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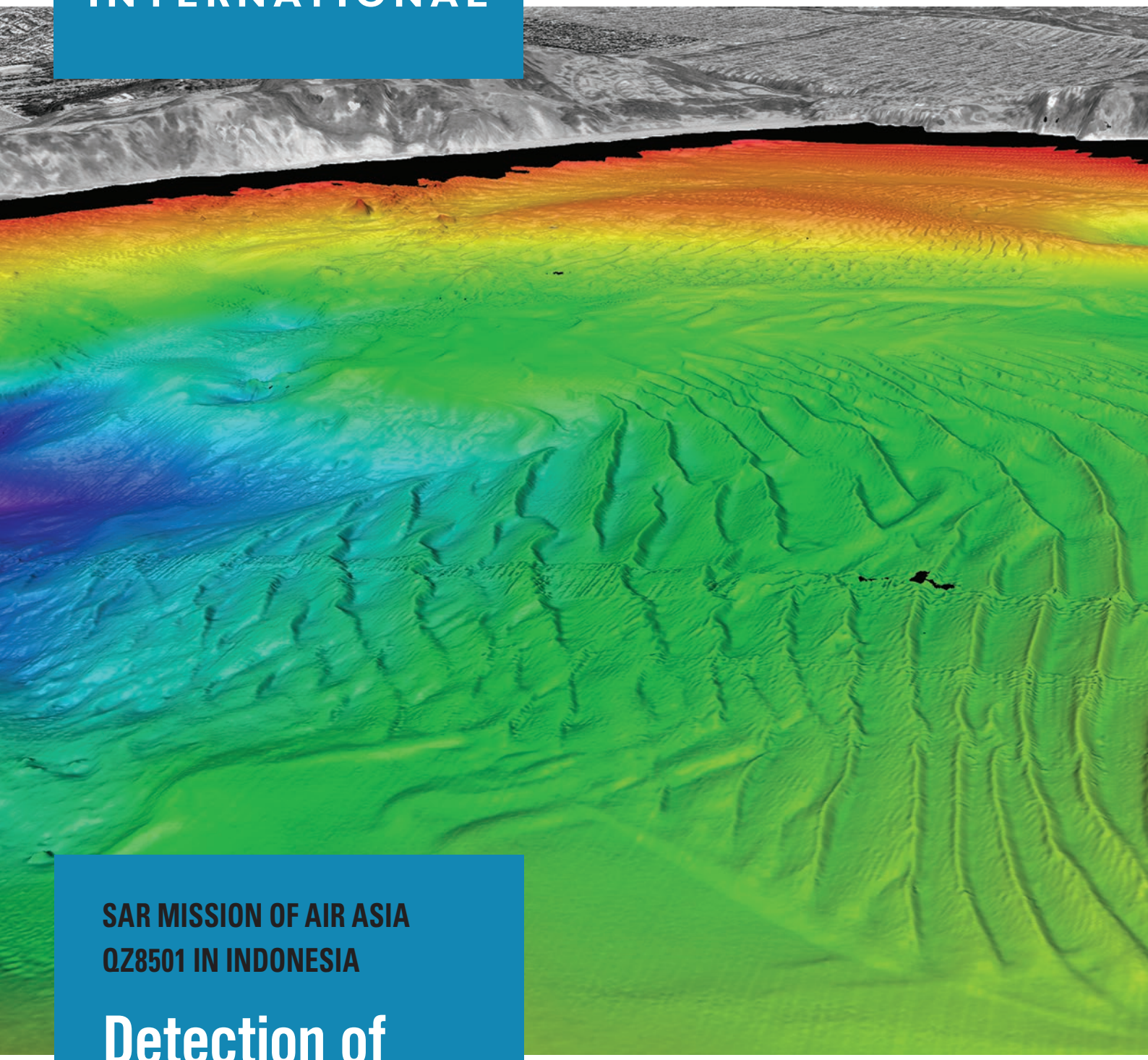


SAR MISSION OF AIR ASIA QZ8501 IN INDONESIA

Detection of Crashed Airplane

DEVELOPMENTS IN HIGHLY ACCURATE IMMERSED TUNNEL POSITIONING

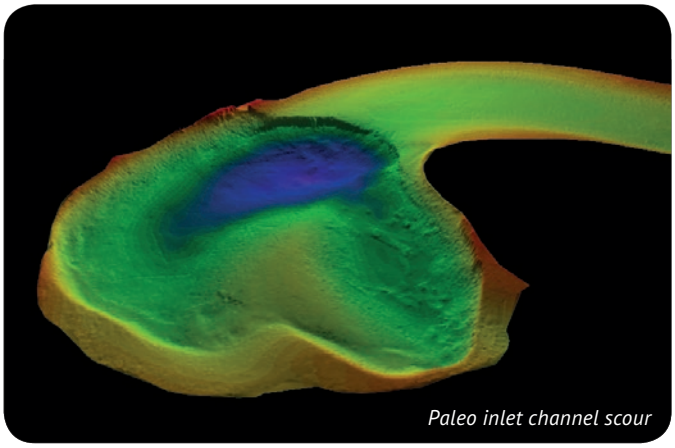
Flying, Landing and then...Surveying

Seaplane Bathymetric Platform

Teledyne Odom Hydrographic

New MB2 Multibeam Echosounder

Fully integrated for fast mobilisation on smaller vessels



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30 YEARS 1985-2015

No. 3656

July-August 2015
Volume 19 #5

Looking to the southeast over entrance to San Francisco Bay (USA). The sand waves are formed from sediments transported by tidal currents. Image courtesy: NOAA.

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PHOTOGRAPHY: ARIE BRUINSMA (WWW.ARIEBRUINSMA.NL)

Summer

Summer is here in the Netherlands! After a cold winter and spring we are finally experiencing some nice, warm and sunny weather and it feels good. This is the time of year that people take off on holiday, travelling to other places, experiencing other cultures and enjoying time off with their families. Everyone celebrates summer in a different way, but relaxation and free time are ingredients for almost everyone, as are a festive and optimistic mood. Somehow I think that hydrography could use a bit of a summer feeling too. This last winter and spring have certainly not been the best. Throughout the global economic crisis of the last seven years, hydrography almost seemed unscathed, but the climate changed quite suddenly last year when the oil price nosedived to a 5-year low. Offshore work diminished or almost disappeared within a few months, investments in new oil platforms also dropped. While newspapers were reporting that the global economic crisis was over, hydrographic companies were looking at an unfavorable rate between the dollar and the euro and economic sanctions against Russia. Together with the low oil price, it made the climate harsh and optimistic news from other places almost sounded ironic. What will happen over the next few months? Will the oil price go up? Will sanctions against Russia be dropped? Will the overall economy recover as predicted? It all looks very unsure. The International Monetary Fund and the World Bank predict a slow uptake of the oil price over the coming years, but nothing spectacular. Tensions in the political arena are only getting worse in different places of the world. Where the currency rate and the global economy outside of the offshore will be going, is as unsure as the weather. I think we cannot give a better outlook than this and it may all turn out very differently, but we don't have a crystal ball: economy is a science, but certainly one of the least predictable. This might well be the 'new normal' as they say and it could stay this way for a long time to come. It looks like the best strategy is now to focus on a sustainable model taking today's economy into account. Of course that always means looking at costs, old habits and usual paths. And changing them! In my view that will also always include taking your business outside of the regular patterns. Where can you find new business opportunities? Where can you add value with existing techniques that will bring in new customers? Whet can you adjust and adopt? It's not easy, but necessary. And if you succeed it's often fun as well. It feels a bit like summer after a cold winter and spring. I wish you all a good, relaxed and enjoyable summer that warms up for lots of optimism for the future!

Durk Haarsma durk.haarsma@geomares.nl

It All Starts with **Hydrographic Charting**

Three years ago we discussed the global proliferation of large coastal hydrographic charting-based projects. The main theme being that modern technologies and methodologies have become so reliable that these larger programmes were not only doable, they had become preferable and even moving toward 'routine". Today we can identify a similar trend related to multiple, diverse deepwater applications of large scale programmes that all rely on MBES-based hydrographic charting applied on a regional scale. The examples presented here demonstrate how large-scale, precision MBES-based programmes are being applied to deepwater studies far beyond improving navigation charting and safe navigation goals.

Seafloor Seeps for Geochem: Based on multiple recent successes, the oil and gas exploration industry has embraced the use of high-resolution seafloor mapping as the basis for geochem surveys that identify and measure seafloor hydrocarbon seeps with the expectation that they can be directly used to aid in the location of oil reservoirs. Typically applied to frontier regions where little or no historic data exists, the design of the study begins with an initial MBES-based hydrographic survey, including the requirement for uniquely tuned backscatter data and the collection of water column information. Hydrographers, geologists and geochemists work together to develop a three-dimensional model that fully displays key features associated with seabed seeps such as mud-volcanoes, topographic highs and ridges, deformation and detectable chemical changes of sediments, plus the signature seep pattern identifiable in the water column. All derived from the MBES-based data. Further data integration, analysis and collection include tying these data to existing deep seismic models, directed sediment sampling of the selected preferred sites, heat-flow measurements and ultimately a full geochemical analysis of the entire 3D derived model. Note that there is a certain amount of 4D component to the findings as these datasets also yield information on the temporal characteristics of the seeps. These programmes typically are applied in water depths between 1,000-4,000m, either as a site specific block survey or extensive regional studies that can be greater than 500,000km² in extent.

Deep Water Forensics: With the advent of reliable, rapid deployment high-resolution MBES charting, another growing application is in support of deepwater search programmes associated with maritime accident investigations involving aircraft or vessels. Again it is the success, quality and proliferation of the deepwater MBES sensors that have led to the acceptance of integrating large-scale hydrographic charting as the basis for the survey. Although only a tiny fraction of the seabed has been mapped to date, generally accepted as something less than 10% of the entire ocean floor, there is no hesitation to employ a deepwater MBES system as the precursor to understanding and planning a search anywhere and at any depth in the ocean. The current ongoing operations related to the search for the MH370 aircraft began with collecting a 200,000km² baseline modernisation of the local seabed terrain and high-accuracy improvement of the water depths in the area of interest. The MBES data proved to be exceptionally important as water depth variations were found to be as much as 1,600m different from existing satellite-derived maps.

It is apparent that deepwater MBES-based studies continue to expand in both size and variations on their applications. The author hopes that it won't be long before the nations and large industry players of the world understand the importance and benefits of a fully, accurately mapped global seabed.

SA Instrumentation's New Premises Includes Test Facilities

St Andrews Instrumentation, UK, has invested in a new headquarters and test centre as it advances its global production ambitions. The new premises will accommodate the company's five research and development engineers, as well as administrative staff. In addition to office space, there will be a new workshop area comprising design, test and despatch areas.

▸ ***http://bit.ly/1J08P09***

CEO Derek Watson sees having all staff together in one location as an advantage for SA Instrumentation.

World ECDIS Day

This year, the first open international event World ECDIS Day will take place in Hamburg, Germany. On 16 September 2015, World ECDIS Day will bring together more than 300 stakeholders who have played or are playing an important role in the history of marine electronic navigation.

▸ ***http://bit.ly/1J08I4P***

Geo-Matching Top 5

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Teledyne RDI WorkHorse Sentinel 600kHz (WHS600)	bit.ly/1KFXzfh
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Nortek AS Aquadopp Profiler	bit.ly/1RfEjsZ

WHOI Names Mark Abbott as President and Director

Mark Abbott. Image courtesy: Oregon State University.

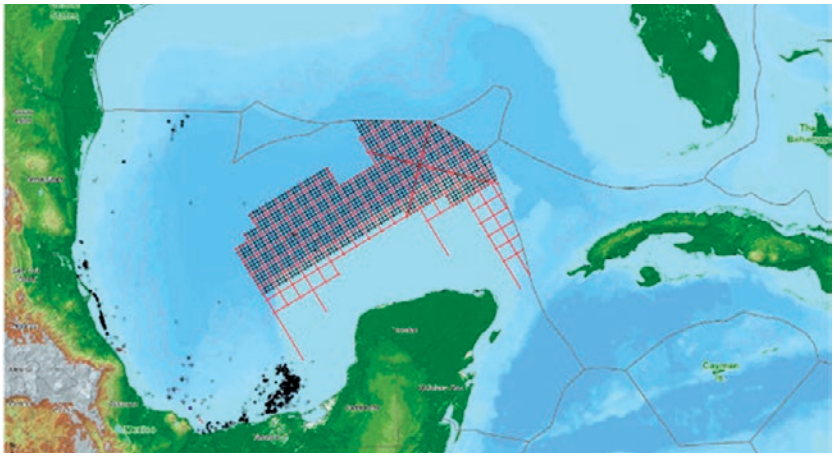
The Board of Trustees of the Woods Hole Oceanographic Institution (WHOI, USA) have announced that Dr Mark Abbott has accepted the position of president and director of the institution. Abbott will become the tenth director in WHOI's 85-year history. Abbott will assume office on 1 October 2015, succeeding Susan Avery who has served from 2008 to 2015.

