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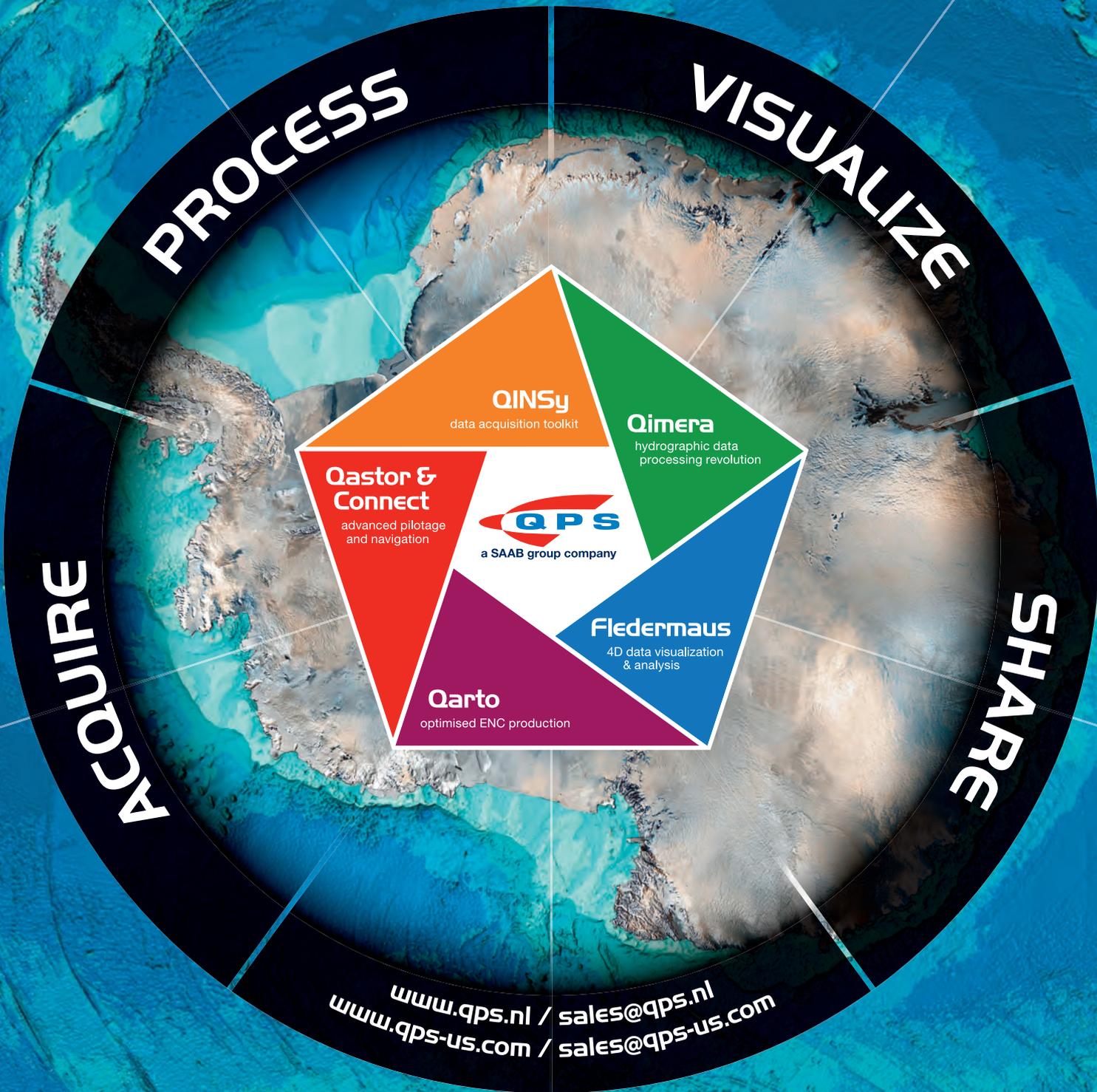


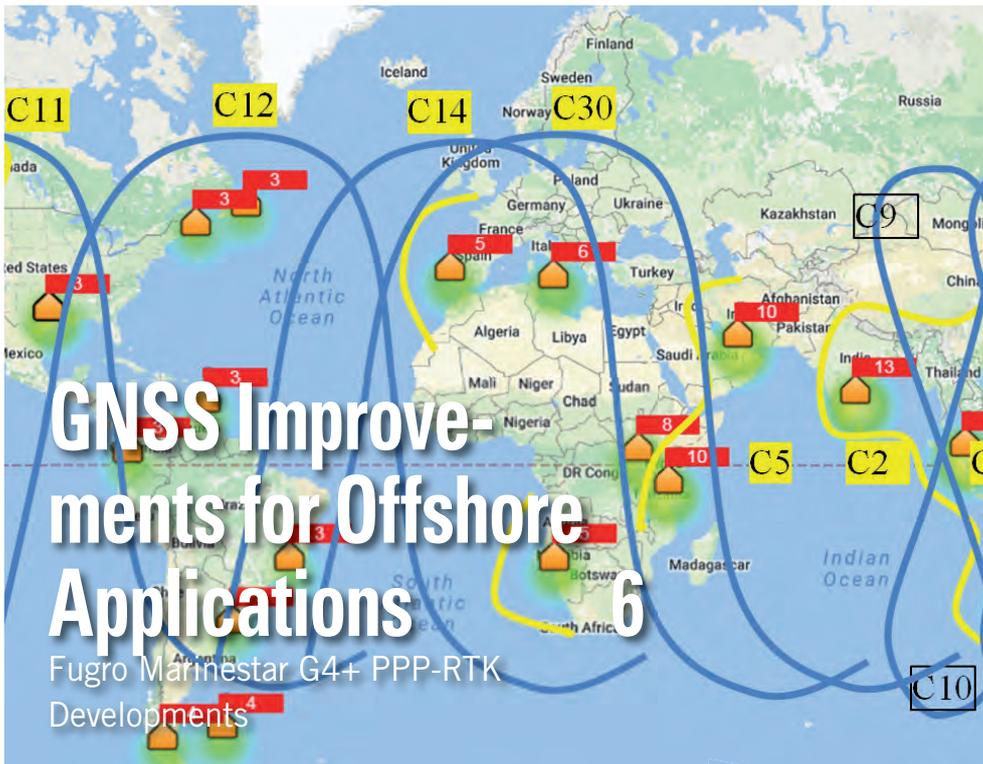
BUSINESS GUIDE 2017 | VOLUME 20 NUMBER 9



# Business Guide 2017

MARKET REPORT | PRODUCT  
REPORT | COMPANIES | INTERVIEWS





**5 Questions to...**

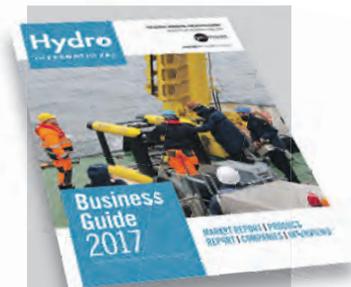
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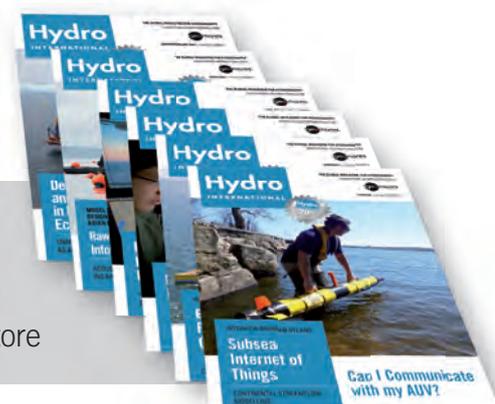


**Company Guide 21**



*This is the first edition of the Hydro International Business Guide which replaces the traditional Buyers Guide. We are very keen to hear your thoughts about this publication, so please feel free to send your comments and feedback by e-mail to editorial manager Joost Boers: [joost.boers@geomares.nl](mailto:joost.boers@geomares.nl).*

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# Business Guide

This is no longer a Buyers Guide. We have decided to rename this yearly edition, always published in the last months of the year together with the regular issue of *Hydro International*, the *Business Guide*. Our idea behind this is that we want to give you a little insight into the business of hydrography, the course it's taking, the developments and the growth opportunities. We've asked thought and business leaders from academia, NGOs and the private sector to shed their light, be it briefly, in 5 questions, on the business of hydrography and where the direction it will take. Captain Robert Ward, Secretary-General of the International Hydrographic Organization, and Martin Jakobsson, vice president of GEBCO, both foresee major business opportunities thanks to autonomous data-gathering by unmanned systems. Ola Oskarsson, from Swedish - based survey company MMT, sees a lot of work for hydrographers coming out of the field of environmental monitoring in the nearby future. Almost all of our interviewees see the need for new skills for hydrographers: being able to adapt and adjust to new markets and new fields, surrounding ours. In an article by Hans Visser et al. from Fugro MarineStar the growing accuracy and growth of the GNSS network for use by marine surveyors is described. Trends in hydrography are handed over to you in an article by Gordon Johnston, looking forward to the years to come and the role that hydrographic surveyors will play in the future.

In this *Business Guide* you will find profiles of companies, both manufacturers and service providers, but also academic institutes and organisations: describing what they have to offer. In the Companies section on the website you will find direct links to the websites of those companies and more. This *Business Guide* is available online and in print and will land on desks of 40,000 professionals and will also be distributed at tradeshow and conferences. It is my strong belief that the number of companies in this guide and its online counterpart show the strength of this industry in adjusting and adapting to new times, a characteristic that is very much needed in entrepreneurship and a characteristic we are expecting from our surveyors as well. Both companies and surveyors will need this to be able to stay or become the right partner to consult for everybody that wants to know something about our seas!

Durk Haarsma [durk.haarsma@geomares.nl](mailto:durk.haarsma@geomares.nl)

## Fugro Marinestar G4+ PPP-RTK Developments

# GNSS Improvements for Offshore Applications

Currently, there are four Global Navigation Satellite Systems (GNSS) available: GPS, Glonass, Beidou and Galileo. These satellites can be used directly but accuracy is greatly improved when using orbit, clock and UPD correction signals. Fugro Satellite Positioning operates a worldwide network of more than 100 GNSS reference stations capable of tracking GPS/Glonass/Beidou and Galileo. This network is used to calculate precise satellite orbit and clock corrections of all four constellations in real-time for hydrographic applications. The corrections are broadcast to the maritime users by geostationary L-band satellites providing worldwide coverage. In this article the recent developments and the resulting accuracy of specifically the Precise Point Positioning (PPP) Real-time Kinematic (RTK) solutions are described in more detail.

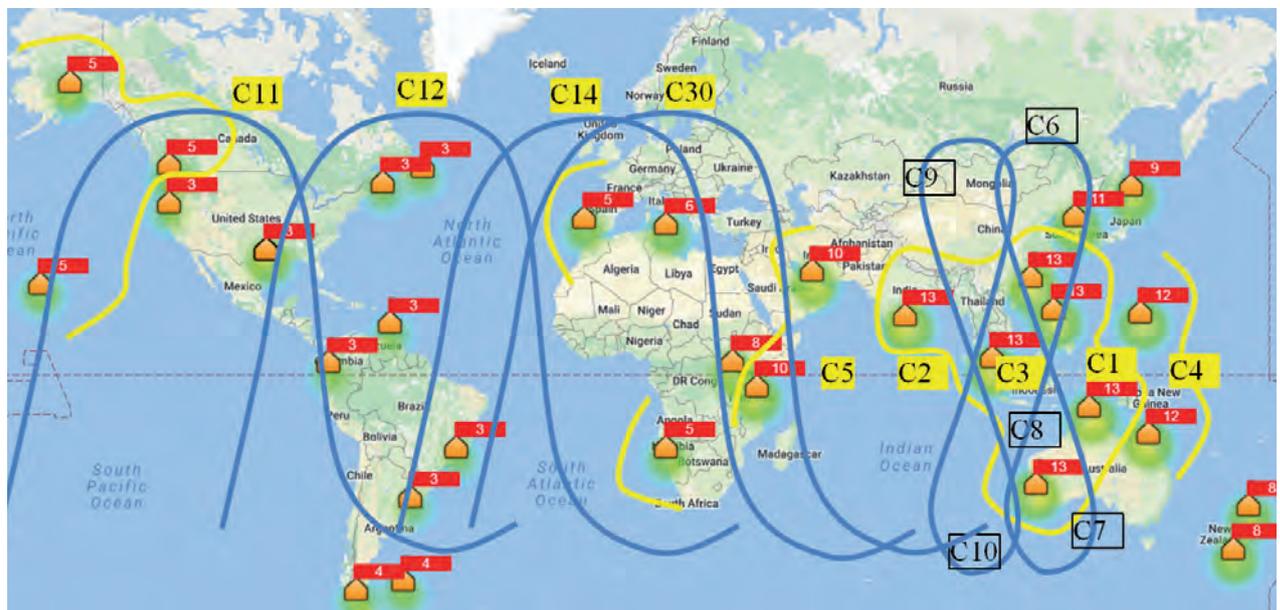
The Fugro Marinestar G4 service uses all four GNSS satellite constellations. The two regional systems (QZSS and IRNSS) are not used. However, not all four global constellations have the same geographical spread or the same number of available satellites. Therefore, one must consider the strength and weaknesses of

each constellation. The current status for each GNSS, based upon a minimum elevation of 5°, is given below.

