SEABED GAZETTE

2019

Amsterdam Ordnance Datum (NAP)

Seabed goes Solar

15 years Seabed

SEABED

Getting to the bottom of things

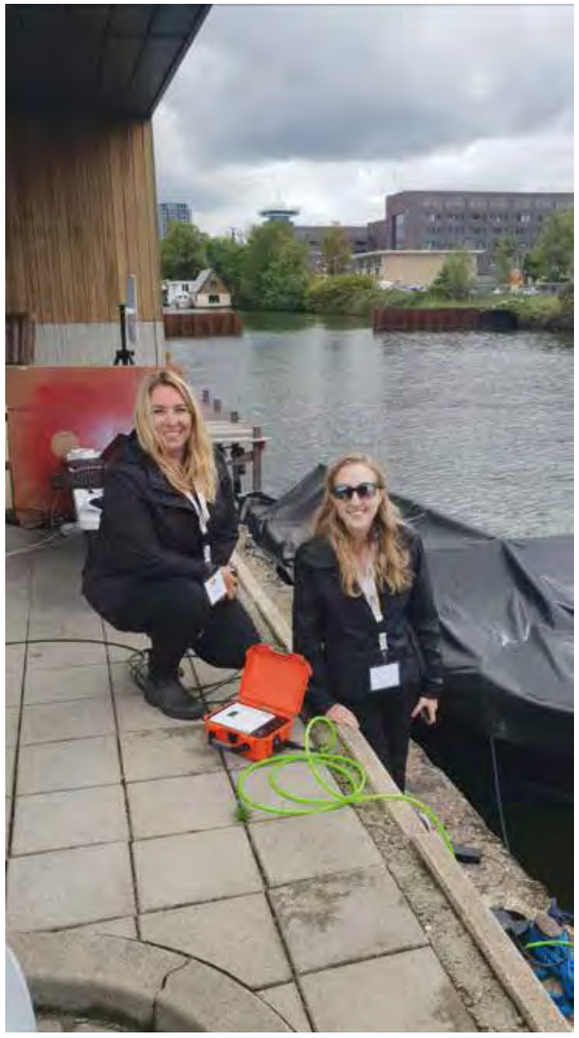
CONTENTS

Seabed end of Summer Demo Days 2018

On the 2018 demo days, Seabed was happy to introduce a new dealership with Maritime Robotics for the Benelux region. Maritime Robotics is the manufacturer of Unmanned Surface Vessels (USV). The Otter was demonstrated by a Maritime Robotics representative during the days.

But the Otter was not the only equipment demonstrated. We showed the Norbit IWBMS as well as the Norbit IWBMS STX multibeams, the Seabed inertial systems, the Admodus density probe, the Ocean Sonics hydrophone, the Seabed mobile lidar system, The AML X series instruments and of course QPS software. All brands send a representative to answer as many questions possible. The demo days are becoming a well known event to see the latest equipment and meet colleagues from the industry, and all of this while enjoying a drink and a snack.

Seabed is looking forward seeing you on the 2019 demo days on September 11 and 12.



Meet...

Maurice Buijsman
Business Consultant

Date of birth? And what is it you like to do on your birthday?
28 January 1968. For the last few years, I take my wife and two kids to go bowling at the bowling ally just around the corner. Big fun!

Single, in a relationship or married?
My wife and I are together for almost 20 years and have a girl of 13 and a boy of 11.

Any hobbies?
Music plays a big role in my life. I play some guitar, but I am definitely better at listening. And I like to read history, politics and economics. But I am also a big John le Carré fan!

Fast food, bistro or Michelin starred restaurant?
All of them! But that's just because I cannot afford to eat in Michelin star restaurants áll the time.

Netflix or the cinema? And what is your favourite TV-series or movie?
Both Netflix and cinema. Each year I spend at least one day at the International Film Festival in Rotterdam. Currently I am watching a lot of those Nordic detectives, like The Bridge.

What kind of job did you want growing up?
I wanted to be an Historian, but studied Economics and now I work at Seabed.

What is it you like most about your current job?
I don't have a technical background at all, but working at Seabed I realize I am much more interested in technical stuff then I ever thought. I learn a lot from our engineers and surveyors.

What do you learn from your colleagues?
As mentioned, I learn a lot about the technical part of our business, but, having worked for a lot bigger firm, I am now learning the dynamics of a small organization.

If you would win the lottery, what would your life look like?
I would eat in Michelin star restaurants all the time and buy my own multibeam.

Seabed goes Solar

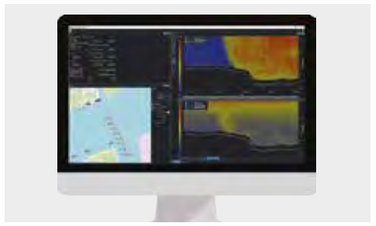
In September 2018, Seabed finalised a project to install solar panels on the roof of its office at the Asterweg in Amsterdam. With advice from the City of Amsterdam (Zonne-adviseurs), Seabed invested in solar energy for its own use.

All available space on the roof of the Seabed office, almost 85 m2, has been covered with 52 solar panels.
It's an investment that will be recovered in 7 to 8 years. In addition, the project may trigger further sustainable business development. Seabed expects that the need for electricity will increase, even naturally. For example, with the switch to electronic company cars. The current solar panel system has excess capacity for developments like these. Another option is to install large batteries. Seabed has investigated the possibilities but does not require this at the moment.

The 52 panels have a total power capacity of 16,900 KWp, generating an expected annual 16.055 kWh (950 kWh/kWp). This is some 20% more than our actual, annual, electricity consumption. Switching to solar power, Seabed will be reducing CO2 emissions with 11,2 tonnes per year!

Signature VM

Vessel-mounted current profiler



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 on 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" PC and interface unit
- Ethernet GNSS heading compass
- VM acquisition software
- Fairing instrument bracket and cabling

www.nortekgroup.com

Ocean Business 2019, Southampton

- **April 9:**
  09:30-10:30
  Product presentation in the Student Centre

  11:00-1200
  Vessel demonstration (RV Callista)

- **April 10:**
  10:30-11:30
  Product presentation in the Meeting Room 344/44

  13:30-14:30
  Vessel demonstration (RV Callista)

Please register at our Nortek booth: P10

How current profiling plays a role in China's maritime infrastructure drive

China's recent wave of infrastructure renewal has included a large portfolio of developments, such as ports and other developments, that have a subsea component.
Why is current profiling proving to be an essential part of these large-scale infrastructure developments?

Developing infrastructure – such as the Qingdao harbor seen here – has been an essentialcomponent of China's economic revolution. Accurate current profiling has been vital in the successful implementation of major maritime projects, ensuring that structures are built to the correct specifications.

Accurate, speedy and cost-effective current profiling has been vital in the successful implementation of major maritime projects, ensuring that structures are built to the correct specifications.

Nortek has been able to play a role in this side of China's economic revolution, through its collaboration with a subsidiary of China Communications Construction Company (CCCC), a Fortune 500 listed firm that has been at the forefront of the infrastructure drive.

Obtaining current measurements in a diverse range of scenarios

CCCC's hydrological surveyors have been using Nortek instruments on a number of projects over the last 12 years and so are well placed to assess how they perform in the field. They use both Signature1000 and Signature500 acoustic Doppler current profilers (ADCPs) to provide hydrological data that informs construction of ports and offshore developments.

Deploying the instruments as part of Nortek's Signature VM package enables the company to obtain measurements in a diverse range of scenarios. These scenarios include cross-section, multi-point, velocity profile measurements and fixed-point measurements for offshore platforms, ports, bridges and other structures in or near the sea, as well as establishing navigation parameters at specific locations at sea.

High data quality while reducing errors and installation time

The integrated package ensures high data quality and that both errors and initial installation time are reduced. The ADCPs and the linked software provide accurate profiles in conjunction with an Advanced Navigation GNSS compass mounted on the vessel, which provides navigation and heading data based on GPS.

"Without this essential data, as well as the verification of the mathematical model, the design and construction of ports and offshore developments would have no basis," says Wang Yan, Senior Manager of Hydrology of the Geotechnical Investigation Division at CCCC's Zhongjiao No.1 Hangwu Engineering Reconnaissance Design Institute.

The company has become a leading force in the field of coastal engineering construction in China. Since its establishment in 1958, it has been responsible for the survey and design work behind more than 4,000 projects, and has worked on over 100 projects ranked 1st in China.

Nortek staff in China mobilizing the Signature VM package under the attentive eye of end user Wang Yan, Senior Manager of Hydrology at CCCC's Zhongjiao No.1 Hangwu Engineering Reconnaissance Design Institute. As Signature VM is a straightforward plug-and-play system for current surveying, the crew were able to sail out for a test survey after only approximately 30 minutes of setup.

Operating in complex and diverse sites

Wang says the Signature ADCP's versatility makes it a good fit for the company, since the hydrological conditions and operating requirements at its sites are complex and diverse. He says the Signature's ability to work both at fixed points and while navigating, and to record measurements both online or as a self-contained unit, have proved invaluable.

The main task of Wang's hydrology survey team is to observe and analyze waves, tides and flows in different sea areas, to issue related reports and to provide basic data for the design and model checking of major offshore projects. Its work focuses include long-term and short-term observations of waves, fixed-point currents, nautical flows, sediment concentrations and tides.

Wang's team has used the Signature VM package in a range of projects. One of these projects encompassed current measurements for a new port in the vicinity of Caofeidian District, in Hebei, China.

"Our customer needed site-specific raw data of currents, waves, depth, turbidity, etc. for a new port in Caofeidian. Their purpose was to use the data to build a mathematical model for the port area. This was very important for the engineering work in connection with the construction of the new port and adjacent buildings," explains Wang.

His team selected two measurement sites according to their customer's technical requirements.

