SEABED GAZETTE

2020

Sea level monitoring using satellites over time

Big Blue Ocean Clean up

On a clear day in Budapest

SEABED

Getting to the bottom of things

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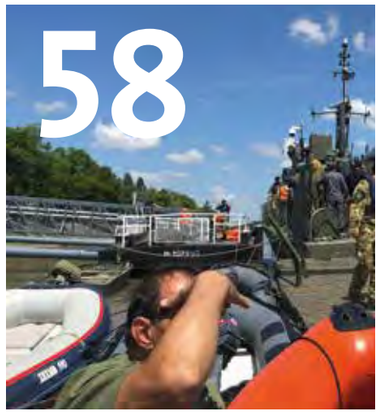
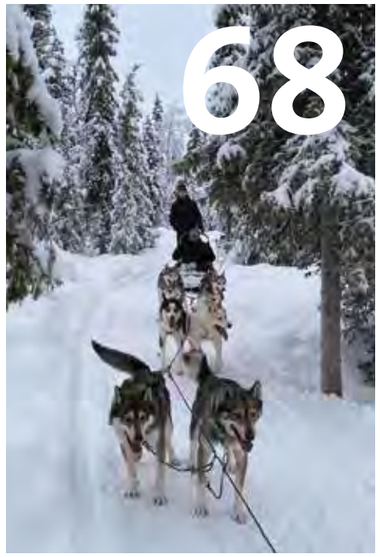




Seabed end of Summer Demo Days 2019

At the 2019 demo days, Seabed was happy to receive the many relations who show real interest in what Seabed has to offer.

This year the Moving Vessel Profiler from AML was introduced. The Moving Vessel Profiler was installed on vessel Naatje for demonstrations.

The Moving Vessel Profiler was purchased to add to the Seabed rental pool. Lately the rental pool has been expanded with the Moving Vessel Profiler, an FSI Sub bottom profiler, an FSI Side Scan Sonar and a Norbit IWBMS STX. Seabed aims to expand the rental pool in 2020 even further.

All equipment demonstrated was guided by the dealer representative to answers as many questions as possible.

Hopefully you will be able to join us (again) on the next demo days on September 9 and 10, 2020. Where Seabed will show the latest equipment, where you will meet colleagues from the industry, and where you can enjoy a drink and snack.

Until we meet again!

Meet...

Ourania Altiparmaki
Surveyor

Date of birth? And what is it you like to do on your birthday?
Spending time with people I love is enough to make me feel happy.

Single, in a relationship or married?
In a relationship during the last 3 years.

Any hobbies?
Love cooking for my people and reading psychology books.

Fast food, bistro or Michelin starred restaurant?
Food is a passion for me, so I enjoy any kind of it!

Netflix or the cinema? And what is your favourite TV-series or movie?
Netflix for daily routine, but also cinema is a pleasant way of entertainment. Addicted to the "Person of interest" TV series.

What kind of job did you want growing up?
To be honest, I didn't have any preference until the moment I started my studies in Geodesy. Today, I am feeling great with my choice!

What is it you like most about your current job?
Every project I deal with is a new challenge for me. Learning a lot and being part of a multi-disciplinary team makes me feel highly motivated!

What do you learn from your colleagues?
Interacting with people having diverse backgrounds and personality traits has taught me that there may exist several approaches of solving problems, something that allows me to think in a broader way.

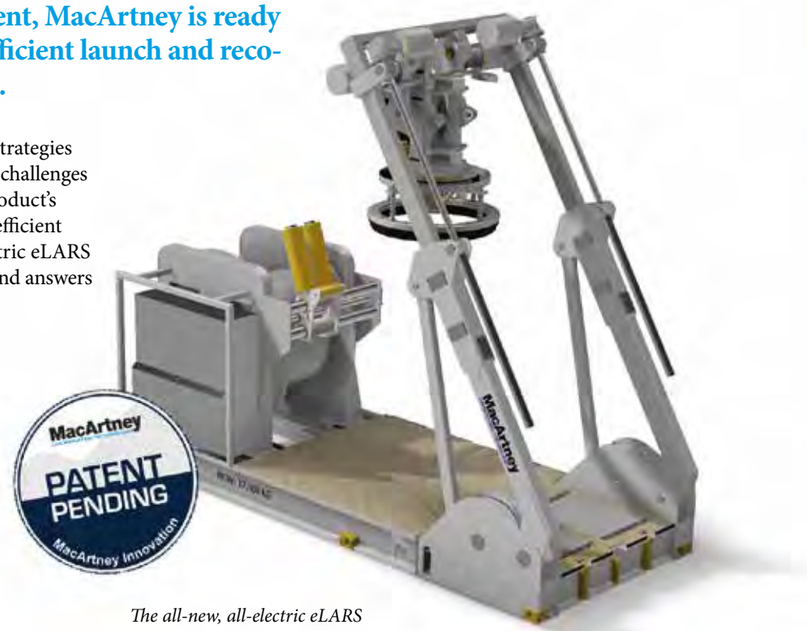
If you would win the lottery, what would your life look like?
I would live in a small exotic island with my family, having only the necessary and helping people in real need!

It's Electric! MacArtney to Launch All-New, All-Electric eLARS

Looking to the future of our environment, MacArtney is ready to launch an all-new, all-electric cost-efficient launch and recovery system for the ocean space market.

As eco-friendly approaches influence future business strategies and product development, MacArtney is meeting these challenges head-on. With the health of the environment at the product's core, MacArtney is ready to launch a robust and cost-efficient product into the ocean space market. The new all-electric eLARS incorporates MacArtney's tried and tested technology and answers a market need for more eco-friendly products.

The all-new, all-electric eLARS can be delivered as a complete system or as a stand-alone A-frame and will support a wide range of inspection and observation class, as well as work class ROVs. The eLARS is centred around a fully scalable platform that can be tailored to any customer specifications.



The all-new, all-electric eLARS

The eLARS eco-friendly features include zero pressurised oil over water, significantly reducing the risk of harmful oil spillages; and improved power efficiency that is considerably higher than that of traditional hydraulic systems. Thus requiring less vessel power and improving overall energy efficiency, and enabling vessels with smaller generator sets to operate the system. Going electric also increases usable deck space in the absence of the traditional HPU (Hydraulic Power Unit).

Following market trends, a zero-energy eLARS is available for delivery, equipped with energy harvest and battery system, significantly reducing the need for external power during operation and in some cases eliminating it entirely.

In addition to the eco-friendly benefits, the new eLARS provides an intelligent and highly versatile control system. A range of real-time condition metrics display vital information that empowers the operator to make operational and maintenance decisions in the moment. The high degree of built-in redundancy and the Emergency Recovery Mode provide a new-to-the-industry level of confidence even in extreme operational conditions. Full automation capability is also considerably easier with a control system design equipped for semi and fully automated operational sequences.

Additionally, the control system can be upgraded to virtually any new function, offering versatility and longevity.
Designed and manufactured in Denmark with more than 40 years of MacArtney expertise, the new eLARS is based on trusted MacArtney technology and principles, tested in the harshest of offshore environments over the last four decades, providing a high level of integrity for our customers.

Throughout the design of the eLARS, strict focus has not only been on providing an eco-friendly solution but to also ensuring economic efficiency. These goals are met with a system that will be competitively priced and will significantly reduce both operational and maintenance costs. This has been achieved through Plug-and-Play mobilisation, use of low weight and low cost readily available spares; all eliminating the need for hydraulic maintenance work and supporting the overall ease of maintenance. All together, maintenance work is reduced by up to 50% when compared to conventional hydraulic systems.

MacArtney's continued journey to develop new eco-friendly system solutions follows a positive trend in the ocean space market. The new eLARS is the culmination of years of hard work. MacArtney's Director of Engineering, Lasse Rasmussen states,

"Developing the eLARS has been an engineering journey during which we have experienced a great level of support from a wide range of our customers, enabling us to present what we believe is an answer to the future market of Launch and Recovery Systems. Through the eLARS, we are offering simple and proven technology configured to replace hydraulic systems directly, and by doing so effectively provide our customers with future proof systems with a low environmental impact, intelligent control systems and not least a high degree of operational efficiency."

Launching the new all-electric eLARS marks an environmental milestone for MacArtney. One of many as MacArtney endeavours to continue to innovate and develop future solutions for the ocean space market.

For additional information, please contact Klaus Brix, Product Manager, MacArtney A/S
Tel. +45 7613 2000, e-mail kbr@macartney.com or visit the company website www.macartney.com

About MacArtney

Since 1978, The MacArtney Group has offered industry leading underwater technology products, systems and integrated solutions to key marine industries.

- **Ocean Science:** integrated instrumentation systems for oceanographic, hydrographic and hydrometic purpose
- **Oil and Gas:** system solutions from seabed to surface, supplying the entire value chain
- Defence: supplying connectivity products, instrumentation, deck and over-the-side handling equipment
- **Civil Engineering:** providing underwater technology products and solutions to a wide range of projects, operators and developers
- **Renewable Energy:** supplying state-of-the-art solutions for wave, tidal and offshore wind applications for projects around the world
- **Fishery:** custom designed and engineered solutions to accommodate advanced custumor specifications

Employees Worldwide: ~450

MacArtney Group headquarters are located in Esbjerg (DK). MacArtney also resides in Bur and Klinkby (DK), Aberdeen and London (UK), Satvanger (NO), Aix-en-Provence (FR), Rotterdam (NL), Kile and Bremen (DE), Houston, Boston and San Diego (US), Victoria and Dartmouth (CA), Perth (AU), Ningbo (CN) and Singapore (SG).

Global representation through subsidiary and disributor networks in Scandinavia, Europe, Asia, North America, South America and South Africa. Providing global access to local support.

For further information, please visit www.macartney.com

MacArtney
UNDERWATER TECHNOLOGY

MacArtney
UNDERWATER TECHNOLOGY

TrustLink
Metal Shell Connectors

- Available worldwide from stock
- Cost saving modular design
- Interchangeable and reversible insert configurations
- Designed and tested to IEC standards
- 40 years of underwater technology experience

WHO DO YOU TRUST?

The MacArtney Group - providing systems, products & solutions for four decades

macartney.com

www.seabed.nl

Seabed Portable Lightweight Multibeam Set (SPLMS)

Seabed is introducing the first lightweight multibeam set in the world that can be transported as check-in luggage with any airline with no extra charge. The SPLMS is ideal for projects where rapid mobilization is required and where logistical challenges are taken into account due to the simple deployment.

SEABED

Getting to the bottom of things

Big Blue Ocean Cleanup

Big Blue Ocean Cleanup are one of the world's leading ocean cleanup non-profits. They help keep the oceans clean, protect marine wildlife, run free educational workshops and support the development of innovative technologies. Big Blue Ocean Cleanup inspires every generation to take action and protect our blue planet.

Big Blue Ocean Cleanup's ambassador network runs coastal cleanups all over the world. They support thousands of ambassadors with the equipment needed to keep the places we love clean. Their Coastal Cleanup program provides a fun and easy way to volunteer and engage with our mission to protect our oceans and marine wildlife.

Volunteers of all ages, local community groups, visitors, clubs, local and corporate businesses around the world contribute to the success of their Coastal Cleaning Program and are vital to keep our beaches and coastline clean.

Every year hundreds of thousands of volunteers comb the beaches and coastlines around the world for rubbish. Coastal cleaning can be entirely rewarding, because you're consciously helping to protect our natural environment as well as your local area, and they can be a great opportunity to meet new friends.

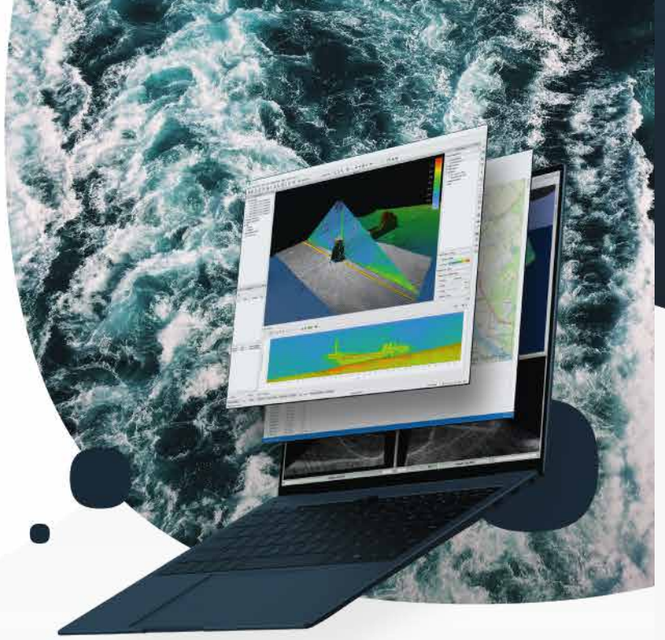
If you are interested in taking part in one of their coastal cleanup events please check out their social channels.

They are always looking for ocean activists to join their official ambassador program and become the face of Big Blue Ocean Cleanup in your community. Their ambassadors are a network of volunteers across the globe, who support Big Blue Ocean Cleanup by representing clean oceans in their local area and help engage people with the work and aims of the foundation.

OCEAN PROTECTION PROJECT

Ocean Protection Project is aimed at companies that want to make a positive contribution to your local community and help support healthy oceans. By making a donation of £250, you'll be an official business member of Big Blue Ocean Cleanup, making a positive change towards clean oceans. You will help us keep the oceans clean, protect marine wildlife and support the development of innovative technologies. It also allows us to run free educational workshops and provide resources for schools around the world; inspiring every generation to take action and protect our blue planet. If you're interested in becoming an official partner please get in touch with Amy from the partnerships team on **amy@bigblueoceancleanup.org**

QPS. | Maritime geomatics software solutions



For clients who demand the best.

From ship to shore, know your ocean.

QPS provides stable, powerful software for streamlined workflows. From hydrographic data collection to piloting, whatever you need, QPS can provide the support and tools to match.

OUR PILLARS

Reliability
With industry renowned stability, we keep the job running smoothly.

Capability
We provide the most powerful tools on the market, and we can meet almost any requirement.

Flexibility
Our software packages can be easily integrated into almost any workflow.

OUR SUITE

Acquire	Process	Analyze
Qinsy.	Qimera.	fledermaus.
Map	**Share**	
Qarto.	Qastor.	

ACQUIRE

Qinsy.

Survey and navigation. Ping and done.

Qinsy is a survey planning, acquisition, and real-time hydrographic data processing solution, with capabilities to handle any job, from simple single beam surveys to complex offshore construction works.

PROCESS

Qimera.

Multibeam processing. It's that easy.

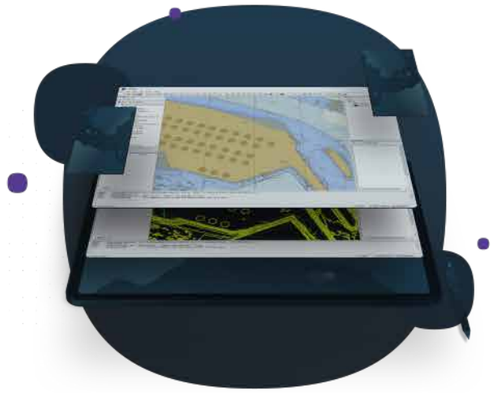
Qimera makes hydrographic data processing as intuitive and as simple as possible, while still offering the most advanced and cutting edge tools to ensure high quality products and rapid delivery.