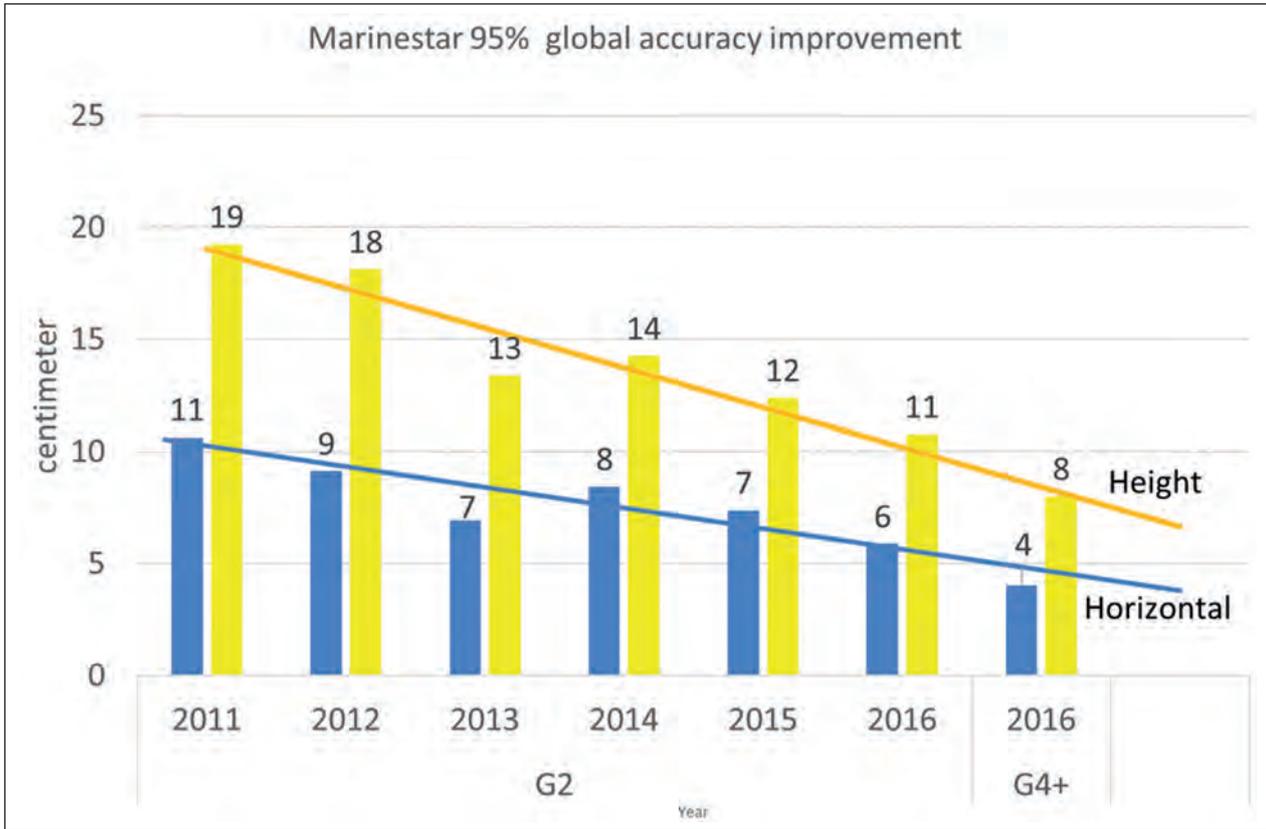
### GPS

In September 2016, there were 31 healthy American GPS satellites with one satellite (SVN

34/PRN 04) acting as a spare. In the current constellation, 19 so-called block IIF satellites transmit the newest, 3 dB stronger, additional L2C signal. This allows for better tracking in marginal circumstances and no impact when the L1 signal is jammed (in contrast with the legacy L2 signal which will be affected).



▲ Typical maximum tracked Beidou Satellites 21 August 2016.



▲ Improvements of the Marinestar solution height over the years.

According to the Marinestar GNSS network data there are between 6 and 13 GPS satellites useable on a daily basis. Local blockage and interference can reduce this to less than 4 satellites, which is not sufficient for a PPP-RTK position calculation. On a typical day, 3 sites were affected by short local GPS interference.

**Glionass**

Currently, the nominal 24 Russian Glionass satellites are available as well as two test satellites. Some satellites can have a higher clock noise and are then deemed unusable for RTK and can be removed from the Marinestar service. Between 4 and 10 Glionass satellites are visible. On an arbitrary day five sites have short-term Globalstar Iridium, L2 Amateur radio or cellular interference reducing the number of tracked Glionass satellites to two or zero.

**Beidou**

The Chinese BeiDou navigation system currently has a constellation of 14 operational satellites consisting of 5 Geosynchronous satellites (GSO) on the equator covering China, 5 Inclined Geostationary Satellites (IGSO) and 4 Medium Earth Orbit (MEO) satellites, which rotate the earth 13 times in one week. Within the Chinese Beidou Conus between 6 and 14

satellites are always visible. The MEOs limit availability in the America's to between 0 and 3 satellites. In Patagonia the Beidou IGSO satellites are visible over the South Pole increasing the number to 4 (See Figure 1).

**Galileo**

On 21 August 2016, 11 Galileo Satellites were available with satellites E14 and E18 in an

**Newer satellites have more signal power, better antenna gain designs and better receiver tracking**

elliptic orbit that still allows them to be used (See [1] Tegedor, ENC2016). There are between 0 and 5 Galileo Satellites in view. The maximum period with 4 Galileo satellites in view for any location is around 4 hours. On 17 November 2016, four extra satellites are planned to be launched. However, with 2 Galileo satellites in view value is already added due to the accurate clocks and increased availability of signals.

Based on the overview it is clear that no single constellation allows consistent positioning for all

current reference stations. The total number of nominally available satellites is 70 (32 GPS, 24 Glionass, 14 BeiDou). When all constellations have been established in 2020, there will be 116 satellites (32 GPS +24 Glionass +30 Beidou+30 Galileo). Marinestar G4+ uses measurements from all four constellations (hence G4) and currently broadcasts the orbit and clock corrections for GPS, Glionass and

Beidou. Broadcast of Galileo orbit and clock corrections is technically possible, but waits for the declaration of Galileo early service capability by the EU. Additionally, G4+ fixes the ambiguities on GPS (hence +) to allow for PPP-RTK positioning (See [2] Tegedor).

**Clock and Orbit Corrections**

Marinestar provides a Precise Point Positioning service using GNSS data of a globally distributed network of around 45 reference stations. Using these stations the precise orbit of the GNSS



## Shore Based Ocean Radar

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Harbour Management



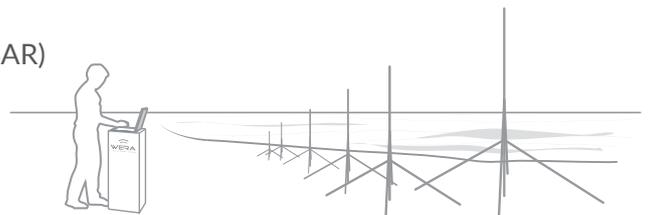
Hazard Management (SAR)



Offshore Operations



EEZ Monitoring



satellites are determined and transmitted to the user every minute. The satellite clock error is also measured and transmitted every ten seconds. Over the years, the accuracy of the orbit and clock solution has improved. For the G2 Glonass / GPS solution from 11 to 6cm horizontally and from 19 to 11cm vertically (see Figure 2). The slight increase in 2014 and subsequent decrease in 2015 is due to scintillations during the solar maximum in 2014 and an improved algorithm in 2015.

With the newer satellites with more signal power, better antenna gain designs and better receiver tracking, the minimum elevation can be reduced as well allowing for resolving blockage of large parts of the sky due to scintillation. This has been tested using data from Macae, Brazil during the scintillation in December 2015 (Figure 3).

Due to improved rubidium clocks in 19 GPS IIF satellites it is now possible to extend the age of the clock corrections from 5 to 10 minutes and still obtain good results although the position degrades slowly as the age increases (see Figure 4a and 4b) for an example from Karratha in NW Australia for the G2 service).

Over time, older GNSS satellite clocks can become noisier. Typically, these satellites are within the specifications for general use, but for high-end PPP-RTK services such as G4+ they are a challenge as the variations between correction epochs can be up to 10cm. This clock jitter needs to be removed which is done within Marinestar.

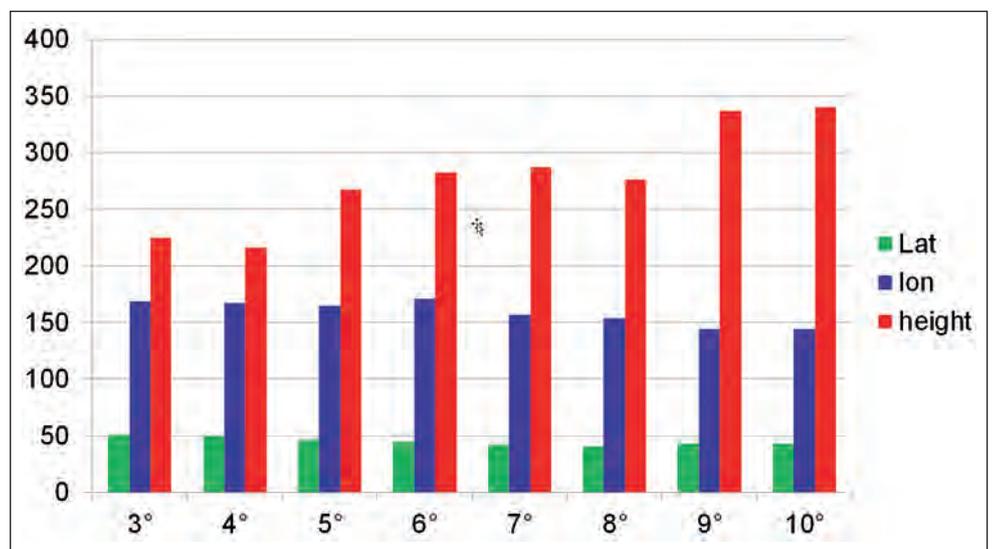
### Benefit of Multiple Constellations

Having multiple constellations provides a benefit. Having more measurements is crucial during heavy scintillation in the equatorial region as seen in Africa and Brazil in 2013-2015. For GPS positioning alone, more measurements are crucial because due to unhealthy satellites there are not always sufficient GPS Satellites available (See [6] NANU's). Adding GLONASS measurements resolves that problem.

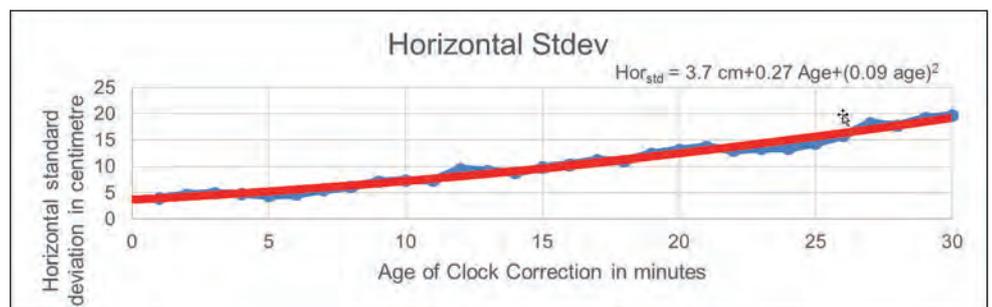
Adding Beidou to the PPP solution improves availability although the Beidou Geo and IGSO

orbit accuracy is limited due to the larger distance to the earth. However, the satellites are very helpful in fixing short-term one-minute data

gaps due to e.g. local interference or in cases of GPS L1 jammer interference where the GPS L1 frequency of 1572MHz is blocked, but the



▲ Macae, Brazil standard deviation in mm versus minimum elevation mask December 2013.



