transformation process was or what parameters would be applied. The application developer has to provide this functionality to ensure the system is flexible, therefore the fault, if there is one, potentially lies with the user, who needs to adequately understand the ramifications of misapplication of the datasets. Often, if unsure, users simply press 'Yes' and judge the accuracy of the map on the premise that it 'looks right'. In this example, the scale of the resultant map means that no accurate measurements could be made, however, the ability to easily zoom in and show the digital data at smaller scales opens up the distinct possibility that uninformed users will make decisions on incorrectly aligned data or display data at scales inappropriate to its acquisition.

> It is not unknown for fairly large errors in data manipulation to go unnoticed

Historical Training

Historically, training provided by surveyors has focused on the

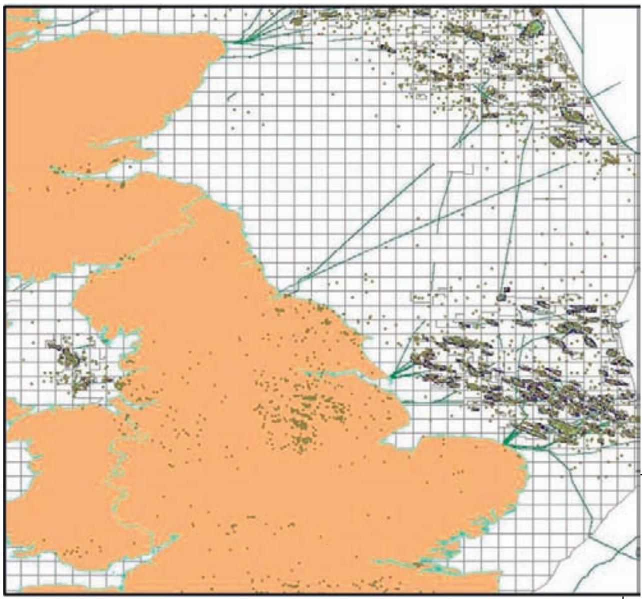


Figure 1: Typical GIS derived chart.

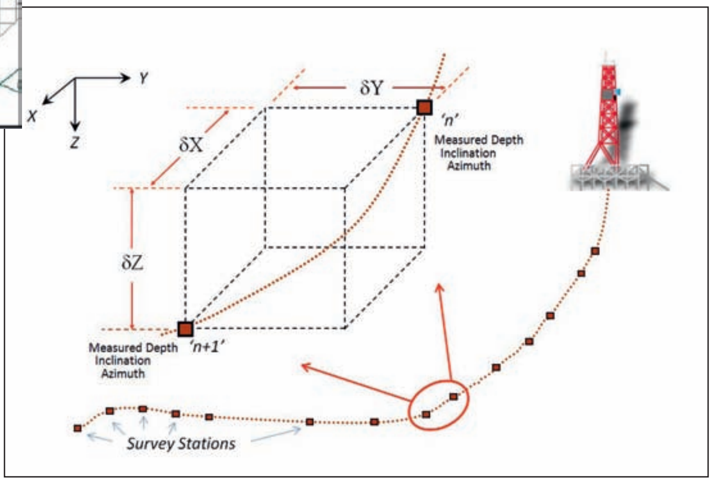


Figure 2: Computation technique for a deviated well.

intricacies of the discipline and the theory of computations on the complex mathematical shape that we inhabit. This perhaps was aimed more at job protection rather than educating the users and is an area that needs addressing. The challenge the surveying community faces involves a re-evaluation of the type of training provided to users. It is not simply enough to explain the rudimentary principles and a demonstration of why datums, ellipsoids and projections are necessary. The training also needs to help a user, who will typically have a different technical background, understand and recognise the potential pitfalls that are relevant to their particular business activity. The majority of GIS applications handle geodetic issues very well and for the majority of users the geodetic parameters peculiar to their operations are normally clearly defined. The biggest potential for error is perhaps the user either not recognising the type of data they are importing into the mapping model, or assuming that it is in the format that they would like. With modern surveys the data generally includes good metadata and the acquisition parameters are well defined. This is not the case with historical datasets where the metadata is either missing or simply wrong. In these cases the user generally makes an assumption that the data is in the format that they are expecting. In addition to disparate geodetic parameters, another issue can often be a lack of understanding of how an application actually manages a dataset and the users make the assumption that the system will correctly transform the data.

How Can the Computer Get it Wrong ?

An example of how a simple survey misunderstanding can have a dramatic effect on the data presentation can be seen in the position of a deviated well. From a surveyors perspective, the deviated drilled well is unique in that there are no redundant measurements during the survey and error checking relies on external data sources such as geological measurements. Figure 2 shows how any errors in the data will have an effect on the next and subsequent positions. The import function of the majority of GIS applications is a fairly automated process, the premise being that the data has already gone through a QC check and the application is simply displaying the approved data. It is not unknown for fairly large errors in data manipulation to go unnoticed. Another area of potential error is in either the lack, or poor quality, of metadata, especially in relation to the measurement units. A frequent issue that appears with historical data, is the requirement for the user to be familiar with the original well design in order to be able to detect if the depth measurements are in feet or metres.

The following example has been reproduced from its original location using Geodetic parameters chosen to emulate the magnitude of the error rather than indicate actual position.

In deriving the position of a deviated well the following three measurements are made at various locations along the well trajectory:

1. Measured Depth (MD) or distance down the well.

Station	MD (Feet)	Inclination (Degrees)	Grid Azimuth (Degrees)
1	0.0	0.00	268.6
2	362.0	0.00	268.6
3	443.8	0.30	84.67
...			
440	7782.0	15.99	58.01
441	7890.0	15.99	58.01

	Datum	European 1950
	Projection	UTM 3°E
	Ellipsoid	International 1924
	Latitude	55° 30′ 00″ N
	Easting	394715.8 mE
Top Hole Position	Convergence	-1.374°
	Longitude	001° 20′ 00″ E
	Northing	6151830.1 mN

Source Data for Well

2. Azimuth (Az) or direction of the well path.
3. Inclination (Inc) from the vertical of the well path.

The location of these measurement points, known as survey stations, are selected so that they reflect the changes in direction of the wellbore in both the horizontal and vertical planes.

The user focused on the fact that the trajectory 'looked' correct in mapping applications

In this particular example, the well ran approximately east to west extending over a horizontal distance of approximately 1.1km to a target depth of 1.8km. The dataset was based on the European Datum 1950 (ED50) with a Universal Transverse Mercator Projection with Central Meridian 3°E.

In contrast to the Geodetic parameters for the source data, the user's corporate database was based on a Transverse Mercator Projection, Central Meridian 0°E and so the above position was re-projected during the import of the data into the database. What the user did not recognise, however, was the effect this would have on how the GIS/Well Computation software used the data in computing the trajectory of the well. The industry standard computational algorithms use True Azimuth to compute the position of the individual survey stations. When imported into the corporate database, the system was unable to detect that the Grid Azimuths were based on the original UTM 3°E projection. The system simply applied the TM 0°E convergence to derive True Azimuths, thus introducing an error in azimuth to the order of 2.47°. Figure 3 shows the impact on the final computation of the well trajectory. The effect of the rotational error across the length of the well trajectory culminated in an error in position of approximately 50m at the Bottom Hole or target location.

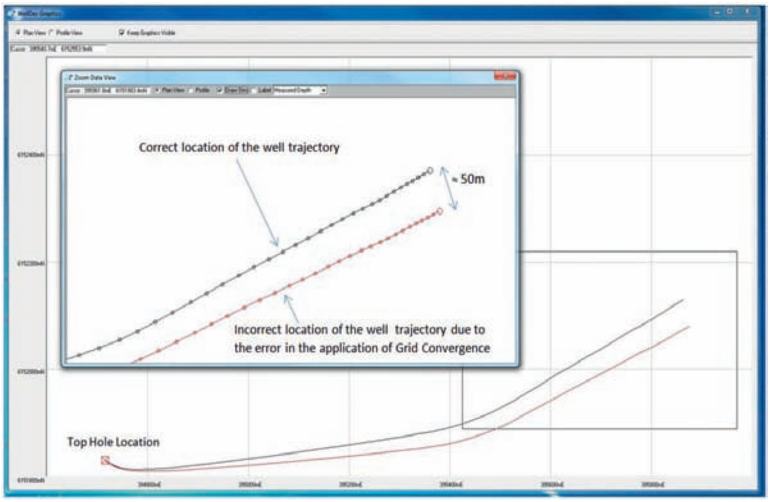


Figure 3: Effect of misapplied convergence on the well trajectory.

Consequences

Often changes in geological formations detected and positioned during drilling operations are used to recalibrate the Seismic Velocity models. It is clear that the placement of the well in the wrong geographical position within the model would have a direct impact on these velocity calculations and hence any subsequent interpretation of the seismic datasets. It took some time for this error to be detected as the user focused on the fact that the trajectory 'looked' correct in the mapping applications and the top-hole location was correctly referenced in the project projection.

Conclusion

Errors such as these, while they might be obvious to the surveying community, are not immediately apparent to the wider user. Our education and training process should therefore be designed to highlight not only the potential errors and their magnitude but most importantly the potential impact on the business. If this is achieved then all users will benefit from the digital survey data we acquire.

The Author

John Kelly graduated as a land surveyor from the University of East London and initially working for J.A. Storey & Partners and Glenn Surveys. He joined Geosite Surveys in 1985 and worked in the various group offices worldwide, and was appointed survey manager for the UK. Later, he joined Hydro Projects in 1994 as a systems developer and currently holds the position of technical manager responsible for the software development division of the company as well as providing Geodetic Awareness courses for various contractors and operators.

Quality Control of Survey Data

A Continuous Process?

Quality control of survey data is an integral part of any hydrographic survey or inspection operation, but the focus is too often concentrated on the wrong sensors, the carrying out of unnecessary comparisons and ultimately burying real issues in a flood of confusing and contradictory error messages, print-outs and alarms. So what is meant by quality control of survey data, why do we need it, how should we measure it and when is the best time to carry it out?

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'QUALITY' IS A PHRASE OFTEN used and is expected to be highly visible in the literature and mission statements of most companies and organisations. The problem facing the surveyor is how to translate this into actions that can be taken on board a vessel conducting a survey.

Quality control originated in the manufacturing industry and can be defined as a mechanism for ensuring that a product conforms to a pre-determined specification. It is distinct from 'quality assurance' which is a higher level process concerned with the ability of a process to deliver a quality product or service. With respect to survey data the focus has been heavily weighted towards quality control i.e. the trapping of errors present in the data, either at the acquisition or processing stage.

There is a cost associated with any failure in the quality control system as you move through the acquisition and processing stages. The further along the process the error is detected the more severe the potential consequences are in terms of time, cost and reputation. It is clear that it is desirable to detect any errors at the earliest possible stage either during or very shortly after the acquisition stage or better still, forestall errors at the set-up stage before acquisition has commenced. (See Figure 1).

Data Quality

The ultimate aim is for the perfect dataset, but it is implicit in the act of measurement that the true value can never be measured, there will always be a residual error between the measurement and the true value. The problem remains as to how to decide

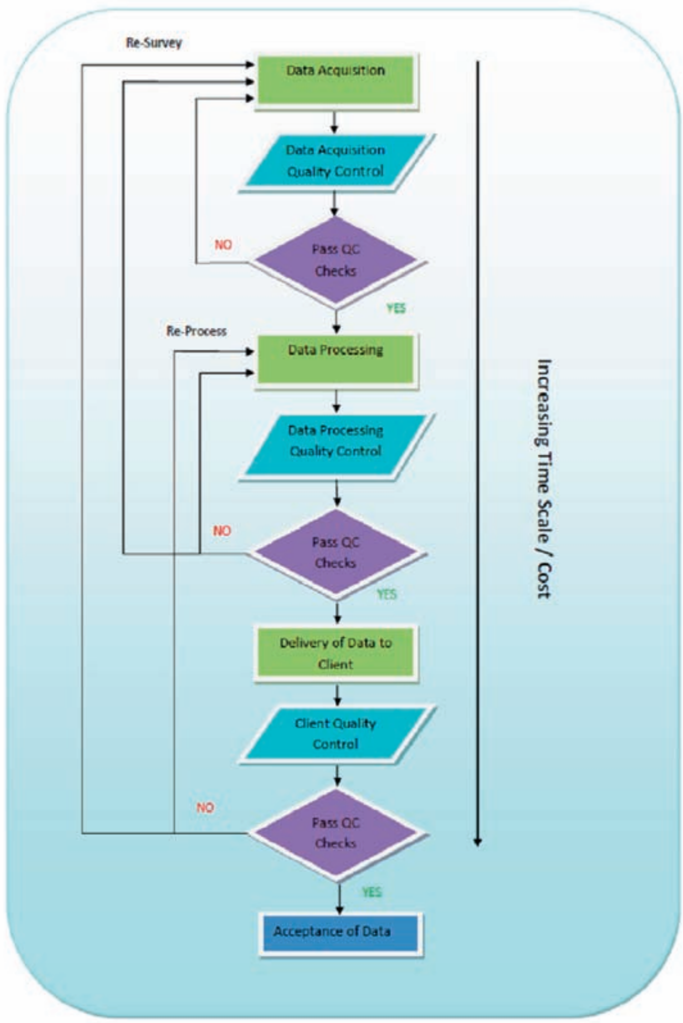

Figure 1: Increasing cost of late error detection.