▸ ***http://bit.ly/1J094Z9***

Collaborative Seismic Acquisition Programme offshore Mexico

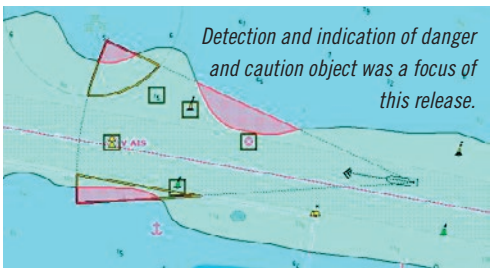
An MoU has been executed for a cooperation agreement between Spectrum, PGS and Schlumberger in Mexico. The collaboration will acquire between 80,000 and 100,000km of modern, long-offset 2D data encompassing all major hydrocarbon provinces offshore Mexico. This includes areas currently on offer for Mexico's Round 1 in the Perdido Fold Belt, Mexican Ridges Province, Campeche Deep Sea Basin. It will also provide seamless coverage across the Yucatan Platform, tying to Spectrum's Big Wave programme in the eastern area of the US Gulf of Mexico.

▸ ***http://bit.ly/1J08YAO***



The area to be covered in the seismic survey programme.

ECDIS Kernel v5.20 Improving ECDIS Usability



Detection and indication of danger and caution object was a focus of this release.

SevenC's ECDIS Kernel SDK (Software Development Kit) 5.20 has been designed to meet all future requirements of the latest international standards (IEC 61174 Standard edition 4.0; IHO S-52 Presentation Library edition 4.0; IHO S-64 Test Standard edition 3.0) in order to reduce implementation irregularities and improve the overall usability of chart display systems. The new stand-alone chart-handling tool ChartHandler allows for handling large amounts of data and sets a benchmark for chart loading and updating in the industry.

▸ ***http://bit.ly/1J09a2N***

Most Shared

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African Dredging Contracts for Boskalis - bit.ly/1J0aP8C
Theme for World Hydrography Day - bit.ly/1J0aRxo
Liquid Robotics Named as Top Innovator in World Ocean Innovation Challenge - bit.ly/1J0aXVz
River Ganges Navigation Capacity Improvement Study - bit.ly/1J09Bu5
Spatial Thinking with Sand and Gravel - bit.ly/1J0b7fH

Research Vessel *Heincke* Serving Science for 25 years

A quarter of a century old, with over 900,000 kilometres (488,842 nautical miles) logged and still on the cutting edge of science and technology: 8 July 2015 marked the Research Vessel *Heincke*'s 25th birthday. Staff from the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI, Germany), which operates the *Heincke*, take part in expeditions with the ship just as often as fellow researchers and students from Germany and abroad.

http://bit.ly/1J08Gdd

XIXth International Hydrographic Conference Dates Proposed

The IHO has proposed that the XIXth International Hydrographic Conference will take place from 24-28 April 2017. This will also be the 1st IHO Assembly.
The conference is to be held in Monaco and the Directing Committee is to start the preparations for the conference.

http://bit.ly/1J09iiJ

USACE Hydrographic Survey Boat Named

The US Army Corps Buffalo has named the latest addition to its high-tech hydrographic survey fleet after retired Command Sgt. Maj. Micheal L. Buxbaum of the US Army on 23 June 2015. The addition of the survey vessel *Buxbaum* enhances Buffalo District's ability to support USACE's navigation mission with a third survey vessel equipped with a multibeam sonar system to meet increased production goals during peak periods.

http://bit.ly/1J09oqT

The Buxbaum.

Fugro and Cross Group Awarded Multi-well GoM Contract

Fugro Synergy.

Fugro's dynamically positioned multi-purpose drilling, well intervention and geotechnical vessel, *Fugro Synergy*, is proving her capabilities on a multi-well intervention campaign which started in the Gulf of Mexico. The campaign involves utilisation of a top-tensioned 6 5/8" riser and coiled tubing, with fieldwork for the contract being undertaken jointly by the Cross Group and Fugro. It employs the expertise of both organisations, providing a safe, efficient and cost-effective field-proven mobile offshore drilling unit (MODU).

http://bit.ly/1J09mPJ

Relocation and Contract Wins for DOF Subsea Angola

DOF Subsea, headquartered in Norway, has marked the relocation of its Angolan office by signing two contracts with a major operator. The Luanda-based team of 12 has just moved from the centre to new 200m² premises 20km away in Belas Business Park in the Talatona area. As well as the move, DOF Subsea are celebrating that the company has increased survey and positioning (S&P) services to a key operator in West Africa by signing two contracts for rig positioning services in two additional blocks.

http://bit.ly/1J09A9m

The DOF Subsea Angola team, from left to right: Colin Ferguson (general manager, Angola), Jan Kristian Haukeland (EVP Atlantic region), Mr. Joao Gil (admin. manager), Mr. Vusie Nxumalo (operation/project manager), Mr. Manuel Nsimba (logistics coordinator).

Coda Octopus MOTION Control Software Release

Coda Octopus announces a new major release for MOTION, providing complete set-up, management, monitoring and replay for all three products in the MOTION range: the F180, F180R and F175 series. Following the intuitive interface design already used with previous releases, some new features have been added like advanced GPS settings and configuration options.

▸ ***http://bit.ly/1J09sH1***

NaviSuite Webinars

EIVA will be offering offshore professionals the possibility of joining a set of webinars to catch up on new and key EIVA NaviSuite solutions and features starting on 1 July 2015. It is possible to get an online presentation of EIVA NaviSuite key solutions and features by joining one or more EIVA webinars. The first webinars have been scheduled in July and August 2015, and more are on their way.

▸ ***http://bit.ly/1J09SgB***

Winners 'Valeport in Action' Announced

An image of a Weddell Seal in Antarctica carrying a Valeport CTD sensor and a hands-on video showing the pilot deployment of a Valeport Midas directional wave recorder at the mouth of the UK's Humber Estuary have been announced by Valeport as the winners in its first-ever 'product in action' competition.

▸ ***http://bit.ly/1J0a4MF***

Daniel Costa's winning photo of a Weddell Seal in the Ross Sea.

River Ganges Navigation Capacity Improvement Study

The Inland Waterways Authority of India (IWAI) is investigating measures to augment the navigational capacity of the River Ganges, under the Jal Vikas Marg project. HR Wallingford (UK), alongside project partners Howe Engineering Projects (India) and PMC Project (India), will undertake a package of river modelling, geomorphology, dredging, engineering and navigation feasibility studies.

▸ ***http://bit.ly/1J09Bu5***

River Ganges for navigation. Image courtesy: La Fessee via WikiMedia Commons.

AtlantOS: Transatlantic Integration of Ocean Observing Systems

The large-scale EU research project AtlantOS aims to advance Atlantic Ocean observation to become more integrated, more efficient and more sustainable. The Flanders Marine Institute (VLIZ) participates in the work package responsible for increasing the harmonisation of data flows and cooperates in the set-up of an Atlantic fish tracking network.

After the kick-off meeting on 10-12 June 2015 in Brussels, Belgium, the 62 partners of the AtlantOS-project – from the EU, USA, Canada, Brazil and South Africa – set out to significantly enhance observing the Atlantic Ocean.

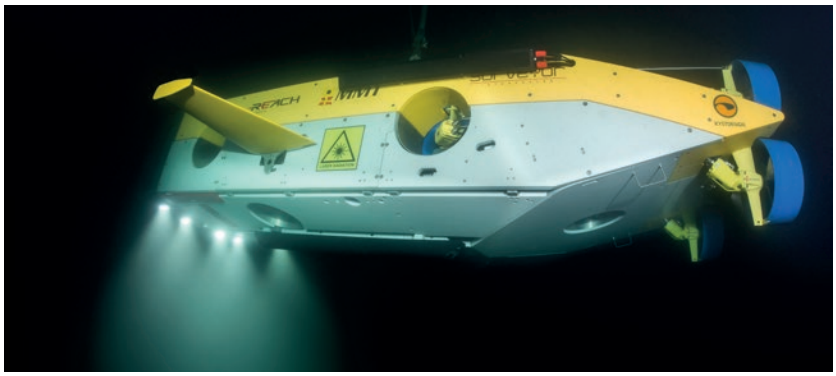
▸ ***http://bit.ly/1J09JK1***

Hydro International Interviews Ola Oskarsson

Maiden Voyage *Surveyor Interceptor* Moved Traditional Boundaries

You have heard of a remotely operated vehicle (ROV), but you might not have heard of the SROV yet. The S stands for Surveyor, meaning that the SROV Surveyor Interceptor is the first ROV built solely for subsea surveys, such as pipeline inspections, seabed mapping and environmental mapping. Compared to the techniques used to date, the outcome of the SROV's first survey in March 2015 was much higher resolution imagery and multibeam data in less than half of the time, a world first. *Hydro International* interviews Ola Oskarsson, founder of marine surveying company MMT and project manager for the *Surveyor Interceptor*.

▲ *Figure 1: Ola Oskarsson.*



▲ *Figure 2: MMT* Surveyor Interceptor *ROV. Image courtesy: Jonas Dahm.*

What made you think of developing the Surveyor Interceptor SROV?

After almost 40 years in the business I felt that there had to be a better way than using Work Class ROVs for advanced hydrographic surveys. A Work Class ROV is a machine constructed to replace divers underwater. It is equipped with videos, manipulators and mobility in all directions. When you equip it with survey equipment many problems arise: the hull is not hydrodynamic, the structure creates false echoes from the echo sounders side lobes, the vehicle is slow and noisy and the positioning struggles to get clear signals.

What did you consider to be important features of the SROV?

The SROV is designed to carry survey instrumentation to perform pipeline inspection, route surveys, subsea installation surveys and environmental surveys down to 2,000 metres water depth. By combining a hydrodynamic favourable hull, thin umbilical and extreme propulsion with the latest sensors the vehicle was developed to deliver never before seen ultra high-resolution data at a substantial lower cost per kilometre.

Where did you look for the specific technical expertise?

When I met the Norwegian ROV experts Jostein Alendal, Sven Magne Storsund and Erik Kold Backevig in 2010, the journey of developing the *Surveyor Interceptor* began. With a mutual vision of what was needed to perform high class hydrographic surveys MMT Sweden AB and Reach Subsea ASA jointly developed the *Surveyor Interceptor* for seabed mapping and pipeline inspection with the Norwegian ROV manufacturer Kystdesign AS.

Even with such a team, what did you consider to be the major challenges?

The project was initially met by much scepticism. The industry doubted that the *Surveyor Interceptor* and DP vessel would be able to move at 8 knots on autopilot. The idea of still imagery and laser replacing video and that laser would be able to detect ovality or damage of pipes accurately was also doubted. The industry did not think it was possible to solve the issues with umbilical and winch tension. But MMT, Reach Subsea and Kystdesign proved the naysayers wrong. There was no money available from industrial funds. So eventually we had to make our own investments with the help of bank loans. In the end we were given a development project from Gassco, which made the extensive sea trials possible.

Can you elaborate on the construction and test procedures?

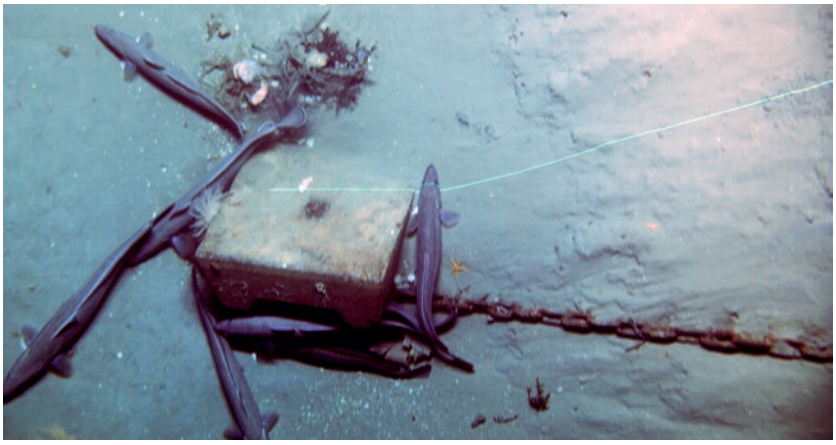
The building of the SROV started in January of 2013. I commuted between Gothenburg, Sweden and Haugesund, Norway weekly until the building and testing was finished, and still make the long trip frequently. In August of 2014, factory acceptance tests were carried out in the harbour of Haugesund. Shortly after they were finished a mobile crane fell over and damaged the Launch And Recovery System (LARS) when the team was spooling the umbilical to the winch. It took until December to repair the damage. In December, the weather on the North Sea was so unforgiving that the testing had to be done in a Norwegian fjord instead of offshore, as originally planned. Finally, there was a weather window allowing the vessel *Edda Fonn* to get out offshore and work on Europipe 2. Due to a fire in one of the engines of the vessel, final testing was eventually done in January of 2015, six months later than planned.

After these tests, the concept had to be proven in a commercial setting. Did Surveyor Interceptor meet its ambitions?

In 17 hours and four minutes the *Surveyor Interceptor* inspected 105 kilometres of Gassco's Knarr gas pipeline in the North Sea from the Knarr gas field, tied to the FLAGS pipeline system on the UK Continental Shelf, a world record. The pipeline lies at water depths between 140 and 400 metres in the northern parts of the North Sea. The inspection aimed to check the external condition of the pipeline and rock berm protection after pipe lying. I call the results astounding. The resolution of the still photography and the laser bathymetry renders unsurpassed detail and accuracy that allows 3D visualisation of the seafloor sub centimetre resolution. We can zoom in on tiny features and identify very small anomalies or identify marine life.

How did you achieve the accuracy of the SROV?