ANALYZE

fledermaus.

4D geospatial analysis. More than just a pretty picture.

Fledermaus is an interactive 4D geospatial analysis software. With movie-making tools and integrated video playback, it is the gold standard for presentation and communication.



MAP

Qarto.

Bathymetric ENC production. Maximise navigable waters.

Qarto is an ENC production platform to rapidly create and update existing ENCs with high resolution bathymetry. It is the tool of choice for the largest ports in the world to increase port availability.

SHARE

Qastor.

Precise piloting. Let us guide you.

Qastor is a precise navigation software for piloting and docking. With under-keel clearance capability and real-time information updates, it is the ultimate in maritime safety.

Find out more at **www.qps.nl**

Client tales #1

The new Hungarian riverbed survey vessel

A new survey vessel, named: GARDA, equipped with a multi-beam echo-sounder was acquired within the FAIRway Danube project. Through the project a new dedicated survey crew was created at the North-Transdanubian Water Directorate (EDUVIZIG), who has learned the technology from the SEABED team. The goal of the FAIRway Danube is to significantly increase the knowledge on shallow sections of the International Danube waterway so that the fairway routing will be optimized and rehabilitation measures drafted.

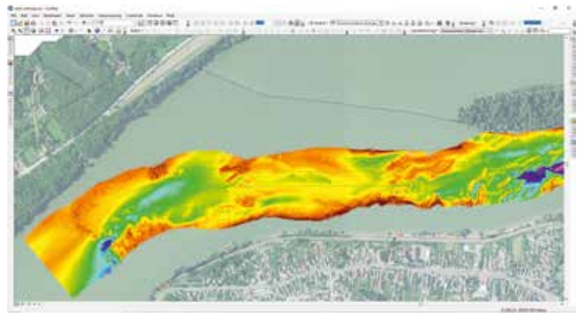
Within the project a compact and high-resolution Dual head curved array bathymetric mapping system by NORBIT has been purchased from Seabed BV. This all-in-one tightly integrated broadband multibeam turnkey solution offers high resolution bathymetry over a wide swath. The high-end sonar with globally leading GNSS/Inertial Navigation System embedded into the unit ensures fast and reliable mobilization and highest quality sounding for installations in all conditions.

The entire Hungarian stretch of the Danube (rkm 1811 - 1433) is characterised as a free-flowing section which includes sections with an easily scouring riverbed. Therefore, surveys will be executed along the entire national stretch of the Hungarian Danube waterway, with specific focus on the critical locations and the common Hungarian-Slovakian section. In addition to EDUVIZIG, there are other two directorates along the Danube where the survey takes place. Qinsy is used for raw data collection and surveying, post processing is done in Qimera and ArcGIS. Measurements are corrected, filtered, and the surface model is done in Qimera, and then the final formatting of the surface is done in ArcGIS. Surveying results – shallow section information – will be published on the FIS portal and on the national website of General Directorate of Water Management.

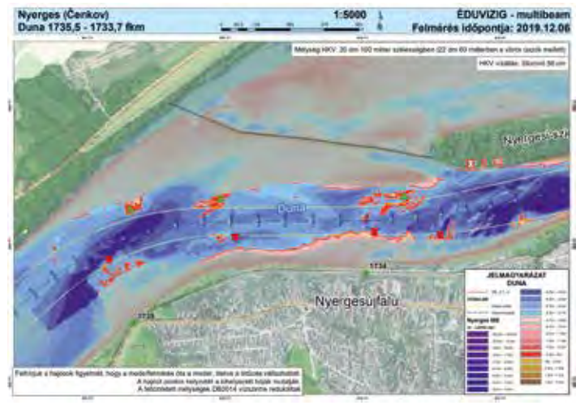
Workstation on the vessel

NORBIT - iWBMSh-Dual Head

The GARDA surveying vessel



The processed terrain model



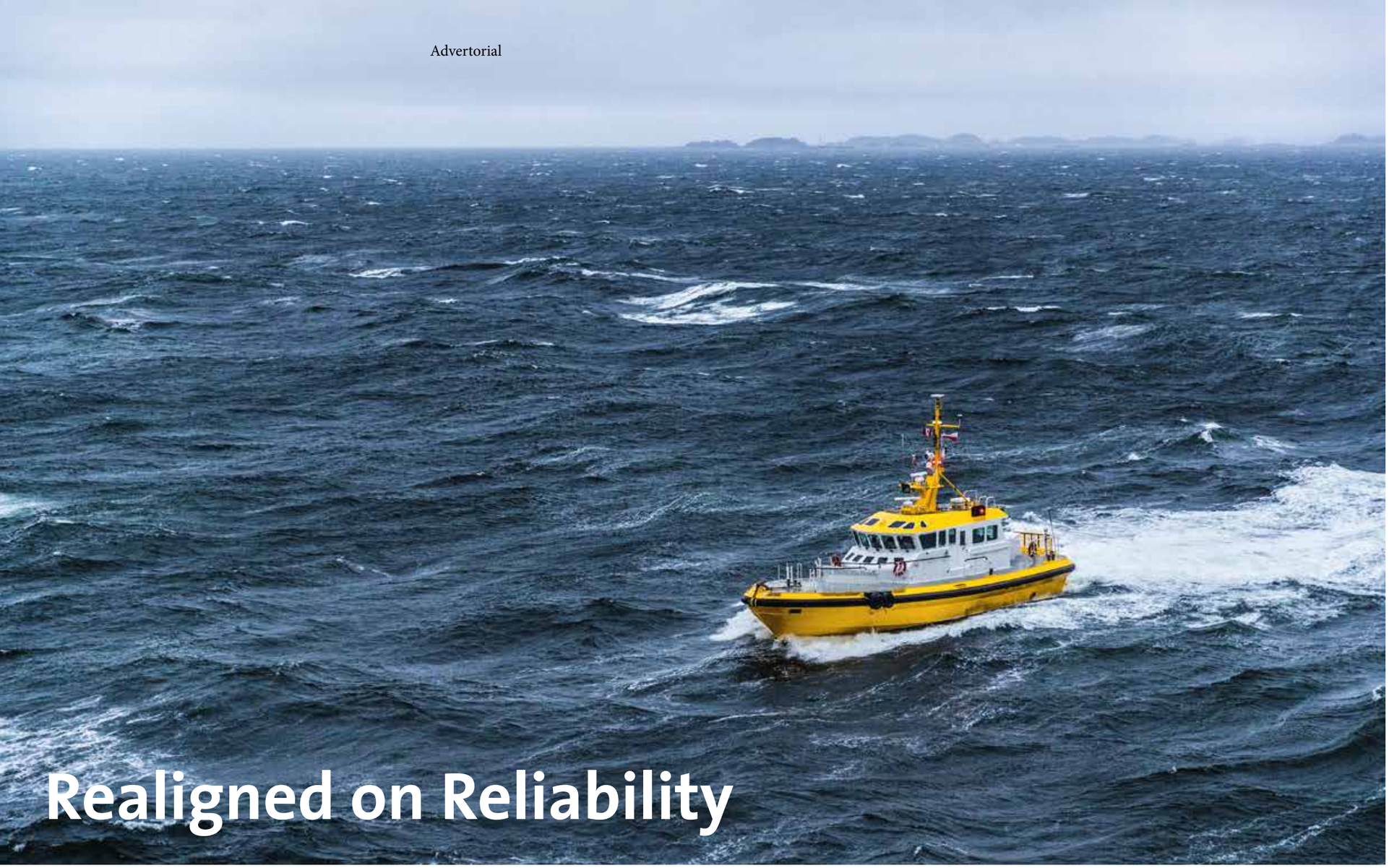
The processed terrain model is converted to a final situation plan for publishing.

SURVEYING VESSEL	NEW EQUIPMENT
Name	Garda
Home port	Gönyű
River-km	1791
Engine power	1 x Mercury F200XL (149 kW)
Minimum speed upstream for surveying (km/h)	5
Maximum speed downstream for surveying (km/h)	10
ACOUSTIC DEVICE	
Name	NORBIT
Type	multi-beam
Operating Frequency (Khz)	200-700kHz
Depth Range	0,2 m - 275m
Accuracy	1 cm
Maximum number of beams	512 EA & ED
Along Track Beam Resolution (grade)	0.90° @ 400kHz 0.50° @700kHz
Across Track Beam Resolution	1.90° @ 400kHz 0.95° @700kHz
Number of beams used	256/512 EA & ED
Swath coverage depth/width	7-210° (1-12x)
MRU	
Name	SBD IMU-S2
Roll/pitch accuracy	0.01°
Roll/pitch resolution	0.01°
Heave accuracy	0.05m or 5%
Heave resolution	1 cm
Heave range	±50 m
Digital output data	NMEA 0183
POSITIONING DEVICE	
Name	Seabed SGR7-D S2
Type	Seabed SGR7-D S2
Base station dGPS	virtual (RTK)
Name of base station	national GNSS network
Positions referenced to WGS84	virtual (national GNSS network)
Projection	HD72/EOV
Horizontal Accuracy of RTK position	RTK 10 mm
Alternative position correction via GPRS	yes
HEADING DEVICE	
Name	Seabed SGR7-D S2
Accuracy of course	0.02°
SOUND VELOCITY DEVICE	
Name	AML SV-XCHANGE
Velocity Range (m/s)	1375-tól 1625 m/s
Velocity Resolution	+/-0,006 m/s
Velocity Accuracy	+/-0,025 m/s
SOFTWARE	
Hydrographic software for survey	QINSy 8
Hydrographic software for post-processing	Qimera
Training for operators of the equipment	5 days

Offshore Energy 2019

Seabed at the Expo's

Ocean Business 2019



Realigned on Reliability

Mitigating the Threat of Offshore Interference, Jamming & Spoofing Attacks

In 2018, the U.S. Maritime Administration issued alerts reporting jammed GPS signals between the Republic of Cyprus and Port Said, Egypt, that affected multiple vessels and aircraft in the area. As recent as December 2019, "GPS spoofing circles" were discovered at 20 different locations along the Chinese coast, which are believed to be designed to conceal illegal oil transactions. The non-profit Resilient Navigation and Timing Foundation research found instances of jamming and spoofing had happened to over 600 vessels over the last few years.

These reports, while still somewhat isolated, are a sign of things to come. Even more concerning is that the signal disruptions last from five minutes to an hour and, in some instances, an entire day—delays that can impact safe and efficient marine operations.

This is why marine integrators worldwide have been relying on world-leading Global Navigation Satellite Systems (GNSS) OEM positioning technology from Hexagon | NovAtel®. From positioning dredging vessels to collecting survey data or used on autonomous platforms, marine professionals rely on accurate and reliable GNSS for a range of activities. Accuracy, redundancy and reliability are vital, and even slight errors or loss of connection can lead to safety issues and downtime that costs time and money.

Dr. David Russell, Marine Segment Portfolio Manager, adds "GNSS has become so ubiquitous in the marine environment that many treat it as a commodity. We expect it to work all the time—and forget that it has limitations, that is until there's a loss of signal during a critical operation."

GNSS reliability in today's environment is possible through a multi-pronged approach that ranges from specialized antennas to multi-constellation enabled GNSS receivers and integration with other sensors such as inertial measurement units.

Null & Void

A common and effective way to mitigate potential jamming or spoofing threats is with multiple antenna arrays, or Controlled Reception Pattern Antennas (CRPA). CRPAs mitigate in-band and out of band interference by creating nulls in the antenna gain pattern in the direction of the suspected jammers.
Dr. Russell explains, "If the GNSS detects interference from a jammer, the antenna pattern can be shaped to 'null the signal' in that particular direction, which preserves the antenna's view of the GPS satellites. GNSS receivers equipped with nulling antennas are more resistant to jamming than receivers without them."

In the past, anti-jamming systems have been very costly. As with most technology, anti-jamming solutions have evolved in both capability and affordability.

GAJT® from VERIPOS

For example, GAJT® from NovAtel is a Commercial- Off-The-Shelf, GPS anti-jam antenna suitable for land and sea applications with performance comparable to much larger systems, but at a significantly lower cost. As a null-forming antenna system, GAJT ensures satellite signals necessary to compute position and time are always available. It is easily integrated into new platforms or can be retrofitted with the existing GPS receivers and navigation systems on existing and legacy civilian or military fleets.

GAJT is an ideal solution for mitigating GPS jamming and spoofing threats, especially when combined with reliable correction services.

Correction Connections

Beyond a quality antenna, a precise, reliable, redundant and repeatable positioning solution requires a global network of stations, Orbit and Clock Determination System (OCDS) and a way to deliver accurate data to end-users.

The OCDS derives real-time corrections for all available satellite constellations using proprietary algorithms—and operates independently from the reference stations, thus providing another form of redundancy and eliminating the chance of common system failures and jamming.

Dr. Russell adds, "The combination of augmentation services, proprietary algorithms and the GAJT antenna provides a complete, accurate and reliable data solution. The use of the GAJT antenna ensures the raw GNSS data continues to be received even when interference or jamming is observed."

Specifically, GNSS positioning services from NovAtel include Oceanix Correction Service, that provide real-time precise positioning for nearshore applications. The Oceanix multi-constellation Precise Point Positioning (PPP) service uses GPS, GLONASS, Galileo and BeiDou constellations that provide redundancy and mitigation against interference, jamming and spoofing events.

Multi-Pronged Approach

Along with better antennas and reliable and redundant correction services, marine users can further mitigate chances of jamming and spoofing with better integration to other navigation sensors, increased use of augmentation and diverse communication links, interference detection algorithms and, most importantly, multi-channel capabilities.

Tight GNSS integration with the Inertial Navigation System (INS) has been shown to detect and remove large jumps in measurements and position from the GNSS receiver during a spoofing attack. As well, the GNSS+INS integrations can provide position through short periods of GNSS denial through interference or jamming.

Satellite and ground-based augmentation signals can also provide an integrity check on the GNSS measurements. Satellite-based augmentation systems support wide-area or augmentation, facilitating precise positioning. As well, using a combination of diverse communication systems such as an L-Band Demodulator (radio frequencies from 1 to 2GH) or NTRIP (Networked Transport of RTCM via Internet Protocol) correction services ensure continued reception and helps maintain a corrected solution.

Dr. Russell says, "The best defense against jamming and spoofing is diversity in frequency bands and modulation techniques, and the functionality that new GNSS receivers have begun to incorporate. Advanced GNSS receivers can track all current and upcoming constellation and satellite signals including, GPS, GLONASS, Galileo and BeiDou. Simply put—more satellite options, less chance of GNSS disconnect."

The value of multi-constellation receivers has already been proven in real-life situations. During the GLONASS event in 2014, where it's believed incorrect ephemeris was uploaded to the GLONASS satellites, a GLONASS-only receiver showed a position 50 km from the correct position. Standalone multi-constellation receivers detected the GLONASS errors and rejected the constellation.

Since then, new generation GNSS receivers have been tested in strong interference environments and demonstrated improved performance over legacy equipment, improved tracking capabilities and interference rejection.