▲ Horizontal (4a) and vertical (4b) standard deviation in metre versus age of correction in minutes for the G2 service in Karratha in NW Australia for 10 Jan 2015.

BeiDou B1 frequency of 1561MHz survives (Figure 5). In case of Iridium/Globalstar interference from >1612MHz, the BeiDou B1 frequency is still tracked while Glonass and to a lesser extent GPS L1 signals can be disturbed.



**Hans Visser** is a geodesist from Delft University who has been working in the field of GNSS for the past 30 years. He currently works for Fugro-Intersite BV in the Netherlands.

✉ [hans.visser@fugro.com](mailto:hans.visser@fugro.com)



**Dariusz Lapucha** holds a PhD in Geodesy from Warsaw University of Technology, Poland and an MSc in Surveying Engineering from The University of Calgary, Canada. He is a senior geodesist at Fugro Chance Inc., Lafayette, USA. He has worked for Fugro Chance since 1991 in the field of high-precision satellite navigation.



**Javier Tecedor** received an MSc in Telecommunications Engineering from the Polytechnic University of Valencia in 2005. He has a PhD in Geomatics from the Norwegian University of Life Sciences. His main research topics are multi-constellation orbit estimation, precise point positioning and ambiguity resolution. He is currently GNSS scientist at Fugro Satellite Positioning AS.



**Ole Ørpen** holds an MSc in Control Theory from The Norwegian Institute of Technology. He has worked with satellite positioning since 1978, initially at the Norwegian Defence Research

Establishment, and since 1987 in private industry. He is a senior scientist at Fugro Satellite Positioning AS.



**Yahya Memarzadeh** received his PhD in Satellite Geodesy and Ionosphere modelling from Delft University of Technology in 2009. He is currently a geodesist in the R&D team of GNSS

precise positioning and ionospheric scintillation monitoring at Fugro Intersite B.V. in the Netherlands.

### PPP vs PPP-RTK

The accuracy of PPP can be further improved if the complete carrier-phase wavelengths can be resolved as is done by standard RTK. Marinestar offers the G4+ service based on PPP-RTK with fixed GPS integer ambiguities using so-called Uncalibrated Phase Delays (UPDs) generated within the Marinestar network.

Applying precise Orbit and Clock corrections in the network of reference stations with inter distances of 1000-2000km, it is possible to estimate the UPDs precisely for the GPS L1

Fixing the integer ambiguities requires better measurements than traditional PPP (see [4] Liu). Items affecting the final accuracy are:

- Radio interference. Far away radio interference, which is normally not noticeable, does have an effect on positioning. For instance, in the Netherlands an L2 radio amateur transmitting on 1247MHz at 2km distance did degrade the standard deviations by 3mm due to interference with Glonass L2 and GPS L2.
- Antenna type. A choke ring or high-end

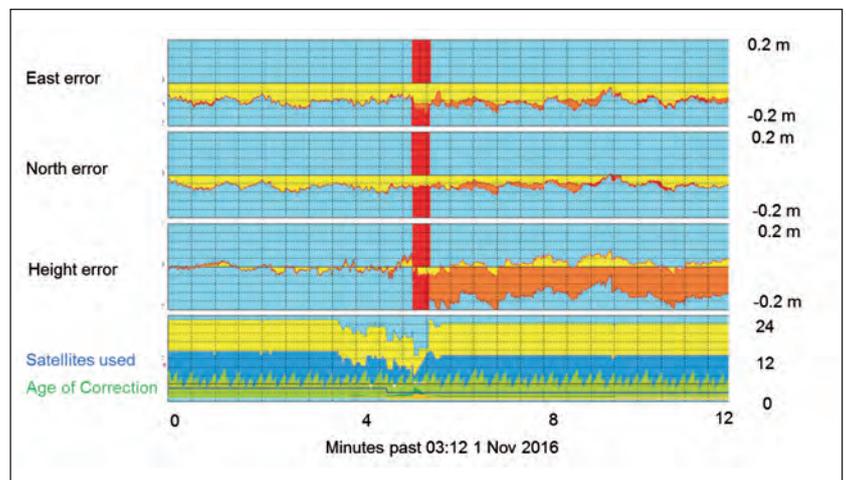
## More measurements is crucial during heavy scintillation in the equatorial region

observations and the wide-lane observations for every satellite in real-time.

The UPD corrections are broadcast over the satellite links to the G4+ users. In the user's receiver, the integer numbers of GPS ambiguities (complete wavelengths of L1 and L2 signals) are estimated using the Lambda Method (See [3] Teunissen). The fixed GPS ambiguities are used in the solution model to re-calculate more precisely the final position (G4+) solution using GPS, Glonass, BeiDou and Galileo observations.

geodetic antenna gives the best multipath resistance. However, due to practical considerations a marine antenna is usually preferred with less multipath resistance.

- Tropospheric error. Heavy tropical rain showers can result in large, unpredictable, tropospheric range errors.
- Phase multipath. Phase-multipath due to reflections less than 20-30cm distance of the antenna such as placement on a horizontal pole or close to metal obstructions influences PPP-RTK solutions.



▲ 11 BeiDou satellites (yellow) fixing a GPS L1 Jamming position gap (orange) in Perth on 1 Nov 2016.

## Conclusions

The quality of the Marinestar position services is continuously improving. Overall and due to the reduced ionospheric disturbances after the solar maximum, GNSS positioning results will be better till the rise of the next solar maximum in 2023.

The typical accuracy of G4+ solution is better than 4cm in horizontal and 8cm in height. The horizontal improvement of a G4+ PPP-RTK over a PPP G2 solution is between 6% and 27% horizontally and between 2%-8% vertically. The improvement in height is limited by tropospheric effects lumping in the height component. However, positioning by PPP-RTK techniques requires more attention to the receiver-antenna setup and environment of the surveyor. ◀

## More information

**Geo-matching.com**

For an overview of characteristics of hydrographic processing software see Geo-Matching.com: <http://bit.ly/gnssreceivers>

## More Information

- Tegedor J (2016) The Galileo contribution to Fugro's G4 Precise Point Positioning service. ENC 2016, Helsinki, Finland, 30 May - 02 June
- Use of BeiDou in operational precise point positioning service, J. Tegedor, E. Vigen, O. Ørpen, T. Melgård, R. Strandli, D. Lapucha, H. Visser <http://www.degruyter.com/downloadpdf/j/jogs.2014.4.issue-1/jogs-2014-0008/jogs-2014-0008.xml>
- P.J.G. Teunissen, "The least squares ambiguity decorrelation adjustment: a method for fast GPS integer estimation," J Geod 70:65–82, 1995
- Liu, Xianglin: Real-time multi-constellation Precise Point Positioning with integer ambiguity resolution, Conference paper IAIN October 2015
- Further observations of GPS satellite oscillator anomalies mimicking ionospheric phase scintillation. GPS Solutions, 18 (3), pp. 387-391. Benton, C. J. and Mitchell, C. N., 2014.
- <http://www.navcen.uscg.gov/?pageName=gpsAlmanacs>

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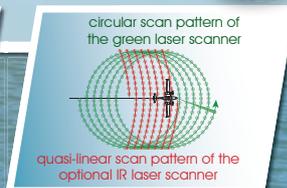
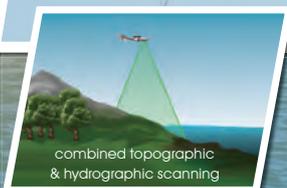


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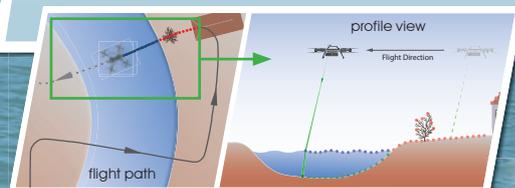
## BathyCopter



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## 5 Questions to...

# William Egan

## Vice president Sales & Marketing, Teledyne Marine Imaging and Instruments

### **Technology and societal needs are changing rapidly. How is your company adapting to these changes?**

We are constantly listening to our customers to ensure we deliver to their needs. Our customers demand better performance and ease of use to maximise their investment and to meet their needs and those of their customers.

This can be exemplified in our complete range of sonar systems across the brands to enable a customer to select the best equipment for their needs. In fact, we recently released the new Integrated Dual Head SeaBat T20-R/ T50-R and the Modular SeaBat T20-R & T50-R Multibeam Sonar at OCEANS 16 in Monterey. The SeaBat T-Series is a uniquely designed modularised sonar concept, of compact ultra-high resolution multibeam sonar systems suited for small survey platforms to larger vessels. The user-friendly configuration utility software SeaBat Updater enables you to configure the sonar processors from a 1 degree super compact and lightweight SeaBat T-20 to the ultra-high resolution 0.5 degree SeaBat T50, and back. We now provide maximised swath coverage of 220 degree and

Normalized Backscatter, Multi-Detect, X-Range and very advanced beamforming modes for superior performance and results. The SeaBat T-series enables our customers to reduce survey and post-processing times to lower costs and offer more competitive service to their customers.

We're also making it easier for our customers to find what they need. We've recently released a new more intuitively navigable Teledyne Marine website, with the content accessible by product brand, technology groupings, market segments and general search. We have also expanded our presence on social media channels and in blog participation, all geared toward making information and interaction more accessible.

### **On which applications does your company focus its research and development activities?**

We see more and more of the market moving to drive the efficiency of working, safety of personnel, and creating better value through cost controls. This is established through early partnering on projects, establishing standards in



We have many things we can work on across the group, but the challenge is ensuring we balance technology gaps, new and emerging technologies, as well as being agile in responding to demands. We continually assess the return on investment both for our customers and ourselves, as well as ensuring we are aligned with market requirements both today and tomorrow.

## The challenge is ensuring we balance technology gaps, new and emerging technologies, as well as being agile in responding to demands.

1024 beams with advanced beam forming options. The built-in pre-configured INS, combined with the incredibly clean data, makes the system easy to use and mobilise and provides survey deliverables faster than ever before.

So for our customers this gives incredibly clean easy to process data, the advanced features like

design, and setting realistic performance requirements matched to the application. Customers are looking for cost-effective solutions for existing and new operations, the ability to gain more insight through better technologies, and ensuring safety of personnel by utilising unmanned or autonomous platforms with longer mission duration.

### **What is your company's growth strategy?**

Teledyne Marine is well positioned to create efficient solutions for new or existing operators through our breadth of components and turnkey system offerings. Our expanded Technical Sales organisation is applications-aware and is structured to allow us to usher in Teledyne subject matter experts to assist our customers in resolving challenges across our vast solutions, whether within Teledyne Marine or via the expanded expertise of Teledyne Technologies, or our many industry partners.

Teledyne has already demonstrated that consolidation leads to better economies of scale for the market. It also leads to better customer interaction and a wider choice of solutions,

which ultimately leads to increased effectiveness for our customers and more efficient technology development for us.

**How would you describe the hydrographic market these days?**

Customers are expecting multiple deliverables from one survey, as well as automation and software for efficiency improvements. Being able to provide this integrated solution enables the user to have confidence in a secure end-to-end process and improve their operational excellence.

The Offshore market, specifically related to Oil & Gas, is down, but hopefully now at the bottom,

so we are expecting a slow return. We continue to see the development of ports

## Customers are expecting multiple deliverables from one survey

and harbours and the investment of governments in civil infrastructures and environmental programs.

**Which new or emerging markets do you foresee in the coming years?**

With the requirement of improved return on investment, there is a greater need to move to

lower cost platforms, e.g. AUVs, USVs, etc. with appropriate sensor suites to enable fast efficient

surveys with faster processing of data, both onboard and post-processing.

We also see that with an aging infrastructure there needs to be a greater investment in civil engineering and dredging for the coming years, but much of this will be dependent on government investment and the challenge will be to get funding released.