The SROV is equipped with an inverted Ultra Short Base Line (USBL) positioning system from Sonardyne in addition to Kongsberg Hipap transponders to achieve accuracy and ensure redundancy. Also the positioning is supported by 2 inertial navigation systems and a Doppler Velocity Log. The inverted USBL is placed on the front of the SROV, where



▲ *Figure 3: Pipeline-object, observed at a speed of 4.2knot and 5m height.*

there is minimum noise interfering with the survey. As the *Surveyor Interceptor* generates less noise and travel in a more stable water environment we achieve better positioning accuracy on our surveys. We use two underwater positioning systems - the SROV is positioned from the vessel and the vessel from the SROV.

How do survey operations relate to a comparable survey with an ROV?

The average speed was 3.33 knots and the SROV was operated at a top speed of 4.5 knots. This is about three times the speed normally achieved by a traditional ROV inspection at these depths. The *Surveyor Interceptor* also performed with high stability and reliability and the data acquired was of superb quality. It was processed and analysed continuously on the support vessel so that the reporting team was able to provide a field report to Gassco on demobilisation. The inspection was performed from MV <i>Edda Fonn<i> and manned by survey specialists from MMT Sweden and ROV specialists from Reach Subsea. Presently we are surveying the world's longest HVDC route from Iceland to UK, the Atlantic Super Connector, with the SROV. 1,500km with water depths from 40m to 1,200m. The work is to be finished in July 2015.

One of the aims was to reduce the cost of a survey. Are there more lessons learned from a business perspective?

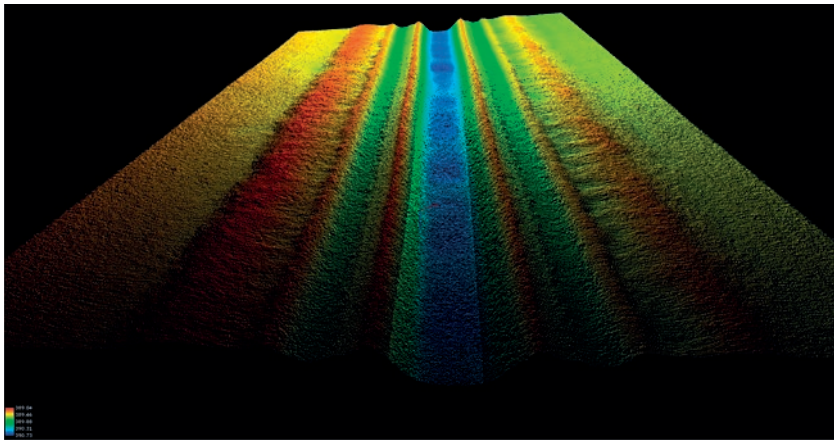
Most of the gas pipelines lie on the seabed, and ROVs controlled from surface vessels must therefore be used for maintenance and monitoring work. Such operations are basically expensive. Factors affecting the price include the offshore vessel, the ROV's efficiency and the choice of inspection technology. That is where the SROV brings serious cost savings based on the reduced time spent; crew change, transit and other fixed costs remain. Apart from being fast and cost effective, another important aspect of the SROV is that it has a smaller environmental impact than other ROVs. The fewer hours you spend at sea, the smaller the environmental impact you make. If you work faster and more exact, you can cut back on vessel time and therefore the emissions.

What other survey types can you envisage for the Surveyor Interceptor?

I am passionate about mapping the seafloor in the most exact manner possible. A major part of the surface of the Earth has not yet been surveyed, and that is the oceans. We are still using ineffective methods, but by increasing the accuracy we can discover a lot of things on the seafloor that are still unknown. That is my driving force. I am interested in high resolution, high accuracy and the possibilities to deliver the same mapping accuracy under the sea as on dry land. I think of mapping of the seafloor, environmental impact assessment and habitat and geological research. The increased photo quality is a valuable tool for environmental investigations and geohabitat classification.

What made you choose still photography rather than videos?

Three machine vision cameras are synchronised with powerful strobe lights, taking 3D, stereo and geocorrected photos of the pipe to produce high-resolution GIS data of pipe status and possible third party intervention. The exposure time for the still photography cameras is down to milliseconds to avoid motion blur and ensure crisp colour seafloor imagery. The quality of these georeferenced pictures is approximately eight to ten times higher than that of standard HD video. From a video you can tell that a thing is round and that a fish was moving, but from a high-resolution still you can make exact measurements and quantify. These pictures are part of a mapping system where stereo and 3D images can be presented in true scale and position. Using still photography instead of video also saves a lot of storage space as every camera on the *Surveyor Interceptor* takes three pictures per second compared to 60 pictures per second on HD video camera.



▲ *Figure 4: Data sample of a trench point-cloud.*

▲ *Figure 5: New technology as an incentive for creativity.*

Does the multibeam data quality meet your initial expectations?

As a result of the silent environment and the SROV being a very stable survey platform the multibeam data has less than 0.5 % outliers. The data is less noisy and more reliable than data acquired by a typical ROV. Less automatic and manual processing is required, resulting in less time and resources are spent on processing the data from the SROV. The possibility to map the seafloor with high accuracy at a lower cost will lead to increased safety for the environment and subsea installations. ◀

Ola Oskarsson

Ola Oskarsson founded MMT in 1976 and was the managing director until 2012. He is currently responsible for MMT´s R& D, market strategies and key clients. He has 40 years of extensive experience in positioning, surveying, bathymetry and software development. He holds a BSc in Marine Biology from the University of Gothenburg, Sweden.

Hydrography for SAR Mission of Air Asia QZ8501 in Indonesia

Underwater Detection of **Crashed Airplane**

The Indonesian Association of Marine Survey Contractors launched a survey operation in early January 2015 to support the Indonesian National Agency for Search and Rescue. The operation was aimed at searching for a commercial plane, Air Asia QZ8501, reported missing on 28 December 2014 over the NW of the Java Sea, Indonesia. Using MBES, SSS and ROV, major parts of the crashed airplane comprising of the tail, seats, body and wings were discovered and located for recovery.

On 28 December 2014, a commercial airplane, Air Asia QZ8501, flying from Surabaya (Indonesia) to Singapore, was reported missing and believed to have crashed into the sea in the very north west of the Java Sea, Indonesia. The Indonesian National Agency for Search and Rescue (BASARNAS) activated a Search and Rescue (SAR) mission on the same day. To support this, a search survey operation was launched by the Indonesian Association of Marine Survey Contractors (AKSLI). The BASARNAS mission was also supported by other teams and vessels from other organisations, including an Indonesian Navy supply vessel, Ministry of Research and Technology research vessel and international parties. None of the parties involved were equipped with underwater imaging technology or specialised hydrographic survey personnel, except for the AKSLI team.

Search Survey Preparation

Following the activation of SAR, AKSLI established contact with BASARNAS to propose support (surveyors and equipment) to the mission. Asking for assistance from AKSLI corporate members was straightforward. With the endorsement of the Indonesian Surveyor Association, this humanitarian mission gained enthusiasm among its members. The Indonesian authority has limited exposure of the hydrographic survey industry that has long exclusively been engaged with offshore energy exploration and exploitation. In the end, AKSLI decided to launch its member vessel and was finally provided authorisation by BASARNAS to be involved in the search operation after a series of focus meetings.

▲ *Figure 1: Pre-mobilisation in Tanjung Priok Port, Jakarta.*

16 technical crews from seven AKSLI corporate members were gathered on board. They served as survey and ROV teams, including geophysicists, MBES processors and technicians, led by a party chief. Survey equipment was also contributed, including EdgeTech 4200 SSS System, R2Sonic SONIC 2020 Broadband MBES and Navajo ROV, as well as a Sonardyne Scout USBL Underwater Positioning System. Additionally, the following standard peripherals were brought in: Starfix 9200-G2 Differential GNSS, Starfix GNSS Heading, Teledyne TSS Meridian Surveyor Gyrocompass, QPS QINSy hydrographic software package, IXSEA OCTANS Subsea 3000Ti MRU, Valeport MiniSVP and Valeport Monitor CTD Profiler.

Search Survey Plan

The survey was conducted as seafloor scouting. It is an attempt to distinguish

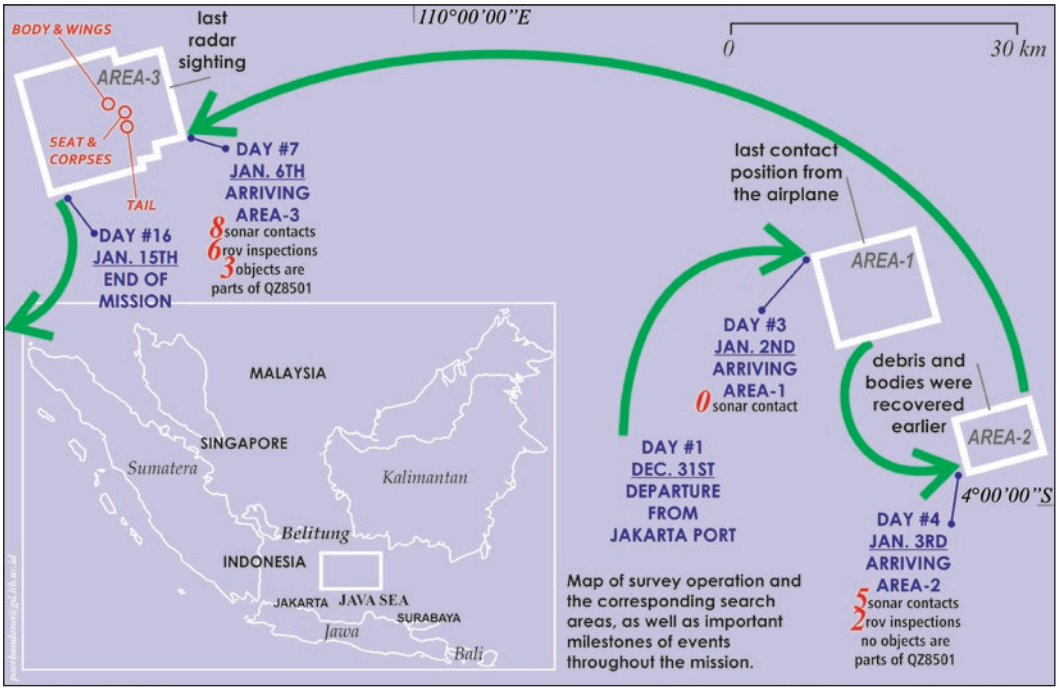


Figure 2: Milestone map of survey operation.

manmade or anomalous objects from the natural seabed including inherent features covering it. Such objects could possibly help interpret parts of the missing airplane. The primary difficulty faced by the AKSLI search survey team was that they were requested to find a defined object in an indefinite survey location, while they usually work to find anything in a definite survey position. The coordination of the search survey operation was under the full consent of BASARNAS. Determination of the survey area (central coordinates of the survey locations) was based on analyses developed by aviation experts facilitated by the Indonesian National Committee for Transportation Safety. The AKSLI team determined the search strategy by planning the survey extent (boundaries), survey line and line interval.

Search Survey Operation

On 31 December 2014, AKSLI's search mission team was mobilised from Tanjung Priok Port, Jakarta. The entire operation was completed by 15 January 2015. Figure 1 shows pre-mobilisation activity of the AKSLI mission. The primary strategy of the survey operation was to maximise the coverage of the seabed search, by tracking line-by-line from the central coordinates as advised by BASARNAS. Throughout the entire cycle of the search survey procedure, the processing of data, the subsequent interpretation, including immediate production of seabed charting and reporting, were carried out simultaneously with the onboard data acquisition.

On one of the first days of the mission, an AKSLI representative quoted to the press that by employing state-of-the-art hydrographic technology, the probability of finding an underwater object is 100%, however, unless the best estimated location of the crash is known, the survey duration could be without end.

As commanded by BASARNAS, the first survey location was the position of last contact with the airplane. Not a single sonar contact was detected here. In addition, the AKSLI mission was requested to search the second location. This site was about 15km southeast of the previous one. Debris and bodies from the crashed airplane had been recovered here earlier. No evidence of the crashed airplane was found here. Figure 2 provides an illustration of the survey milestones in three survey areas. Having completed two locations with negative results, on the seventh day the operation was continued at the location where it was believed that the airplane lost radar contact. Here, the survey area was 10km by 12km and divided into 18 main lines with 400m of spacing. The survey corridors were extended 4km southwest and 6km south-southeast, and widened 2km and 3km northwest with 350m of spacing.

The primary strategy of the survey operation was to maximise the coverage of the seabed search

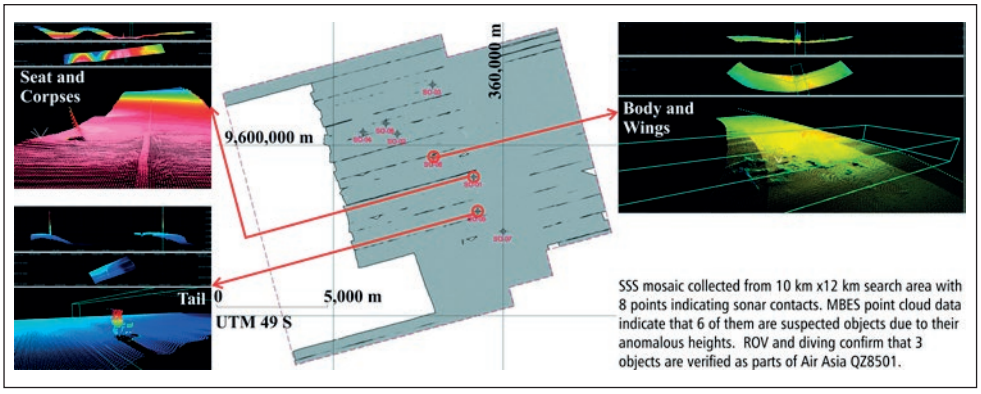


Figure 3: Object distribution and appearance in the search area.