"We surveyed along these two sites back and forth in several rounds to obtain complete datasets of the whole tidal process in the area. Each round of measurements took about an hour, and we performed the measurements continuously 24 times, or almost 24 hours in total," says Wang.

"This was really a great challenge for the technical system, as well as for the people in my team who conducted the survey. But the results proved to be excellent," Wang adds.

Ease of use cuts down on manpower requirements

Signature VM is considerably less complicated to use than similar packages would have been a few years ago, when highly trained, dedicated technicians would have been required.

The relatively low skill requirements for using Signature VM means it can be deployed by a wide range of CCCC employees, Wang notes. Meanwhile, the ease and speed with which the ADCP can be attached to a vessel and then used to autonomously record multiple surveys saves time and so cuts down on manpower requirements.

"The instrument produces accurate measurement results, the whole vessel-mounted measurement process is relatively stable and there are few problems regarding bottom-tracking loss and GPS signal loss," Wang says.

Please contact us for further information and interviews:

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About Nortek

Nortek excels in the development and manufacture of acoustic Doppler instrumentation. Doppler Velocity Logs (DVLs) are used for subsea navigation. Acoustic Doppler Current Profilers (ADCPs) are used to understand physical processes in the ocean, rivers, lakes and laboratories.

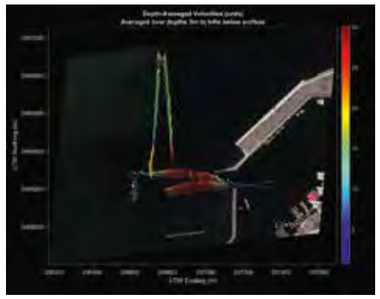
We pride ourselves on being innovative in product development and production processes. Nortek provides solutions to engineers and scientists by offering real-time data collection and support from our responsive technical team.

Nortek's headquarters are just outside Oslo, Norway, where R&D, product assembly and other main functions are situated. In addition, we have subsidiaries in the US, the UK, China, Japan, Australia, Brazil, France and the Netherlands.

www.nortekgroup.com

NORTEK

The Signature VM's ADCP as it is mounted for current surveying in Qingdao harbor.



Visualization of data showing current velocity and direction.

Exported data (in .kml format) showing the tracks sailed in Google Earth. The crew carried out so-called "lines" of current surveying inside and outside of the harbor to identify the differences in the currents' velocity and direction in these two locations.

Nortek China crew explaining the Signature VM software to end user Wang Yan of CCCC's Zhongjiao No.1 Hangwu Engineering Reconnaissance Design Institute.

Quit a journey! Picking up in 2004 from what was left after a technical bankruptcy of Seabed Technology B.V. based in IJmuiden to end up with the whole crew celebrating Seabed's 15th anniversary in Euro Disney Paris! A place were dreams come true!

A journey where Seabed had to reconnect with their clients, withstand two global recessions and had to respond to a shift in communication with client and suppliers due to the rise and use of the internet. During the first period Seabed transformed itself to a dedicated system integrator and product developer with an extensive product knowledge within the hydrographical and dredging market and other related areas. You might recognise or have been using some of our products: Seabed Crane System, the SVC500 Vibrocorer, the Orinoco Solo Tide Gauge, the DLS TP level system, the SGR line of GNSS receivers, the ILidar and the STM data interface.

At the basis of this success is off course the group of people that made it all possible. Without them the journey would not be as joyful, successful and colourful as we have been experiencing. Starting with a group of 4 dedicated specialists growing to a max of 22 people in 2009, we now hold a group of 8 specialist with a need to expand with 3 engineers in the months to come. The diversity in the group of people that we work with makes Seabed what it is in the present, was in the past and I am convinced it will continue in the future.

In the second part of the 15-year Seabed's strategy of being a value added partner for our clients and for the suppliers started to pay off. Our portfolio of dealerships and their products increased to the almost complete package we have now. We would like to thank QPS, NORBIT, AML, NovAtel, Synergetics, Ocean Sonic, Maritime Robotics, FSI, Subconn and Antcom for their constant trust, dedication and support in Seabed for being their motivated representative in the BENELUX.

Last but not least we would like to show our gratitude to all of our clients in the world that have been and still are using equipment delivered by Seabed. So, everybody who reads this: "Thank you from the BOTTOM of our hearts!" 😉

Artificial Island in Indonesia

KSO Ciputra Yasmin awarded Royal Boskalis Westminster N.V. in March of 2016 a contract to construct the land for the reclamation of the Centre Point of Indonesia Project located off the coast of Makassar.

With this new contract that is driven by the necessity to create land to accommodate population growth in a densely populated region, the construction of five artificial islands off the coast of Makassar will be reclaimed. Approximately 75 hectares of land will be reclaimed using 9 million cubic meters of sand sourced from offshore borrow areas. The islands will be protected by rock revetments.

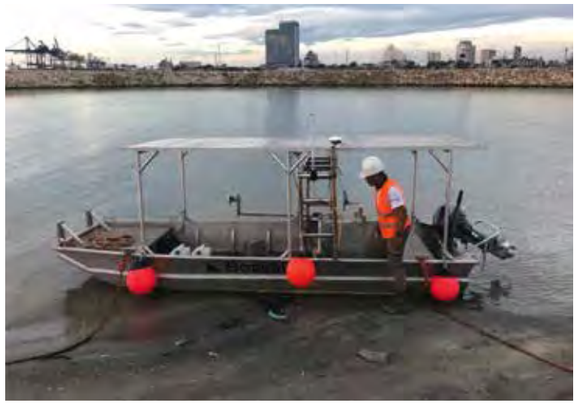
The construction of the five islands marks the first phase of a prestigious development by KSO Ciputra to provide high-quality waterfront land for both residential and commercial use.

Makassar is the largest city in the region of Eastern Indonesia and the fifth largest city in Indonesia after Jakarta, Surabaya, Bandung and Medan. The city's metropolitan area covers 2,5km2 and has a population of 2.4 million.

In the history of Makassar, the trade in spices figured a prominent role, which involved frequent struggles between rival native and foreign powers for control of the lucrative trade during the pre-colonial and colonial period, when spices from the region were in high demand in the West.

After Makassar's independence in 1945 it became the capital of the State of East Indonesia, part of the United States of Indonesia. By the 50s the population had increased to such a degree that may of the historic sites gave way to modern development, and today one needs to look very carefully to find the few remains of the city's once grand history.

The client asked a Seabed engineer to fly in with a Norbit IWBMS for installation and to perform an onside training of the Norbit IWBMS. For more information visit **www.seabed.nl**.



Seabed sponsors Maritime Institute Willem Barentsz

During the 4-year fulltime Bachelor study Ocean Technology at the Maritime Institute Willem Barentsz (MIWB) students are educated to be a hydrographic surveyor. Next to the theoretical knowledge students will also get practical skills and experience.

By the end of the school year the yearly project survey weeks take place. During these survey weeks the first year and second year students will perform a survey together at or near Terschelling. Students experience this as very valuable: "For 1st year as well as 2nd year students this is a very nice moment. To 2nd year students because they can prepare themselves on their 100-day traineeship in the third year of their study, to 1st year students to become acquainted with the 'real' job."

For several years, Seabed has been sponsoring these practical survey weeks by making its intruments available to the students in order to perform a multibeam survey at the Wadden Sea with the MIWB survey vessel "Razende Bol". Next to this, one of the surveyors of Seabed will come to Terschelling to help and coach the students with mobilising and surveying. MIWB appreciates Seabed's sponsoring very much and would like to thank Seabed for their time, effort and instruments!

Client tales #1

We Unique Hydrographic Systems Pvt Ltd Established in 2010, representing Unique Maritime Group with Head Office at (UAE) Founded in 1993, Unique Group which is a 25 years old company and is among the world's prominent integrated subsea and offshore solution providers. Unique Maritime Group has offices in UAE, India, Singapore, USA, UK, Brazil, Russia, South Africa, Rotterdam and has a reputation of very good OEM as well as service provider to its client's base. We deal in Hydrographic Survey Equipment, Oil Spill Equipment, Diving and Subsea Equipment, Buoyancy and Ballast Systems, Marine Equipment and also service providers for Oil and Gas Industry.

As we are in the field of Hydrography and Subsea systems, We came across Seabed BV and are in constant touch with them from the year 2015. We were convinced about their Quality Technical Expertise in this field, and we are proudly the authorised Dealers of Seabed BV in India.

Supply, Installation and Commissioning of Seabed Electrical Vibrocorer SVC500E was done for one of our most prestigious client in India. It was successfully Installed onboard Research Vessel Samudra Saudhikama and successful sea trial coring operation was carried out. Engineers from Seabed BV, Unique Group and Client's side were part of the successful installation. Client and we are very happy with the use and the results obtained from Vibrocorer SVC500E. Excellent Core samples were obtained at 60 m Depth from the Arabian Sea.

SeaBed BV were extremely supportive with the technical and commercial aspects for this successful project. We cordially appreciate the support and cooperation from Elice Collewijn and Maurice Buijsman and are looking forward with all the same in the future for a strong business relationship.

Unique Group
Strength in Depth

Upgraded Port of Santiago

This year the modernization to the Port of Santiago de Cuba will be completed and put to use, due to this modernization the port is available to lager vessels extending the cargo capability to 565k tons per year.

Cuba is a communist state known for its rum and cigars. In 1959 a revolution took place in Cuba that has changed the country forever. This revolution was led by Fidel Castro and Che Guevara, Cuba is a socialist state with only one legal political party. Fidel and Raul became acquainted with Marxism and anti-imperialism during their student days and participated in student protest. When Fulgencio Batista seized power in 1952 after a military coup, the Castro's started their fight against the right and US-backed regime.

In the years under the predecessor of the current US President Trump, a relaxation took place in relations between the US and Cuba. Obama even visited Havana in 2015. The two countries opened embassies on each other's territory again and scheduled flights were allowed. They also talked about easing the US trade embargo against Cuba. However, the improved relations did not last. Trump pursues a harsher policy than Obama and reversed most of the changes that his predecessor made towards Cuba.