## 5 Questions to...

# Bjørn Jalving

## Executive vice president, Kongsberg Marine, Subsea division



companies, universities and research institutes. Key to Kongsberg is our global system of companies that work closely with our customers

providing much more data at significantly lower cost. Connectivity and the internet of things will also change hydrography, and stimulate

## We have just seen the start of marine robotics and autonomy providing much more data at significantly lower cost

and partners in their markets. Being local and being close to our customers is essential in understanding societal changes and the effects on markets, customers and ourselves. To bring it together, we foster a culture of communication, collaboration, innovation, strategy development and change.

development of more user-friendly solutions. For Kongsberg it is a key strategy to support open data formats and architectures, and the development of these.

**Technology and societal needs are changing rapidly. How is your company adapting to these changes?**

We systematically work to understand and apply today's accelerating and exciting technology changes into our products and solutions. At the same time, we consciously define our core areas of expertise and differentiation, where we invest to be the technology leader through our own efforts and collaboration. We collaborate with

**On which applications does your company focus its research and development activities?**

We invest heavily in continuous improvement in resolution, accuracy and coverage in our mapping instruments. We believe we have just seen the start of marine robotics and autonomy

**What is your company's growth strategy?**

To provide leading technology and solutions for detailed and cost-effective mapping, and be a long-term, reliable partner supporting our customers and their operations.

**How would you describe the hydrographic market these days?**

We think it is an exciting market. Understanding

and engagement in coastal and ocean mapping has become global. The ambitions are growing, for instance, the Nippon Foundation – General Bathymetric Chart of the Oceans (NF-GEBCO) Forum for the Future Ocean Floor Mapping endorsed the vision of a high-resolution global digital map this year. We see increasing interest in simultaneous mapping operations for

bathymetry, seabed classification marine life and oceanography.

**Which new or emerging markets do you foresee in the coming years?**

We believe the need for hydrography and safe navigation on the oceans, in coastal areas, ports harbours and waterways will continue to

grow. Security and environmental assessment for naval operations will remain important in today's world. While some markets will experience downturns, as we now see in oil and gas, increased need for mapping will arise within marine research, renewables, aquaculture, marine minerals and environmental monitoring.

## 5 Questions to...

# Ola Oskarsson

Founder, MMT



**Technology and societal needs are changing rapidly. How is your company adapting to these changes?**

We believe that through technological progress it is possible to increase the resolution and accuracy of seafloor mapping while lowering the cost for the end clients. This is the time to invest in research and development and step into the new world of Artificial Intelligence instead of manual labour. The age old tasks of gridding, cleaning outliers and noting side-scan targets by hand in Excel documents can be replaced by machine vision. We already trust machines to send us bills after taking pictures of the license plates of cars when passing tollbooths. The same technology can be used to make our

mapping more accurate and minimise manual errors.

**On which applications does your company focus its research and development activities?**

UXO (Unexploded Ordnance), DOB (Depth of Burial measurements), Machine Vision and Photogrammetry. Generally, we are increasing the possible resolution in a paradigm shift where Sonars, Laser, Magnetometers and Photogrammetry are utilised in combination, revealing hitherto unknown detail of the seafloor. To achieve this, data management and number crunching is the key to success. Therefore, we

working faster with reasonable sized vessels. By cutting time and cost for surveys substantially by spending less time at sea with fewer people on board our vessels we will be able to maintain a high-quality workforce and tools at a price level that clients can accept while we deliver higher resolution and accuracy than ever before.

**How would you describe the hydrographic market these days?**

The price levels are not sustainable. There must be a motion to restore profitability without losing the value for clients. The market is driven by ship-owners offering vessels at prices

## This is the time to invest in research and development and step into the new world of Artificial Intelligence instead of manual labour

also concentrate our R&D on Cloud storage GIS, Point Clouds and Big Data management.

**What is your company's growth strategy?**

To grow by using innovation for more cost-effective solutions for our clients. This is the time to look into vessel speed, vessel size and honing the tools for survey accuracy while

well below sustainable levels. This will over time result in companies struggling hard while low quality and low HSE standards will be the result. The key to survival is to work more effectively while maintaining cutting edge technology to deliver excellent products to the clients. If you deliver the lowest price, chances are you have nothing else to bring to your clients.

**Which new or emerging markets do you foresee in the coming years?**

Environmental Assessment, Geohabitat classification will be a requirement set by

legislation and conventions, which will impact all areas of underwater work. Reporting quality, reporting swiftness and accessibility to data will be the most important competitive measure from 2018. The challenge is to implement

systems for rapid throughput of huge data volumes now, in times of recession, to have the products ready as the market, hopefully changes in 2018-2019.

## 5 Questions to...

# Duncan Mallace

## Head of the Business Development Council, QPS

**Technology and societal needs are changing rapidly. How is your company adapting to these changes?**

We believe that efficiency changes and therefore cost benefits to our industry have to come from technology, therefore we are continually striving to reduce human input and to increase the performance of our applications. This has a twin benefit in that the products become faster which reduces delivery times, but also easier to use which saves on both the number and the skill set that the users require. As an example, our new bathymetry product Qimera was designed to be the fastest, easiest to use application but also the most advanced. It contains guided workflows, a simple GUX and reads as much data directly from the source files, which reduces human error and speeds

cable lay catenary, multi-object tracking, inspection requirements to name a few and the Dredging industry requires very fast turnaround of data, which is also required in Oil & Gas. Our goal is to harness, with our software, the latest technological breakthroughs from the hardware vendors to ensure that our clients in all sectors receive the benefit of our development. The autonomous sector is obviously one sector that will cross many industries and the developments we make for hydrography will provide instant benefits to our Offshore Renewable clients.

**What is your company's growth strategy?**

One of the greatest advantages that QPS has is that we cover all the marine geospatial industries on a global scale from hydrography to



who strive to be the best in their industries and that forces us to continually look at new directions and developments. There are a number of complementary technologies that are coming together, which will enable new methods of data collection and processing which should have tremendous benefits.

## People expect the simple app approach from their smartphones to be the way that they interact with computing technology

up the whole process. This is coupled with the latest technological specifications and tools to correct for any error in a sonar.

**On which applications does your company focus its research and development activities?**

Many industries overlap in the way that they use marine geospatial technology. For example, Oil & Gas and Offshore Renewables both require

Oil & Gas to Maritime Pilotage. In this current period of Oil & Gas downturn, Offshore renewable increase, government austerity and at the same time investment and an uncertain shipping sector we can continue to innovate and grow from the mix of these markets.

**How would you describe the hydrographic market these days?**

Exciting. We have some very demanding clients

**Which new or emerging markets do you foresee in the coming years?**

The way people use software is changing and people expect the simple app approach from their smartphones to be the way that they interact with computing technology. When this is also coupled with much larger datasets being produced by the latest sonar systems and laser scanners it is a challenge but also an opportunity as it will make the technology more useable beyond our traditional market boundaries.

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## 5 Questions to...

# Robert Ward

## Secretary-General, International Hydrographic Organization (IHO)

Robert Ward, Secretary-General, is the chief administrative officer of the International Hydrographic Organization and heads the permanent secretariat.

### **How would you describe your organisation?**

The International Hydrographic Organization is the intergovernmental consultative and technical organisation that was established in 1921 to ensure that all the world's seas, oceans and navigable waters are surveyed and charted in support of the safety of navigation and the protection of the marine environment. The IHO headquarters are in Monaco.

The object of the IHO is to bring about:

- The coordination of the activities of national Hydrographic Offices
- The greatest possible uniformity in nautical charts and documents
- The adoption of reliable and efficient methods of carrying out and exploiting hydrographic surveys
- The development of the sciences in the field of hydrography and the techniques employed in descriptive oceanography.

The IHO develops and maintains international standards and guidelines covering many aspects of hydrography including standards for data exchange, chart compilation and symbolisation, hydrographic training, maritime boundary delimitation, a dictionary of hydrographic terms and a manual of hydrography. Most documents are available without charge from: [www.iho.int](http://www.iho.int)

### **Who are the members of your organisation?**

In 2017, there were 85 Member States of the Organization. The official representative of each Member Government within the IHO is normally the national Hydrographer or similar official with responsibility for the provision of

nautical charting and associated hydrographic services at the national and international level.

In addition, about 30 maritime-related international organisations representing industry and academia participate in the work of the IHO as accredited Observer organisations. Individual experts and companies can come forward to participate and contribute their knowledge and skills in the IHO working groups as expert contributors.

### **What is the role of your organisation in the hydrographic/oceanographic industry?**

The IHO sets the international standards for the provision of hydrographic products and services.

### **How is capacity building strengthening your strategy to achieve your goals?**

The IHO operates a Capacity Building programme that seeks to assist all coastal States

## **An increase in the use of autonomous data-gathering craft and crowdsourcing to gather fundamental hydrographic data will help to address the shortfall in bathymetric knowledge**

in developing an appropriate national hydrographic capability to support their international obligation to provide nautical charting and associated services in the interests of safe navigation, protection of the marine environment and the proper and sustainable governance and development of the blue economy.



### **Do you foresee any developments that will significantly change the hydrographic sector?**

An increase in the use of autonomous data-gathering craft and crowdsourcing to gather

fundamental hydrographic (bathymetric) data will help to address the current shortfall in bathymetric knowledge of many parts of the world's seas, oceans and coastal waters. This, together with risk-based assessment will allow the limited specialist hydrographic capabilities that are available to be better targeted to the identified priority areas.

## 5 Questions to...

# Allen Leatt

## Chief executive officer, International Marine Contractors Association (IMCA)

Allen Leatt became chief executive of IMCA, the International Marine Contractors Association, in autumn 2015 after a career with leading contractors in the offshore oil and gas construction sector. International experience in executive and managerial roles is highly appropriate in leading an international association and helping members across many technical and cultural boundaries.

### ***How would you describe your organization?***

Our mission is simply put – “to improve performance in the marine contracting industry”. Our role and value proposition is to establish a forum for our members in order to improve the industry in key safety, technical, policy and regulatory matters, that are in the best interests of the marine contracting industry. We achieve this through an active committee structure within a matrix of technical subjects and geographic region; a full-time professional secretariat based in London organises and facilitates the output of the association.

Geographically we are organised around five regions: Asia-Pacific, Europe & Africa, Middle East & India, North America, and South America. We have active committee involvement and events in each region throughout the year. We are very strong technically and IMCA is well known and respected for the development of a library of over 200 technical guidance and best practice documents to improve industry performance. These documents cover a broad range of technical disciplines, including diving operations, marine operations, ROV operations and offshore survey operations. They are very important in setting the recognised industrial standard of good practice, and are used extensively by our members and by oil companies and marine renewable energy developers alike.

As well as the technical dimension of our work, we are also very active in the policy and regulatory sphere, and represent our members

with important national and international regulators. IMCA has a consultative membership status of IMO (the International Maritime Organization), which is an agency of the United Nations responsible for international shipping regulations. We take that membership very seriously.

### ***Who are the members of your organization?***

We have around 1,000 members, representing the vast majority of offshore marine contractors and the associated supply chain - worldwide. We have a range of membership categories, including: global contractors who are the recognised industry leaders and have a global operational footprint; international contractors who have a strong presence in numerous geographic markets; national contractors who have strong regional market positions; equipment suppliers to the industry; training and personnel agency suppliers to the industry; and corresponding members including governmental and non-governmental organisations. This reflects a strong and resilient membership portfolio who we are proud to represent.

### ***How is capacity building strengthening your strategy to achieve your goals?***

Where we are in the current business cycle, I see no capacity being added – quite the reverse. After a 10-year bull market driven by USD100 oil, our industry is rapidly adjusting to the market and economic realities of USD50 oil. This means cost cutting, restructuring, and taking capacity out of the market. Our industry has always been cyclical in nature, but this serious readjustment is particularly hard for us all, since the collapse in demand has been so rapid and acute. In such an environment, there will be opportunities of course for companies to re-position themselves and perhaps redefine the marketplace - which could have a tremendous



upside, a growing number of our members are actively involved in the marine renewables industry, particularly the offshore wind sector. Equally, I am confident that our industry will adjust its cost base to be competitive in the industrial new landscape, and will emerge far leaner and more efficient than in the heydays of rapid growth.

### ***Do you foresee any developments that will significantly change the hydrographic sector?***

There is always the possibility of course that some new technology will come along and redefine the sector; however, historically our industry is perhaps better characterised by a relentless series of incremental improvements, rather than a single step-change in technology. Unlike the smartphone industry we don't need to invent a new App every day, but we are very good at continuously improving every day, and we are very good at innovating technically and commercially. I am sure there will be plenty of opportunities for our industry to exercise these skills while climbing out of the current down-cycle.