Eight sonar contacts were recorded by side-scan sonar and their apparent heights were confirmed by MBES. ROV deployment and diving operations were conducted to verify 6 of them. These provided confirmation that the suspected objects identified as SO-01, SO-05, and SO-06 are parts of the missing airplane. In particular, SO-05 was identified as the tail. SO-01 was confirmed to be seats and corpses. It was validated that SO-06 was the body and wing. These three objects were situated on the seabed elongated approximately northwest-southeast across a roughly 3100m distance. Figure 3 shows side-scan sonar mosaic collected from the search area, with 8 points indicating sonar contacts, MBES point cloud data indicate that 6 of them are suspected objects due to their anomalous heights, while ROV and diving confirm that 3 objects are verified as parts of Air Asia QZ8501.

▲ *Figure 4: Recovery of crashed airplane.*

The AKSLI team was requested by BASARNAS command centre to recover objects found in SO-01 (seats and corpses). With the help of the Indonesian Navy Special Force divers deployed from Indonesian Navy vessel *KRI-593 Banda Aceh*, the recovery was accomplished as the technical crews on board lacked underwater recovery training. Figure 4 is a view of the MV *Geosurvey* working deck taken on the 9 January 2015 during the recovery task: recovered objects were towed by the rubber boat approaching the AKSLI vessel.

Concluding Remarks

From the time of arrival in the survey area, the mission was able to detect eight suspected objects in roughly 12km by 15km survey area within 24 hours. Three sites of the crashed airplane were located within the next seven days. Several remarks could be made. Among others, the limited knowledge on the actual sea state and currents during the operation hindered the team from efficiently verifying the sonar contact using ROV and diving operations, although the water depths ranged between only 25m and 38m. Presence of horizontal and underwater positioning devices (attached to divers' gear) enabled the accurate marking of the found underwater objects. This made the subsequent recovery mission effective.

It must also be underlined here that the best practice of the hydrographic survey could be attributed to the specific mission, i.e. underwater SAR. Readiness of crews and equipment, including availability of a dedicated survey vessel ensured effective coordination and execution of the search survey mission. In addition, the trust given to the Indonesian hydrographic services companies as well as availability of international reference and competence standards enabled the maintenance of a high level survey procedure and specialised skills of survey team members along with the persistent adherence to strict safety standards. Figure 5 is a picture of technical crews on board with Indonesian Navy divers. ◀

▲ *Figure 5: Search survey team.*

More information

AKSLI (2015). Search and Rescue of Air Asia QZ8501 by Using Side Scan Sonar, Multi Beam Echo Sounder and Remotely Operated Vehicle, Java Sea and Karimata Strait, Indonesia.

Corporate Social Responsibility Survey and Seafloor Mapping Community for Nation. Survey Report. Indonesian Association of Marine Survey Contractors (Asosiasi Kontraktor Survei Laut Indonesia - AKSLI). Jakarta, Indonesia.

Poerbandono (2015). Seafloor Swathe Survey for Search and Rescue Mission of Air Asia QZ8501. Article of the Month - March 2015. International Federation of Surveyors (FIG).

Poerbandono

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Seaplane Bathymetric Platform for Remote Area Operations

Flying, Landing and then… Surveying

Remote, difficult to access: it just depends on the point of view. Often, trying to reach some areas with a classical survey vessel or with an opportunity launch is like banging our heads against a brick wall, but it appears to be quite easy to land there with a seaplane. Here is the premise for the Seaplane Bathymetric Platform Project, which aims to integrate bathymetric survey instruments into an existing seaplane to conduct hydrographic surveys in remote and difficult to access survey areas.

Maritime navigation development in Canada's Northern Waters is highly impacted by the lack of nautical charts meeting minimum standards for modern navigation. Indeed, less than 10% of the Canadian Arctic waters have been charted to modern standards, and about 35% of the main Arctic shipping routes have been surveyed and charted to these standards. This situation is mainly due to extreme prevailing environmental conditions in the Arctic, the remoteness and the huge size of the Canadian Arctic Archipelago.

Shipping traffic is increasing in the Arctic, essentially due to climate change, which opens navigation routes for commercial cargo and passenger ships. Without reliable nautical charts, the risk associated with commercial shipping will increase with traffic development and intensity.

▲ *Figure 1: The installation set-up. Pole-mounted Teledyne RESON T20-P MBES. CodaOctopus F180 position and orientation unit. Auxiliary motors.*

Data Collection Challenge

The main limitation to massive hydrographic data production in the Arctic remains its underlying cost. Alternative solutions, like satellite bathymetry and airborne Lidar, are limited to very shallow and low turbidity waters, and hydrographic data crowdsourcing is a concept which still remains to be proven in terms of data quality and reliability. Arctic survey missions face problems of running costs and time frames for vessel deployment, due to the huge size of Canada's Northern Waters.

An alternative to classical survey vessels deployment may be found in operating hydrographic instruments from a seaplane, with advantages such as:

- Fast deployment in remote and not accessible areas;
- Possibility of fast reconnaissance surveys, before high density survey planning;
- Much lower deployment and mobilisation costs than hydrographic survey vessels;
- Running cost similar to those of a small survey launch.

In this context, Transport Canada has granted CIDCO and Geosphair Aviation Inc. to evaluate the feasibility of using a seaplane as a hydrographic platform. The goal of the project is to prove that a seaplane could be a survey platform well suited to carry out Multibeam Echo Sounder (MBES) surveys at the International Hydrographic Organization (IHO) special order level.

▲ *Figure 2: The Seaplane Bathymetric Platform in operation on Eel Lake (Rimouski, Qc).*

The main steps of the project included:

1 the modification to the airframe, floats and electrical system to accommodate the bathymetric survey instruments and auxiliary motors;
2 the installation, calibration and configuration of the complete hydrographic survey system;
3 the execution of two hydrographic surveys;
4 the data processing;
5 the quality control and the assessment of the datasets collected with respect to the IHO standards.

Installation Set-up and Survey

The proof of concept was made using Geosphair Aviation Inc.'s Super-Cub seaplane registered C-GBYY. The plane was specially modified for hydrographic surveys purposes. C-GBYY is operated in Canada under a Special Airworthiness Certificate – Experimental. Under this kind of certificate, aircraft modifications and maintenance are approved by the owner. The system deployed is composed of a pole-mounted Teledyne RESON T20-P MBES and a CodaOctopus F180 position and orientation unit. The F180 is divided into an inertial and motion unit (IMU) strapped inside the cabin and two GPS antennas bolted on the wings (Figure 1).

The lever arms and the mounting angles between the different sensors have been accurately measured by a dimensional control survey of the seaplane done with a total station. A patch-test calibration was conducted on the Eel Lake to calculate the residual angular offsets between the MBES and the IMU (Figure 2).

The seaplane then took off from the Eel Lake and landed a few miles away on the St-Lawrence River, in front of the Canadian Hydrographic Service (CHS) offices, in order to perform a sea trial (Figure 4).

The sea trial consisted of survey lines sailed in parallel with the CIDCO's survey launch *F.-J. Saucier*. The *F.-J. Saucier* is a Cheetah Marine Catamaran equipped with a Hydropod mounted Teledyne RESON SeaBat 7125-SV2 MBES and an Applanix PosMV320 position and orientation unit. Each of the two hydrographic platforms produced a bathymetric surface at 50cm resolution (Figure 5).

Dataset Quality Assessment

The difference between the surface of reference (*F.-J. Saucier*) and the surface to be evaluated (Seaplane Bathymetric Platform) made it possible to qualify the horizontal and vertical accuracy of the data collected by the Seaplane Bathymetric Platform. The difference surface (Figure 5) shows a standard deviation of 14cm at 95%. Even if the overall performance can be considered as good, it could have been easily improved with RTK or PPK positioning. Indeed, the sea trial was conducted in stand-alone positioning mode, which results in a horizontal positioning uncertainty of about 1.5m. The impact is low in flat areas (see south part of the surveyed zone) but increases in rocky spots which forgive no positioning approximation.

◀ *Figure 3: Detail of the airplane. The cradle with the multibeam echosounder is visible below.*

Figure 4: The Seaplane Bathymetric Platform just before the sea trial on the St-Lawrence River in front of the CHS offices. One can see CIDCO's survey launch F.-J. Saucier *in the background.*

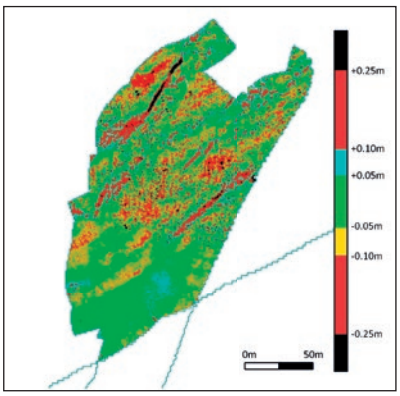

*Figure 6: Difference surface between the reference surface (*F.-J. Saucier*) and the surface to be evaluated (Seaplane Bathymetric Platform).*

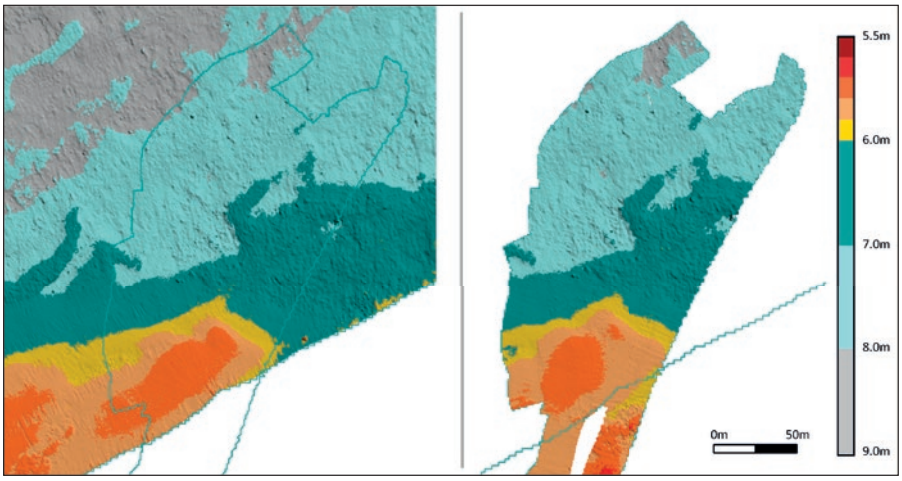

*Figure 5: Bathymetric surfaces at 50cm resolution and 3 times vertical exaggeration. Reference surface (*F.-J. Saucier*) on the left. Surface to be evaluated (Seaplane Bathymetric Platform) on the right.*

A QC report was also conducted to evaluate the vertical uncertainty of the hydrographic survey system T20-P/F180. It showed that the system qualifies for the IHO special order.

Results

The project results proved that the Seaplane Bathymetric Platform is capable of:

- Take-off from its base with a MBES&IMU installed;
- Land at sea in 0.75m of short waves;
- Perform a sea trial at IHO special order;
- Take-off at sea and go back to base.

In demonstrating that the data quality of the Seaplane Bathymetric Platform is comparable with the one obtained from a classical survey launch, the project contributed to developing tools and knowledge to facilitate survey operations in remote areas such as Canada's Northern Waters.

Nevertheless, the Super-Cub is currently not capable of carrying sufficient battery payload. An optimisation programme to reduce weight and parasite drag to the system is underway.

Future

In a second phase, this project could therefore contribute to developing Canada's capacity for the production of reliable hydrographic data in Northern waters, making it possible to map waterways with high navigation risks due to the lack of modern hydrographic data, or to conduct surveys for new ports implantation .

Acknowledgments

The Seaplane Bathymetric Platform Project was granted by Transport Canada's Northern Transportation Adaptation Initiative. Teledyne RESON contributed with the loan of a T20-P MBES and Caris with the loan of one HIPS and SIPS licence.

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A New Approach for Exceptionally Long and Deep Immersed Tunnel Projects

Developments in Highly Accurate **Immersed Tunnel Positioning**

Netherlands-based positioning specialist Geocon was awarded a contract for the immersion of one of the deepest and longest immersed tunnels in the world, in South Korea's Jinhae Bay. Together with its sister company, Strukton Immersion Projects, the main contractor for the immersion operations, Geocon completed the job within the specified time and budget.

In March 2007, immersion specialist Strukton Immersion Projects (like Geocon, a business unit of Netherlands-based construction company Strukton) was contracted to immerse a 3.2-kilometre long tunnel in South Korea's Jinhae Bay. The operation was to be carried out up to 1.5 kilometres from shore, at a direct intersection with the East Chinese Sea and the Pacific Ocean. Jinhae Bay's deepest point is 50 metres with an undercurrent of 2 metres per second. In this area, typhoon-induced 8-metre waves are no exception. Strukton Immersion Projects was given three time frames within which to complete the task, namely the winters of 2008, 2009 and 2010; the probability of typhoons being lowest during that season. There was no margin: less than four years after the signing of the contract, the tunnel had to be traffic-ready.