The socialist ideals are still omnipresent in the streets of Cuba. Black and white images from the time of the revolution are shown on television, posters and billboards every day.

There is a turning point, though the younger generations still have respect for the regime, they are less influenced by socialist ideals. The daily struggle to bring food on the table and the desire for more freedom dominates.

Due to the new desire for change the Cuban government is spending more government money to improve infrastructures. One of the investments is the modernization of Port of Santiago de Cuba.

At present the port can only accommodate ships of up to 30k tons. An upgrade costing 120mUSD will turn the port into Cuba's second most important port.
This will be done by specialized companies by excavating the harbor and so enabling more and larger vessels access.

According to the Chinese state news agency, Xinhua, dredging is being carried out to a depth of 14 meters to increase the access to the new dock for vessels up to 55k tons. During the dredging operations, surveys need to be performed to monitor the operations. The (SPLMS) Seabed Portable Lightweight Multibeam System was hired by the client, which includes the Norbit Wideband Multibeam Sonar, the (SGR7) Seabed GNSS Receiver 7 and the AML Oceanographic BaseX2. This was installed by a Seabed engineer followed by instructions how to operate the equipment. For more information about the equipment please visit **www.seabed.nl**.

Ping and Done:

Evolving QPS Technology for the new Era of Autonomous Hydrography

The implementation of autonomous technology in hydrography has seen steady evolution for 20+ years. The initial developments focused on deploying large diameter (0.5 to 1m) vehicles (AUV's) at great depths. AUV's have quickly proven to be cost-effective solutions for obtaining high resolution bathymetry, imagery and photographic images in environments where preceding technology fell short. The most recent innovation surge is focusing on autonomous surface vessels (ASV's) where organizations have found great gains to be made by removing personnel from the vessel altogether.

Since 1997, QPS has provided options for the user to minimize the interactions with the surveyor and the system by automating key functionality. The combination of Qinsy's automation and Qimera's data processing innovations (Neff and Wilson, 2018) provides a tightly integrated solution for organizations to embark on this new era of Hydrography.

Introduction

One of the challenges posed to the autonomous hydrographic workflow are issues arising from the incorporation of a variety of software solutions with non-seamless linkages. Many autonomous operators are incorporating separate solutions for; mission planning, sensor control (navigation, sonar settings, etc.), acquisition, systems monitoring (QA/QC), data fusion, data processing and final product deliverable. For a single mission this can lead up to eight (8) different software solutions from four (4) or more vendors. A non-seamless workflow leads to increases in error due to a heavy reliance on human interaction (Wilson et al., 2018). QPS has successfully decreased error and improved efficiencies by automating the tasks best suited by computing technology. Since 1997, Qinsy has had the ability to provide all eight of these requirements for surface (ASV) applications. This paper will outline the history of QPS's commitment to autonomous applications and how these requirements are paving the way for this new era of hydrography.

Early Real-time Innovators

The Qinsy software solution has been a market leader in flexible, stable and reliable hydrographic operations for well over two decades. Initially implemented as a software solution for complex positioning projects (rig moves, marine construction, etc), QPS implemented its hydrographic functionality beginning in 1996. By 1997, Qinsy had already laid the groundwork for autonomous applications through the introduction of auto-logging; real-time data processing (including ray-tracing, height compensation - RTK, tides); multibeam filtering (depth, range, sector, quality, TPU, etc); grid generation; systems monitoring alerts (satellites, standard deviations, proximity/ collision alarms) and the Remote Display Client (low to high bandwidth remote access). By 2002, real-time sidescan and backscatter mosaicking (with or without normalization) was added, and by the end of 2006, magnetometer grid generation, autopilot interfaces, generic/user configurable output drivers and advanced survey planning features were released. In 2015, QPS introduced Qimera and shortly thereafter released Qimera Live which provides near real-time processing of multibeam data regardless of platform and data format. Beginning in 2017, QPS has responded to market demands by providing fully automated functionality specific to several key ASV manufacturers, including but not limited to; SeaRobotics, ASVGlobal, Seafloor Systems, IxBlue, Maritime Robotics. Across all of these platforms QPS provides a tightly integrated Five-Point solution which includes:

- Mission Planning
- Automation
- Systems Interfacing & Control
- Systems Monitoring
- Post-Acquisition

The QPS solution ensures 100% survey coverage, tight quality control and fully corrected products upon vehicle retrieval.

Simplifying Planning and Ensuring 100% coverage

A common challenge amongst autonomous operators is the ability to ensure 100% survey coverage in regions of varied slope. This challenge is exacerbated by lack or complete absence of historical bathymetry data essentially making survey planning a futile exercise. In response, QPS introduced "AutoSurvey" (demonstrated at OI2018), a real-time intelligent line generation tool that utilizes the most recently collected multibeam data to generate a line that accounts for variation in slope (Fig 1). Unlike prior solutions, the success of Qinsy's AutoSurvey is the result of having highly reliable and fully corrected real-time multibeam data to generate a line that will prevent gaps or "holidays" in the data by providing course corrections to follow along bathymetric contours. Another unique feature is that AutoSurvey is tightly integrated with Qinsy's Autopilot (serial or network) driver to provide accurate navigation data for vessel control. The "turning track" may also be customized to ensure proper lead-in to the survey coverage and/or to ensure

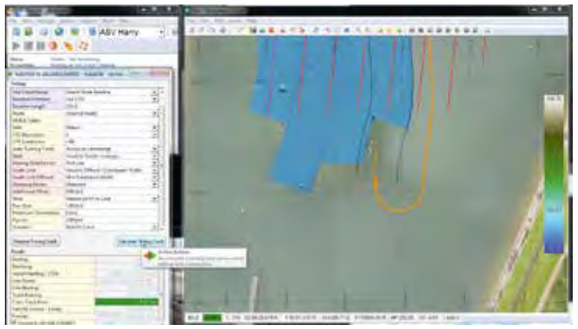


Figure 1: Qinsy autopilot setup window with Autoswath dynamic line planning functionality with turning track (left) and the Qinsy Navigation Display showing the result (right).

proper positioning of a towed object relative to the vessel. Line planning is now reduced to a single line as a starting point to begin the autonomous survey.

While tight integration between line planning and contoured guidance is an idealized real-time scenario, several operators utilize "way point" navigation for their systems. To ensure all requirements for navigation are met, QPS provides direct integration with Control software and direct import of L84 formatted line plans. Direct integration includes driver interfaces with autopilot systems, such as the AutoNav MavLink that is utilized in manned and unmanned maritime, aerial and terrestrial operations. If issues arise due to interface complications or users wish to utilize a pre-planned mission, Qinsy line plans may be exported via L84 and uploaded directly to the Control system software (e.g. ASView software by ASV Global).

Despite extensive planning, one must expect the unexpected: storms arise, sensors fail, collisions occur, power is lost. QPS is in the process of implementing "Murphy" Planning which integrates with Qinsy's on-line systems monitoring to provide system recovery options. Murphy planning is simple and straight forward but requires real-time logical reasoning by the software itself and taps into Qinsy's innovations in automation to ensure proper execution.

Innovations in Automation

A mundane truth about hydrographic surveying is that the majority of the time is spent behind a computer initiating start/stop logging sequences and configuring file management. Qinsy provides several options that may be preconfigured to automate both processes. Auto-logging functionality may be initiated based on distance to start/end of line, distance from swath coverage or distance to predefined survey area. QPS implements a file structure that is automatically configured during installation. Raw data (.dB & .xtf) and processed (.qpd) file names can then be defined based on a user defined name, date (julian day, month-day-year, year-month-day, etc), time or a combination of all options in order to fit the most complex client requirements. Furthermore, eventing and/or fixing (dynamic or passive) may be automatically generated based on time, trigger, distance (sailed, along, seismic, preload). All events and fixes are stored raw data files.

Further, QPS has removed the necessity to create a predefined grid area allowing for attributed grids (SBES, MBES, Sidescan and magnetometer) and dynamic surfaces (DTM-based related to processed qpd files). Users also have the option to include ancillary data files (e.g. sound velocity) in the real-time processing such that the information contained in the resulting grids and processed point files are fully refracted and corrected. If the ASV has the ability for continuous sound velocity profiling, raytracing corrections can be implemented based on most recently available profile in Qinsy. It should be noted that Qimera has several additional raytracing options for concurrent processing including nearest in time and nearest in distance.

Systems Control

The overall purpose of unmanned versus manned surveys is to provide fully automated processes with minimal human interaction. However, it is recognized that operators need confidence in their ability to have the system self-monitor and react, be customized based on variable payloads, remotely interact with the 3rd party control systems (if needed) and provide the option to manage data from multiple manned and/or unmanned surveys taking place simultaneously. Qinsy currently provides over 2000 interface drivers, making it one of the most flexible and readily deployable software solutions on the market. An emerging trait of success for autonomous systems is the ability to rapidly change payloads based on mission requirements. Since these requirements may take place "on the fly", customizations may be required to accommodate varying sensor inputs and outputs. Qinsy satisfies both requirements through a generic user defined ASCII driver which is often used to send out basic ASCII string (serial, UDP, TCP/IP) to monitor ASV position or to control other devices.

Monitoring your System

In response to market demands for low graphics load monitoring options, Qinsy provides two options; a TCP server based Remote Controller and the Remote Display Client. Remote controller is used to send commands over a network to start/stop logging or to shut down Qinsy. This functionality also provides the operator the ability to set or redefine the file naming convention and obtain an overall status of the I/O as well as logging (storage, memory, etc.). The communication can take place internally with an AUV/ASV controller and/or externally to provide remote operator access. For those operators focused more on the later, the Remote Display Client (RDC) (Fig 2) provides the ability to receive settings (computations, current line, steered node, etc.), raw data and positioning results over a TCP/IP network from a Socket Server running under the on-board system. The RDC can set up independent displays (navigation, swath, alarms, etc.) and, if permissions are set, remotely change online settings. Furthermore, QPS provides sonar controllers for several major manufacturers including R2Sonic, Kongsberg and Edgetech. While most of these systems have fully automated sonar control functionality already incorporated, Qinsy RDC provides the option for settings to be monitored and changed if necessary.