## 5 Questions to...

# Martin Jakobsson

## Vice chairman, General Bathymetric Chart of the Oceans (GEBCO)

Martin Jakobsson is the vice chairman of the General Bathymetric Chart of the Oceans (GEBCO) Guiding Committee and Chairman of the International Bathymetric Chart of the Arctic Ocean (IBCAO). He is a Professor of Marine Geology and Geophysics at the Department of Geological Sciences, Stockholm University. He has been head of Department since 2012 and he has served as the first vice president of the Royal Swedish Academy of Sciences since 2016.

### **How would you describe your organisation?**

GEBCO is the world's only international organisation mandated to map the ocean floor. It was founded in 1903, following the efforts of Prince Albert I of Monaco. GEBCO has two parent organisations: the International Hydrographic Organization (IHO) and the Intergovernmental Oceanographic Commission (IOC) of UNESCO. At the Forum for Future Ocean Floor Mapping, held in Monaco in June

### **Who are the members of your organisation?**

GEBCO is the home of IHO and IOC ocean mapping expertise with a pool of people who are leaders in all aspects in this field. They include technology experts in industry as well as research organisations, which work to develop leading edge technology, practical at-sea surveying expertise, data-processing and database managers, software developers, geologists, geophysicists and other relevant ocean scientists.

### **What is the role of your organisation in the hydrographic/oceanographic industry?**

As an IHO and IOC project, free from political bias and constraints, GEBCO can gather bathymetric data and resources from any nation, industry, research or academic organisation. In return, GEBCO provides information for communities and publics. The programme to map the seabed by 2030, with The Nippon



than 100m unmapped by the completion of the programme.

### **How is capacity building strengthening your strategy to achieve your goals?**

Capacity building is the most critical part of the research environment. Since 2004, The Nippon Foundation has provided funding for GEBCO to train a new generation of scientists and hydrographers in ocean bathymetry at the University of New Hampshire in the United States. This is designed to build human capacity in key coastal states by supporting the development of future maritime leaders. At present, 72 scholars from 33 countries have gained their Postgraduate certificates in Ocean Bathymetry. Six more scholars started their studies in September 2016. It is anticipated that this network will play a key role in mapping the ocean floor by 2030.

### **Do you foresee any developments that will significantly change to the hydrographic sector?**

The use of AUVs.

## A global programme with the goal of compiling a high-resolution, openly available Digital Bathymetric Model (DBM), portraying the world ocean seabed at the highest resolution possible

2016, Mr Yohei Sasakawa, chairman of The Nippon Foundation, which co-organised the Forum with GEBCO, announced a new initiative, namely, to map the entire seabed by 2030. GEBCO is now working closely with its partner, The Nippon Foundation, and other interested parties, to explore how to respond to this initiative and to put forward the structure and details of a suitable implementation plan.

Foundation and other partners, is a global programme with the focused goal of compiling a high-resolution, openly available Digital Bathymetric Model (DBM), portraying the world's ocean seabed at the highest resolution possible, from the coast to the deepest trenches, by the year 2030. This DBM should provide bathymetric information to end-users and leave no features of the world's ocean floor smaller



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## Atlas Professionals

Atlas Professionals is an international leading recruitment company. Since 1982, Atlas has played a major role in the provision of professionals to the Energy, Marine and Renewables industries worldwide and has grown to become a no-nonsense, dependable HR service provider with a mission to turn complex personnel challenges into transparent and secure solutions.

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Management. We pride ourselves on representing the largest and most highly skilled pool of survey professionals globally – ranging from personnel for shipyard (Dimensional Control) surveys through to deepwater construction specialists.

Our company is centred on high-quality account management with in-depth knowledge of the industries and the disciplines to which we provide our competent professionals. We strive to ensure that all personnel are suitably skilled and capable for any tasks required of them. Our high regard for continuing the professional development of our contractors is shown

through our regular training courses and workshops, whether this is through our global training providers, or calling upon our in-house expertise. Atlas also launched the Atlas Competency Scheme (ACS), a programme that follows the accredited IMCA framework, allowing professionals to develop and grow within their chosen discipline.

With over 30 years of experience, we meet the demands of the industries by offering a full suite of taxation, administration, logistics and legal services – including up-to-date compliance advice. For further information about our 17 specialist areas and 18 offices worldwide,



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## develogic subsea systems

develogic subsea systems is a German-based company with a focus on developing and manufacturing turn-key customised data-acquisition and telemetry solutions for marine monitoring applications.

To be able to deliver cost-effective systems with short turnaround times the company has developed a building block system containing all necessary elements for collecting data anywhere in the ocean and transporting it to the customers office. Available technology ranges from modular pressure housings, data loggers and acoustic telemetry solutions to seafloor

landers, large sensor- and telemetry buoys.

The end-to-end design and manufacturing process integrates electronic and 3D mechanical design, multi-physics and structural simulation, 3D CAM and computer-aided inspection in order to provide consistent high quality to our customers.

In addition, extensive in-house manufacturing capabilities for both mechanical and electronic systems support the creation of highly integrated, unique solutions.

In 2013, develogic invested close to EUR1M in state of the art CNC machinery as part of the

extension of its mechanical workshop.

Pick-and-place machines, a vapour phase soldering oven and related inspection, test and measurement equipment allow prototyping of highly integrated customised PCBs with shortest turnaround times.

In addition to the custom solutions business, develogic also specialises in marine acoustic solutions: acoustic telemetry systems with proven ranges up to 30,000m, passive acoustic recording systems with continuous recording capabilities up to 3 years and RAFOS sound sources for underwater navigation are part of



the standard product portfolio. Customers are well-known international research institutes, navies and companies in the sectors renewable energy, construction and offshore oil and gas.

Develogic subsea systems, Eiffestraße 598, 20537 Hamburg, Germany, phone: +49 (0)4098262513, [info@develogic.de](mailto:info@develogic.de), [www.develogic.de](http://www.develogic.de)

## Edgetech

EdgeTech designs, manufactures, sells and supports underwater technology solutions. The company has been serving the marine industry for over 50 years with commercial off-the-shelf and customised underwater systems.

EdgeTech sonar systems include side-scan sonar systems, sub-bottom profilers, bathymetry systems and combined and modular systems. The solutions are available in a range of configurations for towed, deep towed, AUV, USV, ROV, ROTV and custom platforms. The company's underwater actuated and transponding solutions include highly advanced and reliable USBL acoustic tracking

and positioning systems, transponder beacons, deep-sea acoustic releases, shallow-water and long-life acoustic releases, underwater acoustic command and control systems and custom-engineered acoustic products.

EdgeTech is known worldwide for its high-quality products and superior customer service. With its global network, EdgeTech serves and services customers including the US Navy, foreign navies, survey firms, oceanographic researchers and the oil and gas and renewable energy industry around the world. The company employs over 100 people between two locations in Wareham,

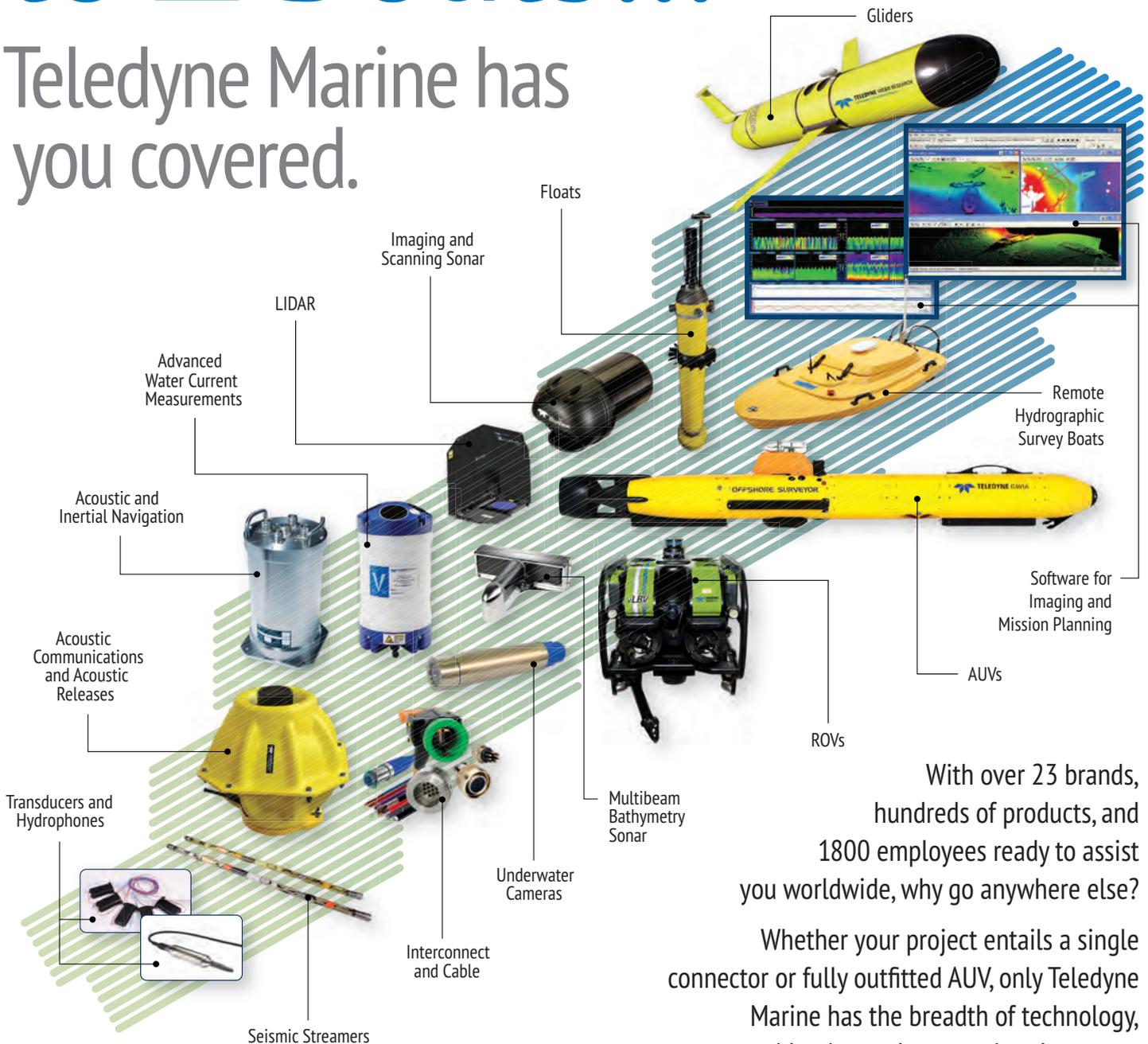
Massachusetts and Boca Raton, Florida and has extensive in-house design, manufacturing and test facilities including a test pool, acoustic test tank, pressure test chamber and two company research vessels for sea trials.



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## HELZEL Messtechnik GmbH - WERA Ocean Radar



The well-established shore based coastal radar system WERA is the most flexible ocean radar system on the market. It can be configured with compact or array type antennas for precise measurements of currents and waves in near real-time. The high temporal resolution allows rapid monitoring of changes of currents, e. g. even small Eddies. The modular system with small and easy to install antennas delivers reliable met ocean data for a variety of applications:

real-time. Quality control ensures that only reliable and accurate data is displayed. This characteristic is essential for data assimilation into hydrodynamic models to improve forecast quality.

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Monitoring of the exclusive economic zone, EEZ, becomes more and more important to protect scarce resources. In addition to oceanographic applications, long range systems are suitable for vessel detection and tracking behind the horizon. In combination with other

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## Hydroid



Located in the US and a subsidiary of Kongsberg Maritime, Hydroid is the world's most trusted manufacturer of advanced Autonomous Underwater Vehicles (AUVs). Our Marine Robotics systems provide innovative and reliable full-picture solutions for the marine research, defence, hydrographic and offshore/energy markets. Our products represent the most advanced, diversified and field-proven family of AUVs and AUV support systems in the world. For more information on our technology, please visit www.hydroid.com.