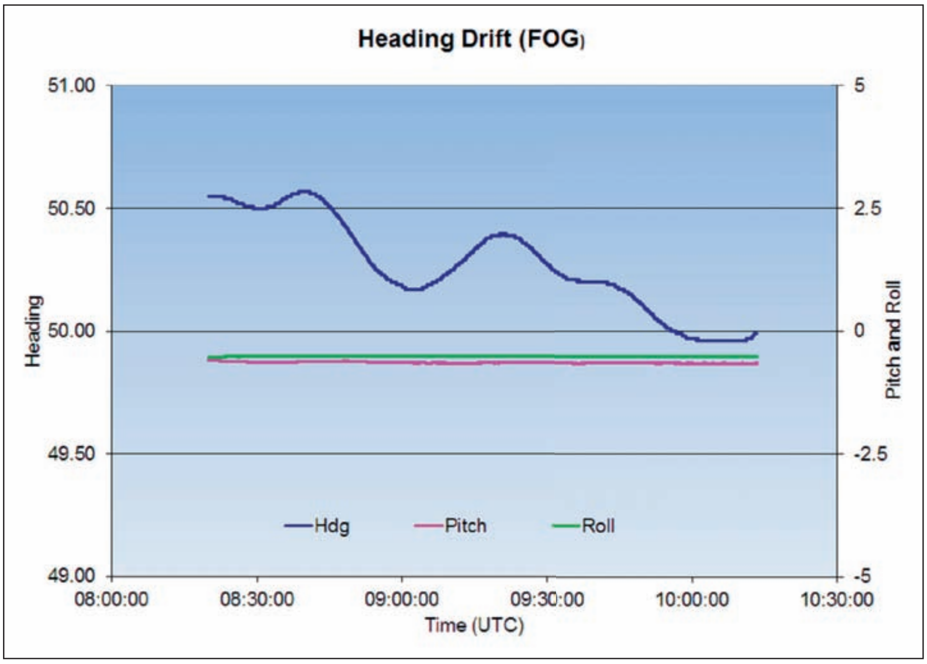

Figure 2: IMU with drifting heading but steady pitch and roll.

what is sufficient data quality and what should be used as a benchmark. There are several sources which can be used when determining what accuracies the surveyor should be working towards.

As a survey contractor, the first point of reference will be the client specifications. When working for a client a company is contractually obliged to perform the work to conform to the requirements in these specifications. This is good when the specifications are well set out, clear and achievable. Too often this is not the case and the specifications can be vague and open to interpretation or worst of all, based on unrealistic expectations of equipment and sensor performance.

The sensor specifications listed in the manufacturer's data sheets are too often theoretical, or based on overly optimistic tests performed under ideal environments. An MRU that only performs within the published specification when it is bolted to a test bed in a laboratory is not useful if it does not perform to this level in the field. (See Figures 2 and 3).

In addition, the figures used in data sheets almost seem to be designed to confuse, as different error figures are often quoted, without specifying their confidence level (1 σ, 2 σ, 95%). This leaves the users with the task of identifying and normalising these figures to understand the actual performance, and it makes it challenging to compare similar sensors.

All providers of survey services will have a set of Internal Procedures: these documents are based on experience and best practice but they are by their nature generic documents. Project specific procedures should be based on knowledge of the scope of work, the specific instrumentation and the client specifications and should be more detailed with respect to specific operations than the generic procedures.

The figures used in data sheets almost seem to be designed to confuse

Also available are Survey Standards: these are documents set out by organisations such as International Marine Contractors Association (IMCA, 1). For example, IMCA produces a set of guidelines covering topics including:
· use of multibeam echo sounders
· use of USBL systems
· use of GNSS systems

While these guidelines provide much useful information they are, by their nature, based on generic scenarios.

Standards are also published by International and National Hydrographic offices, including:
· IHO – International Hydrographic Organisation (Monaco)
· NOAA – National Oceanic and Atmosphere Administration (USA)
· LINZ – Land Information (New Zealand)

These standards are largely concerned with surveys for navigational purposes and are generally not applicable to the type of tasks often carried out by hydrographic surveyors working for offshore and subsea organisations – in addition they are almost exclusively concerned with vessel-based operations and do not consider subsea sensor platforms e.g. ROVs, AUVs and ROTVs.
Finally, the surveyors can base their

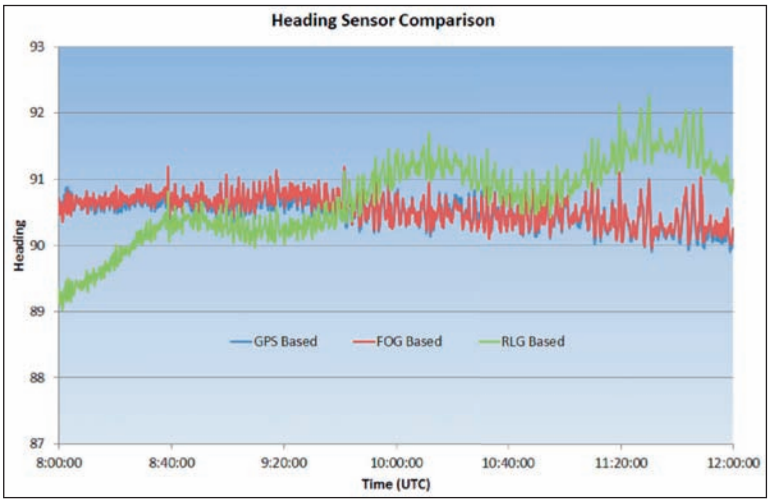

Figure 3: Multiple Sensors: Two heading sensors agreeing and one drifting.

expectations of system and sensor accuracies in a subjective manner based on experience: experience is extremely useful in determining data quality, but it is also extremely dangerous as it can be based on different spreads and client requirements – what is acceptable to one client may be completely unacceptable to another.

Sensor Performance

A major driving factor for improved quality control of survey data is the improvements in sensor performance over the past 10 to 15 years. Pipeline inspection used to be carried out using mechanical scanners, where one scan of 200 points took 4 seconds. Today, more than 500 points can be acquired from a multibeam echo sounder 15 to 20 times a second, and other sensors have shown similar improvements. With these progressions, accurate time-stamping of the data is much more critical than before, and failure to achieve this correctly is probably the most common error found for survey data (See Figure 4).

Another factor is the much greater availability of advanced software on the users' desktop, allowing them not only to view the interpreted data, but also the raw data in far more detail than before.

Online Quality Control

Online quality control is performed in real time or near real time to ensure sufficient quality has been achieved in the acquired data.

Historically, online QC was a function performed by the online surveyor looking at the information in real time and assessing whether problems developed.

The main drawback with this traditional approach is that, with the increased number and complexity of sensors it is often not easy to detect all errors online and problems may only become apparent at the data-processing stage.

There has been emphasis on improving online QC, especially towards the reporting and documentation of the performance of the online system.

Standards do not consider subsea sensor platforms e.g. ROVs, AUVs and ROTVs

The main drivers for this have been:
- Multiple sensors, more sophisticated deliveries and improved viewing tools which allow direct comparisons and highlight errors
- Client requirement to document the QC Process

Daily QC reports will inform the operator (and the client) that something has happened in the previous 24 hours but will not assist during the actual data gathering operations. It is therefore likely that some online QC functions will continue to be manual. This has been carried out using the tools available in the online navigation programs, by setting up:
- Real-time comparison of 'similar' instruments with maximum tolerances for deviation specified
  - Motion vs. motion; GPS vs. GPS etc.
- Monitoring of maximum or minimum values
  - Maximum or minimum allowed pitch etc.
- 'Frozen' values
- QC figures from instruments
  - MBE, pipetracker etc.
- Statistics (near real time, e.g. by file)
- All of the above can trigger alarms

While some online QC functions should continue to be manual, e.g. multibeam quality (noise), the majority of error captures should be performed using the online QC function. This should identify problem data as soon as possible without flooding the users with unnecessary information.

Continuous QC

Although the online QC is considered to be the most critical QC function, due to the cost and effort to rectify issues missed there, the QC process should not stop there. It needs to be an integral and continuous part of the chain from data acquisition until final delivery. In order to achieve this, the data processing should follow a pre-defined set of rules based on:
- Client requirements and deliverables
- Contractors experience and procedures
- The software in use
- The quality of the data

The main advantage with a pre-defined approach, is that the processing becomes less dependent on the individual interpretation, and the results can be better documented and QC'ed.
It should be noted that even though the above is desirable, there are some tasks that by nature are dependent on someone's interpretation, e.g. reviewing video footage from pipeline inspections. The key is then to document this as well as possible and to QC it

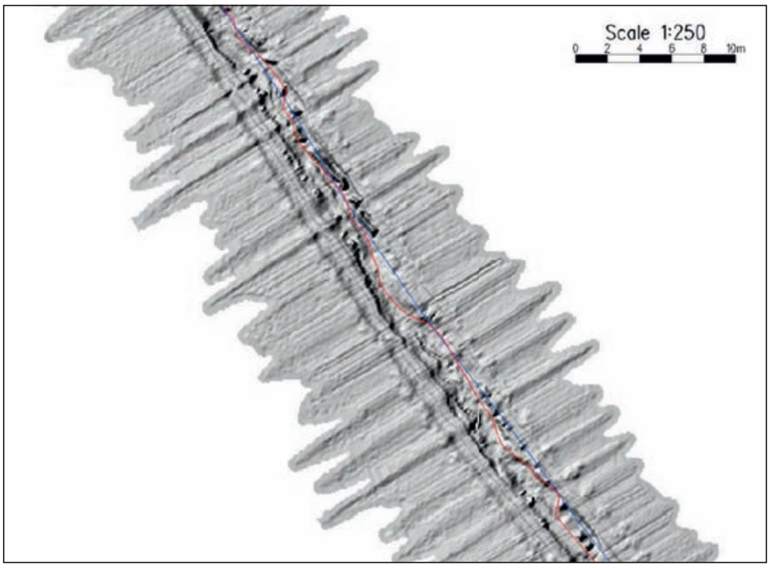

Figure 4: Example of result of incorrect time synchronisation.

against other data, which may be less dependent on individual interpretation.

Conclusion

Quality control functionality should be an integral part of any survey application, both during data acquisition and data processing. The software used should provide the users with the necessary tools to identify errors as soon as possible. Duplication of sensors provides a means to identify that there is a problem, but does not always indicate which sensor is in error. It is also not always possible to duplicate critical sensors, e.g. pipetracker during a Depth of Burial survey.

The future may give us more intelligent sensors, with internal time-stamping of data and with better self-assessment of the data quality, but the key factor to improve the overall quality is to integrate all data real time, and have software that can assess the quality and identify problem areas in real time or very shortly after.

1. www.imca-int.com

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Space-borne Technologies for the O&G Sector

From Operational Environmental Monitoring to Rapid Bathymetry Mapping

Satellite-derived mapping and monitoring technologies can provide important support for a range of applications in the oil and gas industry. Prior to tasks such as pipeline routing and other infrastructure engineering activities, these technologies can be efficiently deployed over large, remote and/or in-accessible areas for bathymetry charting, mapping seafloor habitats and monitoring the health of near coastal ecosystems. During dredging activities, satellite-derived products can deliver near real-time, synoptic information on the extent of dredging plumes and the associated sediment loads in the water column. These satellite-based methods can be more rapid and cost-effective than traditional in-situ and airborne measurements and observations and are furthermore entirely non-intrusive. This article describes the methods, applications, services and validation of such projects, showcasing the possibilities of these technologies.

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AQUATIC ENVIRONMENTAL baseline monitoring is often a requirement in the oil and gas (O&G) sector. An important component of this is the continuous mapping of seafloor ecosystems and habitats, a complex activity which can require considerable ongoing effort. Satellite-derived image products can considerably reduce these efforts.

Optical sensors on board remote sensing satellites are able to detect the spectral properties of aquatic targets. Through semi-analytical, radiative transfer inversion algorithms - which include removing the confounding influences of the atmosphere, water column colour and water column depth - these spectral properties can be used to retrieve characteristics of the benthos. From this, the benthic cover can be categorised and mapped, for example as seagrass, coral, sediment, or rubble, or divided into broader assemblage classes or geomorphic zones.

Using 2m horizontal resolution imagery, these technologies have proven capable of deriving contiguous seafloor habitat maps in up to 15m of water depth, water clarity permitting. Validation studies of these seafloor map products for sites in Australia (Ningaloo Reef and Rottnest Island), the Caribbean (Virgin Islands), in Germany and in the Arabian Gulf (Figure 1) show an overall accuracy of 90% or better, when compared with extensive in-situ measurements.