Raising Awareness

Dr. Russell concludes, "While threats are still largely isolated, the number and frequency is increasing. Seafaring vessels of all types and purposes should remain alert."

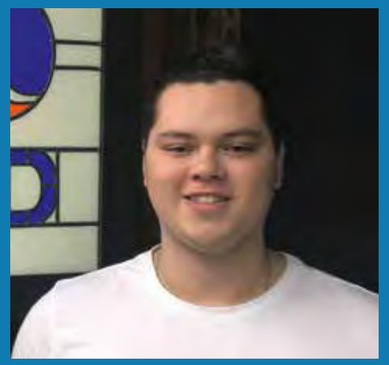
Dr. Russell further reminds the maritime community of the words from leading industry experts on GNSS-related issues. Both Captain David Moskoff, professor in the Department of Marine Transportation at the U.S. Merchant Marine Academy and William Kaag, retired Naval Aviation Supply Officer and Secretary of NATO Transport Group Ocean Shipping at U.S. Maritime Administration, noted in their Threats to Global Navigation Satellite Systems report several years ago: "The maritime community needs to become more vigilant, actively train to recognize and respond to cyber-attacks including jamming and spoofing."

HEXAGON | veripos

Here is the future

Seabed offers students of different types of study programs a chance to do an internship at the company. During the internship, students are offered the opportunity to develop their selves in their field of discipline and to undergo their personal development. So that after their study they have an idea of what the labor market looks like and what is expected of them when they start working. During the internship, students are trained in different fields of work such as sales, administration and engineering.

Introducing the Seabed interns:



1. What is your name?
My name is Jessey van Jole and I am 24 years old.

2. What are you studying?
I study Marketing, Sales and Trades at the University of Applied Science (HvA) it is a bachelor study. The study I am currently doing is for four years, divided in different types of subjects each year about a variety of subjects that relate to the study.

3. Why this study?
I was looking for something that was close to the market of economics, for example marketing and sales. The study offers varied work where you are in close contact with other people and can work on yourself as well. The interests of economic affairs have led me to the study.

4. Why Seabed for your internship?
Seabed seemed a company to me that offers many possibilities and fits well with the study that I follow. From the first meeting it gave me a good impression and I felt that I could develop myself at this company. The products and services they offer are very interesting. They sell products that not everyone has to deal with every day, and that appealed to me.

5. What do you expect of Seabed during your internship?
That I can develop in different areas and get a picture of what a job looks like that can be done after my study.

6. What are your plans after you graduate?
When I am graduated, I would like to have a job in sales or have a purchasing function at a company. After I have the right capabilities, I ultimately want to start something for myself so that I can be an entrepreneur.

"From the first meeting Seabed gave me a good impression."

1. What is your name?
My name is Mike Mulder and I'm from Hoofddorp.

2. What are you studying?
I am studying mechanical engineering at the Hogeschool Inholland in Alkmaar.

3. Why this study?
I always liked mechanical inventions and machines. This is the study to learn more about it and become an engineer.

4. Why Seabed for your internship?
Seabed got my interest because of the connection with the on- and offshore. This seems an interesting opportunity to get to know this work field.

5. What do you expect of Seabed during your internship?
I want to learn more about the on- and offshore work field during my internship. Besides that, I want to make new connections with new people for the future.

6. What are your plans after you graduate?
After I graduate, I'm not sure what I want to do. Maybe continue studying or start working and looking for the job I like.

1. What is your name?
Jacob van Crimpen

2. What are you studying?
The study that I am currently following is electrotechnics.

3. Why this study?
Because it has my interests.

4. Why Seabed for your internship?
Because I am interested in the nautical instruments.

5. What do you expect of Seabed during your internship?
I expect that would be a nice place to work.

6. What are your plans after you graduate?
I doubt between continuing doing another study or going to work after I got diploma.

1. What is your name?
Daniël van der Wansem

2. What are you studying?
Currently I am studying Mechanical Engineering

3. Why this study?
My parents have been in the car industry my entire life, so I grew-up in between cars and all of the techniques. I always loved to solve technical problems and design a solution, so Mechanical Engineering was exactly what I was looking for.

4. Why Seabed for your internship?
A friend told me about Seabed. After I did some research, I immediately sent my application for an internship to Seabed. After the conversation with Hans I was amazed by the dynamic company with a great team and interesting assignment.

5. What do you expect of Seabed during your internship?
An instructive internship with a lot of responsibility. I assume it's a widely internship where every day will be different.

6. What are your plans after you graduate?
At the moment I am planning to follow an Economic master degree in addition to my bachelor's degree.

"I assume it's a widely internship where every day will be different."

1. What is your name?
My name is Jayme Vis

2. What are you studying?
I study electrotechnics

3. Why this study?
I chose this study because I wanted a challenge. A new start. I started with electro on my vmbo school, on that school I learned a lot about the practical side. So i would work with my hands later. I decided not to work with my hands, and that's how I came to this study.

4. Why Seabed for your internship?
I chose seabed because I am not familiar with the technology, I want to learn from it and broaden my knowledge.

5. What do you expect of Seabed during your internship?
I expect to learn about the technology and how to complete a full project with teamwork.

6. What are your plans after you graduate?
I haven't figured it out yet what my plans are after graduation. I do not know what I want to do for the rest of my life. I let it come to me and maybe I find something what I love to do.

"I chose seabed because I am not familiar with the technology, I want to learn and broaden my knowledge."

1. What is your name?
Jorrit Hildebrand

2. What are you studying?
Intelligent Devices & Sensors, Electrical engineering

3. Why this study?
Electronics always had my interest. The study and the field of electronics are very diverse.

4. Why Seabed for your internship?
Seabed provides an interesting challenge and a lot of freedom by developing a new revision of the SGR7. The assignment has a lot of hardware development but also software development in an embedded environment. This makes the assignment very interesting for me as an electrical engineer.

5. What do you expect of Seabed during your internship?
A fun experience where I learn a lot about different subjects of development

6. What are your plans after you graduate?
Master at the University of Twente or TU Delft. The specialization is not chosen yet.

1. What is your name?
My name is Chesney, I'm 20 years old.

2. What are you studying?
I am following the study administrator

3. Why this study?
I chose this study because I'm good with numbers and I always wanted to do this.

4. Why Seabed for your internship?
I saw Seabed on a website called ' www.stagemarkt.nl'. After that I found some information about Seabed on their own website and I liked what I saw.

5. What do you expect of Seabed during your internship?
I hope that they will help me to develop myself and have a great time here.

6. What are your plans after you graduate?
I have no idea what I'm going to do when I graduate.

"I hope that Seabed will help me to develop myself and have a great time here."

Surveying with the Telemetron, an autonomous surface vessel

Last year Seabed was approached by the Port of Amsterdam to carry out a pilot with an unmanned surface vessel (USV). The main purpose of this pilot was to survey the draft of incoming marginal ships at the locks of Ijmuiden. Seabed therefore contacted Maritime Robotics from Norway to join the project, providing the USV ''Telemetron". The Dutch Customs office also took part in the pilot, as they were interested in investigating the multi-beam operation while scanning the hull of a ship. This could give valuable information about the fact whether suspicious packages are mounted on the ship below the water surface. The Dutch Customs office already scans moored ships with diving teams and/or robots. However, one of the advantages to carry out a similar survey with USV is that it saves a lot of time.

Telemetron USV
(Bjørn-Olav Holtung Eriksen, 2017)

USV technology is making a rapid growth the last years and is getting used more widely these days. By using this technology in this pilot it is a great opportunity to gain more experience and information about USV's and its contribution to future nautical processes. Although the USV can sail autonomous, the survey itself was done semi-autonomous. For the future the goal is to have the vessel operated by someone in the traffic control centre in the harbour, while trained assistants can focus on the data acquisition and its quality.

Equipment

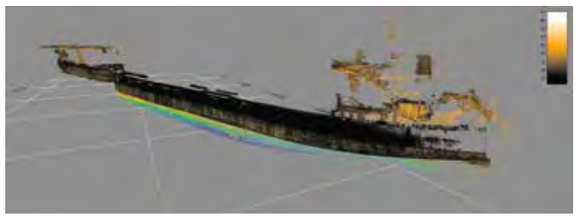
For the pilot the Telemetron was equipped with a iWMBS multibeam system from Norbit, two VLP-16 laser scanners from Velodyne and a Ladybug 5 camera from FLIR. The iWMBS multibeam was tilted 30 degrees starboard to get a good view from the hull of the ships. The lasers were mounted in two different directions, one vertical and one horizontal to collect LiDAR data from the ships above the water level. The Ladybug 5 was mounted on top of the Telemetron in order to have a clear 360 live view to read off the draft marks from the ships. The acquisition and real-time visualization of both LiDAR and bathymetric data were achieved using Qinsy software created by QPS. The processing was done in Qimera created also by QPS.

Salinity measurements

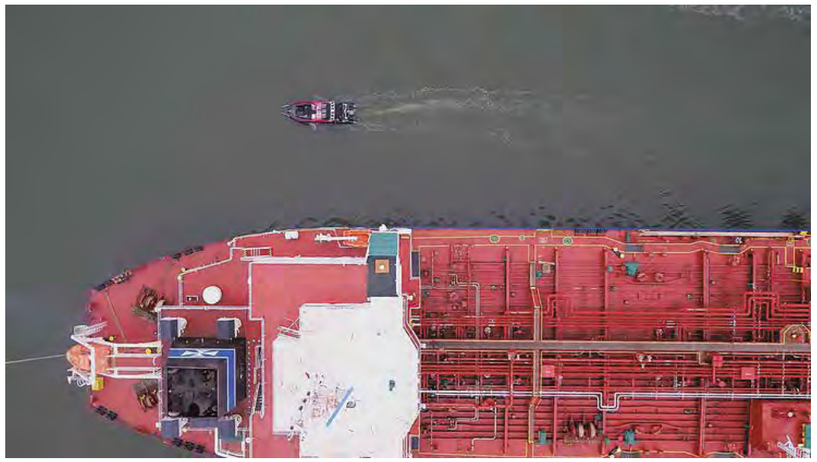
Salinity measurements were performed to calculate the draft of the ships. Since the locks of Ijmuiden mix the fresh and salt water, it has an impact on the difference in draft of the ships before and after the locks. Two methods were used for the salinity measurements. First the manual way by collecting a water sample and then the digital way using an AML Sound Velocity Profiler. Both methods surprisingly gave almost the same results. In the end this data in combination with the multibeam-derived depth will be used to examine whether a ship can pass through the lock or has to be made lighter.

be mounted on the USV depending on the vessel's hull depth or what is the recommended distance between the USV and the vessel in order to maintain high positioning accuracy. Since this was a preliminary experimentation with such equipment from both the Port of Amsterdam and Seabed, further investigation and experiments are needed in order to get desired results for all the possible scenaria that could take place in future similar surveys. Finally, we can conclude that the employed setup is possible to provide a clear 360 deg live view. The recording is possible too, but it requires a lot of hard disk space.

LiDAR data above sea level



Combination of Multibeam and LiDAR data



Telemetron scans the hull of a marginal vessel (Maritime Robotics, 2019)

Conclusions

Prior to the data processing, the surveying team gained experience that was sufficient enough to come up interesting conclusions. Several decisions are really crucial and must be carefully taken before starting the survey, like in what depth should a multibeam

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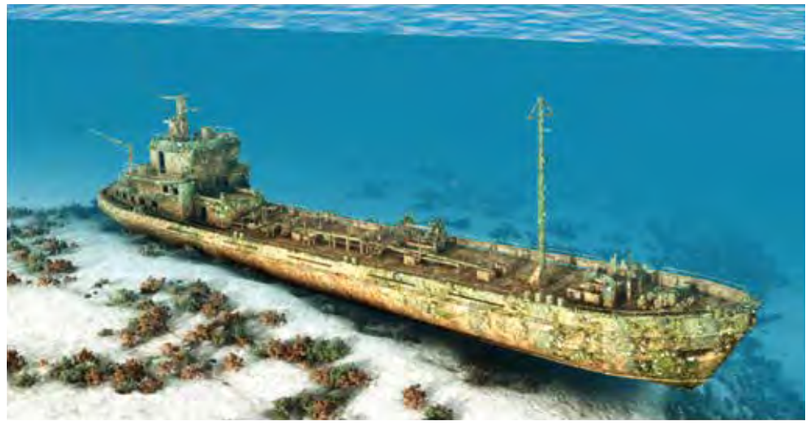
Client tales #2

Ocean Maps offers a complete Digital Twin solution running on smartphones, tablets and PCs. The Digital Twin EASY is based on accurate surveying data and allows the digitization of hydroelectric power plants including buildings, machinery and operating data, and the inspection of underwater structures, dams, quay walls, bridges and wrecks. EASY can be used for the reduction and prediction of maintenance cost, knowledge, data and safety management, as well as training for workforce. Detailed information is collected about the condition of underwater, indoor and outdoor structures, and can be reviewed interactively in 3D.
EASY's high definition visualization of existing or planned structures makes it a perfect tool also for public relations and communication with governmental bodies.

The cooperation with SEABED allows Ocean Maps to provide a variety of surveying and inspection services. Using SEABED's equipment pool in addition to own equipment makes it possible to always provide the appropriate high-end sensor technology for each project, and to deliver the highest quality of data and visualization to our clients.

OCEAN MAPS®

Details of a Power Plant in the Alps



Famous "Sea trader" Wreck at Stuart Cove´s Bahamas

From airborne to sea How Gyro Mounts conquer the oceans

For precise airborne surveying and blur-free images taken from above, they have become indispensable and an established part of the overall equipment: Gyro Stabilization Mounts. Installed into the fuselage of aircrafts, they compensate for its roll, pitch and yaw movements to keep the sensor in a leveled position. This is particularly relevant with regard to extreme weather conditions, as they enable data acquisition under turbulent environments. For maritime applications, the devices are a novelty so far, but this is about to change. What advantages do these units offer?

Pitch and roll are constant challenges for data acquisition missions, even in marine environments

SOMAG AG Jena has been developing and manufacturing Gyro Stabilization Mounts since 2004. In the meantime, more than 550 platforms have been sold all over the world. This proves the significance of these devices, which have been used mainly for airborne applications so far. The gyro stabilizers save time, money and enable an efficient work flow. For this reason SOMAG AG Jena works mainly as an OEM partner for well-known camera and LiDAR manufacturers like Vexcel Imaging, Phase One Industrial or Riegl Laser Measurement Systems.

Not only in the air but also at sea, pitch and roll movements of boats, ships or USVs caused by the swell present a challenge for data acquisition processes. If sensors are mounted without stabilization, they are exposed to the movements of the vessel, which results in numerous sources of error. For image acquisition, this means that the images are not aligned to each other, data gaps occur or the images are blurred. This in turn can require more time-consuming post-processing. For video cameras, a stabilized field of view is essential in order to keep the object to be captured in focus and to be able to evaluate the recordings. For LiDAR systems it also means ranging errors due to the occurring movements.