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## INNOMAR Technologie GmbH



INNOMAR Technologie GmbH has been providing efficient underwater acoustic survey equipment and associated software tailored to customer requirements for about 20 years. The 'INNOMAR SES-2000' series of parametric sub-bottom profilers (SBP), with more than 300 units sold, is perfectly suited for exploring the sub-seafloor at high resolution in water depths between less than one metre and full ocean depth. Applications include visualising sediment structures for dredging and geological surveys as well as mapping buried pipelines/cables or prospective offshore building sites. All the different 'INNOMAR SES-2000' models

feature a narrow sound beam to give results at very high resolution and quality. The delivery includes user-friendly data acquisition and control software as well as dedicated post-processing software. All data are recorded digitally, but analogue outputs are available too. Transmit pulse properties can easily be adjusted by the user to fit specific survey requirements. Transducers are available for installation in the vessel's hull and over the side pole-mounting. There are also 'INNOMAR SES-2000' models incorporating a narrow-beam parametric SBP and a dual-frequency side-scan sonar for

simultaneous operation. New developments include a multi-transducer SBP providing high data density suitable for 3D visualisation and tracking of buried pipelines/cables, a towed SBP, a survey catamaran (USV) for remote operation in protected or extremely shallow areas as well as a low-frequency parametric sub-bottom profiler for operation up to 11,000 metres water depth. INNOMAR's quality management has been certified by DIN EN ISO 9001 for more than 15 years.

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## Leica Chiroptera II & HawkEye III

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& Tug Positioning, Vessel & Barge Positioning, Jacket & Subsea Installations, Pipe & Cable Lay Support, Trenching & Burial Support, ASV and AUV Surveys & Inspections, Real-time Subsea Visualisation, Dredging Support, DSV Support, ROV Support, Visual Inspection Surveys, Spool Metrology, Software development and R&D, and Offshore Personnel Training. INSTALL offices are based in Italy, France, USA, UAE and West Africa.



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## Kongsberg Maritime

Kongsberg Maritime is a global marine technology company providing innovative and reliable technology solutions for all marine industry sectors including merchant, offshore, subsea and naval. Headquartered in Kongsberg, Norway, the company has manufacturing, sales and service facilities in 20 countries and a total of 65 worldwide offices.

Kongsberg Maritime developed systems for vessels covering all aspects of automation, control, navigation, safety and dynamic positioning. Kongsberg Maritime also develops subsea solutions covering systems for Underwater

Mapping (UMAP), Underwater Navigation (UNAV), Subsea Monitoring (SUMO) and Marine Robotics in addition to underwater cameras. Marine and offshore training simulators, LNG equipment, information management software, position reference systems, integrated aquaculture technology and advanced products to support seismic and drilling operations are also part of the company's diverse portfolio. In parallel with its extensive technology portfolio, Kongsberg Maritime provides services within EIT (Electro, Instrument & Telecom) engineering and system integration, on an EPC (Engineering, Procurement & Construction) basis.

Kongsberg Maritime delivers solutions that cover all aspects of technology underwater and on the water, aboard new build and retrofit vessels, and on offshore platforms and rigs, often under a single supplier strategy called 'The Full Picture'. Kongsberg Maritime is part of Kongsberg Gruppen (KONGSBERG), an international, knowledge-based group that celebrated 200 years in business in 2014. KONGSBERG supplies high-technology systems and solutions to customers in the oil and gas industry, the merchant marine, and the defence and aerospace industries.



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## Leica Geosystems

Leica Geosystems develops and sells airborne Lidar survey systems for various applications in the field of airborne hydrography. The airborne Lidar product line includes the Leica Chiroptera II and HawkEye III sensors for combined bathymetry and topography.

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## MMT

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## OceanServer Technology

OceanServer Technology, Inc. is a leading manufacturer of man-portable Autonomous Underwater Vehicles (AUVs), three axis digital compasses and high efficiency Lithium Ion battery solutions. The Iver3 AUV is an affordable, commercial vehicle used by customers around the globe for sensor development, water quality, general survey work, sub-surface security and research. Systems are capable of operating unattended for up to 7-10 hours while carrying a variety of sophisticated payload options. OceanServer Technology is a privately held company headquartered in Fall River, MA, USA. [www.ocean-server.com](http://www.ocean-server.com)

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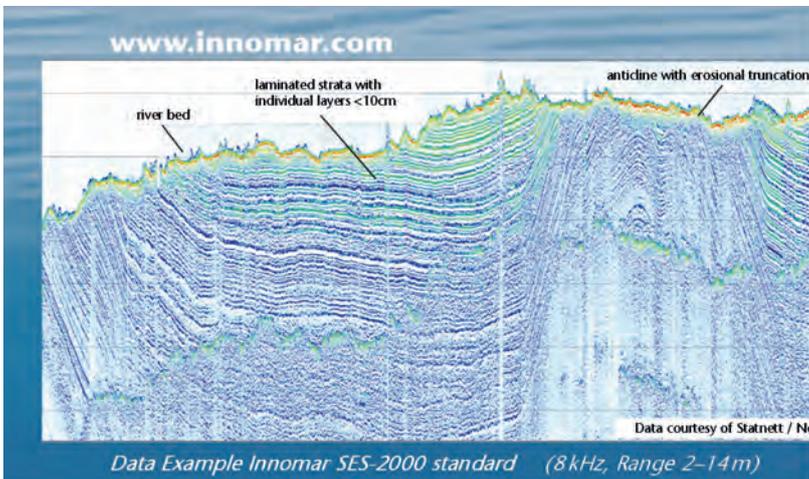
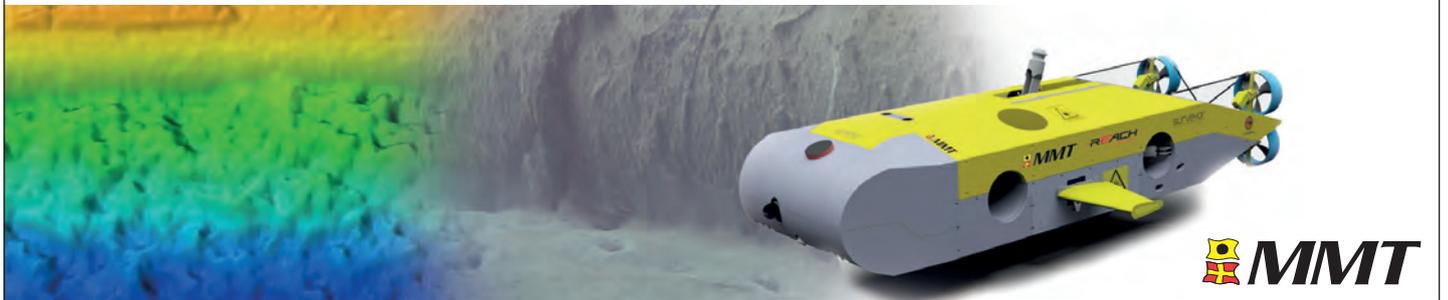




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used by commercial, academic and government clients worldwide to interact in 4D with geographical datasets. Our product QPS Qastor is Electronic Chart Software (ECS) that enables navigation, piloting and precise docking, as well as several other applications such as Oil & Gas FPSO/SPM mooring, patrol vessel and tugboat operations. Using wired or wireless methods, Qastor interfaces to most devices outputting NMEA data strings, to AIS units, and to the QPS Qastor Connect Server, which supplies meteorological data, VTS targets and ENC updates to Qastor users.

QPS is an independent software company that has been headquartered in the Netherlands since 1986, and now with subsidiary offices in the USA, Canada and the UK. In 2012, QPS became a member of the SAAB (Sweden) group of companies (Traffic Management division).



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## RIEGL Laser Measurement Systems

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The system includes a high-end IMU/GNSS and an RGB camera and is fully calibrated off-factory. The integrated infrared laser scanner complements the data from the green laser scanner and supports the detection of the water surface. The compact and robust housing is compliant with typical aircraft hatches and stabilised platforms. The VQ-880-G provides sophisticated RIEGL laser scanning technology including echo digitisation and online waveform processing with multi-target capability as well as multiple-time-around processing for high accuracy ranging.

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## SBG Systems

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The Ekinox Series is a line of survey-grade compact inertial sensors integrating a data logger and a web interface for easy configuration. The product line includes a Motion Reference Unit (MRU) that provides Roll and Pitch accurate to 0.05°, Heading and Heave (5cm) as well as several models of Inertial Navigation Systems, embedding or connecting to an RTK GNSS receiver. Ekinox products come with a surface enclosure (IP68) or a titanium-made subsea enclosure (10 metres, or 6,000 metres).

**Apogee Series, The Most Accurate MEMS INS/ GNSS Affordable to all Surveyors**  
Apogee Series is the most accurate line of inertial navigation systems based on the robust and cost-effective MEMS technology. It provides Roll and Pitch accurate to 0.005° in real-time, Heading and Heave (5cm). The Apogee integrates or connects to a tri-frequency GNSS receiver that receives RTK, Marinestar, OmniSTAR, TerraStar, Veripos, etc. It also provides raw data for even higher performance with post-processing.



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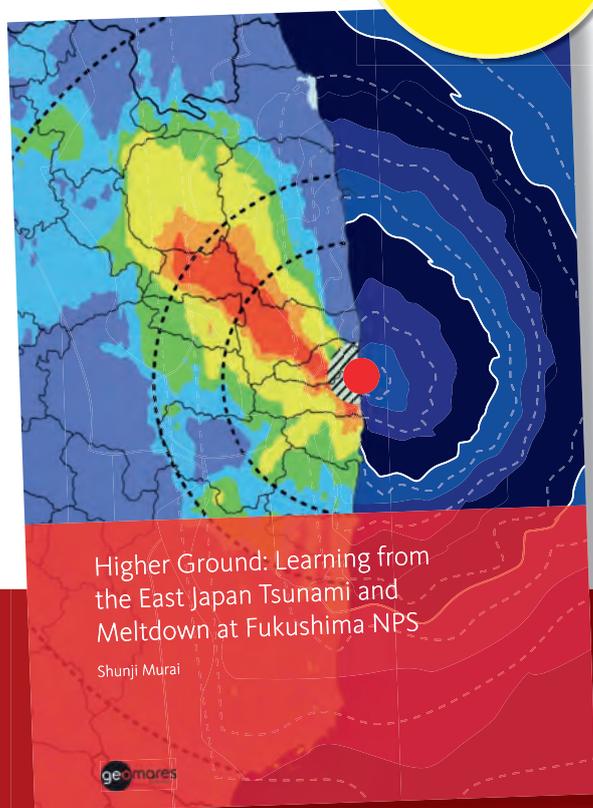


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#### About the author:

Shunji Murai, professor emeritus at Tokyo University, current president of the Japanese Association of Surveyors and chairman of the editing committee of a book on Human Beings and Disaster.

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For over 35 years, Teledyne CARIS™ has been making software designed for the marine GIS community. Not only renowned for its products, but also for outstanding customer service, Teledyne CARIS offers a comprehensive level of support through training sessions and consulting, online technical support, email, and multilingual telephone support. Developed in cooperation with hydrographic clients and universities, the CARIS™ toolset provides clients with resource optimisation and a true operational advantage. Known for the Ping-to-Chart™ solution, we offer a comprehensive portfolio of products, from the

processing of the echo-sounder ping to the production and distribution of the chart. The newest product in the toolset, CARIS Onboard™, is a near real-time and autonomous data processing package which has been developed with autonomous underwater vehicles (AUVs) and unmanned surface vehicles (USVs) in mind. This solution acts as a force multiplier when used on survey vessels by fitting seamlessly into the Ping-to-Chart suite of software, and reducing the overall product creation timeline. Find out why CARIS software is selected by national mapping and charting agencies, survey

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Teledyne Marine is a group of 23 leading-edge undersea technology product brands that have been assembled by Teledyne Technologies Inc. Through acquisitions and collaboration, over the past 10 years Teledyne Marine has evolved into an industry powerhouse, bringing the best of the best together under a single umbrella. Each Teledyne Marine company is a leader in its respective field, with a shared commitment to providing premium products backed by unparalleled service and support. In keeping with Teledyne's philosophy, the member product brands within the Teledyne Marine Group remain committed to their

technical heritage; however, they are now, as 'One Team', able to leverage, combine and expand their relationships, talents and technology to provide customers with a new level of collaborative technology, innovation and worldwide support; while offering the widest breadth of marine technology in the industry. Teledyne Marine's technologies are organised into five key segments: Instruments, Imaging, Interconnect, Seismic and Vehicles, which serve a wide array of commercial, academic, and defence applications.