Key Figures

The tunnel was divided into 18 manageable elements, each 180 metres long, 10 metres high, 26 metres wide, and weighing approximately 48,000 tonnes. Four batches of tunnel elements were built in a dry dock that could hold up to five tunnel elements at a time, see Figure 1. After finishing each batch, the precast yard was flooded and the construction dock door removed. The tunnel elements were floated up and trimmed one by one with the ballast water system inside the tunnel element. Given their imposing size, transporting the elements would be no easy task. During their 40-kilometre journey from the dry dock to the immersion site, they would be able to withstand swells of no more than 30 centimetres. At only 0.025m allowed deviation from the design position, the margin for the connection of the elements at a depth of 50 metres was minimal. Given the dimensions and weights involved, it was clear that precision would play a pivotal role in ensuring the success of this project. There are no standard solutions for reliable immersed tunnel positioning in these extreme conditions.

▲ *Figure 1: The segmented fabrication in the construction dry dock in Anjeong.*

Traditional Measurement Method

Measurements for immersion operations are usually taken using a tacheometric system consisting of three total stations onshore and prisms fixed to the access shaft of the element prior to immersion, see Figure 2. This is a traditional, tried-and-tested method that Geocon has been using for more than two decades. Provided the top of the shaft is high enough to remain above water and the immersion activities are carried out close enough to the shore accurate positioning is possible. However, the 3.2-kilometre tunnel in South Korea's Jinhae Bay was to be immersed more than 1.5km from shore at a depth of 50 metres – too far for the total stations to be able to provide reliable measurements and too deep for practical use of access shafts. Geocons answer to this problem was a proprietary underwater measurement solution, consisting of a combination of existing and newly developed systems.

▲ *Figure 2: Validation of new systems against traditional method with towers.*

Four Measurement Systems

The combined survey system has an increasing accuracy from the transport phase up to the joining of the tunnel elements. A total of four new survey systems were used for the immersion. For the first tunnel elements the traditional survey method with shafts was used to validate the newly developed systems.

Transport and Positioning above Immersion Trench

The first system, an RTK-GNSS system mounted on the immersion pontoons, was used for the transport phase and for the positioning of each tunnel element above the immersion trench. A GNSS receiver was installed on both of the pontoons. A GNSS base station was placed near the immersion location, providing correction signals for the positioning. The accuracy of the system is +/- 0.03m in XY and 0.1m in Z.

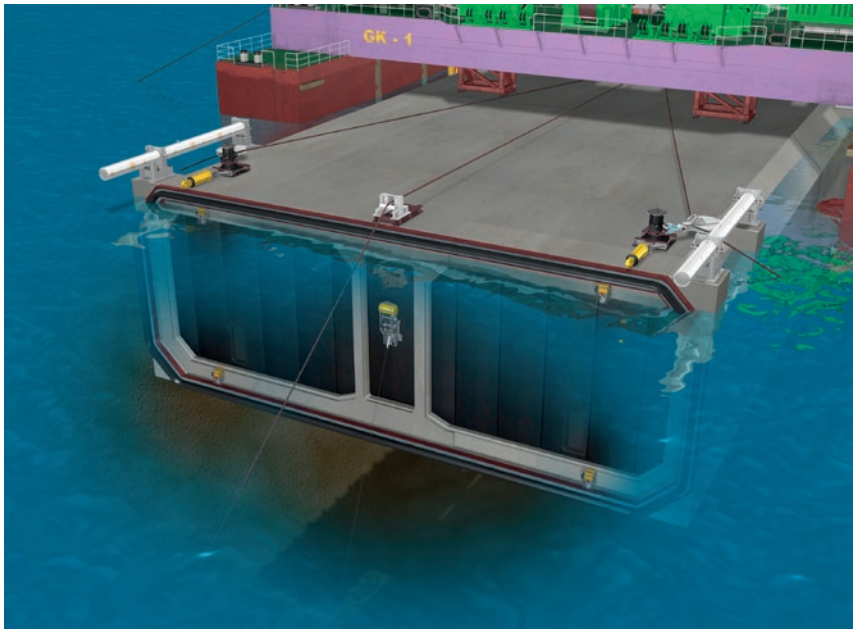
Approach

To immerse the tunnel element to a distance of 0.5m relative to the previous element a custommade 'light tautwire' system was designed, the second survey system. The tautwire is an instrument running a tensioned steel wire up and down on a drum. The tautwire unit was attached to the primary bulkhead of the tunnel element; the wire was connected to the secondary side of the previously immersed tunnel element. The tautwire measures the length of the wire, as well as the angles of the arm guiding the wire. The accuracy of the tautwire increases the closer the tunnel element gets to its final position. Information about the secondary side, referenced to the primary side, was provided by a Fibre Optic Gyroscope (FOG). The accuracy of the tautwire system is +/- 0.03m in X,Y and Z in the final and most critical phase of immersion.

The third system, a USBL system, was used as a backup of the tautwire. This acoustic survey system consists of a transducer and several transponders. The transducer, mounted on the primary side of a tunnel element, transmits an acoustic signal. This signal is received by the transponders mounted at known positions on the previously immersed tunnel element. The transponders reply to the transmitted signal with their own acoustic tone which is subsequently received at the transducer. A sound velocity sensor is mounted near the transducer. The speed of sound is frequently updated in the USBL software. This software outputs forward, starboard and depth values for each transponder. The Geocon immersion software processes these values to an actual position of the tunnel element. The accuracy of this system is +/- 0.15m.

Final Immersion Phase

In the final phase of the immersion process, the Gina gasket is pulled against the steel end frame of the previous tunnel element to obtain the initial water tightness necessary to empty the immersion joint. For this phase, distance sensors were developed to provide accurate measurements. With their range of 0.4m, the four distance sensors are extended just before the moment the Gina gasket touches the previously immersed tunnel element. The sub-millimetre accurate readings of these sensors where used in several ways. The reading of the stroke-length is a direct indication of the distance. Using the four distance sensors on each corner of the primary side of the tunnel element (Figure 3) a conclusion could be drawn about the position



▲ *Figure 3: Distance sensors and tautwire mounted at the tunnel element. Artist's impression. Image courtesy: www.kennisinbeeld.nl, 2013*

of the secondary end from the differences in the readings of the sensors. The accuracy of this fourth immersion survey system is +/- 0.005m at the primary side, and +/- 0.02m at the secondary side.

As Immersed Survey

To determine the final position of the tunnel element after immersion a decisive survey is performed by measurements inside the tunnel through the bulkhead doors using land survey techniques. The accuracy of this final measurement is +/- 0.005m relative to the previously installed element. As the tunnel was getting longer, the accumulated total station data resulted in a declining accuracy as a result of poor geometry and poor survey conditions. Large variations in humidity, temperature and line of sight due to construction works inside the tunnel influenced the survey conditions considerably. The angular reliability of the geodetic network inside the tunnel decreased with the tunnel length. Therefore, the geodetic network inside the tunnel was strengthened using land survey gyroscope observations. This instrument measures the true heading at several chords throughout the tunnel with an angular accuracy of 0.001°, equal to 0.015m/km. The headings measured with the total station are dependent of the accuracy of the preceding survey points that are used in the tunnel. The gyroscope observations on the other hand are independent. The total stations measurements were corrected with the gyroscope observations. With this corrected data the as built tunnel alignment was determined resulting in an accuracy of +/- 0.02m at 3.2km.

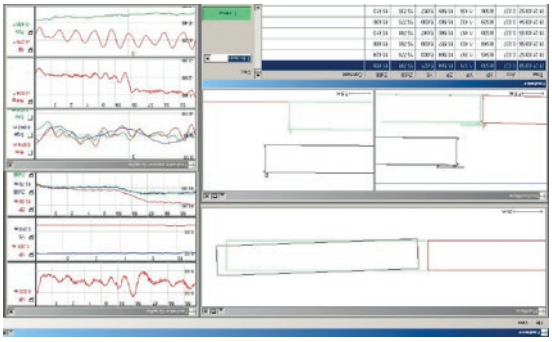
A Clear Picture

All of the measurement data was integrated using Geocon's proprietary software, converted into real-time position data, and presented to the immersion operations supervisor. All of these sensor systems yielded a wealth of data: absolute positions, headings, rolls, pitches, relative position data and data quality indicators. There was a real danger of the immersion team leader not being able to see the wood for the trees. Through the sober but adequate layout of the Geocon software only the bare minimum of relevant parameters was presented to the supervisor, see Figure 4.

Given the nature of the immersion operations, this was the only right decision. The actual immersion of the tunnel elements was a tense, three-day operation that required non-stop concentration. Over the course of those three days, divers, surveying technicians and other experts formed a highly skilled team that did what was needed to make the operation a success. Final decision-making responsibility lay with the immersion operations supervisor, who worked from the command post, where Geocon presented the measurement data.

Continuous Development

A proud South Korean president opened the tunnel to the public in December 2012. At home, the Dutch engineers received a variety of prizes for innovations, while their activities also enjoyed considerable interest from abroad. Later that year, Geocon embarked on a tunnel immersion project on the river IJ behind Amsterdam's Central Station. The tunnel is part of the new North-South metro line that will pass through the heart of the city centre. Geocon used the immersion of the three elements to further develop its proprietary measurement systems. The acoustic system that served as a backup in Korea has now been improved and tested, and with their LBL configuration, the latest CPAP and cNODE transducers achieved a precision of between 1 and 2 centimetres during the immersion process, see Figure 5. On this project, Geocon worked closely with the Norwegian manufacturer Kongsberg, in a partnership it intends to continue for future projects. In this respect, the measurement systems circle is now complete, in that Geocon has all the techniques at its disposal to provide the necessary certainty in future immersion operations. ◀



▶ *Figure 4: The entire immersion operation is supervised from the command post where all data is displayed.*

More information
Strukton Civiel, 2010, Connecting Dreams, Orange House publication, ISBN 978 90 78856 177

Bart-Jan Ruesink

Bart-Jan Ruesink has a background in Civil Engineering and worked as a construction surveyor on a number of construction projects in the Netherlands. He has been responsible for the immersed tunnel systems at Geocon since 2007 and has been involved in 25 immersed tunnel positioning operations on projects in South Korea, Ireland, Italy and the Netherlands.
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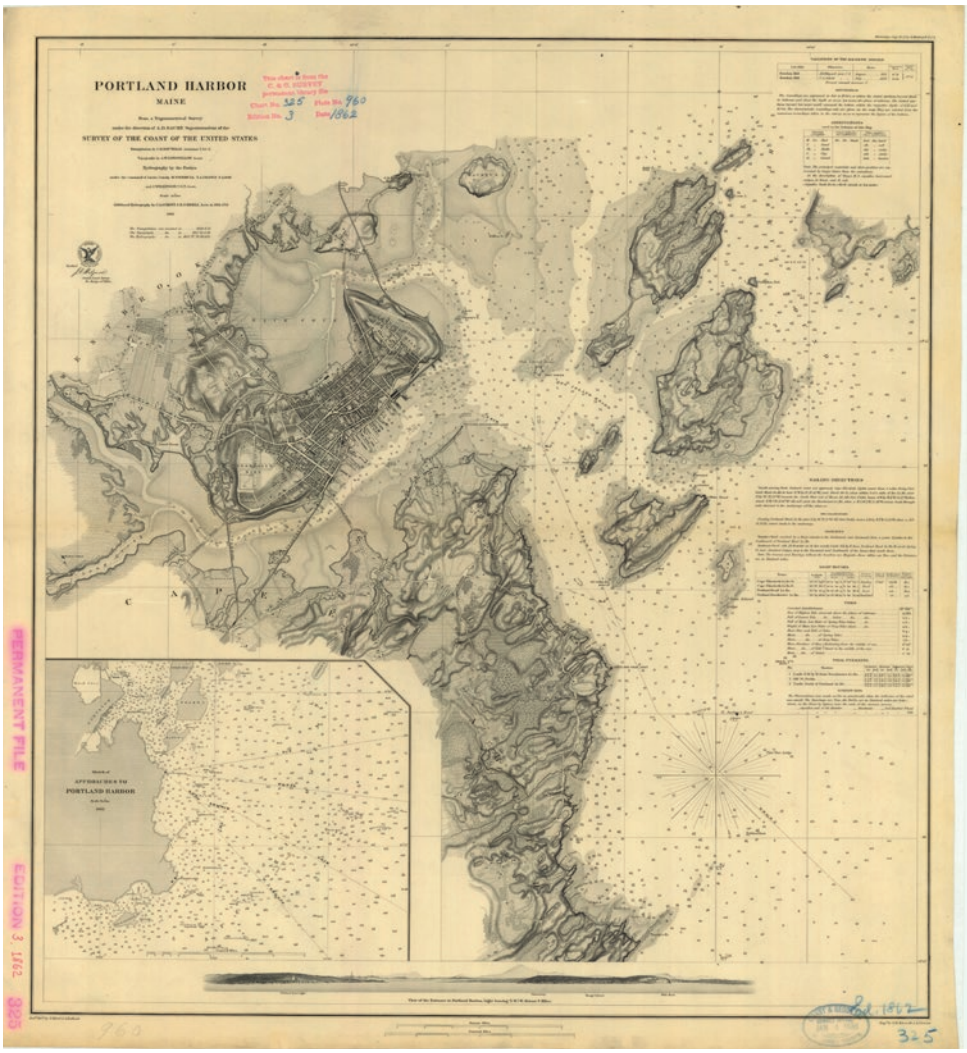
▲ *Figure 5: Kongsberg CYMBAL wideband system tests during immersion in Amsterdam.*

Early Natural Resource Conservation

Portland **Harbour**

A progressive spirit was awakening in the United States in the mid-nineteenth century. This movement was notable for emphasis on education reform, prison reform, women's suffrage, the abolitionist movement and an embryonic conservation movement among other concerns. Although the beginnings of the conservation movement are often traced to the establishment of national parks and the sustainable harvesting of forests (echoing the beginnings of seventeenth century efforts in England), an early whisper of the conservation spirit was found in the work of the US Coast Survey in major harbours of our eastern seaboard.