Regardless of the chosen monitoring option, the QPS alerting system has the ability to monitor all aspects of the integrated system and trigger alarms if acceptable tolerances have been exceeded. Of notable importance is seabed collision avoidance, a critical feature for manned and unmanned surveys. Collision avoidance is set up

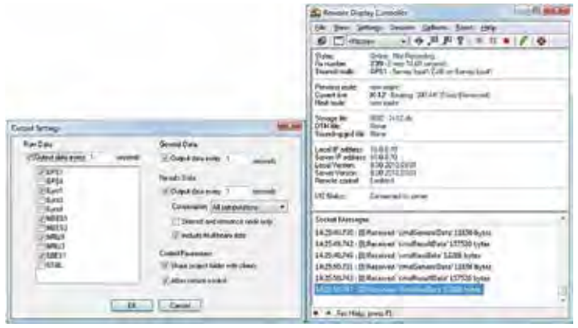


Figure 2. Remote Display Client output settings (left) and Remote Display Controller (right). The RDC controller mimics what is running on the AUV/ASV and allows full remote access and configuration of the system

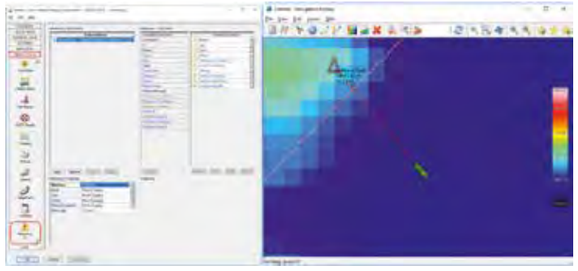


Figure 3. Qinsy Alert System for Seabed Collision Avoidance. A collision point is detected and the estimated time to contact is calculated.

prior to survey and is based on current 3D position and speed over ground. When the seabed is at the same depth or shallower than the defined object (e.g. ASV, AUV or towfish) and within the maximum amount of time, an alarm is generated. The defined seabed may be a model, active grid or real-time observation (Fig 3).

Force Multiplier

Force multiplier technology is another significant advancement in autonomous operations. For Hydrography, running in parallel with other autonomous vehicles and/or alongside manned survey vessels, operators are covering far greater ground while minimizing logistical overhead. QPS is committed to improving the Force Multiplier concept through advances in both real-time data acquisition and processing as well as during post-processing in Qimera. For real-time, QPS is developing technology that will allow for scalable approaches for multiple objects to populate a single grid in real-time. Unique to Qimera, Cooperative Cleaning and Production Line Processing functionality provide seamless workflows highly relevant for the post-production and validation portion of the autonomous workflow.

Cooperative Cleaning – Making the unmanageable manageable

For large data sets, cooperative cleaning allows multiple users to clean and validate large survey projects by dividing into smaller, more manageable projects while maintaining data integrity. This allows multiple processors to work on the same project simultaneously, greatly increasing efficiency. Because the sub-projects are entirely encapsulated (i.e. they can exist independently from the main project), further efficiency can be gained by creating the subprojects locally, which therefore reduces or completely eliminates the near constant network transactions that are normally required when point editing. Data processors work within their subprojects and, once complete, introduce their efforts back into the main project. In parallel, the main project may have ancillary data processing completed (e.g., SBET, SVP, height corrections). The edits from the subprojects may be incorporated back into the main project without affecting the overall progress of the entire project but enormously increasing efficiency (Fig 4).

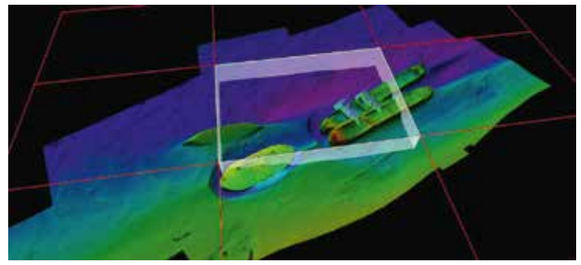


Figure 4. For Cooperative multi-user cleaning, Qimera breaks up the project based on user-defined parameters. This example shows a simple grid of 9 subprojects.

Production Line Processing – Unifying separate projects for a common goal

Production-line processing allows for multiple projects to be treated as stages and encapsulated under a single, much larger effort. These stages can be done based on survey days, survey segments, survey vessels or, in this case, autonomous systems. The processing for a stage (e.g., a day, vessel/vehicle, segment) of data is handled in its own processing project. Further, if real-time processed data acquired by Qinsy is present, these outputs can be aggregated into a master project for review. During review, the stage may be accepted and immediately incorporated into the master project or sent back for additional processing. This is done repeatedly and combined with other stages within the master project. The net result is the integration of multiple smaller projects processed in the exact same manner that can then be seamless integrated into the QPS hydrographic workflow.

Integrating into an already Seamless Workflow

Despite the presence of automated real-time solutions, tedious and manual processes continue to persist in many of the post-acquisition steps of many hydrographic workflows. As previously outlined, human interaction in the workflow is a highly prone to error. These errors are also quite costly, as they have been proven to dramatically increase the time required for data throughput to chart. Qimera is designed to provide a higher return on investment by minimizing the opportunities for human operators to make mistakes. This philosophy stands true whether the data is collected from a manned or unmanned system.

Real-time processing as outlined above is often referred to as "pre-processing" where all of the mathematical operations for data

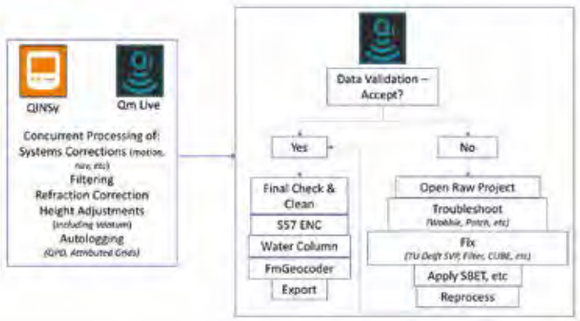


Figure 5. Simplified workflow for QPS's concurrent (real-time and/or near real-time) processing. Qinsy may be utilized as a comprehensive autonomous solution. Alternatively, for non-Qinsy users, Qimera Live may be utilized for near real-time data processing.

fusion, filtering and surface generation have been completed on-board prior to ASV/AUV retrieval. The unique integration between Qinsy and Qimera provides a rapid linkage for final quality checks or to revisit the raw data to trouble-shoot, utilize Qimera's problem solving tools or to reprocess all-together (Fig. 5). Care has been taken to simplify reprocessing by linking the proper metadata (including operations performed) to the raw (regardless of data format) and the processed data.

For non-Qinsy users, QPS introduced an automated stand-alone solution called Qimera Live. With a single command, the "Live" functionality automates the guided workflow such that by the completion of every survey line, pre-flagged data files create and/or update a fully georeferenced gridded surface. The surveyor may choose to use Qimera Live to immediately identify problems in post-processing or have a completely autonomous processing solution that can deliver a final product upon hitting the quayside. Qimera Live is a part of the standard Qimera installation and is maintained through the standard release cycle. It may run on a separate computer or on the acquisition machine, allowing maximum flexibility for implementation in autonomous operations, remote vessel operations and/or multi-vessel surveys.

Once within Qimera, there are several QC tools available to either move towards product deliverable or fix any problems that may be present. Three of these tools are the implementation of many years of academic research to address common problems found in multi-beam data; Wobble test, ENC Plus and TU Delft SV Correction. The TU Delft SV Correction tool is particularly important for autonomous surveys, relevant and reliable sound velocity profile information is often not available. This tool fixes data errors caused by sound velocity issues that are not fixable with available set of SVP measurements. This physics-based approach takes advantage of the overlap between survey lines, harnessing the power of redundancy of the multiple observations. For a given set of pings, the algorithm simultaneously estimates sound speed corrections for the chosen pings and their neighbors by computing a best-fit solution that minimizes the mismatch in the areas of overlap between lines. This process is repeated across the entire spatial area, allowing for an adaptive solution that responds to changes in oceanographic conditions. For accountability, the algorithm also preserves the output of the inversion process for review, vetting, adjustment and reporting (Fig 7).