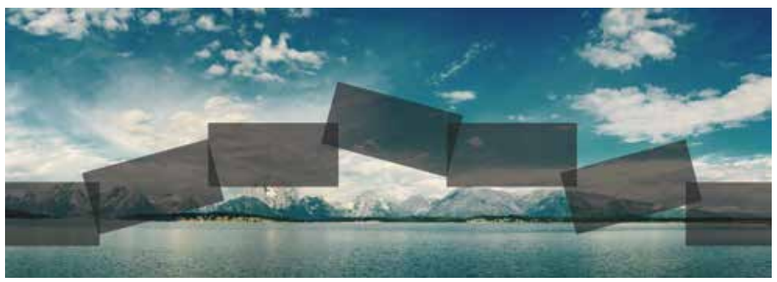


Figure 1: Unstabilized data example of marine and land camera

High-quality capturing with precise gimbal systems made in Germany

For this reason, the German company started developing a range of Gyro Stabilization Mounts specifically for marine applications to precisely stabilize sensors in extremely harsh environments four years ago. The two axis gimbals actively counterbalance vessel movements and ensure a drastic motion reduction of the sensor on top. The results are perfectly aligned images, less image smearing, a stabilized field of view and an increased ranging accuracy for LiDARs.

Figure 2: Stabilized data example of marine and land camera

Gyro stabilization also offers advantages for surveillance tasks. Electro-Optical/Infra-Red systems are usually used for this purpose, as they provide both visible and infrared wavelengths for situation awareness by day and night and under low-light conditions. Image stabilization is also of crucial importance here, since EO/IR systems are mostly used in mobile applications and must be able to detect moving objects under difficult environmental conditions.

Versatile devices that are compatible with a wide range of cameras and scanners

SOMAG AG Jena currently has two different devices in its portfolio which meet different requirements. The smaller device is the RSM 400. With its electromechanical gimbal system the mount compensates roll and pitch up to ≤±15.5° and stabilizes payloads up to 15 kg. By the use of stronger engines even payloads up to 35 kg can be stabilized. The innovative round shape of the base plate allows the adaption of a wide range of cameras and scanners, making the device very versatile for various applications. An example of how customers use the device is in conjunction with a panoramic thermal image camera. This combination is used as part of a collision avoidance system on a USV. The system allows the vessel to detect and automatically avoid static and moving obstacles.

“We realized another interesting project last year when we received a request from South East Asia to deploy our device on a buoy. The aim is to monitor a coastline with a PTZ camera”, explains CTO Sebastian Schreiber. „We have developed various concepts and presented them to the customer. Normally the sensor is located on top of the platform; in this case we decided to fix the camera by means of a frame underneath the RSM 400. Every project is different and the needs and requirements of each client are unique. We already experienced this from our work in the airborne sector. It is particularly important for us to offer tailor-made solutions for every customer. Many years of market experience, our engineering know-how and our position as an independent supplier enable us to react with a high degree of flexibility. Basically, our devices can stabilize anything as long as it meets the specifications of our Gyro Stabilization Mounts. It would also be possible to stabilize antenna arrays or wind measurement systems which are mostly the heart of floating LiDARs. In order to demonstrate the practical use of our units we offer the possibility to rent them for a certain period of time or to perform test series together with our engineers at the customer's site under real operating conditions”, Schreiber continues.

Figure 3: RSM 400 stabilized panoramic thermal camera

Figure 4:
RSM 400 with PTZ camera installed on a buoy

With high-quality materials and a weatherproof design, both the RSM 400 and OSM 4000 are made to last. They are salt- and splash-water resistant and have an extremely rugged housing. In their regular configuration the units can be operated at -15 °C outside temperature. By installing additional heating elements, an operation down to -35 °C can be realized. Like all SOMAG devices, the marine stabilization platforms can work automatically and independently due to their internal gyros but can also process external IMU data. For all gimbals SOMAG AG Jena provides a self- developed Mount Control App which allows the user to control the mount manually, to run various features, to update the firmware and to perform a self-test for a quick status analysis. Schreiber says that the team is already working on a new device. Various customer enquiries have shown that there is great interest in the industry for a mid-range device between RSM and OSM that can stabilize payloads up to 60 kg. The device will be available from QIII 2020.

For further information and technical specifications please visit our website: **www.somag-ag.de**

Figure 6: OSM 4000 (left) and RSM 400 (right)

First choice for marine environments through high-quality materials and a robust design

Last year, SOMAG AG Jena developed and launched a brand new, larger stabilization unit. The OSM 4000 with its hydraulic gimbal system stabilizes unprecedented payloads up to 160 kg and offers a mounting space of Ø600 mm.

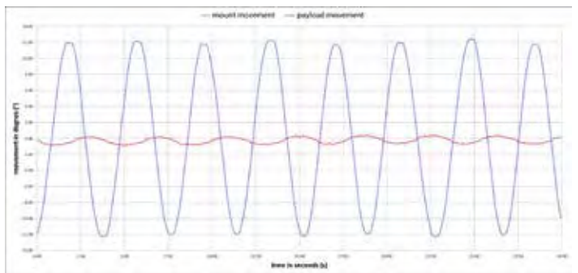


Figure 5: The data above shows the performance of the OSM 4000 in one axis (roll movement in this case). The Mount got stimulated by a sinusoidal movement with a peak at round about ± 12.00 degree. The stabilization unit reduces the residual movements of the payload to ca. ± 0.45 degree peaks whereas more than 95% of the initial motion is compensated.

About SOMAG AG Jena

SOMAG AG Jena is an innovative, medium-sized and worldwide operating specialist for high-precision gimbal systems. The company develops and manufactures Gyro Stabilization Mounts for airborne, land and marine applications. The stabilization platforms improve the quality and efficiency of geodata acquisition processes and surveillance.

In addition to its own devices SOMAG AG offers engineering services, like the design of adapter frames or passive damping systems. Great importance is attached to easy handling and long durability of the products. The company is certified according to DIN EN ISO 9001:2015, which reflects high-quality standards. The headquarters of SOMAG AG Jena is located in Jena in Central Germany, where the products are handmade and tested with highest precision. The company also has distribution partners worldwide.

Meet...

Mark Gerhards
Teamleader Operations

Date of birth? And what is it you like to do on your birthday?
My birthday is on May 10th and I like to celebrate my birthday with family and friends.

Single, in a relationship or married?
I'm in a relationship with my girlfriend and we have two children.

Any hobbies?
Going out for a drink or eat with friends and from time to time play poker. I like to play different kind of sports, especially karate.

Fast food, bistro or Michelin starred restaurant?
I really enjoy a Michelin starred restaurant once a year but I'm more often in a Bistro. And off course I eat fast food because that's my children's favorite.

Netflix or the cinema? And what is your favourite TV-series or movie?
Netflix. Games of Thrones is a fantastic series!

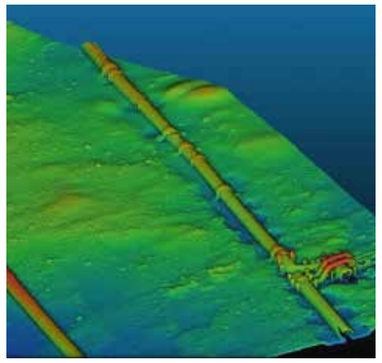
What kind of job did you want growing up?
I can't remember I had a favorite job. I was very enthusiastic with karate but unfortunately you can't make your job of it.

What is it you like most about your current job?
The company, my colleagues, the nice ambiance and the never ending challenging world where we are working in. A day is never the same and I really enjoy to make and create new things with the Seabed team.

What do you learn from your colleagues?
Seabed is a great company with nice colleagues with different disciplines. Every day I learn a lot because we have a group of people who wants to teach and learn to achieve a higher level.

If you would win the lottery, what would your life look like?
Living my life like I do and keep on enjoying it!!

Client tales #3



Travaux-sub is a small company based in Geneva, active in underwater construction, diving and survey.

Specialized for several years submerged structures investigations and inspections, mixing acoustics, diving operations, data collections and analysis, we offer documented results to engineering offices and project managers.

The Geneva Industrial Services (SIG), the public water distribution company, developpes a vast geothermal project (Génilac) using water from lake Léman.

The objective is to create a sustainable solution to cool and heat buildings in the city. The construction has been started for a few years with different steps including, for the underwater part, new water catchment, the laying of a new pipe network (from 20cm to 2m diameter) and the recovery, modification and connecting of old pipes.

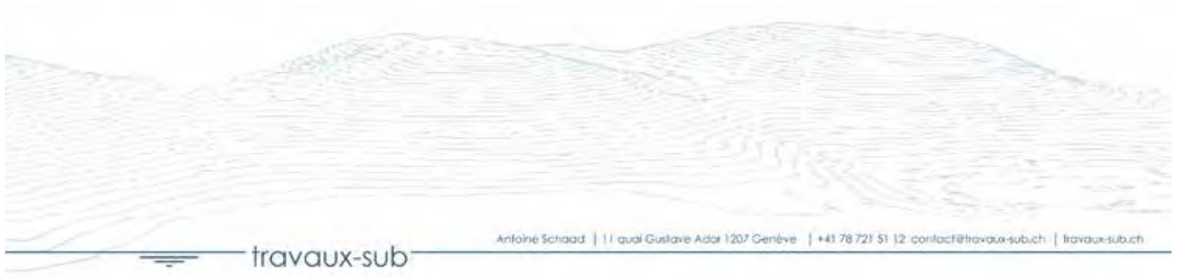
Travaux-sub has been working on the study and construction since the start of this project. In collaboration with lake work companies, we carry out a lot of diving operations for pipe connecting, assistance with laying pipes and their anchoring and inspections. We also perform the bathymetry and the resulting analyzes.

Mandated for underwater investigations as part of new pipes implantation study, Travaux-sub advise and initiate a multibeam bathymetry to establish the first observation step: a high-resolution digital terrain model.

We asked Seabed engineers to implement a Norbit iWBMS STX sonar session, for the calibration and the perfect parameter settings of the devices during the acquisition. The results are very precise, and I recommend the Seabed team for their commitment, their professionalism and the good collaboration with us to carry out this survey.

Travaux-sub process the data allowing the digital 3d inspection of the structures on the points of interest, the extraction of the profiles and the choice of layout plan by the engineering office. A difficulty on this site is the presence of massive macrophyte herbaria. We have worked on a procedure to detect them, delete them and create a new interpolated surface.

This survey allows a detailed observation which define our diving inspection guidelines to complete the study. We thank Seabed for their responsiveness, their experience and their mastery of the equipment. See you next time!



Skilltrade e-learning

Skilltrade wanted to offer easier access to Hydrography Training and therefore developed 3 interactive on-line structured e-learning courses and 2 interactive tests that can be followed by anybody interested in the subject at hand. These modules are also a part of the Hydrographic Survey Category B Course.

Skilltrade offers the following, hydrography and geodesy related E-learning:

- Mathematics
- Physics
- Bathymetry
- Geodesy
- Global Navigation Satellite Systems

The Mathematics and Physics modules are designed to test the students' knowledge of these subjects as required at the entry level for the Skilltrade Hydrographic Survey Category B Course. On the theory slides the student can also find links to specific modules from the worldwide renowned Khan Academy to enhance their knowledge. The other 3 modules. Bathymetry, Geodesy and GNSS are presented as a Power Point video with an overlay of spoken instructions. The study load is approximately 40-50 hours per module.

Level

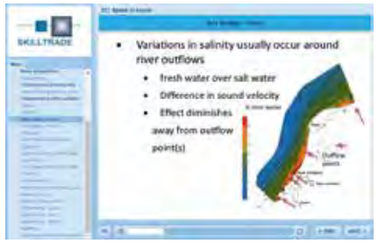
Mr Huibert-Jan Lekkerkerk, lecturer and developer of the Skilltrade e-learning modules: "The theory that is presented in these e-learning modules is actually a little bit above Cat B level. As we include slightly more complicated computations that could have been part of a Cat A level course. We have done this to allow these modules also to be used for continuous professional development. The theory in these slides is the complete theory for these subject according to the Standards Of Competence For Hydrographic Surveyors S5(B). Here and there it is extended to include certain additional topics we found useful from a practical perspective. Each of these theoretical modules is accompanied by a self-assessment the student can do in his or her own time."

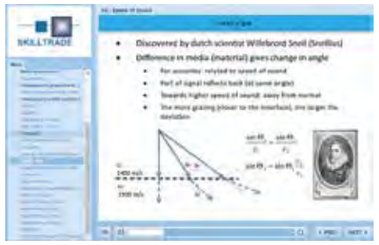
Advantages e-learning

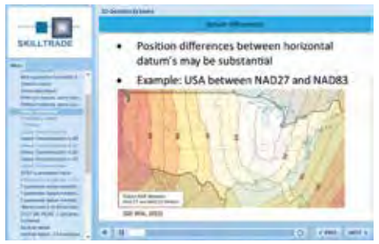
E-learning has boomed over recent years to become a very popular method of learning. This makes sense: E-learning is convenient and flexible. As long as the student owns a computer and has at least once an internet connection, it doesn't matter in which part of the world he or she is and what time it is or with our modules even whether the student has online access when they wish to study. The Skilltrade modules are also followed offline available through an app on a mobile device once downloaded initially. This way learning can be done on the train, on a plane or during downtimes at work. Whilst a student used to be confined to the classroom, the whole world, including any offshore survey vessel or remote dredging project, can now be their classroom. A student will be able to immediately apply the new knowledge on the job, he will be able to make connections and learn more effectively.

Another advantage is that the training is tailored to the student: If a student feels he or she already knows a particular area well and doesn't need to spend an hour on it again, then they can skim over it and concentrate that time on something they feel they need to work more at. This way everyone is able to learn at their own pace.

Furthermore e-learning is cost effective; no more travel and accommodation expenses for employees. The IHO requires







that a Cat B course last at least 26 weeks. With the addition of the 13 weeks e-learning programme we have minimalized this this down to only 13 weeks in class room including a week of offshore recognized safety training. In 2008 the Skilltrade Cat B programme first received recognition by the FIG-IHO-ICA International Board on Standards of Competence for Hydrographic Surveyors. Skilltrade received continued recognition for 6 years for their updated curriculum, which includes the 13 weeks e-learning programme, in April 2016.

Interaction

A potential limitation of online learning is that it may feel like a solo act. The e-learning platform is not a one way road, Skilltrade has added interaction and made it more personal. The student can connect with the experts through e-mail. Huibert-Jan Lekkerkerk: "Not every student likes to do self-study alone. Sometimes they have questions which they cannot solve for themselves. To prevent that a student gets stuck in a module, we offer e-mail support. On a daily basis our teachers check the e-mail box and they try to answer the question a student has". The student can also connect with his or her fellow students from all over the world.

Furthermore we offer the possibility to subscribe for tele-conferencing sessions based on a fixed schedule. Both the student and the trainer can monitor progress through the E-learning system. As each E-learning lecture is accompanied by an interactive assessment, after answering the questions the results is immediately available from the E-learning system.

Hydrographic Survey Category B Course
The students of the Skilltrade Hydrographic Survey Category B Course have to complete their e-learning before continuing their study in The Netherlands.
The Cat B students are positive about the e-learning: it gives them more time to digest the subject matters and relieves the pressure during the theoretical, on-site part of the Cat-B course in IJmuiden.