In the early 1850s, the primary and secondary triangulation of the east coast of the United States was progressing up the coast of Maine and by 1852 had reached the vicinity of Portland, Maine. The triangulation established the latitude/longitude grid for follow-on topographic and hydrographic surveying. The primary triangulation consisting of large triangles and quadrilaterals was observed by Superintendent of the Coast Survey Alexander Dallas Bache and served as the framework for the secondary triangulation that was completed by Charles Boutelle, a multi-talented surveyor who went on to become chief hydrographer of the Union's South Atlantic Blockading Squadron during the Civil War and then Assistant in Charge of the Office of the Coast Survey. The topography was developed by Alexander Wadsworth Longfellow, brother of the famous poet Henry Wadsworth Longfellow. Portland was the family home of the Longfellows and Alexander produced an amazing topographic map that is as much a work of art as technically excellent cartographic product. Lieutenant Maxwell Woodhull, United States Navy, was commanding officer of the Coast Survey schooner *Gallatin* and in charge of the hydrographic surveying. This talented array combined to not only produce a beautiful chart of Portland Harbour, but also pioneer an early example of the conservation movement in the United States.



▲ *Figure 1: The chart of Portland Harbour.*

Because a railroad had recently been built from Canada to Portland, it had become a deepwater port for Montreal and Quebec. Consequently, Portland anticipated a doubling of its maritime commerce within the following decade. Recognising this, Lieutenant Woodhull wrote to Bache in the fall of 1853: "This harbour I look upon as one of the best on our whole coast, remarkable alike for the facility of ingress and egress, with its convenient and safe anchorage… I have been very particular and minute in sounding the harbour within the breakwater and fronting the city, as I hoped thereby to furnish such facts as would give the citizens of Portland full knowledge of this harbour, and

▲ *Figure 2: Detail of the chart, showing piers and buildings.*

prevent the errors that have been committed in some of our commercial ports, in forcing improvements beyond propriety and a due regard to the safety of the harbour. Already shoals are making, caused, I think, by the irregularity in length of the different piers now existing, behind which eddies are formed…."

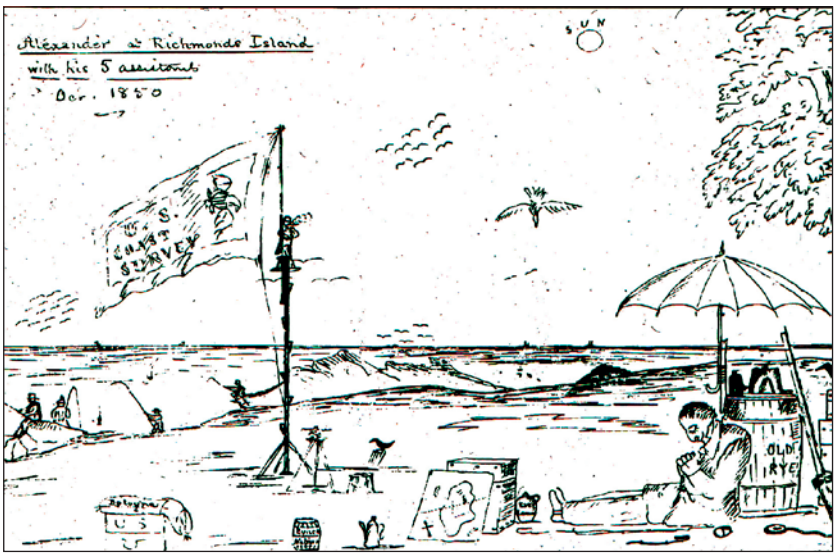
Apparently in response to Woodhull's foresight, city leaders invited a commission to study their harbour consisting of Superintendent Alexander Dallas Bache of the Coast Survey; General Joseph Totten, Chief Engineer of the Army Corps of Engineers; and Commander Charles Henry Davis of the Navy. The report of the commission is a landmark in the study of harbour engineering, perhaps not so much for its scientific content, as for its social and philosophical content. This report claimed to mark the first time that a harbour was studied to determine the most effective and least injurious means of improvement prior to construction as opposed to studying a harbour after improvements that caused great harm had been made. Perhaps reflecting the reform-minded spirit of the times, the commission recommended the establishment of a permanent government body vested with the authority to monitor and regulate changes caused by both natural causes and human activity. The commissioners furthermore espoused the then radical viewpoint that private property rights must be subordinated to the 'common good' in order to assure unbridled development did not irreparably harm Portland Harbour.

The primary objective of the commission's study was to recommend an optimum shoreline "beyond which parties should not be allowed to encroach upon the water" so as "to prevent, by timely action, injury to the noble harbour in question." Alexander Longfellow's topographic map showing the shoreline and configuration of piers was used to establish this optimum shoreline. For Bache and his commissioners, "...the case now presented is one of a novel and singularly interesting character. The common occasions for calling together a council of engineers for harbour improvements have been either to remedy natural defects, to repair the consequences of neglect, to restore a regimen which has been disturbed by natural convulsions, or to remove artificial constructions which have proved injurious to the channels."

"The Commissioners believe there is not one, in the long list of cases which they have met in the course of their reading, where the engineer has not been required either to undo what has been badly or thoughtlessly done, or else to do something which will supply a positive defect. But the grateful task assigned to this commission is entirely different. It is

Longfellow's topographic map showing the shoreline and configuration of piers was used to establish this optimum shoreline

▲ *Figure 3: View over Portland harbour.*



▲ *Figure 4: Self caricature of survey operations on Richmond Island.*

not called upon to introduce any change into the natural state of things, or to condemn the errors of the past. Having before it a harbour of excellent capacity, with sufficient natural means of self-preservation, it is only expected to show how that capacity may be safely used, and how those means may be maintained unimpaired."

A second major goal of the study was to generate a plan which would guide the city of Portland in expanding its harbour facilities and help it "escape, in future, those great evils and expenses which have been so frequently incurred by mismanagement or neglect in other places." In particular, the report referred to other nations as having many examples of mismanaging harbours as the result of rapid and unplanned construction of new facilities in response to an increase in trade.

Thus, the commissioners felt a heavy responsibility to develop a plan which would allow for the increase of commerce while at the same time assuring that the harbour was not damaged. Developing a plan was relatively easy. However: "... it is very evident, the Commissioners would remark that, for the adoption and successful prosecution of any plan of improvement, a controlling supervisory power over the harbours of Portland and all its interior basins must be lodged in competent hands. If no such power exists, action will be always desultory, and sometimes mischievous, as it has been in other places. This is a position which need not be maintained by any long argument. It is quite apparent that owners of lands bordering on the tidal waters will, if permitted, follow out their distinct designs without concert of action, with different objects in view, and with a special regard to those objects, irrespective of any general effect that may result from them. It is equally apparent that, in a case of so much general importance as the present, the rights of private property should not be allowed to interfere with public utility. To enforce this consideration, instances may be mentioned where the exercise of private rights has caused great and almost irremediable injury.... All of them convey the same lesson, which is, that the want of an intelligent and permanent supervising authority, which will examine and regulate in all respects, however detailed or general, any occupation of the water area, is certain to lead to harm, and to produce effects which must be counteracted at some future period with difficulty, hazard, and expense."

Is is expected to show how that capacity may be safely used, and how those means may be maintained unimpaired

The commission recommended that the city government of Portland take over the supervision of harbour improvements unless the state legislature establish a "... permanent Commission, with authority to direct constructions in all the tidal harbours of the State."

"In order, however, to guard against misapprehension, it may be well to say that there is no desire to encroach upon, much less to defeat, private and corporate rights. It will be readily understood that, in this question, there are two classes of interests somewhat distinct from each other - public and private. There are also two classes of objects -- special and general. Neither one of the objects or interests need, necessarily, be sacrificed to the other; but it will often demand a sound discrimination to render them compatible with each other. The exercise of such a discrimination properly belongs to a durable and responsible body. And the Commissioners cannot but express the hope and expectation that they are now addressing a body which either is, or will hereafter be, invested with suitable controlling powers, by means of which it can restrain ignorance, allay contention, reconcile jarring interests, and educe the common (which is the highest) good."

Nearly fifty years after this report was issued, Gifford Pinchot, a leader in the American conservation movement and first chief of the US Forest Service, espoused three principles of conservation:

1. Development: "… the use of natural resources now existing on this continent for the benefit of the people who live here now. There may be just as much waste in neglecting the development and use of certain natural resources as there is their destruction… The development of our natural resources and the fullest use of them for the present generation is the first duty of this generation."
2. Conservation: "… the prevention of waste in all other directions is a simple matter of good business. The first duty of the human race is to control the earth it lives upon."
3. Protection of the public interests: "The natural resources must be developed and preserved for the benefit of the many, and not merely for the profit of the few."

Superintendent Bache, his hydrographers and surveyors, the harbour commission, and the citizens of Portland, Maine, recognised these principles long before Pinchot's insights into the nature of conservation. Although harbours and their waters are not often thought of as natural resources, their study and protection both by local laws and federal laws were among the first actions taken to protect the natural resources of the United States. Next issue: The study of New York Harbour. ◀

Teledyne Marine Acoustic Imaging Group

Teaming up for Multibeam Echo Sounder and Sonar **Solutions**

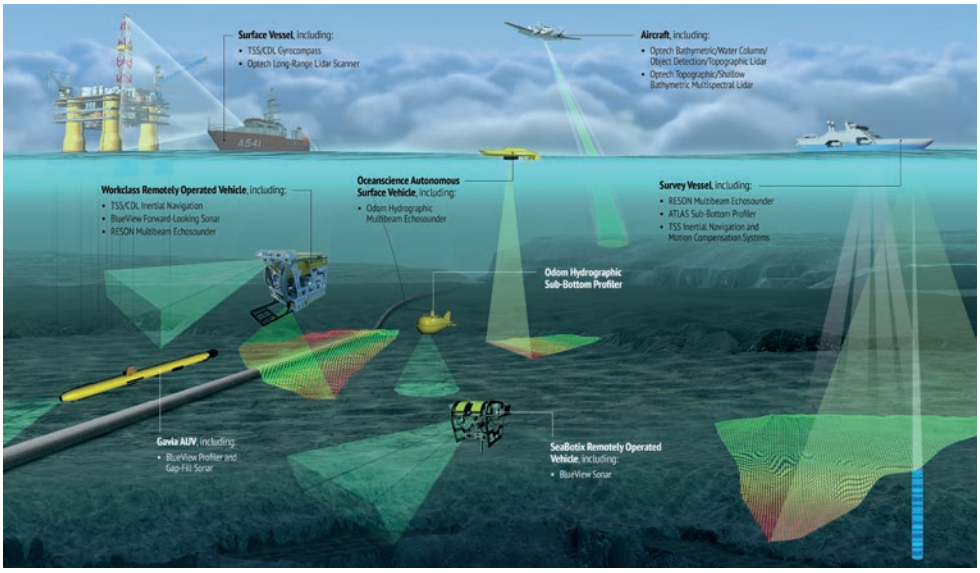
Teledyne Marine Acoustic Imaging Group is part of Teledyne Marine and is a provider of advanced multibeam echo sounder and sonar solutions servicing a variety of markets and applications. Single-beam echo sounders and entry level multibeam echo sounder systems are manufactured by Teledyne Odom Hydrographic, high-resolution multibeam echo sounder systems and long range forward looking sonar systems are manufactured by Teledyne RESON, high-end deep water multibeam systems from Teledyne ATLAS Hydrographic and 2D forward looking sonar as well as 3D multibeam scanning sonar are manufactured by Teledyne BlueView.

Oceanscience, Optech, CDL and TSS are also part of Teledyne Marine, supplying sonar solutions. Teledyne Oceanscience develops the autonomous remotely operated Z-Boat, which in partnership with Teledyne Odom Hydrographic is equipped with single and multibeam echo sounders. Teledyne Optech develops and manufactures Lidar and camera survey instruments. Teledyne CDL and Teledyne TSS design and manufacture gyrocompasses, attitude and heading reference systems, and inertial navigation systems.
Teledyne Marine Acoustic Imaging Group (MAI) has facilities in Denmark, the Netherlands, Germany, the UK, the USA and China. For support, a global sales network of distribution partners in more than 47 countries has been established. The organisation counts over 40 engineers and hydrographic surveyors working from six service centres.
The Teledyne Marine companies cooperate to develop advanced solutions, such as Teledyne Benthos and Teledyne RESON collaborating to develop a deep tow system including a SeaBat 7125 Dual Head multibeam echo sounder and a Teledyne RDI Doppler Velocity Log for Odessey Marine Exploration. This vehicle, to be used for search missions down to 6,000m, is currently undergoing final sea trials.