Such accuracies point to the routine applicability of satellite-derived mapping products for aquatic environmental baseline monitoring. An important further advantage to using remote sensing technologies, in this context, is that access to historical archives of satellite imagery enables the retrieval of past environmental conditions, going as far back in time as 20 years or more in the case of data from the Landsat satellite series.

Dredging Plume Monitoring

Dredging in coastal areas or close to vulnerable ecosystems such as coral reefs, seagrass meadows or mangroves is commonly subject to strict environmental regulations. There is consequently a well-defined need in the O&G sector to map and monitor the extent and evolution of dredging plumes, as well as the corresponding suspended matter concentrations in the water column.

Aquatic remote sensing technologies have been applied, combining various satellite sensors, to monitor dredging plumes up to 3 times daily (subject to cloud cover). These water quality maps are in units of absolute concentration values and have a horizontal spatial resolution of between 30-500m, which is often sufficient for open ocean applications. Where necessary, due to plume size and extent, higher spatial resolution commercial data (2–5m) have also been successfully used.

Conventional methods for this type of monitoring often include deploying aircraft with human observers. The satellite-based approach offers numerous advantages over this, including: reduced OH&S risks; removal of potential observer subjectivity (through standardised, inter-comparable map products); rapid delivery of an updated map product (within 2-24 hours of satellite

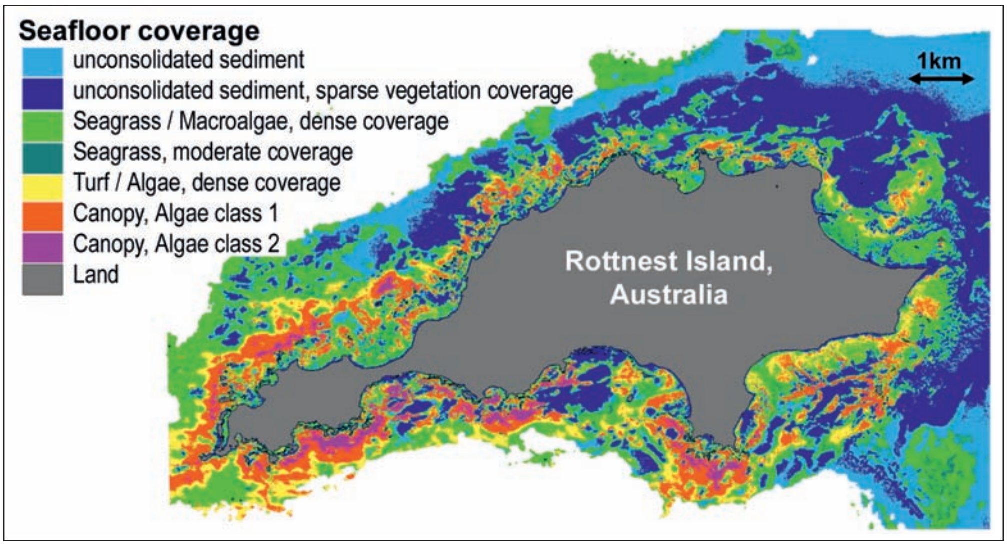

Figure 1: Satellite-derived seafloor map surrounding Rottnest Island.

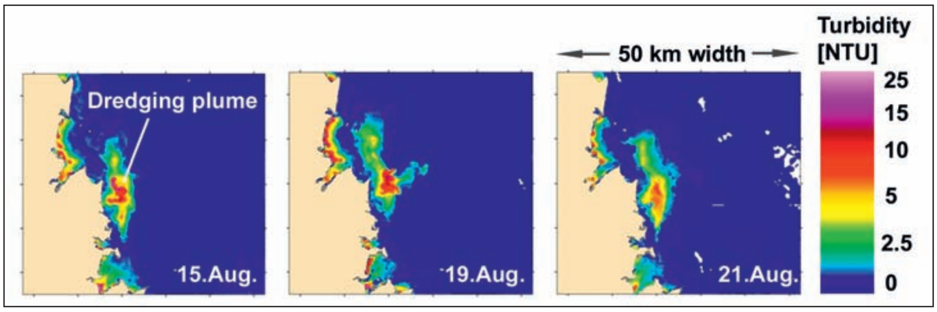

Figure 2: Tracking a dredging plume with satellite data.

image capture); and considerable cost savings.

Timely delivery is a critical issue for dredge plume monitoring and similar compliance applications, and this can be made possible by direct data feed access to the satellite data providers and the fully automated processing systems.

As part of dredging operations in support of shipping channel expansions and pipeline activities for a project off the northwest coast of Australia, Woodside Petroleum commissioned a satellite-based turbidity monitoring system. The need to monitor the dredging plume was critical for this project, as it was located in an area of important marine habitats, including numerous coral reefs. Woodside previously relied on observers in airplanes to perform the monitoring, and found that switching to a satellite-based system enabled cost savings exceeding AUD1 million for this single project.

Bathymetry Mapping

Bathymetric information is essential for many offshore planning, engineering and even exploration applications in the O&G sector. However, it is often not up to date or even available, particularly at the scales or levels of contiguity typically required.

Echo sounding and Lidar campaigns are time- and cost-intensive and typically require extensive upfront planning. Satellite-derived bathymetry (SDB) maps, in contrast, can be delivered within days of initially identifying the bathymetry information requirement (assuming image data availability). That said, SDB processing and delivery time is nonetheless a function of area size, and can be up to a few weeks for areas larger than one thousand square kilometres (if 2m pixel imagery is being used). The most versatile and accurate methodology for SDB in shallow waters relies on physics-based processing of high-resolution multispectral imagery.

The accuracy of SDB is partly a function of water clarity and depth. From validation exercises covering more than 10,000km^2, and ranging from locations as diverse as Australia, Alaska, the Caribbean, the Middle East (Figure 3) and the Baltic Sea, the following accuracies can be considered as generally applicable for SDB: for clear water bodies, maximum depths of 35m can be reached, with an accuracy of within 10% (CE90) for the first 15m of depth; for relatively turbid waters, the maximum depths that can be estimated are approximately 5m, and the accuracy typically decreases, down to within 20% (CE90).

Satellite-based aquatic products are now reaching a more robust and operational status

As with seafloor mapping, the advantages of the SDB approach include applicability to remote, extensive, or in-accessible areas, being non-intrusive, providing continuous

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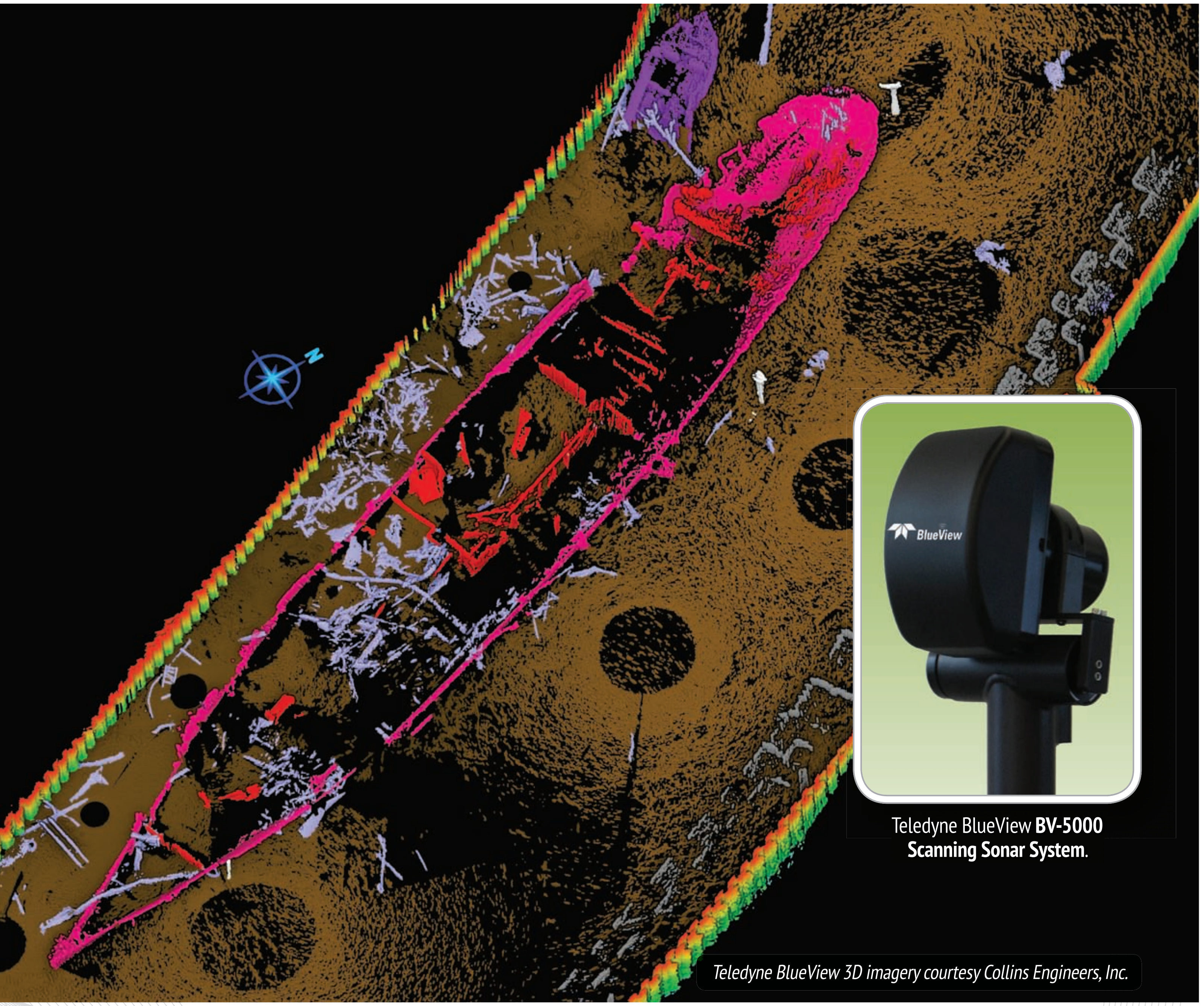

Teledyne BlueView **BV-5000 Scanning Sonar System**.

Teledyne BlueView 3D imagery courtesy Collins Engineers, Inc.

The **BV-5000: Crisp laser-like 3D acoustic imagery**

A model of a 215 ft long sunken ship and associated debris field. The vessel has posed a navigational hazard by blocking over 60% of the steel sheet pile lined channel since 1992. The scans were performed to aid in removal plans and specifications. The BV-5000 was selected due to its ability to image vertical and overhanging surfaces as well as its ability to operate over shallow obstructions where traditional multibeam sonar cannot be safely positioned.

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Figure 3: 3D visualisation using SDB overlain with true colour satellite imagery.

high-density data in raster map form and being very cost effective. Indeed, based on feedback from

Considerable savings in labour, time and costs

numerous bathymetry projects, the costs of an SDB campaign have been calculated to be 5-10 times less than that of comparable traditional methods.

However, it is important to understand the potential uses and limitations of this technology. To begin with, SDB is limited to relatively shallow waters (0 to 35m), but at the same time this shallow zone is also the least practicable and cost-effective zone for ship-based bathymetry initiatives. SDB can therefore play an important complementary role for bathymetry campaigns that include a shallow-water zone. It must be said that SDB is generally not considered as accurate as echo sounding retrieved depths. One alternative approach worth mentioning in this context is the inclusion of a limited number of (significantly more costly) echo sounding, or Lidar transects within an SDB target area. The Lidar data can then be used to fine tune the SDB model. It has been found that this hybrid approach offers a compelling compromise between cost and coverage, where higher than standard SDB accuracies (i.e. consistently better than within 10% accurate in clear waters) may be required.

Conclusions and Outlook

The O&G sector is utilising satellite-based aquatic imaging and analysis technologies for applications as diverse as construction planning, exploration and environmental monitoring. Recent years have seen an increased uptake by the O&G sector of these technologies and the trend looks set to continue. Importantly, satellite-based aquatic products are now reaching a more robust and operational status, as exemplified by projects and applications discussed in this article. Further to this, the specifications and performance of applicable satellite sensors have continuously improved, with new orbiting sensors coming online as soon as 2014, which will underpin the continued uptake of these technologies. The main drivers for this uptake are the considerable savings in labour, time and costs associated with the ability to map extensive or inaccessible areas, rapidly and repeatedly, with standardised units of measure and at relatively high accuracies.