SKILLTRADE

www.skilltrade.nl

www.seabed.nl

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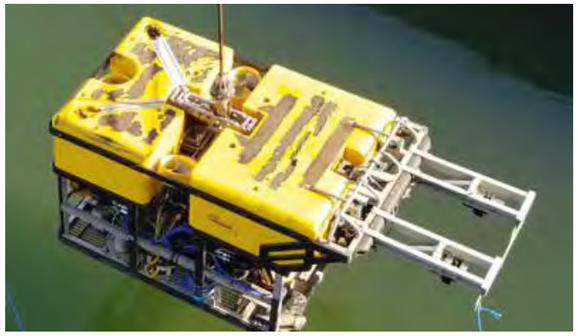
SEABED

Getting to the bottom of things

NORBIT and Jan De Nul Group, ROV Dual Head and STX Testing



Jan De Nul Group provide a wide variety of services in shaping the future of both land and water, offering a wide range of complex projects ranging from largescale offshore dredging and reclamation projects in the Fossil fuel and renewable energy sectors, to all kinds of potential civil and environmental works onshore.

The project was run from Zeebrugge, Belgium. A port town located 20 minutes from the city of Brugge, on board the vessel 'Willem De Vlamingh'. The 'Willem De Vlamingh' was built in 2011 as a Cable and umbilical Installation Vessel, meaning that it was built with a high transport capacity allowing for very large and very long subsea cable and umbilical installations. Additionally, the Ship can be equipped with trenching tools so that it is able to be used for the execution of both cable laying and trenching scope projects, drastically lowering the costs of projects by removing the need for additional mobilization.

The ROV used for the project was an STD Quasar. A medium sized work class ROV with a depth potential of 4000 meters. The ROV was equipped with dual NORBIT WBMS sonars, IXBLUE Rovins, Trimble GNSS and NORBIT GUI 10.3.6. and was mounted on a NORBIT bracket and held by an aluminum frame.

The results showed that all systems performed as expected and without fault, with timing values, trigger and TSS1 all being verified.

Following this an STX system was setup for multidetection of a plastic box. The system used was a NORBIT iWBMSh STX equipped with NORBIT GUI 10.3.6 (10.4 Multidetect) as well as QPS with 3D view for on board the vessel. The System was mounted onto an aluminum plate and held over the side of the vessel by attached ropes and attempted to detect a plastic box that was lowered in detection range of the system.

The results once again showed that all system had performed without fault, with the plastic box clearly detectable on the QPS 3D view with the box visible at all depths during its descent and ascent.

NORBIT

A world's first: offshore floating solar farm installed at the Dutch North Sea

Oceans of Energy successfully installed the first modules of the world's first offshore floating solar farm in the Dutch North Sea in November. The system has already survived the first winter storms, including "Ciara" and "Dennis".

"I am very proud of this success, our team at Oceans of Energy and our partners. Together, we made it possible to install the first floating solar farm modules in the North Sea. The first offshore solar system for open seas in the world is now a fact, making us a pioneer in offshore solar energy generation. Clean energy generation without using land is needed, now and in the future," says Allard van Hoeken, founder and CEO of Oceans of Energy.

The system is designed and tested to withstand 13 meters high waves and it has already survived several storms, including extra-tropical cyclone "Ciara" and storm "Dennis" in February 2020; up to 62 knots of maximum wind speeds and 5 meters maximum waves.

Scaling up

The modular system was increased in size in January from 8.5kW to 17kW, and further expansion to 1MW is planned for the modular system. Oceans for Energy says that a 100MW system could be supported and offshore solar could supply half of the Netherlands total energy demand using less than five percent of the Dutch North Sea. Without an offshore solar system, the Netherlands could not run 100 percent on sustainable energy. *"There is not enough space on the land for that."*

A key feature of the system is that space could be used within existing and planned offshore wind farms. *"The great thing about the combination of offshore sun and offshore wind turbines is that you can generate five times as much energy on the same part of the sea, and by combining these two you get a more stable and continuous power generation: it blows harder in winter and there is more sun in summer,"* says van Hoeken. Further synergies arise through the collective use of components such as the grid connection to land, maintenance and installation works. Offshore solar is expected to arrive at the same low cost level as offshore wind presently is.

Environment

The technology interacts positively with the environment in several ways and the company, together with Universities and Research Organizations, is researching further implementations to improve ocean health. The floating platforms provide new substrate for all kinds of organisms; they act as protective habitat for juvenile fish, increasing overall biodiversity and present opportunities to the local fishing industry. Also, the platforms can facilitate the growth of mussels and seaweed at sea. The systems that are currently deployed in the North Sea are subject to extensive monitoring. The effect of shading on primary production is negligible, as the tides refresh the water below the platforms continuously. With respect to organisms living on the sea floor, the effect of shading is zero, as sunlight never penetrates to the bottom of the sediment-rich waters of the North Sea.

Worldwide application

Half of the world's population lives in coastal areas, where offshore solar can solve the land constraints of renewable energy.

Offshore floating solar farm doubled in size

World's first offshore floating solar farm installed at the Dutch North Sea

Islands and remote locations which have limited space on land, but have a lot of sea space around, can become 100% renewable using the sea, instead of using the current diesel generators. Offshore solar can result in an enormous contribution to the climate targets for each type of application.

"The first step has been made, the floating platforms are floating in the North Sea and have already survived several heavy storms. Our next aim is to expand to 1 MW, the modular system is designed such that we can grow the installations towards 100 MegaWatts and more" says van Hoeken. "By having the first offshore solar system operational in one of the roughest seas in the world, we expect to create a large positive impact worldwide. Currently we are progressing towards the next phase, the upscaling phase. We are now raising the investments required."

About the project 'Zon op Zee (Solar-at-Sea)'

In 2017, six Dutch companies and Research Organizations including TNO, MARIN, ONE-Dyas and Oceans of Energy started with the development, construction, testing, and operation of the first offshore floating solar utility at open sea in the world. The first 17 kW of the modular system has now been installed in the North Sea, and this will be expanded in the coming months towards a 50 kW pilot that will be operational during a testing period of a year.

Oceans of Energy

Oceans of Energy is a young Dutch company that specializes in offshore solar energy, the associated mooring technology and environmental research. The company was founded in 2016 and has since grown towards a team of 10 FTE. 'Develop by doing' is the philosophy. Learning and improvements are achieved not only by developing ideas from our strong offshore background and experience, but also through real life testing, building and going offshore. The company has raised to-date 3.5 MLN EUR in funding and will raise, in a forthcoming round of investment, capital for the upscaling of production and projects.

Average wind speed and solar irradiance data for the Dutch North Sea

Oceans of Energy

Survey in Lake Geneva

Scanning the survey area

Lake Geneva, Lake Léman for the French, is one of the largest lakes in Western Europe. With a surface area of 580.03km², an average depth of 154.4m a maximum depth of 310m and its beautiful clear glacial water the lake of Geneva is not a bad environment for a survey.

To end the year of 2019 Seabed was asked by Travaux Sub to perform together a survey of the surroundings of the harbor of Geneva. Travaux Sub is a diving company which also does, amongst other underwater works, underwater metal construction. With numerous projects in Switzerland, France, on offshore sites in the Atlantic or in Antarctica they have gained experience on working with various marine structures, such as: dams, bridges, ports, locks, pipes, ships and platforms. The contracting authority of this project is the SIG (Services Industriels de Genève) which supplies its customers with 100% renewable electricity, 32% of which is produced locally, mainly with the Verbois Dam, which is built nearby the lake of Geneva.

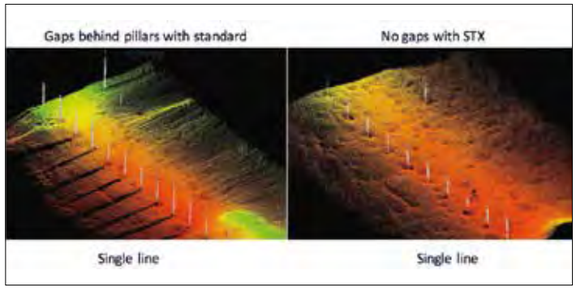
In The area which needed to be covered there are already a few pipes and cables. Part of the purpose of the survey was to find out where the current pipes and cables are exactly placed and if they are in the way of the future pipe/cable.

One of the challenges of this survey was the fact that there are a lot of underwater plants and currents. The plants were mostly present in the shallow areas. The client told us that the plants have always been there so we would just have to cross our fingers that the current would flatten them down do we could still have an idea of what the lake floor looks like.

Survey area

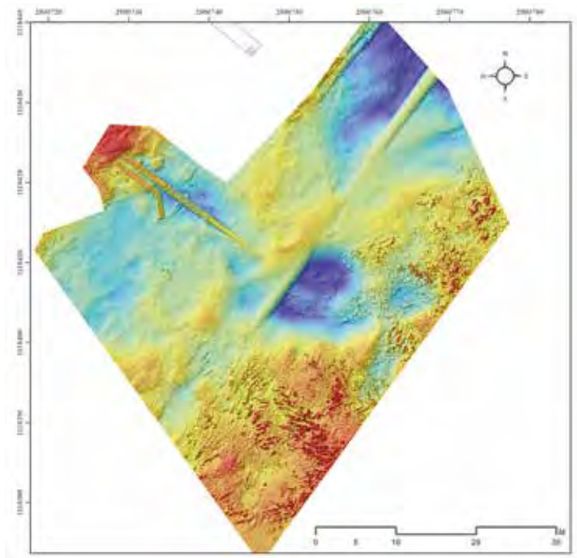
Survey Equipment

The multibeam used for this survey was the Norbit iWBMS STX. The client specifically
asked for the STX because of its special 'Sweeping' function and high accuracy.
By sweeping the beams the STX can 'look' behind objects which is perfect for object detection in our case pipes and cables.



STX case study (Norbit website)

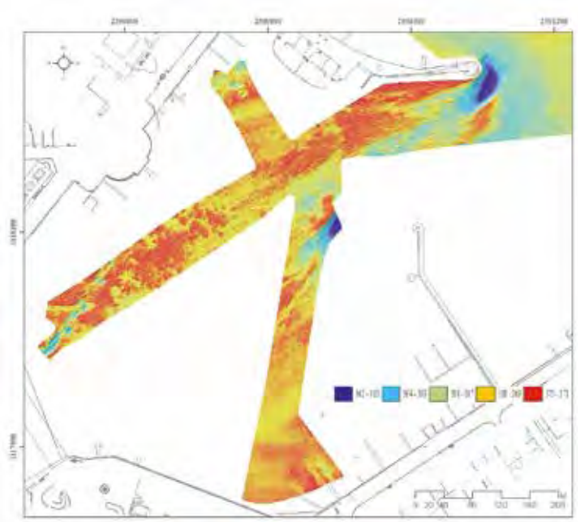
For more information about the STX see the article "NORBIT STX Multibeam sonar solution for 3D & 4D bathymetry operation" in the Seabed Gazette 2018.



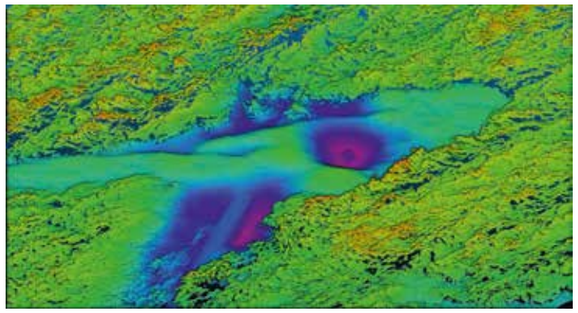
Kempinski: connection area of the pipes

Results

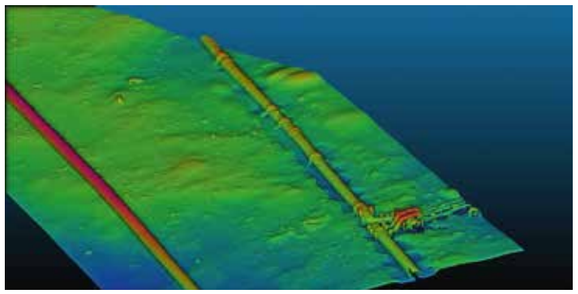
First we surveyed the whole area with the normal function and after that we went back to the points of interest and surveyed them again but this time with the STX on. Which resulted in some pretty nice pictures of the data.



Area of high intertest with a lot of plants and currents



Crater next to Y / Mtblanc connection area



Cluster of old and new pipes

SV vs. CTD

Why Your Sound Speed Measurement Method Matters

By Jehan Zouak and Chris Bueley

It's an age old question (Okay, maybe not that old): Should I collect sound speed data for my hydrographic survey with a CTD or a Sound Velocity (SV) profiler? What's the difference?

How does a CTD profiler measure sound velocity?

A CTD profiler measures three parameters: conductivity, temperature, and pressure (depth). These parameters are considered fundamental because they form the foundation upon which seawater can be characterized. Measurement of these parameters enables the calculation of a host of characteristics, most notably density and salinity. Another quality that can be obtained from conductivity, temperature, and pressure data is sound speed which is calculated through an empirically derived formula.

What is an empirically derived formula?

An empirically derived formula is created from correlations observed in data rather than from proven theoretical derivations.

How does an SV profiler measure sound velocity?

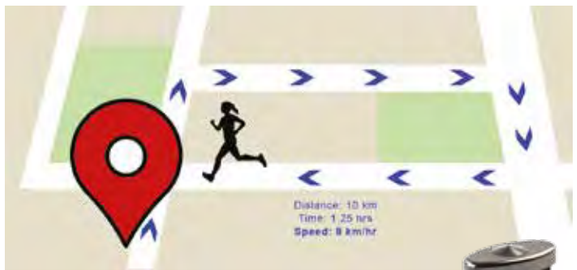
AML Oceanographic (then Applied Microsystems Ltd.) released the first time-of-flight (TOF) sound velocity sensor in 1995. Unlike CTDs, which rely on an empirically derived formula to calculate sound speed, the measurement methodology of a TOF sound velocity sensor is based on physics and first principles. TOF sound velocity sensors have improved in form and function over the years, but the core physics behind the technology remain the same.

To measure sound speed, the sensors time an acoustic pulse as it transits a known, fixed distance. Speed of sound in seawater (or in any fluid) is then determined just as one would calculate the average speed of your morning run: speed = distance/time.

What are first principles?

First principles are theories supported by established science. Associations are made through derivations rather than assumptions made through observations as they are in empirically derived formulas.