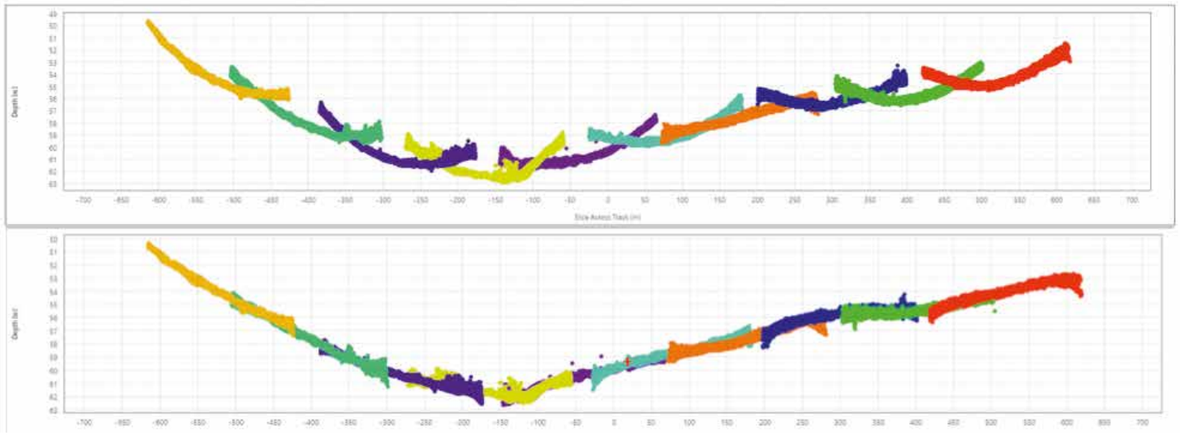


Figure 7. Slice Editor view, colored by file, showing the smile effect, before (top) and after (bottom) running TU Delft Sound Speed Inversion Tool

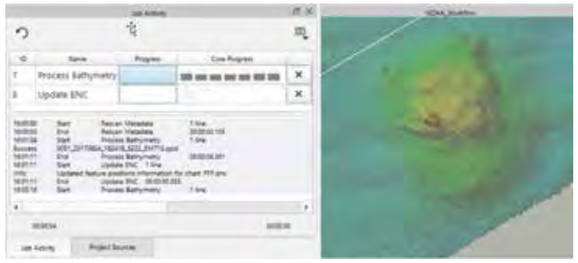


Figure 6: As shown in the Job Activity window above, post-processing steps performed to bathymetry in Qimera automatically updates the wrecks, rocks, and obstructions on a corresponding S57 feature file. This is accomplished via a link between the S57 attribute value of sounding (VALSOU) and either a particular sounding or grid node. This functionality leads to considerable time-savings in those surveys that encompass a multitude of features.

Further, artifacts associated with autonomous installations may also be an issue for the new era hydrographer. To correct these issues during post-acquisition, the Wobble Test is designed to dynamically adjust the echosounder and/or motion sensor configuration in a trial-and-error method to isolate causes of integration errors resulting in so-called "wobbles" in the sounding footprints. Finally, to comply with the deliverable requirements for Hydrographic Offices, the ENC Plus tool in Qimera features a built-in linkage between S57 features and the corresponding bathymetry (Fig 6) to ensure parity between these data submissions.

Further production can be done through QPS's "one button" mosaic tool in FM Geocoder or utilizing Qimera's built-in water column processing tools. Both tools have been successfully deployed for hydrographic based projects ranging from substrate identification with least depth determination to seep hunting activities. All water column detections processed utilizing Qimera are fully corrected and raytraced requiring very little interaction from the user aside from identifying what it is they wish to add to the processed data files (Fig 8).

Summary

Since its entry into the hydrographic market in 1997, QPS has strived for minimizing error due to human interaction by automating the mundane tasks which can best be achieved through computing automation. A byproduct of this early innovation is the foundation for Qinsy to become a comprehensive autonomous solution suitable for both subsea and surface applications. It's real-time processing functionality paved the way for new innovations that simplify in mission planning and provide dynamic line guidance tools that ensure 100% survey coverage. Since the data processed during survey are fully corrected and refracted, the positions on the seabed can be utilized to improve systems control and monitoring through QPS's Collision avoidance tools. Qinsy is also highly flexible tool to implement into existing systems through a wide range of systems drivers, customizable generic drivers and options to interface directly to systems control software (remote control).
This flexibility is scalable allowing for users a wide range of options to fully control the system remotely (RDC) or, when something is wrong, have the system alert the user and allow them to respond (e.g. the "Murphy" plan). This scalability is now allowing for multiple vessels and/or vehicles to be incorporated into a single project. These Force Multipliers are expanding the concept of autonomous hydrography and Qimera provides the unique functionality to either break up large projects into manageable sections or to consolidate several small projects (e.g. multiple vehicles/vessels) into a common space. The seamless integration between Qinsy and Qimera is providing options for users to simply QA/QC data at the end of the day or tap into the most recent innovations in post processing to identify problems, correct them, reprocess and confidently deliver.

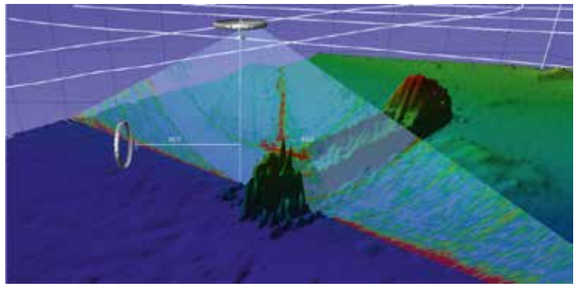


Figure 8. Water-column processing above a wreck reveals a mast with a more accurate least depth to be incorporated into bathymetry, ensuring the utmost in safety of navigation for those nautical charting products later derived.

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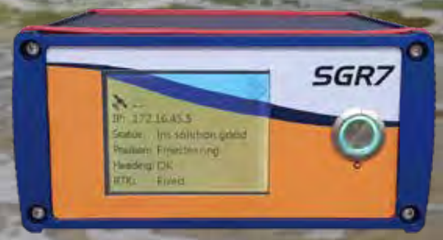

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Back to the Future: AML has Returned MVP to the Forefront of Surveying

By Jehan Zouak, AML Oceanographic

In June of 2017, AML Oceanographic announced their acquisition of the Moving Vessel Profiler (MVP) product line from Rolls-Royce. Less than two years later, AML's Atlantic office near Halifax, Nova Scotia is a hive of activity, bustling with new builds in various stages of completion and older systems in for refurbishment.

The Moving Vessel Profiler was no stranger to AML at time of acquisition. Having supplied SVP and CTD instrumentation to the real-time, underway profiling systems since initial development at Brooke Ocean Technology around 20 years ago, AML was familiar with both the technology and the team behind it. Murray Eisan, Mark Smith, and Darrell Groom have over 50 man years of design, manufacture, and support experience with MVP. The trio now serve as a rock-solid foundation for AML's MVP team, which has more than quadrupled in the past 18 months.

The types of organizations already using MVP and those currently approaching AML about the solution span the full spectrum of the ocean space. Navies use MVPs to ensure they get data they can trust as efficiently as possible; a particularly crucial factor when faced with surveying an area in a limited timeframe. Universities, research institutes, and government bodies reach out in search of a solution that can help them collect the high density data they need to complete their research. Often in need of more than just CTD, they are pleased to learn that MVP can accommodate a wide range of parameters; from Dissolved Oxygen to Crude Oil, they can be confident in their ability to collect the quality and quantity of data required for their work.

AML's Nova Scotia office has expanded significantly since relocating to new customised production facility to accommodate a higher volume of MVP builds.

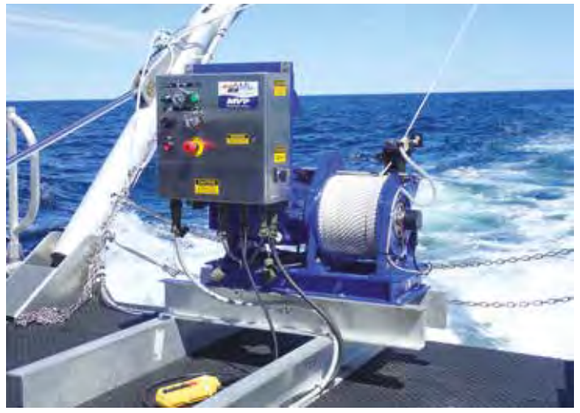
For commercial survey companies large and small, MVP provides a stability that brings financial reward by removing the need to compromise between data quality and survey efficiency when oceanographic conditions are variable. MVP's ability to provide real-time sound velocity data while the vessel is underway removes the productivity loss and risk associated with stopping the vessel to take additional static profiles.

Below are a couple case studies highlighting some of the benefits MVP is bringing to survey organizations around the world.

Win More Survey Projects with MVP

In early 2018, AML was contacted by a survey company that specializes in coastal surveys along the eastern seaboard of the United States. The company won two contracts that put them in a potentially risky situation, as the second project would need to mobilise almost immediately after the scheduled completion of the first. It was critical that the first project be completed on time. Any delays would jeopardize the second project, activating financial penalties and damaging the company's reputation.

Given the high sound speed variability expected in the near shore survey area, the Survey Manager was concerned that stopping the vessel for additional static SV profiles and reducing multibeam swathe coverage posed a significant threat to punctual completion. He knew that the only way to finish the survey on schedule and to the specifications stipulated in the contract would be to collect SV data underway, without stopping the vessel. The previous year they had tried an entry level system, but found it inadequate. He then approached AML, who provided MVP30, a real-time underway profiling system proven to withstand the rigors of commercial survey work.



The compact MVP30 is ideal for small vessels surveying in coastal waters.

As a result, the survey company was able to deliver a high quality product to both of their clients on time and within budget. The benefits have not been limited to that first experience. With the removal of the unpredictability associated with profiling frequency that often plagues survey operations, the company has been able to tender for and win more contracts, thereby improving their productivity significantly, all the while delivering a better end product to their customers.

MVP's comeback story is not only about supplying new systems to organizations seeking to remove technical and financial unpredictability from their survey operations. It is also about supporting those who have been surveying with MVPs for years, and helping them get the most out of their equipment. The new guardianship has resulted in a reinvigoration of systems that had been out in the field – and in some cases, out of the field – for years. Many long-time MVP users have been reaching out to AML to have their systems serviced or re-furbished.

INFOMAR Shakes the Cobwebs off their MVP for Joint Mapping Expedition

In 2017, Ireland's national marine mapping programme set an objective to better understand the dynamics at play in the oceanographically complex Celtic Sea. With the area being of major economical and biological importance, the Integrated Mapping for the Sustainable Development of Ireland's Marine Resource programme (INFOMAR) - a joint venture comprised of the Geological Survey of Ireland (GSI) and the Marine Institute (MI) – assembled an international team to investigate the nature of internal waves and variability of the thermocline. Joining INFOMAR on the survey was Prof. John E. Hughes Clarke, leading teams from the Centre for Coastal and Ocean Mapping (University of New Hampshire) and the BEAMS programme at the University of Charleston.