Acknowledgement

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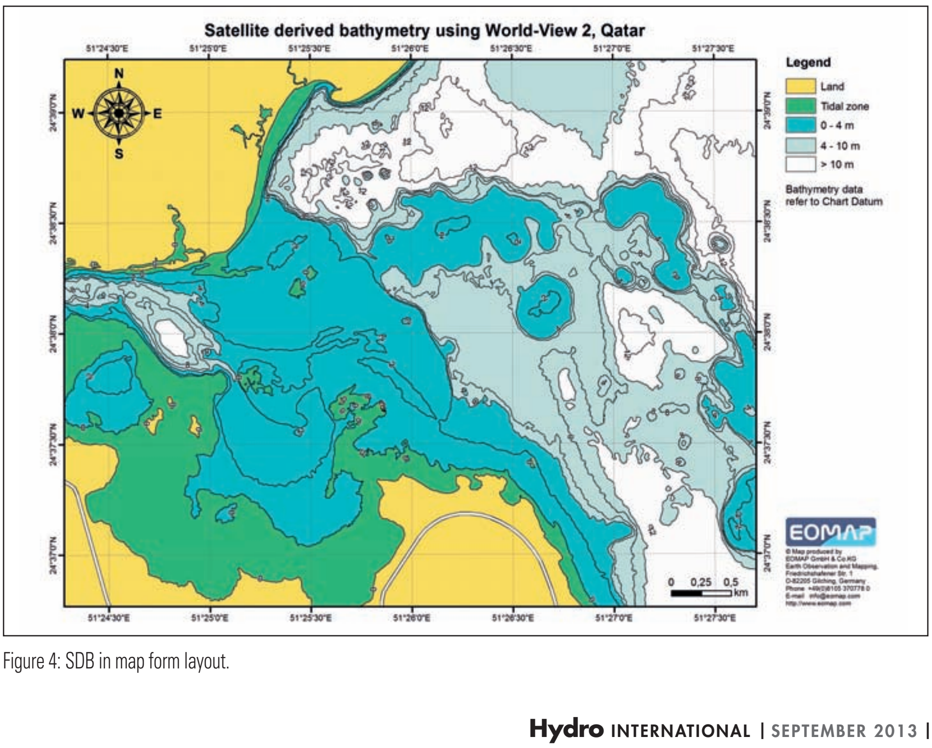

Figure 4: SDB in map form layout.

Dynamic Calibration of Navigation Sensors Using GNSS Technology

New on the move approach of calibration for vessel navigation sensors

Over the years there has been a requirement to calibrate navigation (heading and motion) sensors and verify DGNSS systems on vessels working in the offshore oil industry. These calibrations are a requirement of oil companies and need to be undertaken prior to commencement of a project and/or at regular intervals throughout a project. This article covers the techniques and accuracies related to applying GNSS technology to vessel sensor calibration and verification.

John Vint, Fugro Survey AS, Norway

HISTORICALLY, VESSEL SENSOR calibrations have been undertaken in port using traditional land survey techniques, where the vessel is moored alongside a quay. The current advances made in GNSS technology and software over the past few years has led to newer streamlined dynamic techniques. These dynamic calibrations have a number of advantages over traditional land survey techniques:

- The calibrations can be undertaken anywhere and at any time; in port, in transit between projects or even during production.
- They are cost effective as there is no longer a requirement for the vessel to berth alongside a quay.
- They are 'environmentally friendly' as the requirement for an extra person and equipment to be sent to a vessel to undertake the work is now obsolete.

Vessel Preparations

The first step in the preparation for dynamic calibrations is to install three or more GNSS antennae (with associated receivers) on the superstructure of the vessel. These antennae mounts must be rigid and located in positions that optimally define the vessel's heading, pitch and roll and should have an open view of the satellites with as few obstacles as possible. Nominally, one is mounted in the bow and two at the stern (port and starboard side) as indicated in Figure 1.

Once installed, these antennae positions must be precisely coordinated within the vessel's local coordinate reference system to an accuracy of ± 3mm system using precise dimensional control techniques. This is normally a 'one time' task as the antenna and/or brackets are left in place on the vessel between calibrations.

4 hours of data at a 1Hz update rate is sufficient to produce good results

Calibration Data Collection

In order to collect data to undertake the calibration, GNSS raw code and carrier data are data logged by the GNSS receivers at these three antennae. Based on our current experience, 4 hours of data at a 1Hz update rate is sufficient to produce good results. Once the logging session is complete, the logged GNSS data is transferred from the receivers and converted into uncompressed Rinex format and is then ready to be processed.

Simultaneously with the raw GNSS logging, data from the vessel sensors (heading sensors, motion sensors and DGNSS Systems) are also logged at 1Hz data rate time tagged in UTC such that it can be matched to the processed GNSS data during the calibration computations. The requirements for vessel sensor data logging is as follows:

- The heading sensor data shall include UTC time and uncorrected heading observations.
- The motion sensor data shall include UTC time and uncorrected pitch and roll observations.
- The DGNSS System data shall

include UTC time and geographical coordinates referenced to WGS84 or one of its derivatives.

Upon completion of the vessel data logging, the calibration and verification data should be reviewed and converted into ACSII files.

All the logged data can be transferred from the vessel to Fugro Survey by use of a secure FTP Site. In addition to the logged data, vessel metadata is also received. This includes:

- Vessel Name, Survey Date, Location and Timings.
- Precise offsets within the vessel reference frame for the GNSS logging antennae.
- Precise offsets within the vessel reference frame for the vessel' DGNSS antennae.
- Start and stop times for the logging sessions.
- A list of system names along with manufacturer and serial numbers.

GNSS Processing

Upon receipt of the data by Fugro Survey an initial quality control process will be undertaken to ensure all the required data and metadata have been received.

Once the data has been checked, the raw GNSS Rinex data from the reference receivers is processed in two stages:

1. RTK Processing – The derivation of the relative antennae positions at 1 second epochs using software that allows processing of data logged on a moving platform. The technique of processing directly between two moving kinematic objects, significantly improves the accuracy of the relative trajectory. The results of the RTK processing (in combination with the precise vessel offsets) are used to determine the values used for the vessel heading, pitch and roll calibrations (ref. Figure 2). These computed values are matched with vessel heading and motion sensor observations to derive corrections to be applied to the systems.
2. PPP Processing – The technique for the Precise Point Positioning (PPP) solutions is capable of computing accurate positions without the use of Reference Stations data or DGPS services. Reference stations are made obsolete by employing precise satellite orbits and satellite clock corrections coupled with state of the art error modelling. For this process, the IGS (International GNSS Service) rapid orbits data is obtained via the internet and used in the computation. The results from the PPP processing (in combination with the RTK results and precise vessel offsets) are used to verify the DGNSS Positioning Systems.

As Fugro Survey can also deliver DGNSS systems to a number of our dynamic calibration customers, which also require verification, all the GNSS processing is undertaken using third party software. No Fugro algorithms are used in the computational process, which ensures the independency of the results obtained.

Correction Calculations

Data synchronisation of the GNSS processing and the logged vessel sensors are undertaken and, as described, the relative vectors

Figure 1: Antennae locations.

Table 1: Heading C-O Comparisons – from 2010.

Location	Technique	PosMV	Gyro #1	Gyro #2
Indonesia	In Transit	-0.13°	+0.05°	+1.05°
Romania	In Transit	-0.11°	+0.10°	+0.72°
Australia	In Port	-0.14°	+0.00°	+0.81°
Romania	Traditional	-0.13°	+0.08°	+1.00°

Table 2: Motion C-O Comparisons – from 2010.

Location	Technique	Pitch	Roll
Indonesia	In Transit	-0.03°	+0.28°
Romania	In Transit	-0.04°	+0.26°
Australia	In Port	-0.05°	+0.25°
Romania	Traditional	-0.02°	+0.28°

Table 3: DGNSS Comparisons – from 2010.

Location	Technique	Easting	Northing
Indonesia	In Transit	-0.06 m	+0.01 m
Romania	In Transit	-0.01 m	-0.06 m
Australia	In Port	-0.04 m	+0.03 m
Romania	Traditional	+0.01 m	+0.09 m

Table 4: Heading C-O Comparisons – from 2012

Heading	Seapath*	Octans
Traditional	-30.25°	+1.13°
Dynamic	-30.23°	+0.96°

from the RTK processing are used to derive the vessel's heading, pitch and roll values which are compared with the vessel's sensor observations and correction values with statistics derived for each vessel sensor of interest. Similarly, the absolute positions derived from the PPP processing are used to verify all the DGNSS Systems of interest.

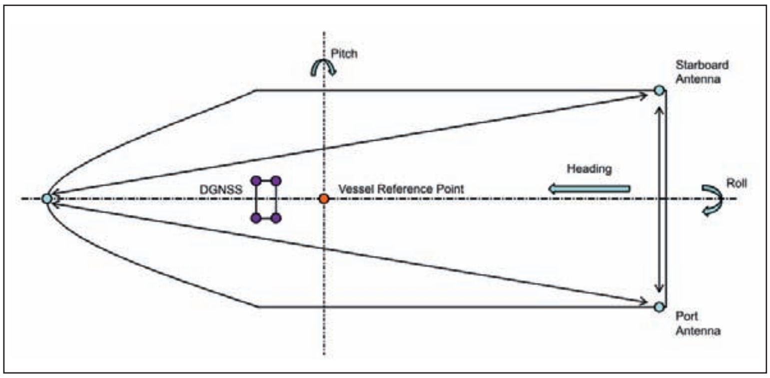

Figure 2: Layout of sensors in relation to the vessel coordinate system and heading, pitch and roll axes.

Independency of the results is ensured as no Fugro algorithms are used

Quality Considerations and Results

To ensure the quality and accuracy of this technique, it is essential to ensure an optimal installation of the GNSS reference antennae. The following points must be adhered to:

- A clear view of the satellites, down to a satellite elevation angle of 10 degrees. It is very important to minimise the location's surrounding obstructions
- Precise offsets for the antennae in the vessel's local coordinate system (X, Y, Z). This is obtained through an accurate offset survey of the three antennae.
- Longest possible baselines to optimise the accuracy of the RTK processing.
- Firm and horizontal antennae mountings.
- Designated and well-defined antennae locations.
- Well-defined vessel metadata.

In addition to the importance of optimal antennae locations, the processing software is vital to the success of this technique and the result examples presented below are a verification of the effectiveness of the 'state of the art' software used by Fugro Survey.

The relative vectors between the GNSS antennae need to be of high quality in order to obtain a good calibration. In the software, the vectors are processed both in the forward and reverse directions and the solutions combined. As an example of the precision of this method data processed from a 4 hour set acquired in transit offshore had a standard deviation of the vector between the two antennae on each end of a 27.7m baseline of 0.005m.

As a verification of these accuracies, the following tables present the results for one vessel calibrated / verified on three occasions during a one month period in 2010. As a reference, the results from a traditional land survey calibration have also been included.

Additionally, the accuracies are confirmed from a later survey in 2012, again with a comparison to a traditional land survey calibration take at the same time.

The reason for the apparently large C-O value is due to the Seapath being installed with its heading alignment approximately 30° to the vessel's heading.

Motion	System	Pitch	Roll
Traditional	Seapath	-0.29°	+0.01°
Dynamic	Seapath	-0.30°	+0.03°
Traditional	Octans	-0.24°	+0.10°
Dynamic	Octans	-0.26°	+0.13°

Table 5: Motion C-O Comparisons – from 2012.

DGNSS	System	Diff E	Diff N
Traditional	Starfix.G2	-0.01 m	-0.04 m
Dynamic	Starfix.G2	+0.01 m	-0.01 m
Traditional	Starfix.G2	+0.03 m	-0.04 m
Dynamic	Starfix.G2	0.00 m	-0.04 m

Table 6: DGNSS Comparisons – from 2013.

Conclusions

From the information presented here, it is clear that the accuracy of undertaking the calibration and verification of navigation sensors has been proven to equal that obtained when calibrating by traditional methods. The technique is flexible and the constraints imposed by the traditional land survey methodology are removed.

The technique has a growing interest amongst our customers and to date we have undertaken around 55 calibrations for 6 different customers. Additionally, this technique has gained approval from a number of major oil companies with a total of 10 different oil companies amongst the end customer of our customers .

The Author

John Vint graduated from Newcastle University (UK) with a BSc in Surveying Science. After university he joined Racal Survey and then via acquisitions worked for Thales GeoSolutions and now Fugro Survey. He currently has the position of survey manager for the Norway operations (based in Bergen), a position he has held since 1999. His specialist knowledge is in the field of satellite navigation.


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Figure 1: Portrait of Augustin Fresnel.

Heaven Descended to Earth

The Invention of the Fresnel Lens

Theresa Levitt, University of Mississippi, USA

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

At the dawn of the nineteenth century, France, like every other nation, regarded shipwrecks as an inevitable downside of maritime life. There were fewer than 20 lighthouses dotting the French coastline, and these were generally limited to its harbours, intended to guide ships into port. The government did not keep any records about the number of ships that went down, but the numbers were clearly in the hundreds every year.