Here's how you'd determine speed on a morning run:

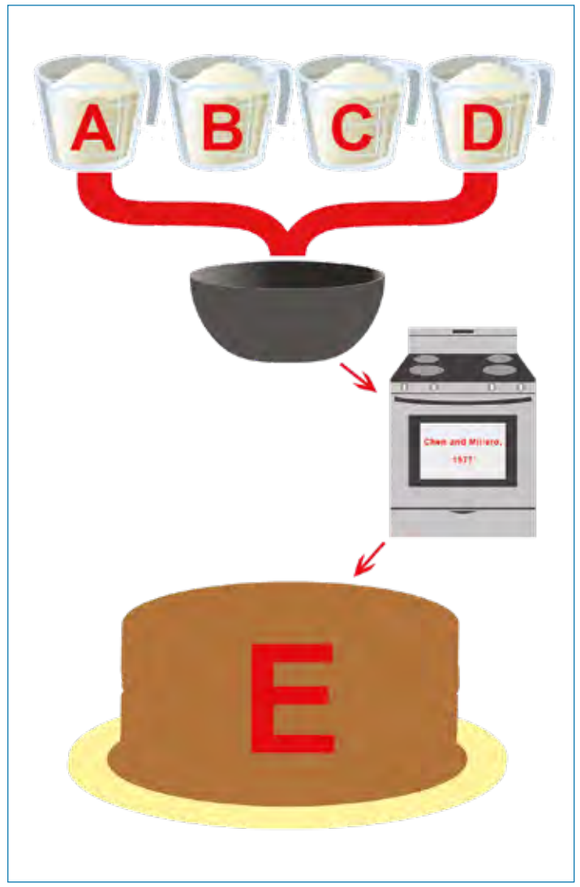


And here's how you'd measure sound speed using the same principles on a TOF sensor:

You'll notice that the only value being measured is time; not conductivity, not temperature, not pressure. The sensor relies on first principles rather than an empirically derived formula. For this reason, TOF sensors are fluid agnostic – they work in any liquid be it orange juice, tomato soup, or vodka (Yes, we've tried this).

Which is more accurate?

CTD-derived sound speed measurements have four primary sources of error. The individual measurements of conductivity, temperature, and pressure (depth) each have respective error margins. Those inaccuracies, combined with the limitations of the empirically derived formulas used to calculate sound speed from CTD data, result in a generally agreed upon accuracy limitation of 0.25 m/s. In addition to having their own accuracy specifications, each parameter has a different response time which can further exacerbate the issue.



The consolidation of various parameters and equations brings the accuracy of CTD-derived sound velocity to 0.25 m/s.

Typical CTD Error Margins

A: Conductivity measurement = 0.003 mS/cm
B: Temperature measurement = 0.005 °C
C: Pressure measurement = 0.05 %FS
D: CT&P conversion to Salinity = 0.01 ppt
E: CTD-derived Sound Velocity accuracy: 0.25 m/s

Sound velocity sensors measure directly, rather than an amalgamation of different measurements. If you remember from the previous section, sound velocity sensors use a basic distance/time relation to calculate speed. This relation assumes of course, that total distance is known.

It should be noted that the total path length of a given sensor is not known at the time of manufacture. For a sensor to produce accurate results, the path length must be known to an extremely high accuracy; an accuracy which cannot be achieved by direct ruler measurement. To put this into context, a path length measurement error on the order of half the width of a human hair would yield a sound velocity measurement error well beyond the sensor's accuracy specification.

Ruler measurement won't cut it when tolerance is less than half the width of a human hair.

It's all about the calibration.

The path length of a given sensor is determined during its calibration process. Calibration is done by submerging the sensor in a fluid in which sound speed is known to a very high accuracy, referred to as a reference fluid. In our case, the reference fluid is distilled water. We use distilled water because the relationship between sound speed and temperature is described to a very high accuracy by the work of Bilaniuk and Wong[2]. With baths of distilled water at a known pressure, sound velocity can easily be calculated as a function of temperature. With this process, we back-calculate the path length. This provides the unique path length for each sensor which is then programmed into the sensor's memory.

The accuracy of modern time-of-flight sound velocity sensors is limited largely by the available reference fluids. The best equation to date yields an SV reference accuracy of 0.02 m/s2. As it is not possible for a sensor to have an absolute accuracy that exceeds (or even exactly meets) its reference standard, sound velocity sensors have a generally accepted accuracy of 0.025 m/s. This accuracy specification encompasses the reference fluid's accuracy limitation plus a bit of 'wiggle room.'

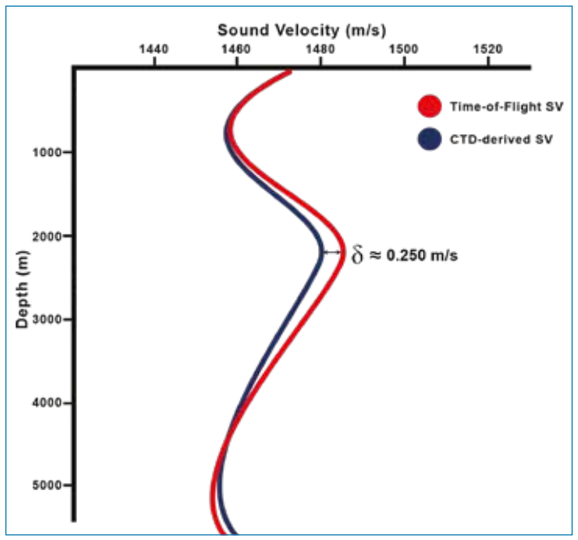
Measuring Flight Time

As the method's name implies, the time it takes an acoustic pulse to travel over a fixed path length – the flight time – is a key element of time-of-flight sound velocity. Time is measured in nanoseconds to achieve the required precision.
How does the sensor measure time with such precision? The timing technology behind modern sound velocity sensors is adopted from GPS applications. As would be required for any technology launched into space and expected to provide accurate data for years, the timing technology is extremely precise and stable.

Contrary to popular belief among some CTD manufacturers, CTDs are not used as reference standards during the calibration of sound velocity sensors. Why? Simply put, they aren't good enough. Why would you use a reference that can only provide accuracy to 0.25 m/s when there is a reference that is ten times more accurate?

So, which should I use?

For hydrographic surveying, TOF sound speed sensors are the way to go. Beam steering and refraction correction demand highly accurate sound velocity. CTDs can't compete with the direct measurement of TOF SV for accurate sound speed measurement.



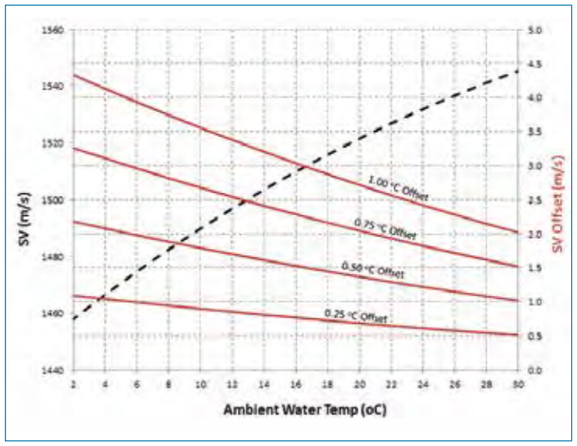
Sound speed profiles obtained with a CTD can result in significant errors. TOF sensors can provide a more accurate picture of the water column, providing better multibeam data.

Another important, but less discussed factor, is robustness. Even if CTD-derived sound velocity data were as accurate as time-of-flight sound velocity, CTDs are generally not suitable for measuring sound speed at the multibeam transducer face. Why? They're too fragile. The sensing structures of CTDs are typically made of glass or ceramic; far too delicate to withstand the rigors of being installed on the underside of a ship hull. A TOF sound speed sensor, in contrast, is typically made of titanium and carbon fibre.

Sea Chests

Most users install their sound velocity probe at the multibeam transducer face, but some prefer to install their probe within a sea chest. This facilitates easy installation and removal, and also protects the probe from the aforementioned impacts to which probes installed on the hull are vulnerable.
Installing your sound speed probe in a sea chest has trade offs, however:

- The water velocity inside the chest will be different than outside the vessel. This can create a thermal lag between sound speed seen at the sonar acoustic face and that measured by the probe.
- The water temperature inside the chest is quite often warmer than outside the vessel due to thermal shedding. A small change in temperature will result in a large change in sound velocity.
- Sensors in a sea chest are more susceptible to fouling due to the reduced flow of water.



Sound speed in sea water is extremely sensitive to temperature. For example, a temperature difference of 0.5°C at an ambient water temperature of 6°C will yield an SV offset of 2 m/s!

There are, however, a few reasonable arguments for using a CTD for water column profiles:

1. Oceanographic data: If you are collecting data for more than hydrography, you probably need a CTD. Remember, Conductivity, Temperature, and Pressure (Depth) are the parameters that form the foundation from which a long list of characteristics can be calculated. CTD is the basis for all TEOS10 equations.
2. Continuity: With CTDs having been the best tool for sound velocity measurement for decades before TOF SV instrumentation came along in 1995, continuing to use CTDs allows data to merge with decades of historical data.
3. Backscatter data: Accurate salinity calculation is required to determine absorption coefficients. Salinity is most often calculated from CTD measurements.

There is one small yet important fact I have not mentioned: We're not in the '90s anymore!

Profilers equipped with both CTD and TOF Sound Velocity sensors have been on the market for years now and they become more compact and easier to use with every generation. So even if you do need CTD data for scientific applications or historical continuity, it doesn't have to be at the expense of hydrographic performance. Use a combined CTD-SV instrument and satisfy all requirements.

Minos•X combined CTD&SVP is known for its rugged performance and ease of use.

This article was originally published in The Steered Beam, AML Oceanographic's blog. For more articles on best practices in hydrographic surveying and other applications, visit:
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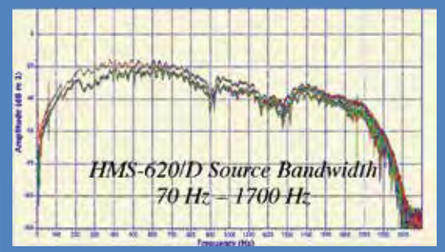

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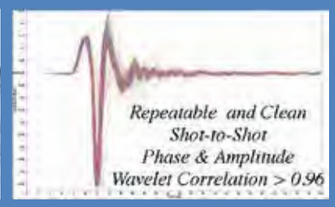

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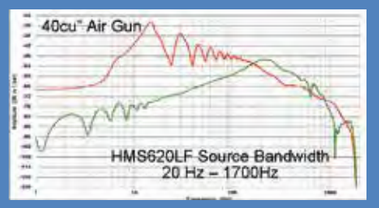

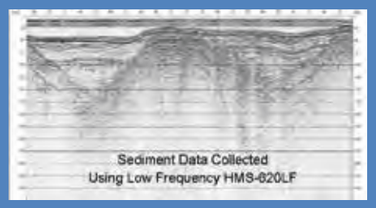

TYPICAL APPLICATIONS

- Coastal Engineering
- Bedrock Investigation
- Harbor Expansion Surveys
- Shallow Gas Hazard Surveys
- Geotechnical Site Investigation
- Pipeline and Construction Surveys
- Offshore Wind Turbine & Dam Site Surveys

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Sensors – Systems - Transducers

On a clear day in Budapest

On the 29th of May 2019 catastrophe struck when The Viking Sigyn cruise ship hit the Mermaid, a 27 meter river cruiser that operated on the Danube river. As both vessels passed the Margaret Bridge near the Hungarian parliament building in Budapest. Once hit, the vessel sank within only 7 seconds.

The Mermaid was a Moskvitch-class river cruise boat with two open decks and a capacity of 45 passengers for sightseeing. She was built in the Soviet Union in 1949 and had her engine replaced in 1980 by a Hungarian company. She had been used for regular cruises on the Danube since 2003.

Medical response units arrived within 10 minutes after being notified of the accident, and immediately began with search and rescue efforts. These were complicated by the conditions, there were high water levels due to a lot off rain fall in that period. This caused fast-moving water between 10-11 kilometers per hour with a temperature of 10 to 12deg.

Only seven of the 35 people on board were rescued, some bodies were quickly recovered, but others were swept away in the swollen river or trapped inside the vessel. The vessel was carrying South Korean tourists when it was hit by a cruise ship and capsized, killing 28 people. The seven rescued South Korean tourist were taken to local hospitals where they were treaded for hypothermia and shock.

The Hungarian police launched a criminal investigation into the collision, the Viking Sigyn's captain, 64 year old Ukrainian national was detained on suspicion of reckless misconduct in water traffic leading to mass casualties. It appeared that the fatal crash in Budapest wasn't the first accident the captain was involved in, just a few months earlier he was behind a similar collision in the Netherlands. For a comprehensive investigation, the investigators contacted all co-authorities of the Danube states and the Dutch Police.

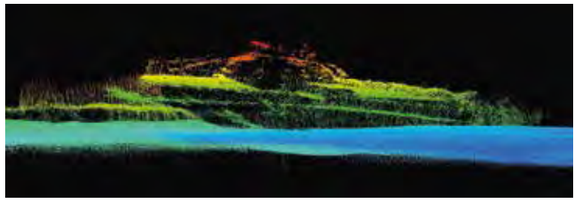
The Ministry of Interior and other government agency's asked 60 experts for assistance and to help experimenting to find a "unique" method to salvage the sunken tour boat and rescue the bodies trapped inside. The South Korean government also send emergency rescue workers to aid the Hungarian effort.

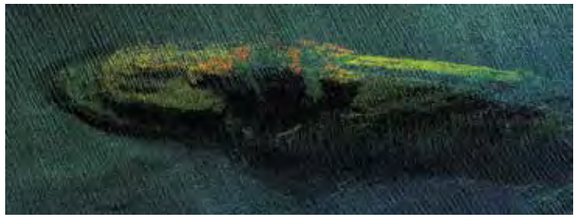
Seabed was one of the teams onsite, the role that Seabed had was obtaining and processing MultiBeam data of the wreckage so the condition of the hull and the condition of the riverbed could be made visible for the dive and salvage experts. For this survey Seabed used the Norbit integrated Wideband 1deg STX multi-beam. This STX Multibeam improves the efficiency of the survey by utilizing scanning that allows seeing behind structures which otherwise give shadows and gaps so it was much easier to get more detailed images of the Mermaid.

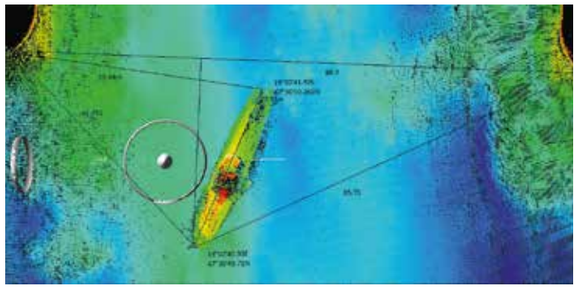
After all the data was collected and studied the officials devised a plan to excavate the wreckage in the safest way possible. Damage was visible to the rear part of the Mermaid where the collision occurred. The lifting of the vessel from the water was planned in several stages, depending on factors such as the condition of the hull and the discovery of bodies.

Since the accident divers had been unable to enter the submerged boat due to the strong current in a river swollen from weeks of rain. The plan of the authorities was to use a crane vessel with a 200-ton lift capacity, to lift the sunken ship from the bottom of the Danube. The arrival of the crane ship was delayed by the flooding of the river, the equipment was unable to pass under several bridges. It wasn't until a week after the disaster that the floating crane arrived in Budapest. On 11 June lifting of the Mermaid began. Previously the salvage operation had focused on fixing wire harnesses underneath and around the vessel to prepare it for hoisting. The floating crane raised the boat from waters beneath the Margaret bridge and was reported via live television coverage.

The boat was finally deposited on a barge by the floating crane. Thereafter, the wreck of the Mermaid was transferred to a secure location to further police, nautical and technical examiners.