The Marine Institute of Ireland's MVP200 before its return to service. (Image courtesy of INFOMAR)

Recognizing that their objective of measuring thermocline variability would not be possible without a high density of data, INFOMAR contacted AML about recommissioning their MVP200, which had been removed from service for several years.

Over the course of three days, AML's Darrell Groom assisted the Marine Institute to transform their MVP200 from a dusty piece of machinery lying dormant in the corner of a warehouse to a fully-functioning system onboard the RV Celtic Explorer, which produced instant results on their next survey.

Fourteen days, 4,000 km of survey line, and 500 MVP casts later, the survey was completed with success. With MVP profiling to just 10 m off the seafloor every 30 minutes, the data was dense enough to enable location of the top and bottom of the thermocline while also providing accurate sound velocity control in real-time for the multibeam echosounders, thus enhancing the quality of MBES data collected.

Not having to stop the vessel for profiles allowed a steady speed to be maintained and reduced the number of line turns required, improving the expedition's efficiency by 12%.

Additionally, the crew would have lost several days of seabed mapping had they not had MVP200 onboard. The system continued to automatically collect SV profiles through Sea State 7 conditions, an environment in which for safety reasons it would have been impossible to stop the vessel and collect static profiles, rendering any multibeam echosounder data unusable.
For 2018, the Marine Institute relocated MVP200 onto the smaller RV Celtic Voyager for another successful survey campaign.

After experiencing the benefits of real-time, underway profiling first hand on board the Celtic Explorer, GSI decided to acquire MVP30-350 systems for both of their 16m survey catamarans, RV Mallet and RV Keary. GSI expects these additions to simultaneously improve the productivity, safety, and data quality of their survey operations.

With AML now firmly established as the manufacturer of MVP and support operations in full swing, the company is looking towards future development of MVP for both traditional applications and potential new markets, such as integration onboard Unmanned Surface Vessels.

GSI has added MVP30-350 systems to both of their survey catamarans, RV Mallet (shown) and RV Keary. (Image courtesy of the Geological Survey of Ireland)

Can MVP help your organization's survey operations?

AML Oceanographic provides ocean sensing solutions for hydrographic, environmental, and research applications. Supported by 45 years of experience manufacturing proven technologies including Moving Vessel Profiler (MVP) - the world's only automated, real-time underway profiling system - AML helps organizations around the globe remove technical and financial unpredictability from their operations. Headquartered in Sidney, British Columbia, the past few years have seen AML add footholds in Dartmouth, Nova Scotia, and Aberdeen in the UK.

It was all smiles aboard RV Celtic Explorer after the successful recommissioning of the MVP200. (Image courtesy of INFOMAR)

Client tales #2

DEME offshore starts cooperation with Seabed BV for the development of time-synchronised solution for AML Bathymetrec unit

Since 2011, DEME invested in new versatile AML Plus-X units, which can be equipped with exchangeable sensors for temperature – pressure – Sound velocity and Conductivity.

A lot more practical and cost-effective with respect to yearly calibrations: easier & less expensive transports, less rental costs and faster with respect to re-calibration times.

For vertical referencing on our deepwater fall pipe ROV's, the present survey equipment on the market however was not always performing as it should:

- problems with the timing interface was an issue and it's accuracy was limited to ZDA synchronization only
- the achievable output rate was limited
- the system required a top unit and a subsea unit
- the system was running on an outdated operating system
- the technology was not further being developed or significantly being improved
- comparing multiple sensors parallel, prove there was too large differences between individual measurements.

At that time, Seabed introduced the AML Bathymetrec unit, which has built-in Digiquartz, together with the same sensors that can be used with the AML Plus-X. Seabed were so nice to offer a loan unit to test and compare it to the present equipment we had available at that time.

Key element we were missing into this new unit was accurate timing and upon our request, Seabed developed the STM timing module, that would allow for ZDA + PPS time synchronization and this via an ethernet interface.

Additionally this unit will soon have lots of improvements like extra subsea serial SV outputs for direct input into multibeams, faster output rates, versatile webinterface, pressure to depth conversion & one day even shallow water wave action filtering.

DEME OFFSHORE

Seabed at the Expo's

Oceanology International 2019

Hydrographic Society 2019

Offshore Energy 2019

Meet...

Anya Siemons
Financial Administrator

Date of birth? And what is it you like to do on your birthday?
10th of October 1968. My birthday is always celebrated, sometimes as a party with family and friends but sometimes also on a city trip with my husband and children.

Single, in a relationship or married?
I have been living with Benny for 34 years. We have 2 lovely children, Melissa of 22 years and Joey of 18 years.

Any hobbies?
Not club related but I can enjoy lots of things and find many things fun to do. Whether it is reading a book, take a walk with the dog, skiing, going to a football match, or going out with friends or my children. Never a dull moment.

Fast food, bistro or Michelin starred restaurant?
I am not really into fast food, women always think about their figure. Besides fast food you can give me all kinds of food. Did I say that going out for diner is a hobby of mine? Especially the tapas concept is always very nice because you can try everything.

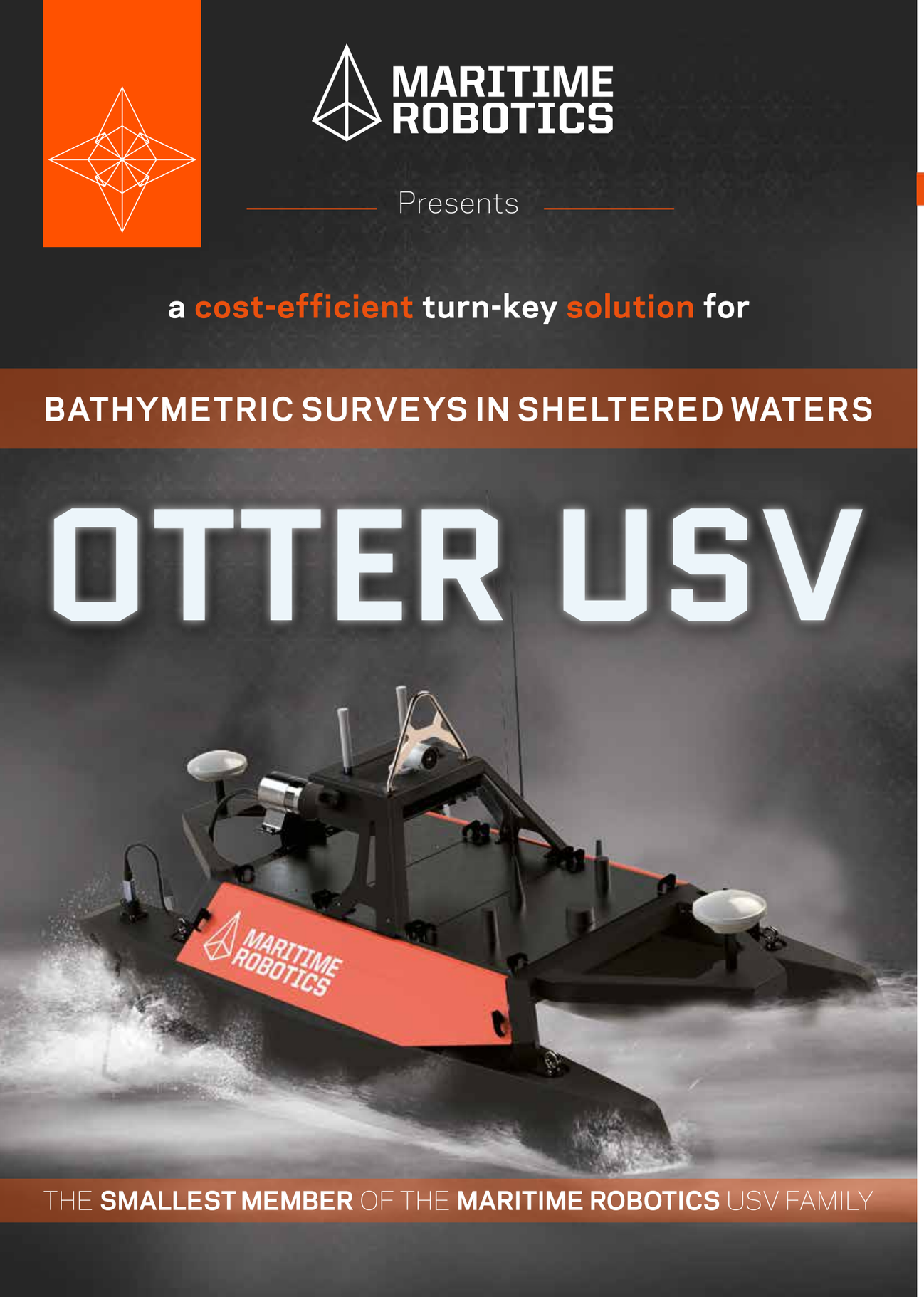
Netflix or the cinema? And what is your favourite TV-series or movie?
It doesn't matter to me, going to the cinema and have a bite to eat with friends or some good series on Netflix are both things that I like to do. When I go to the cinema I'd like to see a thriller and sometimes a feel-good movie, it depends on my mood at that moment.

What kind of job did you want growing up?
As a little girl, my father was a taxi driver and he allowed me to go with him sometimes. Tourists always found it very nice to have a little girl next to the driver and often gave me presents or money. I always enjoyed that very much, so I also wanted to be a taxi driver. But to be a taxi driver, I thought first I had to become a little boy that was quite complicated for such a little girl (at that time).

What is it you like most about your current job?
Working in a team. During my previous job I worked a long time by myself. At Seabed we work as a team to achieve good results and serve the customers as good as possible. I like to be a link in the chain.

What do you learn from your colleagues?
Work together, I have worked very long on autopilot and didn't get any feedback from anyone. When you work in a team you can get or give feedback in a positive way which can make you grow as a person.

If you would win the lottery, what would your life look like?
I would definitely book a vacation to a beautiful destination with my family. But in general it wouldn't be very different from now.