NAPOLEON BONAPARTE FORMED the first national lighthouse organisation, the Commission des Phares, in 1811. This came at the peak of his imperial conquest of Europe, and his decree promised to improve lighthouses "on the universality of the coast of the Empire" – a coastline that stretched from the Baltic Sea to the Straits of Gibraltar. He appointed a number of high-ranking luminaries to the commission – the top names from the Navy, the engineering corps, and the Academy of Sciences. The Commission accomplished little in its early years, as most of its members were occupied with Napoleon's military endeavours. In 1819, however, it turned its attention to the dismal state of France's coastline and one of its members, the physicist François Arago, saw the opportunity to bring one of his protégés, Augustin Fresnel, to Paris. Fresnel was a young engineer assigned to road-building duty in the provinces, but had spent his evenings in his tent dreaming up a revolutionary theory of light that completely overturned the existing doctrine. Arago, wanting to work with Fresnel on his theory, procured his services as a temporary assistant. He assigned him the task of comparing the brightness of various configurations of the existing lighthouse apparatuses, which consisted of parabolic mirrors placed behind a lamp to reflect the light outward into a single beam.

Fresnel mounted the reflectors on top of the Arc de Triomphe, whose height offered the best vantage point for several miles around. As he struggled to coax light out of the finicky devices, he "perceived at first glance where the difficulty lay." Even the most perfect mirror lost half its light on reflection. In practice, it was inevitably worse, as the mirror was never perfectly reflective, the parabolic geometry was hard to get right, and the device needed a hole for the lamp's burner to fit through.

Fresnel surmised that using lenses instead of mirrors would solve this problem since much less light would be lost passing through glass than reflecting. But a convex lens large enough and powerful enough to capture the light from a lamp and bend it into a single beam was impossible. It would have been way too heavy and beyond the capability of glassmakers to produce. Additionally, the required short focal length meant the middle would be very thick and more light would be lost traversing it.

Fresnel's solution was a lens built in steps. He broke the single curved

Note: This past month, I read *A Short Bright Flash: Augustin Fresnel and the Birth of the Modern Lighthouse.* I was very impressed by this work and recommend it for all hydrographers and those interested in maritime history. I invited the book's author, Dr. Theresa Levitt, to contribute to this issues History column which she graciously consented to do.

Albert E. Theberge Jr.

surface of the lens into several concentric sections consisting of distinct prisms. Each of these individual prisms bent the light from the light source into a parallel line. Added together, they sent their light out in a single beam, precisely as a big lens would. But the bulky middle section was gone. The lens' major problems had been solved.

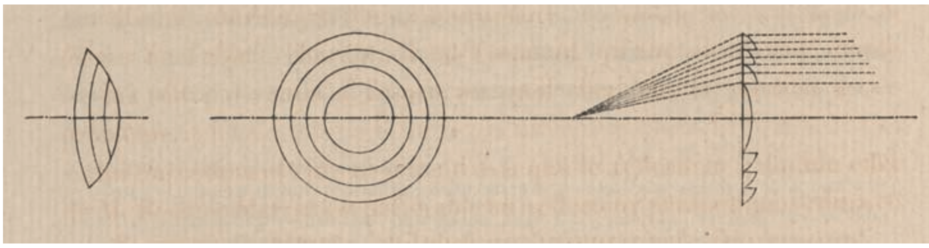

Figure 2: Fresnel submitted this sketch to the French Lighthouse Commission. It shows a thick convex lens on the left. Fresnel proposed to cut away sections in four steps, which would produce the thinner lens on the right, still capable of bending the light into a single beam.

The Lighthouse Commission met his idea with some scepticism, and Fresnel was determined to build a model on his own to demonstrate its effectiveness. This was no easy task, as he had extraordinary demands for the quality and precision of his glass pieces. Working with the noted instrument maker François Soleil, he completed a prototype panel by April, 1821, and invited the Lighthouse Commission, together with a number of sailors, to witness its first trial run. Seated high on the hill of Montmartre, they saw the lens far outshine the reflectors they were paired against.

Even the most perfect mirror lost half its light on reflection

The leading maker of the parabolic mirror apparatus was also present, only to lament that his enterprise was about to "enter into oblivion."

The Lighthouse Commission ordered a full lens from Fresnel and Soleil, to be placed in France's most illustrious lighthouse, La Cordouan, known as 'The Versailles of the Sea.' Outfitted for Louis XIV with fine marble and stained glass, La Cordouan was also a showcase of the latest lighthouse technology. Lit in 1823, the new lens was a triumph, drawing the attention of sailors from around the world.

After witnessing the success at Cordouan, France immediately embarked on a massive project to blanket the entire coastline in Fresnel lenses. In order to determine the best sites for lighthouses, Fresnel, who now had a permanent position as secretary of the Lighthouse Commission, worked with another member of the Commission, Admiral Paul-Édouard de Rossel, the chief hydrographer of the Dépôt des Cartes et Plans de la Marine (who would go on to head the department in 1827). In addition to the maps at the Dépôt, Fresnel and de Rossel used the recently published *Le Nouveau Neptune*, the work of France's premier hydrographer, Charles-François Beautemps-Beaupré (who would also become a member of the Lighthouse Commission in 1826). Nicknamed 'the father of modern hydrography', Beautemps-Beaupré had revolutionised the field in the 1790s when he began using an improved version of the reflecting circle (an instrument which used mirrors to measure the angle between two objects) to produce vastly more accurate surveys. The product of many years of work, his *Nouveau Neptune* appeared in 1819. It was "a complete collection of the general and particular maps necessary for navigating the entirety of the French coastline," and was accompanied by an updated *Pilote Français*, which listed hidden dangers along the coastline, and gave directions for entering ports.

Using the improved maps, Fresnel and de Rossel put together a Carte des Phares which blanketed the French coastline in light. They conceived of it as a system, a rational network where everything fit together as a whole. Knowing the range of visibility of Fresnel's apparatus, they carefully calculated the placement of lighthouses along the coast such that as one light faded away, the other came into view. This meant a lot of new lighthouses. The grand plan that Fresnel revealed in 1825 called for a system of 51 lighthouses, nearly four times the paltry 13 that were currently operating in France. All would have new Fresnel lenses.

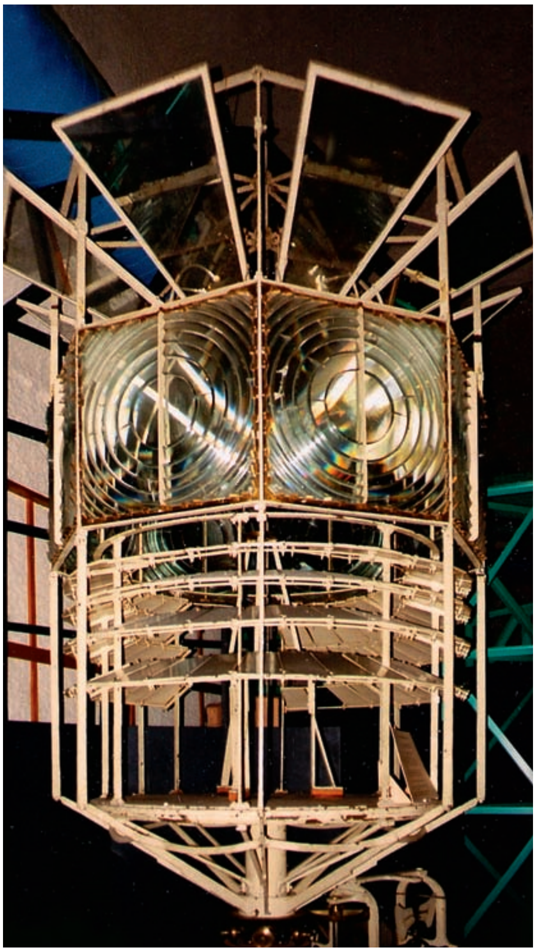

Figure 3: The Fresnel lens installed at Cordouan in 1823. The middle bulls-eye panels consist of concentric prisms, while the top and bottom sections are inclined mirrors. Later designs replaced the mirrors with internally-reflecting prisms that could bend the light through a larger angle. (Image courtesy: Thomas Tag).

Rossel and Fresnel broke the lights down into different categories. The largest were the 'land lights', the first lights the sailors would see coming in from the open sea. These would be roughly eighty miles apart. In between them would be smaller lights whose specific characteristics would help sailors identify where they were,

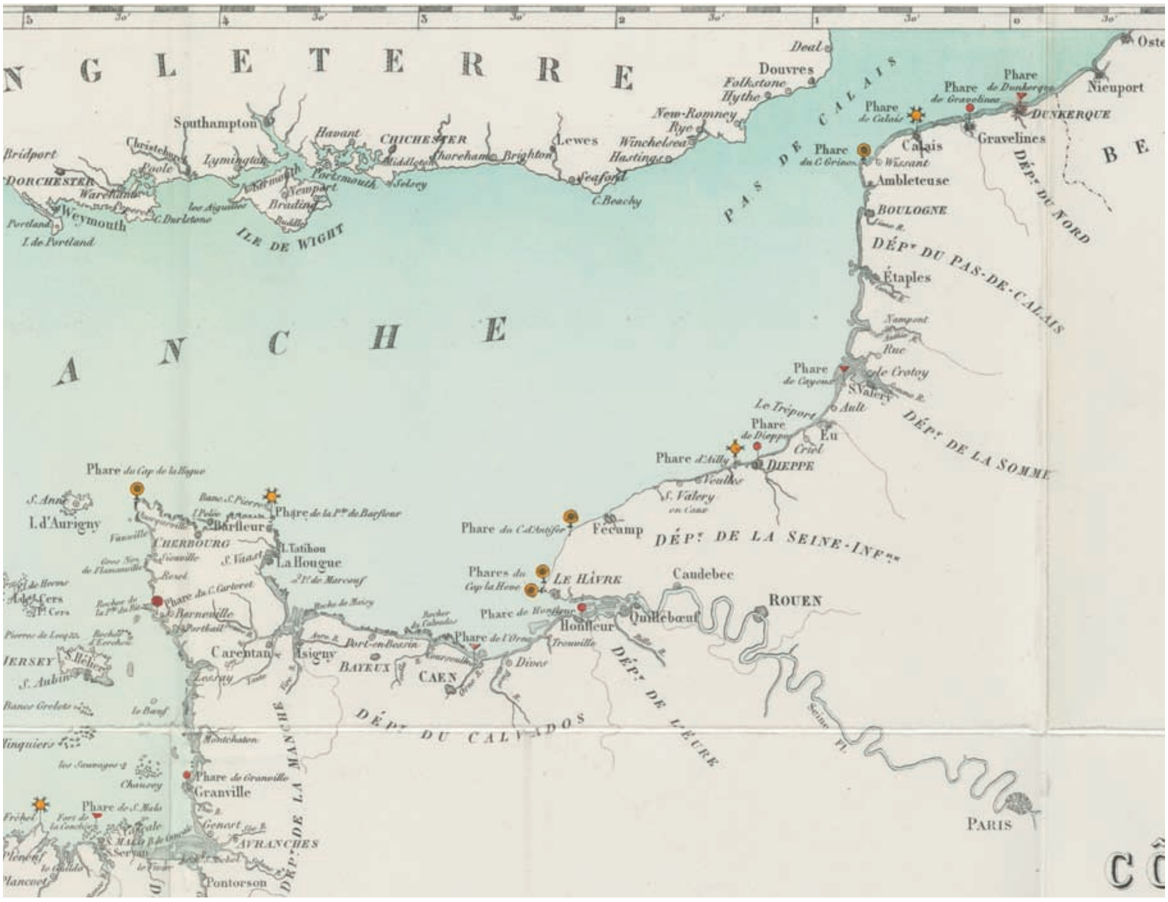

Figure 4: Inset of the Carte des Phares, showing the English Channel. The orders of the lenses are represented by the size of the circles (the large ones are first-order lenses; the small ones, third order). Fixed lenses are represented by solid circles, while rotating lenses have marks indicating the number of panels on the outside.

and help guide ships into particular harbours.

As part of this system, Fresnel devised a classification system for his lens. He divided them into 1st, 2nd, and 3rd order lights, with a separate category of smaller harbour lights. First order lights were the largest, with an interior diameter of nearly 2 metres. Second order lights were 1.40 metres across, third order 50cm, and the harbour lights 30cm. The orders used different lamps as well, with the largest using Fresnel and Arago's innovative 4-wick design, the 2nd order a 3-wick design and the 3rd order a 2-wick design. The larger lights thus consumed a great deal more oil. But the Commission did not skimp. The majority of the lights in the plan were the 28 1st orders, while the 18 3rd orders were reserved for use in sounds, river entries, and bays, and 5 2nd orders were for very particular situations.

It was also important for sailors to distinguish the lights from one another, and thus know where they were. Fresnel proposed three variations: 1. fixed lights, which shone continuously; 2. rotating lights that flashed every 30 seconds; and 3. rotating lights that flashed every minute. The minute-flashing lights, which used eight bulls-eye panels and rotated once every eight minutes, shone the brightest. For the 30 second rotation, Fresnel used an apparatus with 16 half-lenses (as tall but half as wide), which divided the light into twice as many (weaker) beams. Fixed lights, which had no bulls-eye panels but sent their light evenly across the horizon, were the weakest of all. Putting together the map thus became something of a jigsaw puzzle, where Fresnel tried to place the brightest lights where they were most needed, while ensuring that no two adjacent ones were alike.