Sea level monitoring using satellites over time

Source: Yopi Ilhamsyah, 2019

It was already in the 90s when an important study took place about the percentage of people who were living along coasts. The result was really impressive as almost half of the world's population was living within 60 km of the shoreline and it was increasing over time (Turner et al, 1996). Taking into account the dynamic behavior of the water environment and the frequent changes of its level which could pose a threat for the human life, people had to overstep and find reliable ways of measuring the sea level globally. As the established tide gauges were not enough neither to cover all the residential areas nor to predict possible abrupt changes over the world, people decided to use the satellite technology and set specific satellites in orbit, known as altimetry satellites, which can monitor the sea level globally with high accuracy. Nowadays, more than 10 altimetry satellites have been and are being launched, giving us important information about the sea level changes, the ice melting and the correlation between them. It is really outstanding how many crucial-for-sustainability questions have been answered thanks to this technology.

But what is an altimetry satellite and how does altimetry work? Is an altimeter a modern invention? Let us have a look in the past!

Louis Paul Cailletet[1]

The altimeter is an instrument that measures vertical distance with respect to a reference level and it has been invented by the French physicist Louis Paul Cailletet. It can give the altitude of the land surface above the sea level or the altitude of an airplane/satellite over the ground. Cailletet was also the first to liquefy oxygen, hydrogen, nitrogen, and air in 1877. He had been studying the composition of gasses given off by iron in the blast furnace of his father's ironworks. (Mary Bellis, 2019)

Paul Kollsman[2]

In 1928, a German-American inventor named Paul Kollsman changed the world of aviation with the invention of the world's first accurate barometric altimeter, which was also called the "Kollsman Window". His altimeter converted barometric pressure into the distance above sea level in feet. It even allowed pilots to fly blind. (Mary Bellis, 2019)

Radio Altimeter

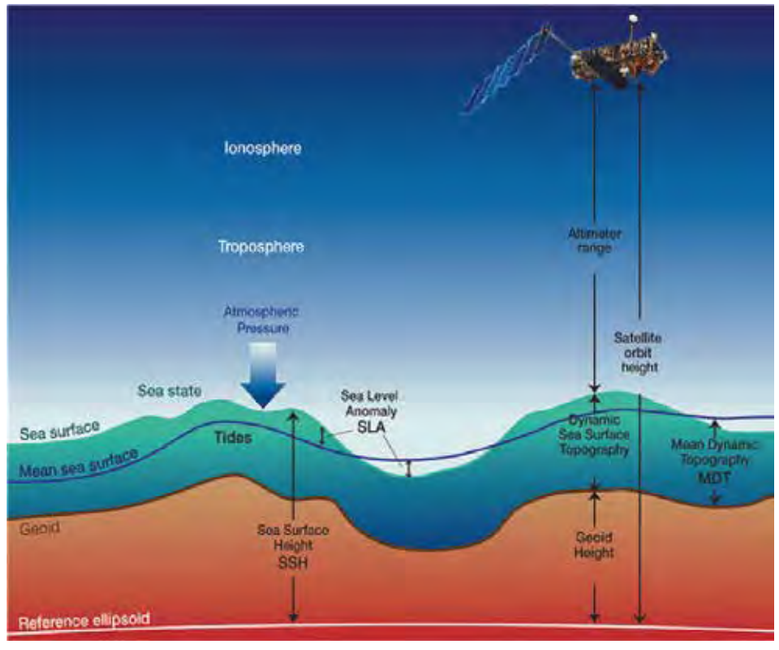
Lloyd Espenschied[3]

Lloyd Espenschied invented the first radio altimeter in 1924. Espenschied was a native of St. Louis, Missouri who graduated from the Pratt Institute with a degree in electrical engineering. He was interested in wireless and radio communications and worked for telephone and telegraph companies. He eventually became the director of high-frequency transmission development at Bell Telephone Laboratories.

The principle behind how it works involves monitoring a beam of radio waves transmitted by an aircraft and their time to return as reflected from the ground to calculate altitude above the ground. The radio altimeter differs from the barometric altimeter in showing altitude above the ground rather than above sea level. That is a critical difference for improved flight safety. In 1938, the FM radio altimeter was first demonstrated in New York by Bell Labs. In the first public display of the device, radio signals were bounced off the ground to show pilots the altitude of an aircraft (Mary Bellis, 2019).

Altimetry technique

The satellite altimeter is an instrument which is mounted on the satellite and it is capable to collect useful sea level information. The principle is based on the transmission of radar waves and the analysis of the return signal. In more detail, it measures the amount of time these waves need to bounce off the sea surface and return to the satellite antenna. This measurement provides a wealth of information that can be used for a wide range of applications – in particular, for understanding sea-level rise. The surface height, then, is the difference between the former measurement and the satellite orbit height with respect to an arbitrary reference surface (a rough approximation of the Earth's surface is the reference ellipsoid) (Radar Altimetry Tutorial and Toolbox, 2020).



The principle of radar altimetry for retrieving sea level parameters[4]

[1]MEMIM Encyclopedia, 2020; [2]LW, 2018; [3]Engineering and Technology History wiki, 2020; [4]Noor Nabilah Abdullah, 2018

Satellite altimetry missions (AVISO, 2020)

Satellite altimetry missions

In 1969, the feasibility of a new discipline, known as space oceanography, by radar instrumentation was discussed for the first time at the Williamstown congress. It is interesting that satellite altimetry was initially designed to measure sea level by a combination of radar technique (used to measure the distance from the satellite to a reflecting surface) and a positioning technique (allowing a very precise location of the satellite on its orbit) (ESA, 2018).

GEOSAT (GEOdetic SATellite) was launched in March 1985, and ended its mission in January 1990. Its primary task was to measure the marine geoid for the US Navy, but it also provided measurements of sea state and winds which proved to be useful for operational Navy purposes. (AVISO, 2020) GEOSAT carried a radar altimeter capable of measuring the distance from the satellite to sea surface with a relative precision of about 5 cm (Wikipedia, 2020).

In 1987, CNES and NASA formally created a partnership for a joint project involving French and American instruments, on an American satellite to be launched by a European rocket and this is known as Topex/Poseidon. In 1991, ESA launched ERS-1, which carried several instruments including a radar altimeter. During the Topex/Poseidon mission, new altimetry missions were launched: ERS-2 (1995), GFO (1998), Jason-1 (2001) and Envisat (2002). This allowed the data combination of different altimetric missions, leading to higher spatial and time resolution. Missions like ESA's CryoSat -2 (launched on 8 April 2010) and Copernicus Sentinel-3 (launched on 16 February 2016) use synthetic aperture techniques (delay-Doppler Altimeter) that "can be seen as" a beam-limited instrument in the along-track direction (ESA, 2018). Furthermore, Copernicus Sentinel-6A satellite is being prepared for a scheduled launch in November 2020.

Thanks to the fast processing systems, nowadays, we are able to get near real-time altimetry data-derived forecasts with high accuracy. It is achieved through their assimilation into models, in combination with other data, like in-situ, water temperature and salinity. After recording altimetry data for more than 20 years, it is vital to continue improving the spatial and time resolution, which will help us out to describe and understand better the dynamic water system of our planet, but also to keep monitoring the sea level change and the ice thickness or periods of freeze (AVISO, 2020).

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Meet...

Niels van Wijk
Engineer

Date of birth? And what is it you like to do on your birthday?
01-12-1991. I like to celebrate my birthday with family and friends.

Single, in a relationship or married?
I am in a relationship

Any hobbies?
Electrical engineering is my biggest hobby, like programming on my laptop or a raspberry pi. I recently bought a small 3D printer, so that's a new hobby of me. I also like to go out or go to festivals with friends.

Fast food, bistro or Michelin starred restaurant?
All three I think. But I have never been to a fancy Michelin starred restaurant.

Netflix or the cinema? And what is your favourite TV-series or movie?
Both. I like films and series. The series that I am watching now is The Big Bang Theory. I really like that show. For a movie I think the classic Blues Brothers.

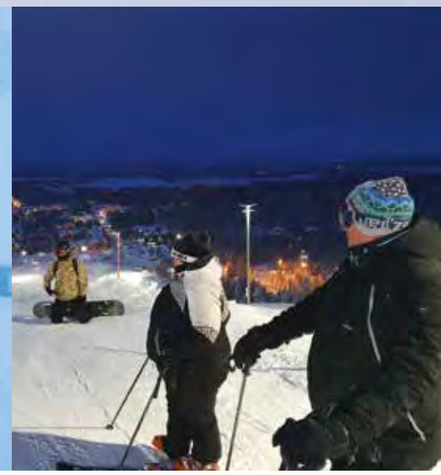
What kind of job did you want growing up?
I always knew I wanted to do something with electronics. As a kid I was already playing with battery's, lights and motors and trying to connect everything. Sometimes I broke some devices, like an alarm clock what I wanted to work on too high a voltage.

What is it you like most about your current job?
I like the diversity in projects and the development of electronics or software. Finding new solutions to make things better.

What do you learn from your colleagues?
I learn a lot from my colleagues. For example about all the equipment we sell, how to give support to customers and all kinds of survey related things.

If you would win the lottery, what would your life look like?
I think I would buy a bigger 3D printer.

Seabed goes Arctic



Comparing the performance of vessel-mounted current profilers with fixed-point instrumentation

Vessel-mounted current profilers are changing the face of oceanographic measurement, offering similar performance to fixed-point profilers in a more flexible package. But how do they stack up in a direct comparison? Nortek and its clients were recently able to find out.

The ability to gather data from acoustic Doppler current profilers (ADCPs) has been renewed with the new Nortek Signature VM ADCP. It opens up the possibility of assessing current patterns across multiple depths over a wide swathe of ocean in a relatively short time, in a more simple way than before – and resulting in better data.

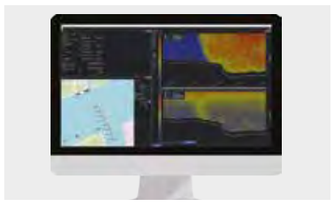
These vessel-mounted ADCPs have undergone rigorous ocean testing at the development stage, but a comparison with longer-established technology in an operational setting helps to confirm what they are capable of.

So, when a survey vessel equipped with Nortek's Signature VM 500 kHz profiler was working in the Belgian North Sea close to two buoy-mounted current profilers, Nortek arranged to carry out comparative tests.

The Signature VM was mounted on the state-of-the-art survey vessel Geo Focus, owned by Dutch hydrographic surveying firm Geo Plus. The vessel was contracted to Van Oord, another Dutch firm, which needed to study sea conditions affecting a new offshore wind farm it was building.

Satellite altimetry missions (AVISO, 2020)

Signature VM Coastal



Challenge

Until now, ADCP surveys have been complex and time-consuming processes. Essential to securing a successful survey has been access to highly skilled and specialized personnel, such as technical engineers and senior surveyors. Hardware set up is unique for each vessel, and this leads to concerns about serial-port interfacing, time synchronization, heading offsets, cabling and mounting. A miscalculation in connection with one or more of these factors may lead to errors that affect the final data quality.

Solution

Data quality can be safeguarded, and both errors and initial installation time can be substantially reduced, by using state-of-the-art and user-friendly vessel-mounted technology. The Signature vessel-mounted package delivers vessel-mounted ADCP survey capabilities based on present-day technology. This solution opens up new and unprecedented opportunities to the scientific community while offering operational convenience and reduced complexity.

The Signature vessel-mounted package is composed of:

- Signature 500 or 1000 kHz AD2CP
- 19" processing unit
- Ethernet GNSS heading compass
- VM acquisition and processing software
- Fairing instrument bracket and cabling

Highlights

- A coherent system that is quick and convenient to operate
- Fifth echosounder beam for sediment measurements down to the bottom
- Ethernet ADCP and GNSS hardware offering tight network timing
- Concurrent current and depth information in one place, at the same time
- Outstanding bottom-track performance, even under challenging conditions
- Straightforward data-acquisition and processing software

Visit us on stand G200 at Oceanology International in London.

A Nortek Aquadopp Profiler mounted in a TRIAXYS™ with Currents Buoy

On 7 April 2018, a series of current measurements was carried out using the Nortek Signature VM when it was adjacent to each of the two buoys, which were located around 4 km apart. The Signature VM data was then compared with the current measurements made by the Nortek Aquadopp Profiler 400 kHz current profilers attached to each of the buoys.

The Nortek Signature500 VM, hull-mounted on the vessel Geo Focus

Close data correlation

The results have been published by Nortek, Van Oord and Geo Plus in a report, which is accessible on Nortek's website. They show that the Signature VM was able to produce readings that correlate closely with those from the buoy-mounted profilers, as indicated by the tables in figures 1 and 2, taken from the report.

Northern buoy	Mean current speed	Mean direction
Signature VM 1	0.70 m/s	40.96°
Signature VM 2	0.75 m/s	38.17°
Buoy-mounted Aquadopp Profiler	0.74 m/s	39.35°

Fig. 1. Two sets of results recorded by the Signature VM around 6:00 a.m. close to the northern buoy, followed by one taken on the buoy at the same time.

Southern buoy	Mean current speed	Mean direction
Signature VM 1	0.57 m/s	220.45°
Signature VM 2	0.56 m/s	219.20°
Signature VM 3	0.54 m/s	217.74°
Buoy-mounted Aquadopp Profiler	0.61 m/s	214.80°

Fig. 1. Two sets of results recorded by the Signature VM around 6:00 a.m. close to the northern buoy, followed by one taken on the buoy at the same time.

"The tests went well, and our clients told us they were happy with the outcome," says Herman Huitema, Nortek's Product Manager.

The report concluded that the recorded differences were minimal and well within the tolerances that may be expected when measuring from moving platforms. That the vessel and data was close to but not recorded at exactly the same time and position as the buoys also helps account for any small variations.

"Sea conditions were calm, which was important for an accurate comparison. In more unsettled seas, the buoys would move around quite a bit, which would affect their readings, even if a survey vessel may not be so badly affected," Huitema adds.

Global deployments

The Signature VM has operated successfully in a wide range of conditions since its launch in 2017. Coastal research, port and harbor mapping, studies of tidal currents and sediment transport studies are among the instrument's main uses.

It is fitted with five beams for current profiling throughout the water column and depth measurements. It also has outstanding bottom-track ability.

Demand looks set to expand. For example, current profilers are a vital tool for developers such as Van Oord in the fast-expanding offshore wind market. They need to know as much as possible about current conditions across a wide swathe of ocean to ensure that the scores of turbines that make up a wind farm are positioned correctly.

"A buoy-mounted profiler is designed to measure the current at a specific place for weeks, if not longer. But if you need flexibility for operational support or need find out more about currents in the wider area then a moving profiler is the best option," explains Huitema.

The Signature VM is also designed to be convenient and simple to use.

"The good thing is that it doesn't require much attention – you just switch it on at the start of the day and off you go," he adds.

Meet the Seabed Team

Evert Bootsman
Engineer

Anya Siemons
Financial Administrator

Niels van Wijk
Engineer

Ourania Altiparmaki
Surveyor

Hans Tuinman
Sales

Elice Collewijn
Sales

Mark Gerhards
Teamleader Operations

?