The Otter USV:

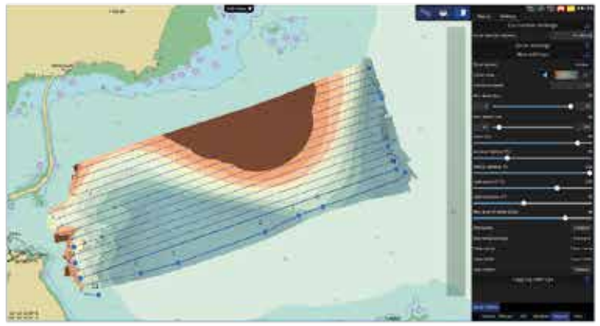
A cost-efficient solution for bathymetric surveys in sheltered waters

Maritime Robotics' Otter USV is the ultimate hydrographic survey tool for mapping sheltered and enclosed waters. With tight integration between the on-board control system that enables autonomy and the multibeam echo-sounder, a bathymetric survey can be executed with a simple, streamlined workflow.

The Otter USV is the smallest member of the Maritime Robotics USV family. With a footprint of only 200 x 105 x 85 cm (78" x 41" x 33"), it fits into any small cargo van for convenient transportation to survey sites. With a weight of 95 kg assembled, and with the ability to be disassembled into parts weighing less than 20kg, a single operator can launch the Otter from a jetty, lake- or riverside, or the beach.

The autonomous future is electric: the Otter is equipped with electric thrusters that are powered by up to four powerful and easily interchangeable battery packs. This gives the Otter a best-in-class endurance for its size, operating up to 20 hours (at 2 kts). The battery solution is built on off-the-shelf components, providing easy access to spare parts all over the world.

The Otter can be controlled via a graphical user interface, Maritime Robotics' vehicle control station (VCS), or a mobile phone app. The app provides manual joystick-like control, while VCS has many control modes, such as course and speed control, heading control, or waypoint control.



For waypoint control, the operator can easily plan missions consisting of individual waypoints, or use templates for creating common patterns such as lawnmower surveys. Furthermore, live monitoring of sensor data quality parameters and visualisation of actual data coverage are provided in the same graphical user interface, and sensor parameters can be adjusted from the same GUI.

The Otter's robust catamaran design and the tightly integrated bathymetric survey system make this system a cost-efficient turn-key solution for bathymetric surveys in sheltered waters such as small lakes, canals, rivers, ponds, and harbour areas.

Customize your payload

The Otter USV is available in two versions: Basic and Pro. With the Pro you get in addition to the default set-up, a camera, AIS receiver, and additional high-bandwidth communications via marine broadband can be added.

For payload options, Maritime Robotics accommodates the integration of many custom payloads. Some of the already supported systems include:

- iWBMS multibeam echosounders from Norbit, Kongsberg EM2040P and Teledyne ODOM MB2, ideal for seafloor surveys.
- Biosonics MX echosounder, for habitat mapping,
- Ecotone Underwater Hyperspectral Imager,
- Option to integrate a UHF modem for receiving RTK corrections from GNSS Base Station, or on-board software for correction services over the NTRIP protocol.

From the second half of 2019 onwards, the SVP winch will be available with the AML Base X2, or Valeport Swift SVP.

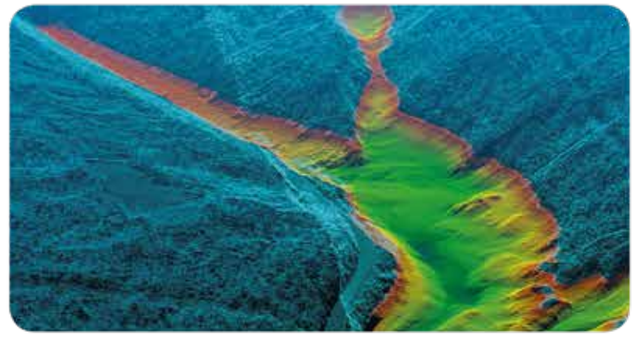
The Otter has been designed to operate in sheltered waters, and is ideal for inland water that are hard to access with bigger boats and ships, such as artificial ponds, water reservoirs, small lakes, remote areas, and protected areas. Examples of operations include; shallow water hydrographic surveys, habitat mapping, port & harbor security, marine debris search, water quality sampling, and data collection for dredging operations and for underwater archaeology.

Case study: Mapping a Water Reservoir using the Otter USV with Norbit

Terratec AS, Norway's largest supplier of geodata, had a problem: They wanted to conduct a multibeam bathymetric survey on a client's water reservoir, but access to the reservoir was limited and not sufficient for their regular survey vessel. They contacted Maritime Robotics to demonstrate the capabilities of the Otter USV equipped with the Norbit iWBMS.

The reservoir to be mapped was Storfossdammen in Norway, which today covers an area of 0.17 km2. The Otter USV was deployed with the Norbit iWBMS to map this water reservoir.

The Otter USV was controlled via a broadband communications link while mapping the water reservoir, and for operations up the feeder rivers, the Otter was controlled via Maritime Robotics' mobile phone application over a WiFi link. During the survey, the bathymetric data was displayed in real time in Maritime Robotics' Vehicle Control Station (VCS) software, allowing the operator to finetune data acquisition parameters based on the sensor performance.



For the final data delivery the data was processed with Qimera from QPS, and aircraft LIDAR data overlay from the Norwegian Mapping Authority *[https://hoydedata.no/]* was added, producing some stunning imagery of the reservoir. Terratec was also able to produce improved estimates of reservoir volume because Maritime Robotics enabled them to survey more of the reservoir's extent with the small unmanned vehicle.

For sheltered waters where access for bigger vessels is limited, the Otter USV with integrated Norbit iWBMS is an ideal platform for bathymetric mapping, developed for rapid deployment and easy operations.

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Thomas Fuller once said, "Seeing is believing." But how easy is it to believe and understand what we cannot see. For many, the inability to physically see the impact of something non-visual can be difficult. For instance, we can quickly and easily visually assess something like pollution. It's undeniable, we can see it, quantify it and, hopefully, eliminate it. Noise pollution, however, is something we know exists, yet we cannot see, so how do we measure and mitigate its effects. Using innovative technology such as digital hydrophones, the mystery of what lies beneath the surface and our impact on these environments is becoming more obvious every day. As we begin to understand more about our influence on the ocean environment, many are taking steps to ensure we manage and mitigate any negative effects.

Around the world, the need to understand the effects of sound and noise in the aquatic environment has been established. Recommendations by groups ranging from individual researchers and organizations, all the way to the top levels of government and industry leaders are leading the charge.

In 2008 the European Union established the Marine Strategic Framework Directive, commonly referred to as MSFD. The intention of the MSFD is to establish baseline studies and create guidelines and standards to achieve Good Environmental Status, or GES, in all European waters by 2020.

MSFD Regulations and Recommendations

The MSFD has put regulations and recommendations in place that all those operating in European waters must follow. Included in MSFD is Descriptor 11, Energy, Including Underwater Noise.

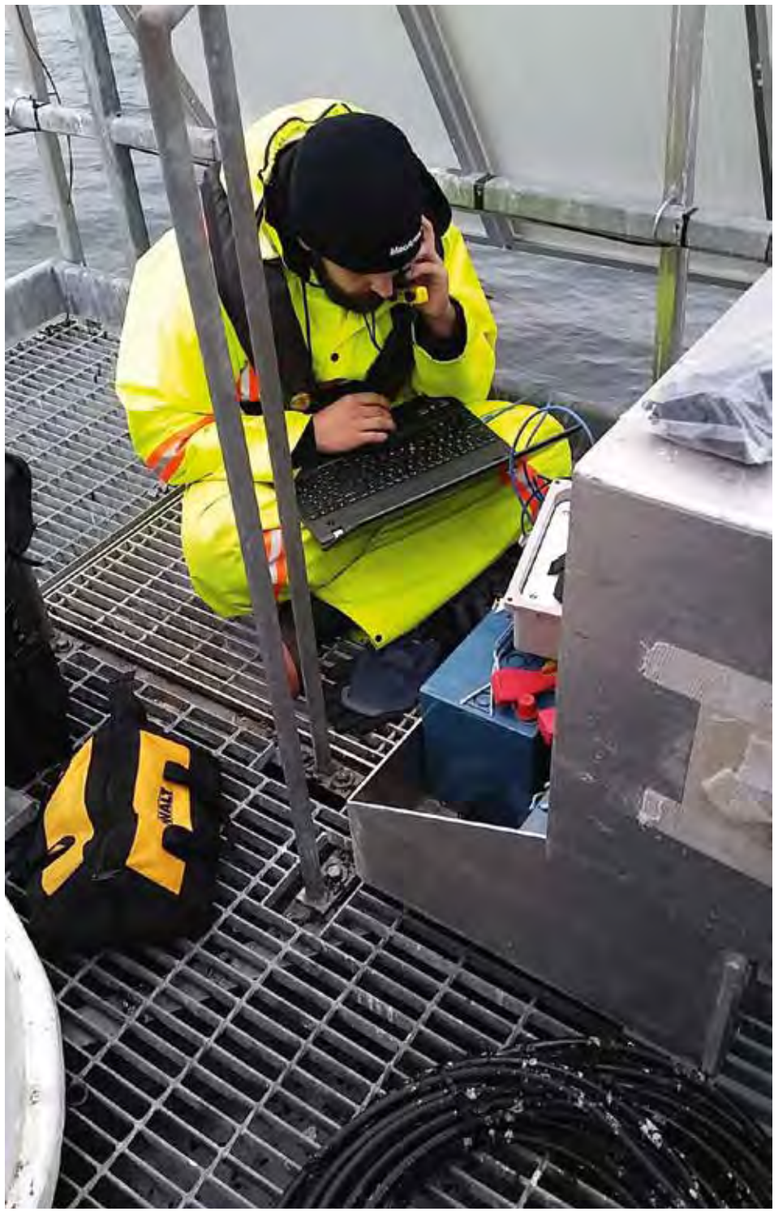
The major sources of energy/noise introduction in underwater environments are:

- Construction including vibratory and impact piling
- Dredging
- Shipping
- Sonar Systems
- Operating platforms for offshore energy

These industries are incredibly important to the economy and therefore must continue and thrive, but there is a balance that can be struck between industry and environment. The first step in achieving this balance is understanding the effects of these industries, then finding solutions to allow for a thriving marine ecosystem and prosperous industries.