The project took nearly twenty years to complete. Each lens made was a painstaking exemplar of technology and craftsmanship, and the design continued to evolve. The lighting of Baleines on 15 January 1854, was the final lighthouse completing Fresnel and Rossel's 1825 plan. Fresnel lenses now illuminated the entirety of the French coastline, with their studied differences of flashing and duration allowing every sailor to pinpoint his location exactly. Unfortunately Fresnel and Rossel died in 1827 and 1829 respectively and did not live to see the completion of their great work. However, their work lives on today as even in our era of GPS, Fresnel lenses offer comfort to those making landfall and the coastwise sailor. France's premier historian, Jules Michelet, praised the tight network of overlapping rays for its enlightened design. "For the sailor who steers by the stars, it was as if another heaven had descended to earth."

The Author

Theresa Levitt is an Associate Professor at the University of Mississippi, USA, specialising in the history of science in nineteenth-century France. She has a PhD in the History of Science from Harvard and a BSc in Physics from the Massachusetts Institute of Technology.

Figure 1: ENL Group CEO, Gareth Hodson.

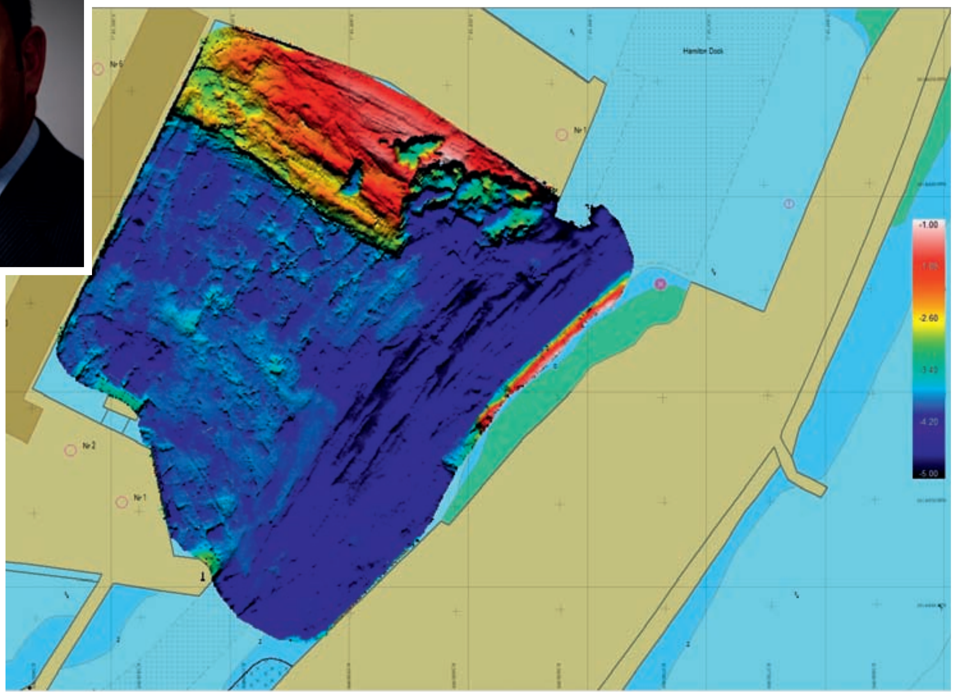

Figure 2: WASSP MBES in QPS QINSy.

Multibeam Technology from Land of the Long White Cloud… New Zealand

WASSP, Part of ENL

Freddy Foote

Founded in 1945, ENL is New Zealand's largest marine electronics company, employing around 50 people across its two locations: Auckland, North Island (head office) and Nelson branch, South Island. Its core business activities focus on 4 main groups: import & distribution / service and support / systems engineering / MBS R&D.

With its origins firmly rooted in the commercial fishing industry as a technology supplier and service operation to the fleets, the company has expanded as technological innovation in areas such as radar, sonar and satellite communications has progressively become more critical to both commercial fishing operations and other marine applications. In line with this growth the company has also spearheaded its own R&D activities over the last 10 years with the development of the multibeam system WASSP (Wide Angle Sonar Seafloor Profiler).

Entirely designed and manufactured by ENL in New Zealand and sold by a global network of authorised dis tribu tors covering some 39 countries, WASSP has systems reliably serving to a broad range of hydrographic and commercial applications. From fishing to dredging to complex mapping applications, WASSP provides a reliable and comprehensive real-time MBS solution at a very competitive price point.

Continual investment by ENL in WASSP R&D has been a key driver to its rapid growth. From an original base of a single product model to a multi-model portfolio comprising the WMB-3250, WMB-3230 and WMB-5230, WASSP is now offered in various frequency and beam configurations to suit the application: 112 or 224 beams, 160kHz & 80kHz, various

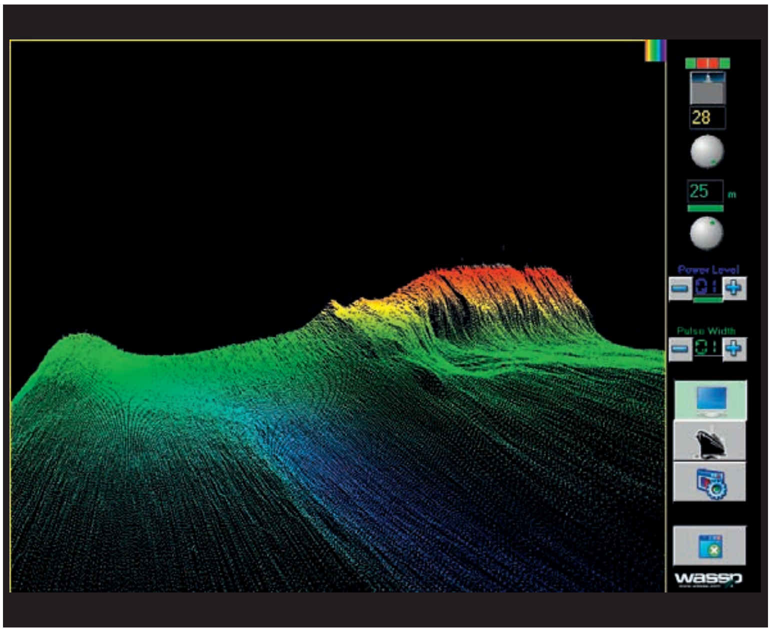

Figure 3: Survey around the pilings of the Freyburg Wharf, Auckland, New Zealand.

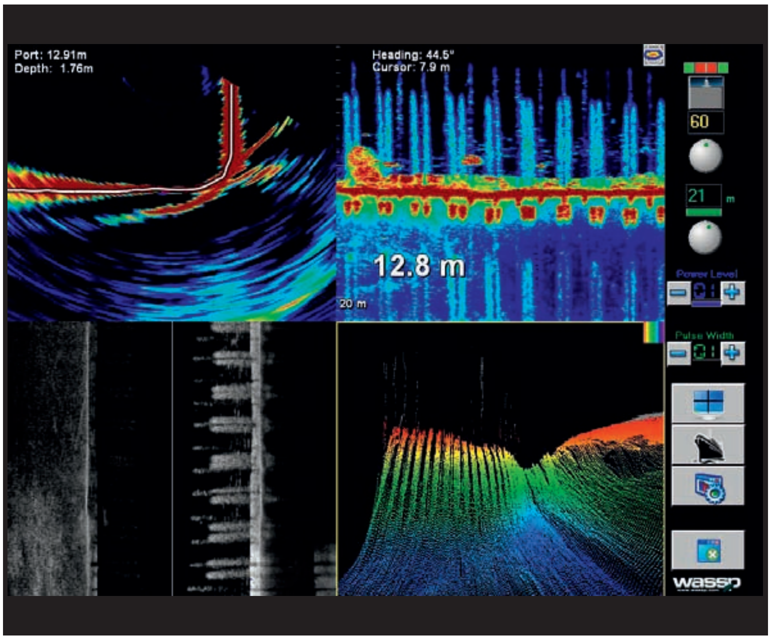

Figure 4: The versatility of WASSP S demonstrated, displaying both seafloor and water column information in real time.

3rd party survey & mapping interfaces and all with a 120 degree swath capable of mapping the seafloor approximately 100 times faster than a single beam system.

Investing

"The only way to keep our market position and continued growth path is through investment - whether it be in seeking the very best design & software engineers, in ensuring we use the very latest technology or in ensuring our manufacturing systems are the 'leanest' possible – investment underpins everything we do", says Gareth Hodson – MD ENL.

10 years of development have been put into ENLs WASSP. From its original inception and focus on developing an MBS system for a niche seafloor mapping application in the commercial fishing industry to where it is now has been a steep learning curve. One of the driving tenants from not only its demanding fishing customers but also the growing surveying and mapping users has been to provide a far simpler user interface – GUI, particularly for customers using WASSP in a real-time mode where time equals money and the need to collect accurate data efficiently and quickly is paramount. Capable of being operated as a standalone real-time system with its own Navigator software suite or interfaced to engineering suites such as QPSs QINSy, Hypack or EIVA for real or post-processing of data, WASSP provides a wide selection of user options.

Future

In line with what its markets and customers want, WASSP's overall development path will see its model range go both deeper and shallower and with further enhanced signal processing and novel transducer designs. These technology drivers will also underpin WASSP's development in a number of critical user-specific applications – enhanced water column analysis, seafloor categorisation and image resolution. Customers of WASSP face the same market dynamics as any other industry – competition, and if they are confident that a system's performance will meet the performance and operational criteria required…the most competitively priced product will usually win. Customers view any capital purchase in terms of a 'payback period'…and a competitively priced MBS system provides a commercial opportunity to them, particularly in the survey/mapping market, enabling them to not only bid their work more competitively but also gain a quicker payback period and hence path to profit. ENL saw a market opportunity for a high performance entry level MBS that combined quality data capture with ease of use and ability to interface to mainstream software suites such as EIVA , Hypack and QPS. The physics of underwater acoustics will not change, but what is changing is the use of advanced technology and digital signal processing techniques to drive MBS development and that will only accelerate further – and it is the latter that ENL is focused on. Speed to market and continually pushing the development envelope out further are key to ENL's strategy and continued growth. MBS is no longer the sole domain of large, complex, expensive systems. Advanced signal processing combined with novel transducer designs are very rapidly bringing the benefits of MBS to a wider user base.

www.wassp.com

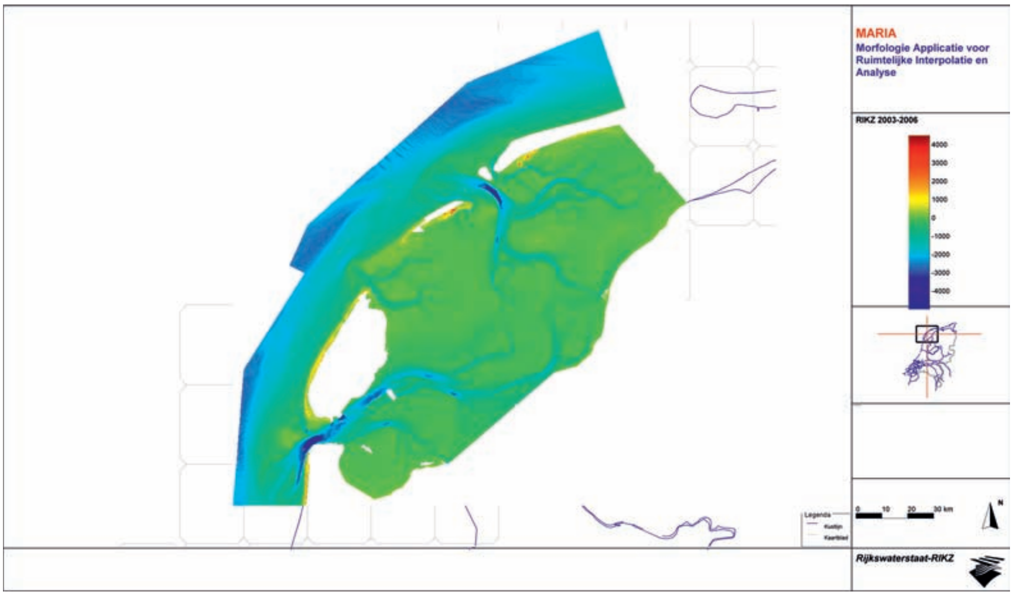

Figure 1: Western part of the Wadden Sea.

Hydrography for Modern Water Management

Rijkswaterstaat Hydrographic Department

Niels Kinneging, Rijkswaterstaat, The Netherlands

Dry feet, sufficient clean water and reliable and useful information. That is what integrated water management means to Rijkswaterstaat in the Netherlands. All measures are planned around the users, nature and the landscape and are carried out in close cooperation with water boards, other public authorities, NGOs and private organisations. Hydrography plays a major role in the work of Rijkswaterstaat. New demands from policymakers and the public as well as pressure on the budgets pose new challenges for the hydrographic department of Rijkswaterstaat.