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## Valeport Limited

Valeport are the UK's leading manufacturer of Hydrographic and Oceanographic instrumentation which include Sound Velocity Probes / Sensors, Altimeters, Radar Level Sensor, Current Meters, Tide Gauges, Fluorometers, Wave Recorders, CTDs, Multi-Parameter CTDs and GPS Echo Sounders. Supporting Hydrographic surveys with the latest in technology is always our prime aim and our latest SVP, the SWIFT, does not disappoint. Designed from the outset with the intention of a seamless workflow, the SWIFT SVP has integral GPS to geo-locate every profile. This new compact and robust unit features high-accuracy Sound Velocity,

Pressure, Temperature, Salinity & Density measurement, plus integral GPS, re-chargeable battery and LED status indications for GPS, battery and communications. A 'twist and go' action ensures data can be easily and quickly downloaded, reviewed and translated to common SVP formats wirelessly via Bluetooth Smart using the SWIFT APP on iOS devices where data can be instantly shared via FTP, email and cloud services. Valeport's DataLogX2 software is supplied for those wishing to use a PC. Valeport's work with MBES manufacturers and OEMs has allowed interesting interfaces of SV sensors and Valeport's new ultraSV is designed for

simple integration and easy exchange where required for both shallow and deepwater transducer applications. 2017 will see new monitoring challenges and Valeport will be at the forefront innovating and ready to pursue them.



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## 5 Questions to...

# Nicolas Seube

Scientific director of the CIDCO (Interdisciplinary Center for the Development of Ocean Mapping), Rimouski, Québec, Canada; formerly the coordinator of the French Category A programme at ENSTA Bretagne from 2005-2014.

***Attracting sufficient students is a first priority at universities. What is the situation at your university?***

CIDCO is a research centre which offers a Category B programme (CIDCO course in Hydrographic Surveying). But we share the same concerns as universities in attracting

is increasing and new techniques are being investigated to respond to the need for hydrographic data in extreme environments (for instance, deep, turbid, non-accessible). This creates new avenues for education in hydrography, but to keep programmes within acceptable time frames, we focus on the core

## The biggest challenge in hydrography is to automate survey operations

students to marine geomatics careers. Hydrography is not well known, geomatics a little bit more, and students in geodesy-geomatics programmes can easily find jobs in land survey, geomatics.

To attract students to marine geomatics, our Category B programme has been designed as follow-up to the technical diploma in land surveying. This enables us to start our course on firm grounds in applied geodesy, positioning and land surveying techniques, and to focus our programme more on the marine survey topics. CIDCO also offers part of the programme in e-learning and distance learning. CIDCO has invested a considerable amount of time in designing educational methods and content specific to hydrography-related e-learning with the help of experts in educational science. This innovation is well appreciated by students.

***What impact does the increasingly important role of hydrography have on education?***

The growth of hydrography requires more professionals, who are well educated and/or trained. The complexity of hydrographic systems

content of hydrography. Our main learning outcome is to enable students to learn by themselves and to adapt to new technologies.

***How do you cooperate with manufacturers of hydrographic hardware, software and geodata?***

We invite manufacturers to sponsor our programme through the free loan of equipment and software. Some of them are very collaborative, and we appreciate the involvement of the industry in our Category B programme.

***What do you regard as the biggest challenge in the hydrographic sector and how can universities contribute to tackling it?***

To me, the biggest challenge in hydrography is to automate survey operations using unmanned underwater or surface vehicles specifically devoted to surveying. Unmanned systems are very effective force multipliers and should contribute to reducing the cost of survey operations. To do so, we need to re-define a certain number of survey tools and



components and to integrate them in robotic systems.

In our Category B programme, the final comprehensive field project includes shipborne survey operations, but also the integration of an autonomous survey vehicle and remote survey operations. We think this will be part of the future, and we need to prepare our students in using these techniques.

***If students from your university plan to start their own company, what do you advise them?***

I would advise them not to start a company before gaining some field experience. Competence is made of prior education and experience. I believe that competence in hydrography is an absolute pre-requisite to starting a successful company. For experienced ex-students, my advice would be to start companies at the frontier between innovation in survey system design, new survey techniques and survey operations.

## 5 Questions to...

# Larry Mayer

Professor and director of the School of Marine Science and Ocean Engineering and director of the Center for Coastal and Ocean Mapping, University of New Hampshire, USA.

**Attracting sufficient students is a first priority at universities. What is the situation at your university?**

As the reputation of our Center has grown, we have been fortunate to have a steadily increasing number of applicants. The applicant pool is aided by our GEBCO training programme and the close ties we have with NOAA and other government agencies. Our programme is a graduate level programme and the challenge is to find students with the appropriate undergraduate background to succeed in advanced hydrographic training.



**What impact does the increasingly important role of hydrographics have on education?**

We see an increasing demand for well-trained students but as the breadth of ocean mapping applications grows, it presents challenges to us to train students with the appropriate suite of skill sets required.

**How do you cooperate with manufacturers of hydrographic hardware, software and geodata?**

We have a formal programme of 'Industrial Associates'. The Industrial Associates provide an 'in kind' contribution to the University (e.g., access to their hardware or software) and in return they have access to our research programmes and the tools (typically software) we develop. We also

have an 'Industrial Associates Day' where the industry partners and senior leadership from our NOAA (and other) sponsors come together to discuss current and future problems facing the hydrographic community.

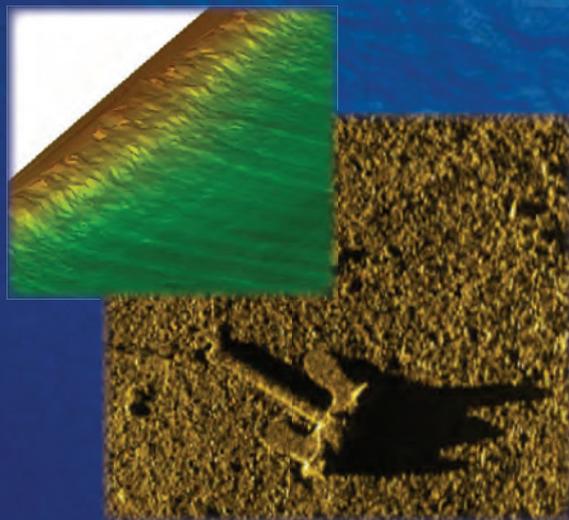
**What do you regard as the biggest challenge in the hydrographic sector and how can universities contribute to tackling it?**

The collection of modern hydrographic data requires an increasingly broad set of highly technical skills including geodesy, cartography, engineering and computer science while the applications of seafloor surveying are expanding well beyond chart making to a range of biological, engineering, and earth science applications. The key

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challenge we face is to ensure that we continue to provide students who are capable of collecting and processing the best data possible while at the same time able to appreciate and contribute to the broad range of applications.

***If students from your university plan to start their own company, what do you advise them?***

We encourage them but with caution. We suggest they get some experience in the

industrial sector before they strike out on their own – and we also suggest that technical skills alone are not enough – they must also ensure that they have an understanding of good business practice.

## 5 Questions to...

# Dr. Mohd Razali Mahmud

**Head of GeoCoastal Research Unit, Faculty of Geoinformation and Real Estate, Universiti Teknologi Malaysia (UTM).**



***Attracting sufficient students is a first priority at universities. What is the situation at your university?***

In the past, UTM was more focussed on the undergraduate intake. But now the university is also committed to postgraduate enrolment. As a consequence, we have reduced the undergraduate intake to cater for the postgraduate students. Therefore, the intake of the undergraduate students at UTM is sufficient.

***What impact does the increasingly important role of hydrographics have on education?***

In Malaysia, the tragedy that occurred to flight MH370 has opened the eyes of Malaysians to the importance of hydrography in search efforts. People are now more aware of the important

role of hydrography on education.

Furthermore, the recognition granted to our FIG/IHO/ICA Category A and Category B Hydrographic programme has helped UTM management to appreciate the important role of hydrography on education. In April this year, UTM was also granted recognition by the FIG/IHO/ICA for our Nautical Cartography Programme as equivalent to Category B level. The response from the government agencies and private sectors, local and abroad to these programmes is satisfactory.

***How do you cooperate with manufacturers of hydrographic hardware, software and geodata?***

We are very fortunate to receive support from various manufacturers who are willing to cooperate with UTM on educational activities related to hydrographic education. The support from the university in purchasing the various hardware and software provide the linkage of continuous cooperation with them. These manufacturers are also very helpful in providing different geodata for use by the students for their study. We are also fortunate to have an academic partnership with a software manufacturer.

***What do you regard as the biggest challenge in the hydrographic sector and how can universities contribute to tackling it?***

Getting a potential candidate that has strong qualifications in the industry with high

hydrographic knowledge. This candidate has attended and passed the FIG/IHO/ICA Category A Hydrography programme with a strong educational background. They are not only strong in the theoretical aspects of hydrography but are also well versed with the hydrographic operation. Hopefully, this candidate will rise from a staff member to a principal level and finally a custodian level in their work place. The university can help to train this candidate to obtain the necessary academic certificate in hydrography and expose the candidate to various hydrographic operations by cooperating with the hydrographic sectors in building their career. Therefore, the candidate should be given the opportunity to attend what is known as industrial training after their graduation in order to gather the necessary experience in hydrography.

***If students from your university plan to start their own company, what do you advise them?***

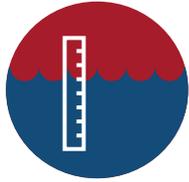
Normally, we will expose the students to the manufacturers and industry related to hydrography by inviting them to join many activities at the university. Furthermore, the students are given the support to attend various activities such as short courses, seminars, conferences, exhibitions, etc. These opportunities will expose them to networking that will be very helpful to the students if they plan to start their own company.

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# Trends in Hydrography

It's often a cliché to say that everything offshore has changed since the introduction of GPS, but I really think it's true, almost everything has changed since back then in the 1980s. The other obvious transformational technology has been computers and computer processing that, like the rest of the world, has totally and radically changed our lives. It didn't happen immediately of course -- no that would never do in the ultra conservative environment of hydrography and offshore surveying -- however, it's clear when comparing mid-20th century surveying with today that they have totally and fundamentally impacted our projects. Nowadays, such technologies are often taken for granted, but whilst its totally clear they have been adopted and are omnipresent in our working lives, what lessons can we take when considering today's technical developments, revolutions and the ever evolving trends?



▲ Unmanned vehicles being launched for a scientific survey mission. Image courtesy: NOC, Southampton.



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One lesson is that whilst computers and computer processing have developed and continue to do so there is a time-lag between the next development and its full use and adoption. This is in part due to the cost of development and production as well as the availability to the market but also the perceived benefits (or lack of) between existing computing capabilities and technologies.

A second aspect, when considering GPS, is that the relatively high cost of establishing a radio positioning system (often tens of thousands of dollars) for the very few hydrographic and survey users was massively reduced, when GPS was proven to perform reliably, to a few hundred dollars. The effect of creating something with mass appeal enabled a very high engineering and development cost to be reduced for the user. Again a time-lag occurred as initial coverage, availability and performance issues were dealt with.

A third outcome is that the mass appeal and availability of emerging technologies, especially computers and GPS, have generated a great number of new and innovative uses and applications. An example could be the development of digital cameras replacing film-based cameras and of course smartphones



▲ GNSS receivers have reduced the cost of positioning compared with radio navigation systems.

### Reflection on Autonomous and Unmanned Systems

The current technological trends of autonomy and unmanned systems with AUVs and ASVs clearly offer potential advantages for certain projects. As they develop and our appreciation and use increases we may find that there are some consequences we had not fully expected. They can be super efficient resulting in a relatively high unit cost for an area of survey or a period of time. The potential to increase productivity and perhaps reduce certain types of offshore personnel seems likely but they have limited sensor payloads and

Data, the final frontier for many, which has been with us in some form forever, continues to grow in volume and complexity and consequently offers an opportunity and a challenge. Yes MBES, Lidar, remote sensing platforms and scanning systems create and generate large volumes of data. In fact, the vast volume of data they are generating has caused the traditional silos of the data owners to become too large and cumbersome when filled and data is to be made more and more available for other potential users. In reality, consuming these datasets is constrained due to access being limited, varied formats, limited metadata to explain what is present and simply knowledge of the data's existence and availability. I anticipate that development efforts will be made to enable these large data volumes to be made more accessible, more easily consumed and to actually provide some additional value and benefits for the wider user community.

### Data, Resolution and Range

New technologies for the collection and near-real time processing of large data volumes will continue to evolve and push the data analysts and interpreters into responding with new and more powerful tools. Satellite Derived

## We must strive to inspire, encourage and attract the future talent

that offer a location and include a camera. It's perhaps unlikely that many of our hydrographic and offshore surveying developing technologies will see such dramatic change and innovation, but their adoption may be more effective and transformational with integration into and together with other technologies.