Hydrography

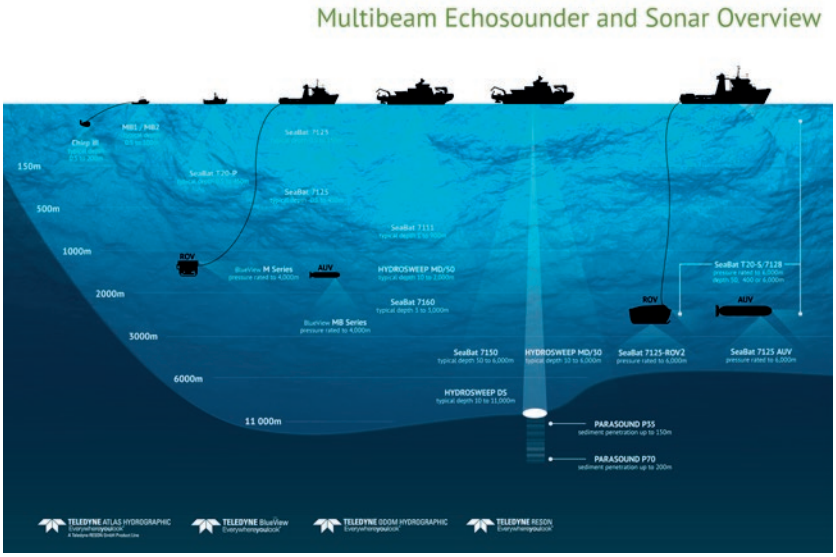
Within Hydrography, MAI provides a product portfolio for seabed mapping from extremely deep water to shallow water. Within that range, Teledyne Marine can match the client's requirements for size, ease of use and performance with a quality package according to the budget.

Also accessories that contribute to delivering a complete solution ranging from sound velocity sensors, brackets, mounting kits, gondolas, and cables to motion compensation and INS systems including processing station, installation and final hand-over to qualify and ensure the final system performs optimally can be provided by the company.



▲ *Figure 1: Teledyne Marine multibeam echo sounder, sonar and Lidar solutions.*

▲ *Figure 2: The deep tow vehicle is co-developed by Benthos and RESON.*



▲ *Figure 3: Teledyne Marine multibeam echo sounder and sonar range overview.*

Teledyne PDS's software solutions provide turn-key packages for MAI's single-beam echo sounders, multibeam echo sounder systems, and multibeam scanning sonar systems. All sonar solutions produce industry standard data to interface with all major hydrographic sonar data collection packages.

Offshore

Teledyne RESON and BlueView offer a product programme for offshore use. The forward looking imaging sonar from Teledyne BlueView assists ROV operators navigating around offshore subsea structure, and for pipeline surveying many companies use the SeaBat 7125. Features such as target detection systems for ROV station keeping and automatic tracking systems to detect and follow pipelines are Teledyne Marine developments. The main applications are pipeline surveying, metrology, inspection & monitoring, obstacle avoidance and leak detection.
Teledyne's sub-bottom profilers look deeper. With PARASOUND, sediment structures from 15cm can be visualised, buried objects can be localised prior to offshore cable trenching, or geologically stable pipeline routes identified. Multibeam echo sounders are also used for gas plume surveys for exploration and environmental monitoring purposes.

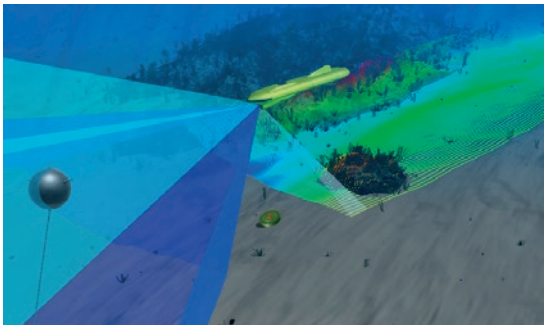
Civil Engineering & Dredge

MAI offers a suite of solutions to support civil engineering & dredge operations. The product range includes hydrographic grade single-beam echo sounders, sub-bottom profiles and sound velocity profilers by Odom Hydrographic, 2D imaging sonar systems and 3D multibeam scanning sonar by BlueView and the SeaBat world leading range of multibeam echo sounders all coupled with the power of Teledyne PDS software for hydrographic surveying and dredge guidance operations. The organisation thus provides a range of acoustic and software solutions to meet the demands of the civil engineering and the dredging market. Main application areas are during, pre and post dredge surveys, dredge guidance, construction support, bridge dam & harbour inspection and scour and undercut monitoring.

Defence and Security

MAI supports Defence & Security needs offering Commercial-off-the-shelf (COTS) products providing performance combined with the cost of ownership through the product life cycle typically being much lower than bespoke products. It is represented by products from RESON and BlueView including multibeam echo sounders for tactical bathymetric mapping, 2D forward looking sonar and hydrophones widely used by navies and institutes around the world. Main applications include terrain mapping, obstacle avoidance, mine counter measures, diver detection and first responder support.

Surface vessels rely on charts for safe navigation, but for naval operations charts are often unavailable. Underwater vehicles must avoid objects in their path and are often fitted with single-beam scanning sonar. Their slow update rate only covers part of the forward sector at any given instant. Long range SeaBat systems can operate on surface vessels to 6,000m depth, whilst the most compact low-power BlueView 2D sonar is rated to 3,000m – thus covering a wide range of applications.



▲ *Figure 4: BlueView FLS, micro-bathymetry and gapfil sonar on AUV.*

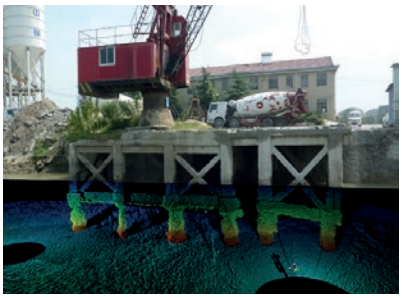
For the support of first responders, Teledyne Marine solutions include 2D multibeam imaging sonar such as the RESON SeaBat 7128 for surface vessel mount, to the more compact BlueView multibeam sonar, suitable for surface vessel use or on portable low logistics ROVs and diver hand units.

Teledyne PDS Software

Teledyne PDS is a multipurpose software platform supporting tasks within hydrography, dredge guidance, construction support, search & recovery operations and port entrance monitoring. The suite is developed to solve challenges arising from each specific task in the main application areas. It interfaces with survey instruments such as Lidar, multibeam and single-beam echo sounders and can be used for interfacing to a variety of periphery sensors, including dredge and construction sensors, sound velocity measurements, positioning and motion systems.

Teledyne PDS, now available in a 64-bit version, is optimised for Teledyne Marine products and other available systems from recognised manufacturers, enabling immediate data visualisation and quality control. The software is designed to be used in the maritime world with an intuitive user interface that is easy to learn. ◀

More information
www.teledynemarine.com



▲ *Figure 5: BlueView construction monitoring data image.*

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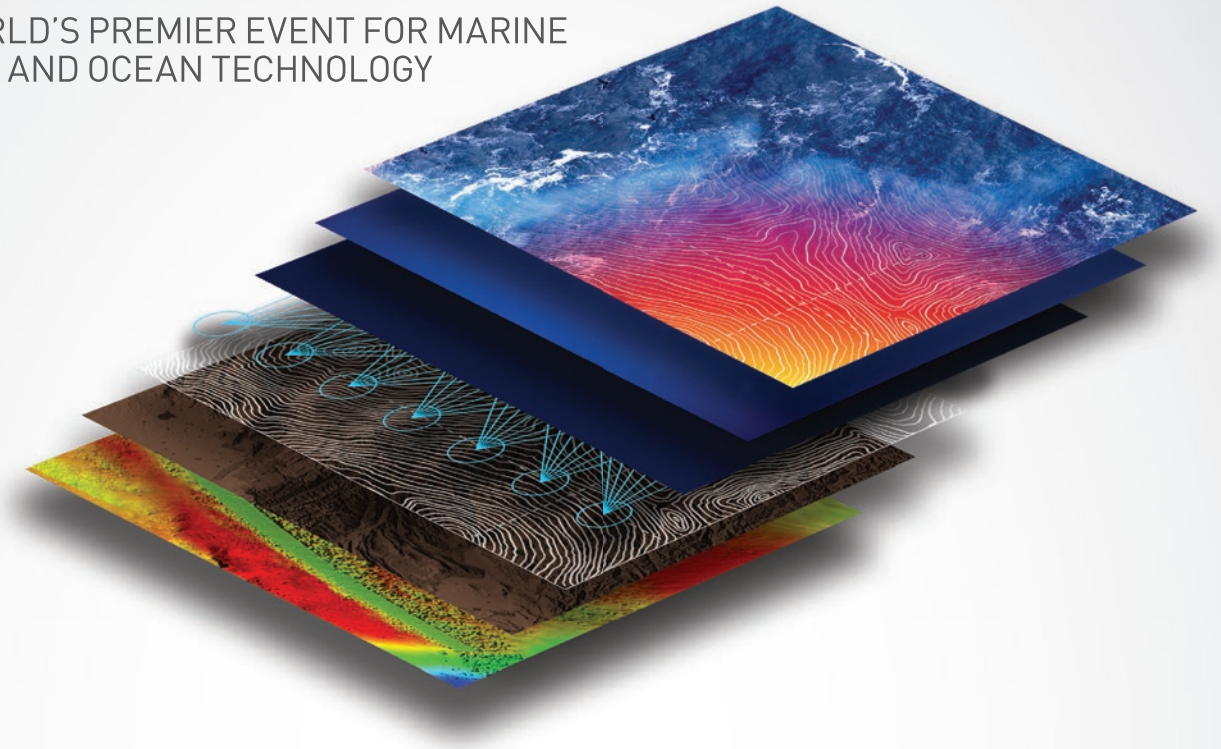

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JOOST BOERS, EDITORIAL MANAGER, HYDRO INTERNATIONAL

5th EMSAGG Conference, Delft, the Netherlands

Spatial Thinking with Sand and Gravel

The European Marine Sand and Gravel Group (EMSAGG) held its 5th conference on 4 and 5 June 2015 in Delft, the Netherlands. More than 100 delegates from eight countries gathered at the auditorium of Deltares, that kindly hosted the event. An array of speakers updated the audience on monitoring and impact of sand and gravel extraction, technologies and developments and spatial planning aspects. On 5 June, the Sand Engine attached to the North Sea coastline in the Netherlands was a highlight and well worth a visit.

▲ *Figure 1: The panel getting stuck into the final discussions. From left to right: Emre Otay, Keith Cooper, Brigitte Lauwaert, Gerrit van Solkema and Mark Russell.*

▲ *Figure 2: The delegates were interested in sharing knowledge and learning from the speakers.*

▲ *Figure 3: Delegates participating in the Sand Engine Project visit.*

The challenges of extraction of sand and gravel off the Dutch, Belgian and UK coasts were the subject of contributions by respectively Ad Stolk (Rijkswaterstaat, the Netherlands), M. Roche (FPS Economy, Continental Shelf Company, Belgium) and Keith Cooper (CEFAS, UK). Tommer Vermaas (Deltares,the Netherlands) showed a detailed analysis of dredging and sedimentation patterns in the Maasgeul near Rotterdam, the Netherlands.

Objects in the Sand

Large objects were the subject of the next contributions: UXO was highlighted by Merijn Terlou of Abeco, the Netherlands, followed by Robert Langman of MarineSpace UK talking about identification and handling boulders. Vera van Lancker gave an insight into the status of EMODNET as a digital platform for the sharing and quantifying of information. The link to marine spatial planning was quickly made using this 'bridge'. Brigitte Lauwaert elaborated on the Belgian approach of planning in their part of the North Sea. Nick Everington and Olivia Thomas of Crown Estate highlighted the way in which the UK is optimising and innovating for using marine aggregates. Sean Leake (GoBe Consultants, UK) added to this the cooperation with the industry, even creating a win-win situation.

Panel Discussion

The panel discussion between the session chairs generated many questions from the audience and a lively discussion on various aspects presented during the day ensued. Especially the mapping of unexploded ordnance and the consequences of removal, and practical aspects of spatial planning were discussed regularly.

It was at that point that EMSAGG president Cees Laban concluded that the day had added to the knowledge of the participants and forged relationships between them. He emphasised after the conference: "the growing demand of marine sand and gravel and increased use of the seabed space by infrastructural works together with EU and national legislations claiming protected areas, is asking for cross border planning of the available resources, and in-depth studies of the seabed characteristics and processes. This 5th EMSAGG conference provided the audience with insight in the latest developments by speakers from the industry, institutes and governmental agencies. The great involvement of the participants during the panel discussions made this conference a great success and a step towards the key theme 'Finding Common Ground'."

Sand Engine Project Visit

On 5 June 2015, as part of the European Marine Sand and Gravel Conference, delegates from across Europe travelled to the Sand Engine coastal protection project on the Dutch coastline.

The day opened with presentations by Deltares scientists Bert van Der Valk and Arjen Luijendijk who outlined the initial concept, the construction process and the ongoing monitoring, analysis and research of the development of this innovative coastal protection project.