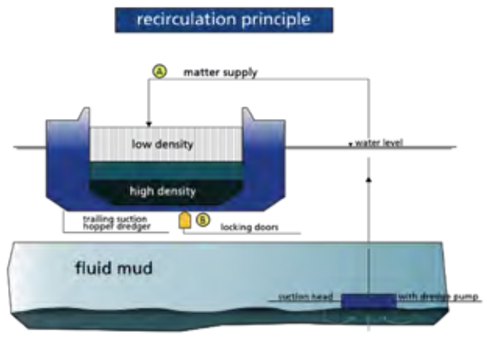
This could be your picture! Join the Seabed Team now.
Send an e-mail to sales@seabed.nl

DENSITY matters...

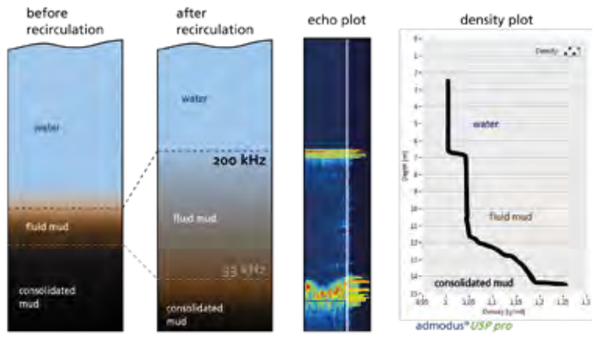
Port of Emden, Germany reducing dredging costs by 90%

In many of the world's largest harbours, appropriate hydrographic survey is a necessary requirement in order to keep dredging costs low. The port of Emden succeeded in reducing the dredging costs by 90% with the help of a new dredging management and hydrographic survey using the density probe admodus® *USP pro*.

In 1994, after many years of research, the port authority managed to maintain the fluidity of suspended sediments, which were carried into the harbour basin by the river Ems. This so called "sediment conditioning" is mainly based on the prevention of the fluid mud's reconsolidation process by a regular treatment (recirculation). As a result, these sediments no longer have to be removed from the harbour basin and a lot of disposal costs can be saved.



Recirculation principle



Fluid mud layer before and after recirculation.

The challenge:

How to monitor the density of this 'fluid mud' or measure the nautical depth in the harbour basin in a fast and reliable way, in order to guarantee navigability?

After 10 years of experience and development, admodus® MARITIME DEVICES released the new admodus® *USPpro* in 2013, with improved precision, ruggedness, better software and easier handling like the one-man-automatic-mode. The port of Emden was the first customer who purchased and still uses this device with great success.

Conclusion

A lot of maintenance costs can be saved by an intelligent dregding management. Investigations in recent years have shown, that ships can navigate safely through fluid mud layers up to a density of 1.15kg/dm³ at the port of Emden. This 1.15kg/dm³ horizon is often much deeper than the 200kHz horizon of an echo sounder. Thus, there is 'more water' under the keel with less dredging.

admodus® MARITIME DEVICES is a brand of Synergetik GmbH - Am Nusskopf 20 – 66578 Schiffweiler, Germany
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Hydrography – growing in importance

Safety for maritime traffic and harbours

International trade is booming, and shipping along with it. Given the ever growing quantity of shipments and the expansion of harbour locations, there is a corresponding increase in requirements for the secure maintenance of waterways and harbour basins.

In many of the world's largest harbours, appropriate hydrographic monitoring of suspensions accumulating as fluid mud, as well as sediments in the form of more or less consolidated silt, is a necessary requirement in order to keep dredging costs for maintaining a satisfactory nautical bottom[1] within commercially sensible limits.

Every year in Germany alone action taken to secure the prescribed water depth produces an accumulation of around 45 million cubic metres of dredged material, the disposal of which entails high financial and environmental costs. Accurately determining the nautical bottom allows for a considerable reduction in operating costs, since dredging work can be carried out more systematically and efficiently.

[1] The nautical bottom is defined as „the level where physical characteristics of the bottom reach a critical limit beyond which contact with a ship's keel causes either damage or unacceptable effects on controllability and manoeuvrability".
(Joint PIANC-IAPH Report on Approach Channels: A Guide for Design, Vol. 2, 1997)

admodus®

admodus® solutions for cost-effective waterway management

Echo-sounding is an internationally recognised technique for establishing the depth of a body of water. Dual frequency echo sounders such as the admodus®*SONAR* work with signals of differing frequency. Where there is a firm subsurface, both signals deliver identical readings for the depth of water, and in this case the readings correspond to the nautical bottom. However, if the results show greater variance this indicates the presence of sediment suspension: while the high frequency signal is dispersed at layers of low density, the low frequency signal penetrates through the suspended matter almost entirely, and is only reflected from deeper, more solid layers. Even though this technique succeeds in identifying accretions of low-viscosity suspended matter and fluid mud, it is not possible to determine the exact location of the nautical bottom. For this, an additional in situ analysis is required.

A method of analysis still frequently used, albeit one which is very time- and cost-intensive, is that of sampling combined with subsequent offline analysis in the laboratory.
An innovative and significantly more cost-effective option is the highly accurate online characterisation of suspensions and sediments achieved using the admodus®*USP pro* depth-profiling probe. The probe is lowered from the vessel, and can thus carry out real-time measurement of the density profile of the layers through which it penetrates, as well as record other parameters of rheological value. With the help of this profile, the nautical bottom can be established on the spot and with great accuracy[2].

[2]The nautical bottom can be defined area-dependently by a limiting density of approximately ρ=1.20 g/cm3.
„Determining the Nautical Bottom", Markus Jänen

Determining nautical depth in real time

The admodus®*USP pro* is an innovative in situ measuring probe for online monitoring of the nautical bottom in harbours and waterways. The system provides a depth-dependent density profile quickly and reliably, as well as a variety of other indicators for characterising suspended matter and sediments.

The probe is a robust and easy-to-use device made of seawater-resistant stainless steel. With its high inherent weight it can be used even in extreme flow conditions

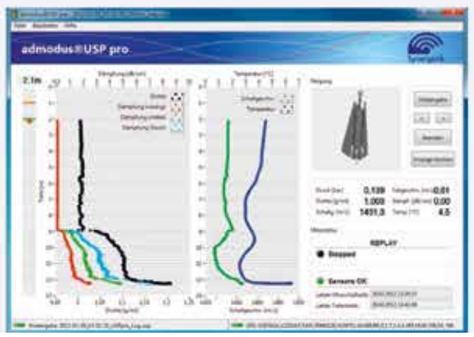
The admodus®*USP pro* is linked via high-speed Ethernet to a PC which displays all measurement data clearly laid out and in real time, stores them, and exports them as a PDF report as required. The user software features an automatic recording mode which permits serial measurements without interaction.

As the probe descends it continuously records its depth and inclination, as well as the density, frequency-dependent acoustic loss, speed of sound and temperature of the medium.

- Monitoring the navigability of harbours and waterways
- Supporting intelligent dredging management by technically efficient measurement
- Silt and sediment characterisation
- Analysis of fluid mud layers (e.g. in estuaries)
- Monitoring in sedimentation basins
- Investigation of sediment transport
- Online analysis in place of costly sampling

The measurement data ascertained can be stored together with the GPS data of an external receiver, so that the precise location of measuring points and a correlation with echo sounder bearings are both easily achieved.

The highly accurate point-by-point measurements achieved with the admodus®*USP pro*, combined with the area data capturing of the dual-frequency admodus®*SONAR* echo sounder, are one of the most accurate methods for hydrographic surveying currently available.



admodus®*SONAR*

Registering and recording sediment layers

The admodus®*SONAR* dual-frequency echo sounder is especially suited for hydrographic surveying of harbours, waterways and coastal water areas.

The admodus®*SONAR* can be operated as a self-contained echo sounder with a variety of different transducers. Furthermore, it can be used as a passive digital supplement to existing analogue echo sounders.

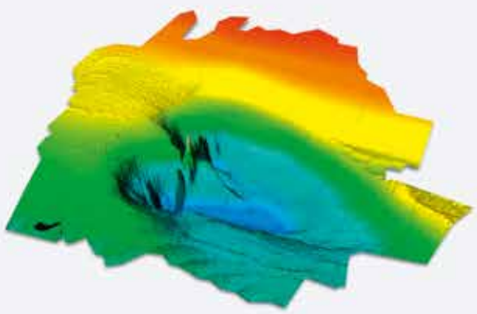
The single beam system with dual frequencies enables effective surveying of seafloor conditions, and of the different layer formations of suspended matter and sediments, ranging from fluid mud to well consolidated silt.

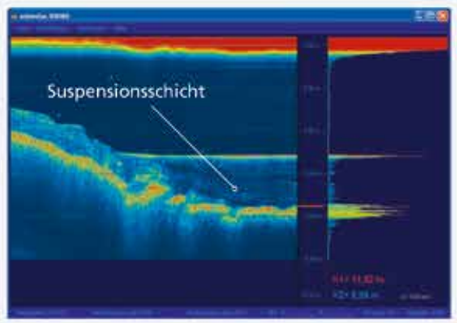
All data are transferred in real time to a computer via Ethernet, then visualised and stored. In addition, the admodus®*SONAR* user software provides an interface with widely available surveying software programs such as QINSy, WinProfile and Profile 2000, so that the horizons identified can also be externally recorded and further processed.

With its compact dimensions and the splash-proof design of its housing, the system is also highly suitable for mobile field work.

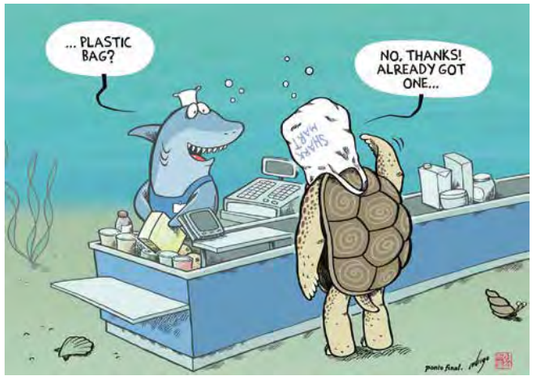
The area data capturing of the dual-frequency admodus®*SONAR* echo sounder, combined with the highly accurate point-by-point measurements achieved with the admodus®*USP pro*, is one of the most accurate methods currently available for hydrographic surveying.

- Hydrographic surveying of harbours, waterways and coastal water areas
- Area monitoring of fluid mud and silt layers
- Supporting intelligent dredging management by technically efficient measurement
- Creation of digital terrain models
- Digitalisation of existing analogue echo-sounder systems





Make them laugh



Did you know?

Scuba divers roll backwards out of boats. Because if they rolled forwards they would just go into the boat.

Puzzle

R	O	R	O	C	O	R	B	I	V
M	E	R	E	V	I	E	C	E	R
U	V	T	A	I	N	A	R	U	O
L	E	A	A	S	E	L	I	C	E
T	R	Y	S	W	S	L	E	I	N
I	T	N	N	E	R	M	A	R	K
B	N	A	A	T	J	E	A	B	E
E	N	O	H	P	O	R	D	Y	H
A	E	C	A	F	R	U	S	N	D
M	E	M	I	T	I	R	A	M	U

ANYA
ELICE
EVERT
HANS
HYDROPHONE
MARITIME
MARK
MULTIBEAM
NAATJE
NIELS
OURANIA
RECEIVER
SURFACE
UNDERWATER
VIBROCOROR

The object of the puzzle is to find the listed hidden words. The words may be hidden in any direction: horizontally, vertically, diagonally, forwards and backwards. The letters that remain make up a well known name.

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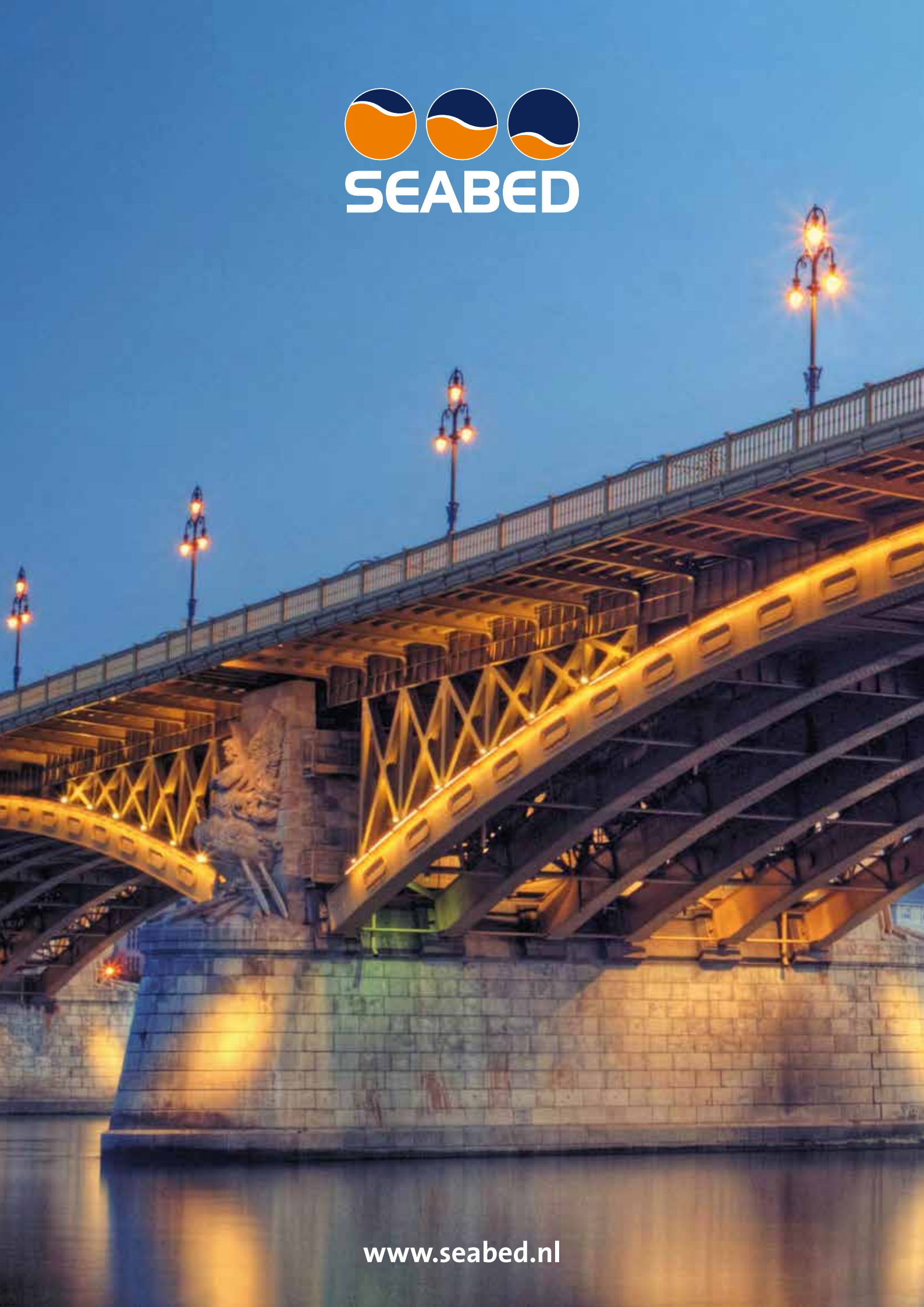
Design: RBREG Concept & Art Direction
Words: Elice Collewijn, Ourania Altiparmaki, Evert Bootsman, Ray Breg
Photography: Elice Collewijn, Stock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