So it's all good and we should be very pleased right? Well, a further lesson to appreciate is that many technologies bring with them some form of unintended consequences. Not all are significant but some are. Few would have thought of the impact modern day DP vessel systems would have on reducing the need for the survey system installations or the security implications of, for example, pirates' use of AIS (the Automatic Identification System).

the technology of autonomous operations, replacement fuel systems and the data drops at each end of mission turnaround may balance these benefits with challenges for certain operations. At least until it becomes clear how best to overcome and reduce these. System integration with a more open architecture and better adaptable capacity regarding data transfer and

## There is a time-lag between the next development and its full use and adoption

processing could unlock even greater opportunities as could fuel cell and power storage developments from other markets.

Bathymetry (SDB) is one developing areas that may have a huge impact on the traditional survey data collection and processing as remote

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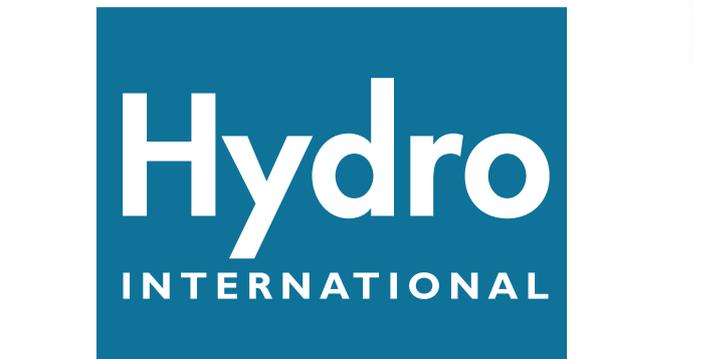
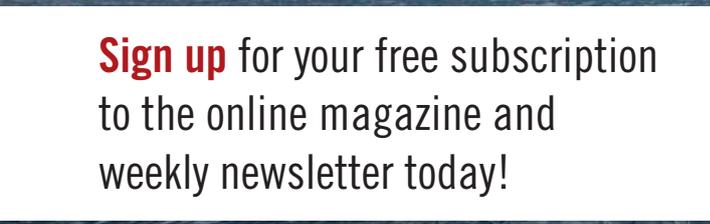
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sensing earth observation datasets gain more use due to better resolution, appropriate sensors and their up to date and frequent coverage. More use of SDB is due to the increasing number of users who wish to access data at an appropriate and cost-effective rate. An important recent trend has seen surveys

can be obtained, but SDB is of a relatively poor resolution relying too much on sparse depth measurements to be accurate. AUVs that do offer the ultimate in data resolution are limited by their range and duration. What is really needed is a truly accurate high-resolution surface-based, or near surface-based, system

worlds oceans by 2030 (see <http://www.gebco.net/>). A significant challenge that would benefit from improvements in acoustic, autonomous vehicle and data processing technologies. Another interesting programme is the Atlantic Ocean Research Initiative that includes, through its Coordination and Support Action, efforts to map areas of the unexplored north Atlantic as part of the Canada/USA/Europe Galway Statement. What these initiatives represent is a clear will, both politically and economically, to further map and understand our seas and oceans. However, for the benefits to be truly realised I believe technological advancements will be required, e.g. in terms of data resolution (it should be in the order of sub 10 metres on the seafloor or at the 0.075 to 0.1 degree beamwidth).

## Many technologies bring with them some form of unintended consequences

collect not just seafloor depth and associated backscatter data but now more and more operations are able to adjust their data collection to include the water column data. This has a potentially large new consumer base of users interested in the water and oceanographic components.

Of course, the generation of large datasets is all well and good, but if we are not able to share and distribute the data for the broader community to use then some of the benefits will be lost. Responsible agencies and institutions will endeavour to share their data and the EU has encouraged this through such programmes as the INSPIRE initiative. However, wouldn't it be great if we had contractual terms that removed the privacy and exclusive use of the data after a reasonable period of time so that we could develop a more recognised supply of information.

So the continual trend of new and ever more data-rich systems will have an impact on some of the traditional projects that we would normally undertake. However, let's not pretend that SDB or a swarm of AUVs will be totally effective and efficient in mapping our seas and oceans at a useful resolution and accuracy (A totally new topic for later!).

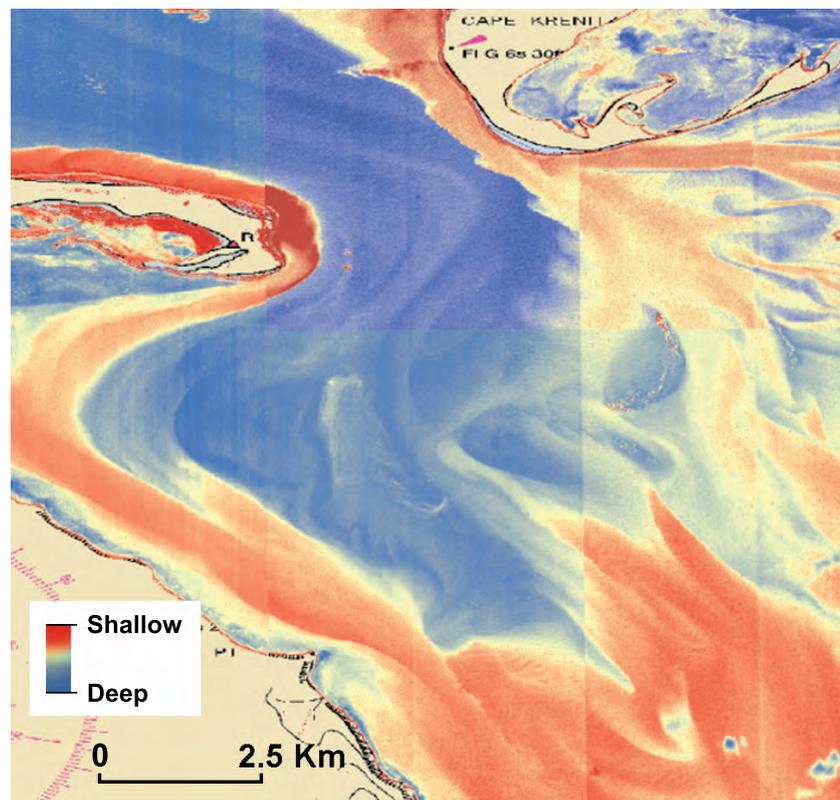
Rather, we still need to develop a seriously efficient, cost-effective mapping technology to cover our seafloors and water column. Currently, AUVs are too slow, of limited power and thus range and duration, but also they collect but don't easily distribute their large volumes of data.

Current global seafloor maps have inaccuracies in their depths of over 1km and much more often of hundreds of metres. Better coverage

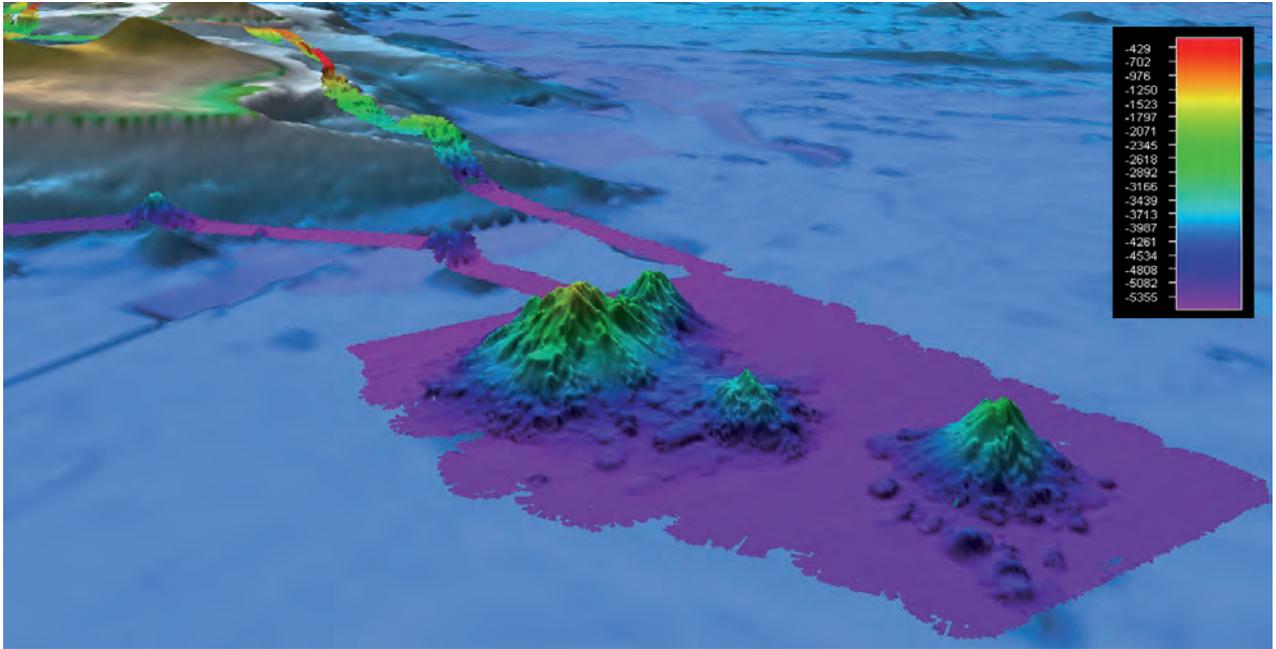
that can operate very efficiently and transfer its collected data as it surveys. You might ask why and to what purpose? Well there are several initiatives to increase our knowledge and understanding of the oceans. A well established one is that of GEBCO (the General Bathymetric Chart of the Oceans) being directed under the auspices of the International Hydrographic Organization and the Intergovernmental Oceanographic Commission of UNSECO. It has recently announced its aim of mapping the

### Evolution in the Human Factor

A further trend I want to mention is that of demographics. When I started offshore there were surveyors and engineers. Some navy personnel were recorders but that seemed a luxury only available on permanently fitted



▲ Satellite Derived Bathymetry is gaining interest. NOAA has already produced an official nautical chart based on SDB data.



▲ *Multibeam data acquired with Okeanos Explorer's EM302 multibeam system overlaid on top of satellite-altimetry data. The EM302 multibeam is detailed, allowing to define previously unknown or poorly known features, gaining a more accurate and precise picture of the character and nature of the seafloor. Image courtesy: NOAA Okeanos Explorer Programme.*

vessels. Then we got specialist engineers for the acoustics, ROVs, followed later by data processors and report coordinators. The range of equipment appeared to increase too. It was an exciting environment with varied and interesting projects that often involved doing new things. The industry is still exciting, but can

we still attract Millennials into our profession and do they have the necessary skill base or is their education leaving our industry behind as they gain alternative new and exciting career

attract the future talent to ensure that hydrographic surveying remains a truly exciting and rewarding activity. This is a trend that will continue and may become even more vital in

## More and more operations are able to adjust their data collection to include the water column data



**Gordon Johnston, BSc(Hons), MRICS, FHydSoc, FRIN** Gordon is based in the United Kingdom and has over 25 years of experience in the surveying industry, in particular, the offshore and hydrographic survey industry. He has been a director of Venture Geomatics Limited since 2006. Before, he was the global chief surveyor with Racal Survey Limited and then the vice president Geomatics at Thales Geosolutions Limited. Gordon is a Chartered Surveyor of the Royal Institution of Chartered Surveyors (RICS), chairing the RICS Global Geomatics Professional Board and he is head of the UK delegation to FIG (International Federation of Surveyors) as Commission 4 - Hydrography representative. He is an active member of the International Board for the Standards of Competence of Hydrographic Surveyors and Nautical Cartographers (IBSC). He has published numerous papers on offshore survey-related themes.

opportunities? The development of new technologies can continue to be an attraction to young professionals so it's important that we support and sustain appropriate training and educational institutions. This could help in determining what skill sets and competencies are of the greatest benefit and those that are perhaps no longer as useful. Whatever technology we develop, adapt and adopt we must strive to inspire, encourage and

our specialist sector to secure a future with skilled people enjoying a continuously evolving career.

Whilst the exciting technology will evolve and hydrography and offshore surveying adapts, we will, as a profession, increasingly make a significant impact on the world. It would be nice if the rest of the world became aware of just how great it is going to be. ◀

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