The Sand Engine is a pilot project for an innovative method of coastal protection. The Sand Engine (also known as Sand Motor) is a huge volume of sand that was applied along the coast of Zuid-Holland at Ter Heijde in 2011. The Sand Motor will gradually change in shape and will eventually be fully incorporated into the dunes and the beach, as waves and currents spread the sand naturally along the coastline. Building with Nature is an ongoing research project that examines how to utilise natural processes and provide opportunities for nature while achieving a hydraulic infrastructure. The work in the programme is carried out by the EcoShape consortium that consists of private parties, government organisations and research institutes. ◀

More information
http://www.ciria.org/EMSAGG/

Review of the Cadcorp conference 'Blue Growth'

Expanding Role For GIS In Marine and Maritime Sectors

The 'Blue Growth' conference held in London in May 2015 and hosted by British software developer Cadcorp, was an opportunity for marine and maritime professionals to discuss some of the ways in which coordination in the marine and maritime sectors can be improved through greater sharing of geographic information and the use of geographic information systems (GIS).

It became apparent that there are many different vehicles for sharing information about marine and maritime geographies. These range from data hubs and portals, through to desktop and web mapping applications, layered PDF documents, and even that most traditional of media - paper maps and charts. Attendees learned that the choice should depend on local circumstances, including the motivation for data sharing and the capabilities of recipients to read data.

Berrit Bredermeier from the Centre for Environment, Fisheries and Aquaculture Science (Cefas), talked of the experiences of Cefas in a major survey project it has been undertaking since 2007 - the British Energy Estuarine and Marine Studies Programme (BEEMS). The project entails Cefas gathering survey data on marine environmental, ecological and local issues relating to the intake and discharge of cooling water by nuclear power stations. Having collected and processed the survey data, Cefas shares its findings with various stakeholders. It does so by creating and distributing maps as layered PDF documents.

For the next speaker, Russell Bird, Group Hydrographic and Dredging manager at Peel Ports Group, the driver for data sharing wasn't so much ease of use, but rather the speed with which data can be shared through hydrographic charts. By following a standardised process, surveyors at Peel Ports Group can produce hydrographic charts within minutes of a survey being completed. Russell pointed out this 'just-in-time' approach is vital when dredging has to be carried out at a particular berth in order to accommodate a waiting vessel and when producing charts for the range of port authorities under the group jurisdiction.

One of the arguments against the use of web mapping in the marine and maritime sectors – that it is too complex – was called into question by Cadcorp. In a live demonstration, Cadcorp staff showed that off-the-shelf web mapping applications can be both sophisticated in functionality, and at the same time capable of being used by non-expert users. Cadcorp demonstrated a web mapping application that changed its behaviour as the user changed his or her behaviour, switching from desktop to tablet and mobile devices. It was argued that such 'responsive' web mapping software has the potential to transform the sharing of spatial data in marine and maritime sectors.

GIS technology is a great integrator of diverse datasets and because of this it has the potential to serve as vehicle for bringing

▲ *Figure 1: Russell Bird of Peel Ports achieved faster chart production.*

◀ *Figure 2: Interactive round table discussions.*

▲ *Figure 3: The delegates were interested and keen to participate.*

together different interests. Marie Pendle reported on an EU-funded marine project being carried out by HR Wallingford, which is designed to put this to the test. The purpose of the project was to evaluate how useful GIS and GI could be in helping determine the availability and suitability of sites for wind farm development along national maritime boundaries in the North Sea Basin. It involved bringing together a number of diverse datasets from different countries. These included administrative/legislative boundaries, shipping lanes, bathymetry, geology, wind strengths, commercial fishing, environmental sensitivities, etc. By representing these datasets as maps, overlaying them, and applying summations to these overlays, an analyst can get an aggregate view of the suitability of different sites. A conclusion of the project was that it would be possible to use GIS and public data for the commercial siting of marine projects, and to understand overlapping areas of interest.

Dr Sean Gaffney gave an update on the work of the MEDIN network designed to provide a single point of access for UK marine data and information. He reported that the MEDIN portal went live as planned in 2010 and now directs users to over 9,500 marine datasets. MEDIN also provides 115 GIS reference layers on many marine topics, compiled by a range of organisations. Layers are categorised using INSPIRE themes, and all layers are available under the Open Government Licence.

We were reminded in a presentation by Caroline Levey of Oceanwise, that using GIS in a marine environment requires functionality specific to the sector. Caroline showed how Oceanwise has extended generic Cadcorp SIS desktop software with workflow extensions to support dredging and licensing, environmental sampling, infrastructure and asset mapping, and the management of hydrographic survey metadata.

The marine sector with its insatiable appetite for survey data can claim it has been working with Big Data for a number of years. Presenters from Cadcorp reminded us that general purpose GIS software often has to be enhanced in order to accommodate the very large datasets generated in marine surveying and modelling applications. Attendees were shown an integration between Cadcorp SIS software and the Lidar processing application, 'TeraSurf' from Cadcorp partner Geomod. They saw how TeraSurf can support unlimited bathymetric and Lidar survey data in a memory efficient way, and how the application can coexist with Cadcorp SIS desktop software.

Mike Postle-Haco demonstrated that satellite-based positioning systems such as GPS have not made an understanding of geodesy redundant. He reminded us that latitude and longitude values don't necessarily define a unique location on the earth. The values only define a unique location when used in conjunction with a defined geodetic datum. Use a different geodetic datum, and you can shift the physical location of the latitude and longitude values. A possible consequence? Vessels have run aground because they have been navigating using GPS transformed to a local datum, against a route survey made against a global datum.◀

More information
Conference presentations: http://cdcp.io/J

Successful Kick-off of **North Sea Offshore** Event

On 4 June 2015, the first North Sea Offshore Event took place, excellently organised by 'Ontwikkelingsbedrijf Noord-Holland Noord'. The event started decentralised with seven morning workshops at seven different companies in the Den Helder region. One of these companies was NIOZ Royal Netherlands Institute for Sea Research on the isle of Texel. The NIOZ workshop focused on the NIOZ Deep Sea Science and Technology Centre (DSSTC).

DSSTC chief scientist Prof. Gert-Jan Reichart gave a general background introduction on why deep-sea mining recently gained global interest and showed some of the first results of the current international project 'TREASURE' in the Atlantic Ocean near the Azores on the possible environmental effects of deep-sea mining. Chief engineer Marck Smit explained the different types of technology available at Royal NIOZ for deep-sea research. After the theoretical part, the participants were split into two groups for a guided tour through the institute to see the labs, the equipment and workshops. At noon the participants left for the general afternoon programme at the 'Dukdalf' on the old wharf of the Royal Navy 'Willemsoord' in Den Helder on the other side of the Marsdiep Tidal Inlet.

After an animated lunch, the afternoon programme, enthusiastically led by chairman Stefan Morssink for all (> 250!) participants, included a lecture by Ante Frens on the plans to scale down the (mainly) gas exploration activities of the Nederlandse Aardolie Maatschappij (NAM) in the Dutch and UK sections of the southern North Sea, followed by a lecture by Eric Wesselman that lifted a tip of the veil of a KPMG study on the outlook of the offshore sector over the coming decades. Eric explicitly promoted the joining of forces in the maritime sector with the quote 'It is easier to hunt in packs'. The full KPMG report will be available after the summer. The day was closed with a lecture by Annemarie van Gaal, one of the most successful business women in the Netherlands, who started with a media company in Russia in the 1990s and now guides and invests in start-up firms. She closed her very inspiring session with a quote from a leading ice-hockey international: "Always look where the puck is going; it is more important than where the players are". All in all a very good day; definitely worth repeating next year!

Deep-sea mining recently gained global interest

Figure 1: Animated lunch during the first North Sea Offshore Event. Image courtesy: North Sea Offshore.

Figure 2: Inspiring keynote lecture by Annemarie van Gaal. Image courtesy: North Sea Offshore.

Hydrographic Society Benelux

Workshop and Site Visit

On 26 June 2015, the Hydrographic Society Benelux organised a workshop in "Het Keringhuis", situated next to the Maaslantkering (storm surge barrier) in Hoek van Holland.

The theme of this workshop was the same as the theme of World Hydrography day, 'Our seas and waterways - yet to be fully charted and explored'.

The workshop was kindly opened by the chief Hydrographer of the Royal Dutch Navy.

▲ *Figure 1: The workshop also consisted of a visit to the Maaslantkering.*

We invited Dick Schaap (project manager at MARIS) and Marc Roesbeke (application manager at the Flemish Hydrographic service), to shine a light on this theme. Their presentations were mostly about organising Hydrographic data in such a way that it is more openly available, and that different datasets can be combined, in order to make better use of the data and thus the effort by hydrographers over the world.

In addition to the very interesting presentations there was a tour and a video presentation about the Maaslantkering and structures in Zuid Holland that manage the never ending thread of water, which doesn't only come from the North Sea.
The workshop ended with a nice drink organised on the terrace of Het Keringhuis in the warm June sun.

▲ *Figure 2: Indoor presentations were provided.*

▲ *Figure 3: The Chief Hydrographer of the Netherlands welcomed the participants.*

▲ *Figure 4: Keynote speakers Dick Schaap and Marc Roesbeke.*

Australasian Hydrographic Society

Australasian Hydrographic Symposium 2015

The AHS will be hosting the Australasian Hydrographic Symposium 2015 in warm, sunny Cairns from 3 to 7 November 2015. Cairns is the gateway to the Great Barrier Reef and is a beautiful, tropical city in northern Queensland – a great to place to be, particularly for anyone in wintery northern climates….. We look forward to seeing you later this year.

For more information
Visit the AHS website at: www.ahs.asn.au/AHS.html
A detailed description of the Symposium can be found at: bit.ly/1KPQcyi.

JULY

South East Asian Survey Congress (SEASC 2015)
Marina Bay Sands, Singapore
→ 28-31 July
For more information:
pat@eventspeople.com
www.seasc2015.org.sg/index.html

RIO Acoustics – Acoustics in Underwater Geoscience
Rio de Janeiro, Brazil
→ 29-31 July
For more information:
secretariat@rioacoustics.org
www.rioacoustics.org

SEPTEMBER

ICE Coastal Management
Amsterdam, The Netherlands
→ 7-9 September
For more information:
www.ice-conferences.com/coastal-management

Shallow Survey 2015
Plymouth, UK
→ 14-18 September
For more information:
www.shallowsurvey2015.org

VideoRay International Partner Symposium (VIPS)
Pottstown, USA
→ 16-18 September
For more information:
www.videoray.com/vips-2015.html

AUVX 2015
Annapolis, USA
→ 21-24 September
For more information:
AUVX@hydroid.com
www.auvx.com

OCTOBER

Teledyne Marine Technology Workshop
San Diego, CA, USA
→ 4-7 October
For more information:
www.teledynemarine.com

European Dredging Summit
Antwerp, Belgium
→ 7-8 October
For more information:
www.wplgroup.com/aci/conferences/eu-mdr1.asp

Kongsberg Maritime HiPAP Survey Engineer Training Course
Aberdeen, UK
→ 9-10 October
For more information:
km.training.aberdeen@kongsberg.com
www.km.kongsberg.com/training

Offshore Energy 2015
Amsterdam, The Netherlands
→ 13-14 October
For more information:
www.offshore-energy.biz

OCEANS '15 MTS/IEEE
Washington DC, USA
→ 19-22 October
For more information:
info@oceans15mtsieee-washington.org
www.oceans15mtsieee-washington.org

PLOCAN Glider School
Telde, Gran Canaria, Spain
→ 19-24 October
For more information:
www.gliderschool.eu

8th ABLOS Conference
Monaco
→ 20-22 October
For more information:
www.ablosconference.com

Nortek Pulse-Coherent User Symposium
Karlsruhe, Germany
→ 22-23 October
For more information:
www.nortek-as.com/en/news/nortek-user-symposium-22-23-october-2015

IADC Dredging Seminar
Singapore
→ 27-31 October
For more information:
www.iadc-dredging.com

NOVEMBER

The ECDIS Revolution
London, UK
→ 3 November
For more information:
www.ecdisrevolution.org

Oceanology International China
Shanghai, China
→ 3-5 November
For more information:
www.oceanologyinternational.com/en/Exhibiting/Oceanology-China-2013/

Australasian Hydrographic Symposium
Cairns, Australia
→ 3-7 November
For more information:
bit.ly/1KPQcyi

CEDA Dredging Days
Rotterdam, The Netherlands
→ 5-6 November
For more information:
www.cedaconferences.org/dredgingdays2015

International Subsea Event China International Underwater Intervention
Xiamen, China
→ 6-8 November
For more information:
www.subseaevent.com

Sustainable Ocean Summit
Singapore
→ 9-11 November
For more information:
www.oceancouncil.org

FEMME
Singapore
→ 17-19 November
For more information:
bit.ly/ZSYNyo

Hydro15
Cape Town, South Africa
→ 23-25 November
For more information:
www.hydrographicsociety.org

JANUARY 2016

HYPACK 2016
Tampa, USA
→ 4-7 January
For more information:
www.hypack.com

FEBRUARY

Underwater Intervention
New Orleans, USA
→ 23-25 February
For more information:
www.underwaterintervention.com

MARCH

57th Marine Measurement Forum
Wallingford, UK
→ 3 March
For more information:
www.mmf-uk.org

Oceanology International
London, UK
→ 15-17 March
For more information:
www.oceanologyinternational.com

APRIL 2017

XIXth International Hydrographic Conference
Monaco
→ 24-28 April
For more information:
www.iho.int

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

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