THE NETHERLANDS HAS A LOVE and hate relationship with water. First of all water is of major economic importance to the Netherlands for the transportation of goods from all over the world through the Port of Rotterdam to the European hinterland e.g. Germany. On the other hand, water forms a threat for flooding the low land.

Rijkswaterstaat is the Dutch government organisation responsible for the maintenance of the main water systems and main waterway network for shipping, flood conveyance and ecological purposes. Hydrographic information is essential for these tasks.

Rijkswaterstaat has made an inventory of all the uses of hydrographic information within the organisation, the most important being safety. The information is used to guarantee safe shipping to the major harbours of the North Sea as well as on the main inland waterways. The information is made available through port-ENCs and Inland ENCs.

Another safety application is the defence against flooding. The coastal defence is based on the yearly measurement of the coastal zone and dunes. Numerical models, that need the bathymetry as input, are used to predict the water levels in case of high or extremely high river discharges.

Furthermore, hydrographic information is needed for the maintenance of the waterways by means of dredging and as a basis for different ecological information products. These products are required by various European directives.

Finally, some scientific studies (e.g. the Sandmotor project) make extensive use of all available hydrographic information.

The Hydrographic Department of Rijkswaterstaat

Rijkswaterstaat is one of major commissioning organisations for hydrographic work in the Netherlands. The other one is the Hydrographic Office, which is part of the Royal Netherlands Navy. Rijkswaterstaat and the Hydrographic Office plan their activities in close cooperation and exchange

Figure 2: Survey vessels of Rijkswaterstaat in the Port of Rotterdam for a comparison test.

Figure 3: Surveyor on board.

bathymetric and other hydrographic data.

Rijkswaterstaat has a department for data acquisition and processing. A total of about 50 employees work at the hydrographic branch and a fleet of 18 ships is available.

The Rijkswaterstaat organisation is rapidly changing. Whereas ten years ago almost all data acquisition and processing was performed by Rijkswaterstaat itself, most of the hydrographic work is now carried out by hydrographic contractors. Rijkswaterstaat is still responsible for contract management, quality assurance and data acquisition in special situations, like calamities.

A very recent development is the commissioning of hydrographic work in combination with major dredging contracts for the maintenance of the major shipping channels. More responsibility has been moved to the dredging contactors. This also means that extra attention needs to be paid to the data quality in the contracts.

These developments require a major change in the competence of the personnel. A strong focus is laid on quality assurance together with the contractors. A Dutch version of the IHO S-44 standard has been developed for very shallow water. These standards are imposed on all hydrographic work done on behalf of Rijkswaterstaat.

New Challenges

A new challenge for Rijkswaterstaat is the implementation of risk-based monitoring. Hydrographic surveying is always aimed at reducing risks. Based on expert judgement for all waterways, a resurveying frequency has been defined, but a direct link to the risks involved is absent. Expert judgement is not sufficient to handle major changes in the system, like the development of the Maasvlakte 2 harbour near Rotterdam. Quantification of the risks and incorporation of risks in the monitoring planning is a major challenge for the coming years. It will require a flexible organisation to react to upcoming risks.

Another development is the implementation of good data management practices. Within Rijkswaterstaat 28 different applications of hydrographic data have been identified and the principle 'capture once, use many times' is embraced. Outside the organisation there is a demand for the data. Rijkswaterstaat is currently implementing the open data policy. All these developments require data management to be a specialised profession in the organisation. Information on the current state of the waterways as well as historic information should be available to all interested people.

The hydrographic role within the organisation is subject to constant change and always adopts the most advanced technology. Therefore, professionals, young and old, like Level A and B hydrographic surveyors as well as academically educated professionals, are needed for the challenges described above. Rijkswaterstaat, together with other hydrographic organisations and companies, should be able to offer good prospects for these professionals.

http://rijkswaterstaat.nl/en/


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Data Buoy Successfully Deployed

The UK Met Office has funded a meteorological/oceanographic data buoy from Hydrosphere UK, which has been installed as part of the Western Channel Observatory. The buoy was deployed at station E1 and is being operated and maintained by Plymouth Marine Laboratory (PML) in collaboration with the Met Office. The buoy consists of a 3m diameter hull constructed from multiple-section polyethylene floats bolted around a central steel structure, with through-hull access for underwater instrumentation and cabling.
http://tw.gs/R7rbaa

The newly positioned metocean buoy.

Automatic Scour Monitoring Solution

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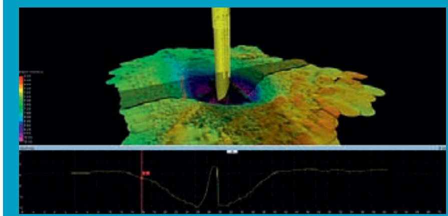


EIVA NaviSuite Edulis.

Dual Antenna GNSS Inertial System

SBG Systems, France, adds a new inertial system to its Ekinox Series. With integrated Dual Antenna GPS + GLONASS receiver, the Ekinox-D is a ready-to-use survey grade inertial navigation system which provides consistent true heading (0.05°). The Ekinox-D embeds a Dual Antenna L1/L2 GNSS receiver to deliver more robust heading and position, while increasing satellite reception availability. Ekinox-D is an integrated system. GNSS data and inertial information are fused by an Extended Kalman Filter (EKF) to improve data integrity. This computation allows the system to achieve 0.05° Roll, Pitch, and True Heading; 5cm Heave; and 2cm RTK GNSS position.
http://tw.gs/Qav3CW

SBG Ekinox-D.

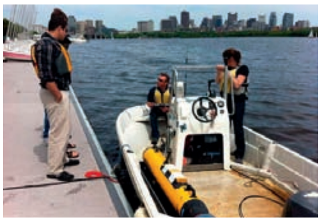
UK eLoran Roll-out to Back up Vulnerable GPS

Seven differential eLoran stations will be installed along the south and east coasts of the UK, following approval by the Department for Transport. The stations will provide alternative position, navigation and timing (PNT) information to ensure that ships equipped with eLoran receivers can navigate safely in the event of GPS failure in one of the busiest shipping regions in the world.
http://tw.gs/R7raC3

Phoenix AUV Upgraded to 4,500 Metres in Depth

Phoenix International Holdings, USA, has taken delivery of its Bluefin-21 Autonomous Underwater Vehicle (AUV) after designer and manufacturer Bluefin Robotics completed a depth upgrade from a 1,500-metre to a 4,500-metre capability. The Phoenix AUV is equipped with field-swappable acoustic and optical payloads. The acoustic payload section can concurrently operate a Reson 7125 multibeam (400kHz), Edgetech 2200-M side scan sonar (120/410kHz), and Edgetech DW2-16 sub-bottom profiler (2-16kHz) on 20 hour dives at speeds up to 3.5 knots.
http://tw.gs/Q5x503

AUV Plug-and-play Payload Autonomy Demo



The testing set-up.

Bluefin Robotics and the Laboratory of Autonomous Marine Sensing Systems (LAMSS) at the Massachusetts Institute of Technology (MIT, USA) have demonstrated the MOOS-IvP Payload Autonomy, or Backseat Driver, concept running on a field-exchangeable Gumstix computer on two Bluefin AUVs, a Bluefin-9 and Bluefin-21. The demonstrations prove that the software can be applied to multiple vehicles to support the development, testing and fielding of new behaviours needed to advance AUV applications and even enable rapid mission configuration changes in the field.
http://tw.gs/R7raEY

Long Endurance USV Development

Long endurance unmanned surface vehicle.

Autonomous Surface Vehicles (ASV, UK) has won a research contract to design and build a Long Endurance Marine Unmanned Surface Vehicle (LEMUSV) under the Small Business Research Initiative (SBRI). This initiative is supported by the UK government. Run by the Natural Environment Research Council (NERC) and the Defence, Science and Technology Laboratories (Dstl) the competition brief sought to develop an autonomous vehicle to gather data from the ocean over several months.
http://tw.gs/R7rbi4

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

Figure 1: Some of the attendees at the NZR AGM at the Port of Tauranga.

Figure 2: NZR Committee: L to R. Cdr. David Crossman, Maurice Perwick, Kevin Smith, Gary Chisholm (missing Neville Ching).

Australasian Hydrographic Society

AHS Awards

The AHS Awards for 2013 are as follows:

- Patron's Gold Medal: CDRE Rod Nairn AM, RAN
- Award of Merit – Literary and Media Achievement (Nob-Fiction): Dorothy Prescott
- Chairman's Letter of Appreciation: Frank Guerts

Congratulations to each of the recipients. The Awards will be presented at various AHS World Hydrography Day events.

East Australia Region

A one day technical seminar and celebratory World Hydrography Day dinner was held on 16 August 2013. The seminar did coincided with the visit of a delegation from the new Hydrographic Society of Korea (HSK). The Korean delegation was led by the HSK president. This event also involved the signing of a Memorandum of Understanding between the Australasian Hydrographic Society (AHS) and the HSK. The president of the HSK advised us that he would be bringing three professors that have a background in Law of the Sea. The August seminar therefore had a 'Law of the Sea' theme. The theme is topical noting the recent tensions in the South China Sea and the vital role that hydrographic surveyors play in maritime boundary delineation.

New Zealand Region

The New Zealand Region held its 2013 Seminar Day and AGM on World Hydrography Day in Tauranga. The Port of Tauranga is the largest port in the country in terms of total cargo volume and the second largest in terms of container throughput. It is also associated with the grounding of the container vessel *Rena* in October 2011 on a reef 20km offshore. A group of 30 attended and enjoyed a 2 hour tour of the port facilities in the morning. In the afternoon 10 high quality presentations were presented covering interesting hydrographic and dredging projects, new technologies and hydrographic education. The AGM was held and attendees enjoyed socialising and an evening meal afterwards. The presentations are at www.hydrographicsociety.org.nz/events.htm .

Hydrographic Society Benelux

World Hydrography Day 2013

The Hydrographic Society Benelux highlighted World Hydrography Day 2013 (WHD'13) with a workshop dedicated to the theme of WHD'13: 'Hydrography – underpinning the blue economy'.

The workshop was organised in Scheveningen (the port of The Hague), a fishing port. Two deep-sea trawlers (length > 110m, GT >6,000) owned by Jaczon BV were berthed for maintenance and participants were invited to visit the ships for an explanation by their skippers on the use of oceanographic parameters and sonar equipment to catch fish in pelagic fishing operations. An interesting subject (water column imaging) for hydrographers. Rijkswaterstaat's survey vessel *Zirfea* was berthed nearby the fishing vessels, enabling the participants to visit this ship.

The workshop in the Fish Auction Hall covered a variety in subjects.

The workshop was held on the premises of the fish auction. Presentations were given on: *Open Earth Data: a community approach for managing and visualising dynamic coastal bathymetry data* by Gerben de Boer (Deltares). OpenEarth is a free and open source initiative to deal with data, models and tools in marine & coastal science & engineering projects. In current practice, research, consultancy and construction projects spend a significant part of their budget on setting up a basic infrastructure for data and knowledge management. OpenEarth aims for a more continuous approach to data & knowledge management.
'Zandmotor' (Sand engine): Pilot project for coastal defence using nature by Arjen Luijendijk (Deltares). The 'Zandmotor' (Sand engine) concept is an innovative way of coastal defence as well as coastal maintenance.
Military Hydrography: rapid environmental assessment and capacity building by CDR RNlN T. Hamburger. He mentioned the tasks of the Netherlands Hydrographic Service, then highlighted less familiar aspects like the task of ensuring the physical environment information for 'out of area' operations of the Royal Netherlands Navy. Another aspect is supporting capacity building with hydrographic services.
The Netherlands Hydrographic Institute (NHI), presented by Mr N. Kinneging (Rijkswaterstaat), was founded in 1986 to strengthen and formalise the cooperation between the Hydrographic Service of the Royal Netherlands Navy and Rijkswaterstaat of the Ministry of Transport. It improved the surveying capacity and promoted exchange of data. A changing environment, innovations and organisational changes encouraged adaptation to this of the agreement.
After the interesting presentations, Dutch herring and Jenever were served (in line with a workshop in a fishing harbour) as a start to the networking session.

Leeke van der Poel, Chairman, Hydrographic Society Benelux.

Hydrographic Society Russia

The International conference on 'Problems, methods and means of research of World oceans' took place in Zaporozhje, Ukraine on 13 and 14 May 2013. The conference was organised by the Scientific and technical Center of Panoramic Acoustic Systems of the Ukrainian National Academy of Sciences (UNAS). UNAS corresponding member and HSR member Anatoly I. Gonchar was head of the organising committee, and the secretary was HSR member Lubov Shlychek. Experts from 15 scientific research institutes from Ukraine, Russia and Moldova participated in the conference. 52 reports considered all aspects of oceanographic research and were presented.

Participants of the conference accepted recommendations for interaction and information interchange.

The HSR Council did not overlook World Hydrographic Day and sent best wishes to 15 organisations.

A significant date for Russia was 25 June 2013. On this day 80 years ago the Polar Hydrographic organisation was established. HSR president congratulated all hydrographic organisations working in Arctic regions and also the outstanding polar explorers: A.N. Chilingarov (president of the Association of polar explorers), N.A. Mon'ko (deputy chief of Administration Sevmorput), Dr. V.I. Peresypkin and others.

In 2013, the 100th anniversary of the last significant geographical opening on our planet will be celebrated. On 3 September, the Hydrographic Expedition of Arctic Ocean (HEAO) headed by the captain 2nd rank Boris Vilkitsky opened a land unknown until then to the north Taimyr peninsula.

After a proposal by Boris Vilkitsky it was named Emperor Nikolay II Land. In 1926, the Soviet Government gave it the new name Severnaja Zemlja (Northern Land).

It is so successful that a new book *Expedition of a century* was issued to mark this anniversary. The authors are: HEAO participant hydrographer and oceanographer Nikolay I. Evguenov (1888-1964) and polar oceanographer Valery N. Kupetsky (1929-1999). The technical editor of the book was HSR member Svjatoslav N. Mishin. The book was issued by the Russian State Arctic and Antarctic museum.

The book tells the HEAO history on icebreaking steamships *Tajmyr* and *Vaigach* in 1910-1915. Participants of this expedition not only discovered Emperor Nikolay II Land (36700km^2.) and some islands, but also proved to be an opportunity to navigate from the East to the West by the Northern maritime way from Vladivostok to Arkhangelsk in one go. The 350 pages of the book contain documents, diary records and unique photos.

To mark the 100th anniversary of such an important event and to underline the fact that geographical names are memories of culture, HSR council member Viktor Rybin decided to initiate returning the historical name to the discovered land. Furthermore, it would be a tribute to the participants of expedition and would restore their rights as first discoverers. He will try to achieve this with a group of HSR members.

Figure 1: The new book *Expedition of a century.*

Figure 2: Officers of expedition on ice breakers *Tajmyr* and *Vaigach* in 1913. The fourth person from the left is the chief of the expedition, Boris Vilkitsky. Standing third from the left is the author of the book, Nikolay Evguenov.

Hydro Agenda

SEPTEMBER

RESON World Tour - Underwater Technology Seminar 2013
Shanghai, China
→ 01-03 September
For more information:
E: marketing@reson.com
W: www.reson.com/worldtour

Hypack Africa 2013
Cape Town, South Africa
→ 02-05 September
For more information:
E: gaynor.deacon@cnav.com
W: http://bit.ly/12AQanw

Seafloor Exploration Training Course
Malta
→ 02-13 September
For more information:
E: micallefaaron@gmail.com
W: http://malta2013.hgiss.com/

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

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.oceanology-international.com/china

Operational Oceanography: Synoptic Views of the Sea
Ostend, Belgium
→ 09-13 September
For more information:
E: claudia.delgado@iode.org
W: www.iode.org

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

Saudi International Marine Services Exhibition 2013
Dammam, Saudi Arabia
→ 14-15 September
For more information:
E: Subhash@arabianreach.com
W: www.saudimarineshow.com

Seminar
Copenhagen, Denmark
→ 17-19 September
For more information:
E: marketing@reson.com
W: www.teledyne-reson.com/events/worldtour

OCEANS MTS/IEEE 2013
San Diego, CA, USA
→ 23-26 September
For more information:
W: www.oceans13-mtsieeesandiego.org

ADCPs in Action
San Diego, CA, USA
→ 29 September-02 October
For more information:
E: mnewcombe@teledyne.com
W: www.rdinstruments.com/aia2013.aspx

OCTOBER

19th Asia Upstream / Asia Oil Week 2013
Singapore
→ 02-04 October
For more information:
E: amanda@glopac-partners.com
W: www.petro21.com

General Bathymetric Chart of the Oceans (GEBCO)
Venice, Italy
→ 07-11 October
For more information:
W: www.gebco.net/about_us/meetings_and_minutes/

International Workboat Show
New Orleans, LA, USA
→ 09-11 October
For more information:
E: bcallahan@divcom
W: www.workboatshow.com

KONGSBERG AUV Conference
Lirici, Italy
→ 14-17 October
For more information:
E: katharina.nygaard@kongsberg.com
W: www.viaregi.com/registration/deltagerweb.aspx?kid=2919&aid=34565

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

5th Annual Offshore Wind Construction, Installation and Commissioning Conference
Hamburg, Germany
→ 14-15 October
For more information:
E: jon@windenergyupdate.com
W: www.windenergyupdate.com/farshore-installation/

Underwater Technology ABLOS 20 Business Meeting and LoS Seminar
Muscat, Oman
→ 28-30 October
For more information:
W: www.iho.int/mtg_docs/com_wg/ABLOS/ABLOS20/ABLOS20.htm

Digital Hydrography on the Maritime Web
Southampton, UK
→ 29-30 October
For more information:
E: digitalhydro@ths.org.uk
W: www.digitalhydro.org.uk

OTC Brasil 2013
Rio de Janeiro, Brasil
→ 29-31 October
For more information:
E: otcbrasil@ibp.org.br
W: www.otcbrasil.org/2013/

NOVEMBER

Europort 2013
Rotterdam, The Netherlands
→ 05-08 November
For more information:
E: info@europort.nl
W: www.europort.nl

RETECH 2013
Washington, DC, USA
→ 09-11 November
For more information:
E: smccollum@accessintel.com
W: www.retech2013.com

Subsea Survey
Galveston, TX, USA
→ 11-13 November
For more information:
E: ladd@subseasurvey.com
W: www.subseasurvey.com

Teledyne RESON World Tour - Underwater Technology Seminar 2013
Austin, USA
→ 18-21 November
For more information:
E: marketing@reson.com
W: www.teledyne-reson.com/events/worldtour

EWEA Offshore 2013
Frankfurt, Germany
→ 19-21 November
For more information:
E: events@ewea.org
W: www.ewea.org/offshore2013/

DECEMBER

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

JANUARY 2014

Offshore West Africa 2014
Accra, Ghana
→ 21-23 January 2014
For more information:
E: tonybm@pennwell.com
W: www.offshorewestafrica.com

MARCH

Oceanology International 2014 (OI2014)
London, UK
→ 11-13 March 2014
For more information:
W: www.oceanologyinternational.com

APRIL

ENC-GNSS 2014
Rotterdam, The Netherlands
→ 14-17 April 2014
For more information:
W: www.enc-gnss2014.com

JUNE

CARIS 2014
Brest, France
→ 02-06 June 2014
For more information:
W: www.caris.com/caris2014

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Filling in the White Space on Charts and Ocean Maps

Improving the Global Bathymetric Dataset

When the world's national Hydrographers gathered in Monaco last year for the IHO's Conference, they considered the state of hydrographic knowledge around the world and the uncomfortable truth that we have higher resolution maps of the Moon and Mars than we do of most of the world's seas, oceans and coastal waters.

REGULAR READERS OF THIS publication would know from IHO articles earlier this year that the world's fleet of surveying ships has shrunk in the last 30 years. So, significant improvements are unlikely unless we find some other ways to gather hydrographic data. This is unwelcome news at a time when mankind is becoming increasingly dependent on the sea through the development of a blue economy.

It seems to me that there are several ways to get more data for the much-needed global bathymetric dataset in a context of scarce funding. One of them is to significantly widen traditional 'passage sounding' programmes, where ships collect soundings along their voyage track, particularly in poorly surveyed ocean areas, and make them available to hydrographic offices or mapping authorities. There are some commercially-led programmes that provide for the offshore fishing industry. There are also emerging programmes in the recreational boating sector.

What is missing is an easily accessible international programme that allows all seafarers to contribute their passage soundings to a central data store in a standardised way. Such a programme also needs to cover the nearshore area and to enable all the submitted observations to be available - even before they make their way on to a chart. It is now relatively simple and cheap to combine the outputs from satellite positioning systems fitted in ships with the output from a modern ship's echo sounder. Involving all ships in 'crowdsourcing' is therefore a real possibility.

The IHO has had a programme of international data collection in place since 1922. The GEBCO Project, which began in 1903, was transferred to the IHO and later became a joint project of the IHO and the UNESCO Intergovernmental Oceanographic Commission. So far, GEBCO has concentrated on the oceans rather than closer inshore. But times are changing. The GEBCO Project has been collecting data from governments and from scientists for the nearshore areas since 2006 - but progress is slow. Now is maybe the time to extend the scope of the Project so that other contributors can be included as well.

Another way to improve the global bathymetric dataset is to access data that has already been collected, but has never been made widely available. This includes both data collected for scientific and for commercial purposes. While some of this data may be commercially sensitive, particularly high-resolution data, or may only be offered for a fee, just knowing about it could increase our knowledge and avoid costly and wasteful surveys in the same areas. Why not an international hydrographic metadata store as part of the GEBCO Project?

A third way is to look more closely at satellite derived bathymetry - the use of multi-spectral satellite imagery to determine depths in relatively shallow and clear waters. This offers the possibility of obtaining at least some data to cover areas that otherwise will lie unsurveyed for many years to come. The main hurdle to overcome with using satellite derived bathymetry is to consistently determine the uncertainty of each depth value obtained from an image. But I know that work is in hand on this.

Whatever the problems, it is obvious to me that we need to do something to improve the global bathymetric database. If we stand on the beach waiting for an armada of survey ships to sail over the horizon we will be waiting a long, long time.

Robert Ward, president, Directing Committee of the International Hydrographic Bureau

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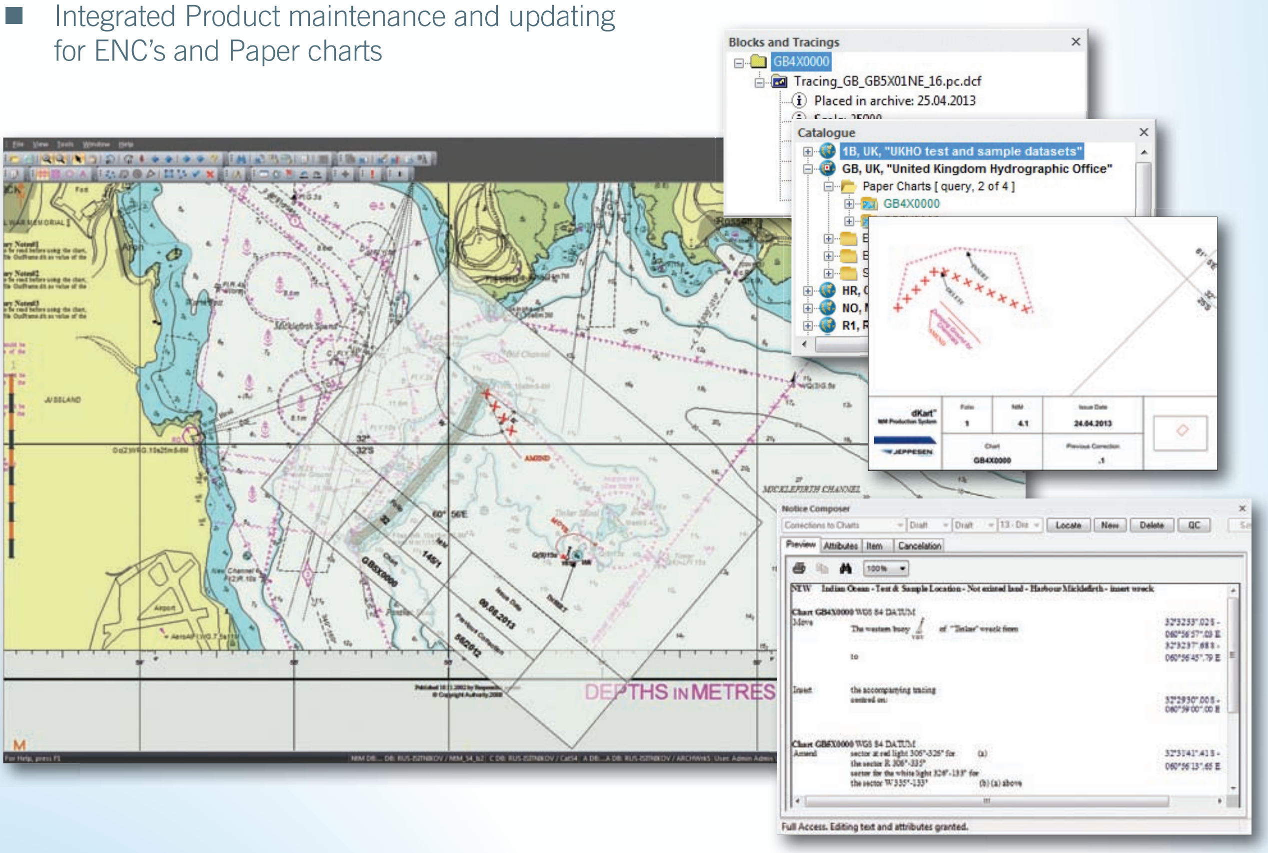

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