MSFD in the North Sea

The North Sea is an important marine ecosystem. It's home to a multitude of marine species, including the harbour Porpoise.



Porpoises are congregated particularly in the Wadden Sea. The Wadden Sea borders the Netherlands, Germany and Denmark and has been identified as the most important breeding and feeding ground for harbour porpoises in the world. As activity in these areas increase, so does the threat to these essential ecosystems. These animals, and many others in the area, rely on sound for all their basic functions, making sound one of the most important items to monitor.

Monitoring and Mitigation in the North Sea

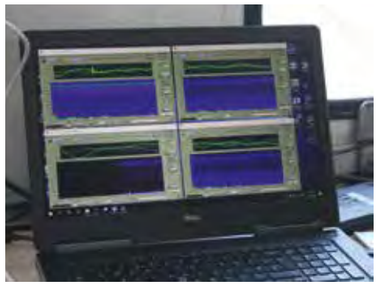
The Dutch government has already established the need for noise monitoring programs in order to remain compliant with the MSFD. In an effort to establish baseline data, the JOMOPANS project was created. JOMOPANS is a joint project, involving the input and expertise of all the countries that border the North Sea. The goal of JOMPANS is to measure ambient noise in the North Sea and develop new methods for long-term sustainable management of the region. JOMOPANS began January 2018 and will continue until December 2020. Measurements and modeling will be combined to create management tools, the most effective of which is environmental monitoring.

Monitoring Tools

Monitoring is cost effective as well as being a reliable resource in establishing anthropogenic vs. natural noise, spatial variability, and forecasting change among other benefits.
A simple, cost effective way to monitor projects is to use hydrophones. Instruments like the icListen make compliance easy. These underwater microphones collect HD audio and process the data inside the instrument, saving time, reducing costs and allowing the user to feel confidence in its measurements. Ocean Sonics Lucy software also simplifies compliance, as sound limits can be entered into the program, allowing users to set SEL limits and track sound pressure, exposure and peaks.

Lucy software now has a PAMGuard plug-in, meaning that icListen hydrophones can be used with PAMGuard software when monitoring for marine mammals. PAM Guard is most commonly used during seismic surveying but has been gaining popularity with other industrial projects where monitoring of marine mammals is a requirement.

Recommendations from the JOMOPANS project as part of the MSFD become law for new projects as early as mid-2019 and for all projects, old and new, in 2020. In order for projects to remain compliant, mitigation and monitoring projects must be employed. Hydrophones present a reliable, cost-effective monitoring and compliance solution. Through the studies compiled through JOMOPANS and efforts made by those operating in the North Sea, industry can continue to grow and thrive while maintaining the integrity and abundance of the ocean ecosystem.



Meet...

Jesse Houter
Engineer

Date of birth? And what is it you like to do on your birthday?
5 December 1996. Just sit around with a bunch of friends and family having some drinks.

Single, in a relationship or married?
Single, I've got other things to think about beside a relationship at the moment.

Any hobbies?
I guess games, tabletop as well as computer.

Fast food, bistro or Michelin starred restaurant?
Anything that tastes well goes for me.

Netflix or the cinema? And what is your favourite TV-series or movie?
The cinema has my preference over Netflix. My favourite show has got to be Black Lagoon.

What kind of job did you want growing up?
I know I wanted to be a lot of different things like construction worker, pilot and even dentist at some point.

What is it you like most about your current job?
The people. There are few places where colleagues treat each other the way they do at Seabed and I like that a lot.

What do you learn from your colleagues?
I learn many different technical terms and such from them.

If you would win the lottery, what would your life look like?
I would probably buy myself a decently sized house, put some away for savings and invest in real estate.

Assisting in Florianopolis Brazil

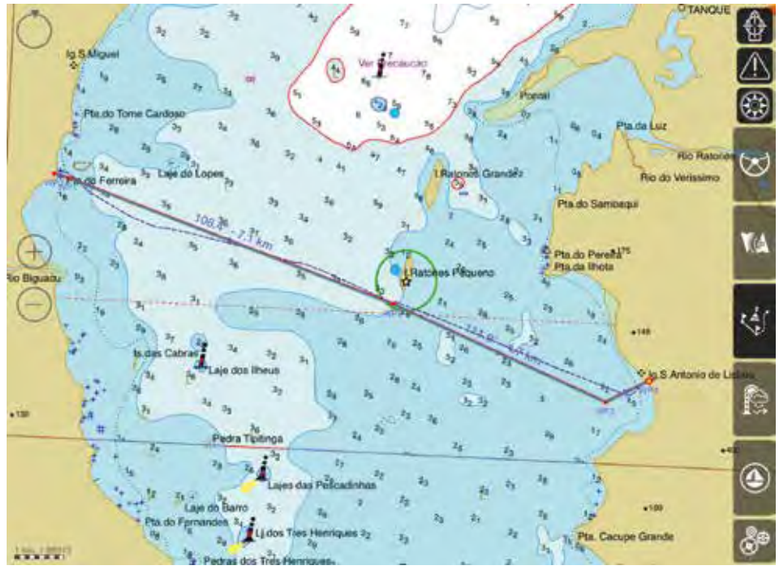
Florianópolis is the capital and second largest city of the state of Santa Catarina, in the South region of Brazil. The city encompasses Santa Catarina Island and surrounding small islands, as well as part of the mainland. It has a population of 477,798, according to the 2016 IBGE population estimate, the second most populous city in the state (after Joinville), and the 47th in Brazil. The metropolitan area has an estimated population of 1,111,702, the 21st largest in the country. The city is known for having the country's third highest Human Development Index score among all Brazilian cities (0.847). The city is considered safe by Brazilian standards. In 2014, Florianópolis had the second-lowest incidence of murders of Brazilian capitals. Florianpolis is connected to the main land by two bridges.

The economy of Florianópolis is heavily based on information technology, tourism and services. During the past decade technology and software development firms also experienced strong growth, and today Information Technology services are one of the top revenue generators in Florianópolis. Several technology centers are spread around Florianópolis, making the city an important pole in this economic sector.

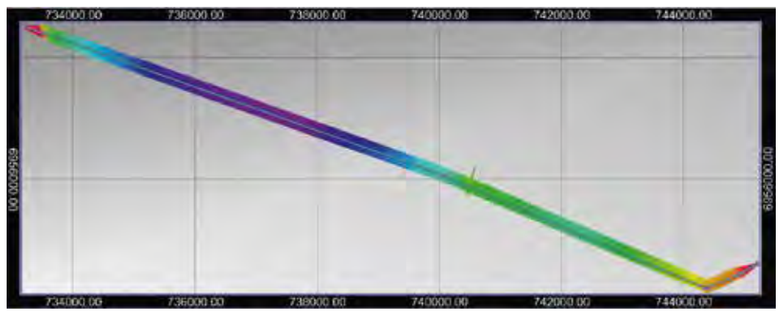
Due to its growth economically in the technology sector it is of utmost importance that they have high quality data connection with the rest of the world. Therefore we were contacted by Aquamar to consult and provide the right equipment to do the pre survey for the power cable placement.

AQUAMAR's mission is to "reconcile effort, dedication and experience in the search for innovative, practical and efficient solutions in the realization of underwater services, always with the conscience and respect to the preservation of the environment".
To assist Aquamar we traveled down to location with our SPLMS system, a base station, side scan sonar and a subbottom profiler. For specification and rental options visit our website **www.seabed.nl**.

Seabed installed the equipment and trained the local surveyors on how to operate the equipment, how to process the data in QPS Qimera and how to calculate the cable length using QPS Fledermaus route planning.



The vessel of opportunity



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.

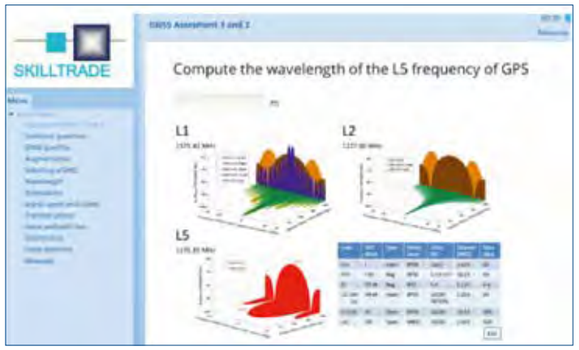
Skilltrade offers the following, hydrography and geodesy related E-learning:

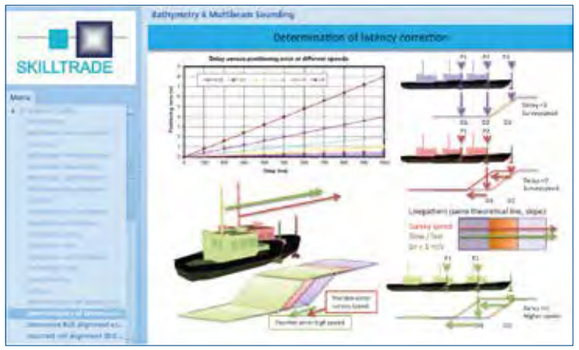
- Mathematics
- Physics
- Bathymetry
- Geodesy
- Global Navigation Satellite Systems

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 21st Skilltrade Hydrographic Survey Category B Course all successfully completed 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.

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SKILLTRADE

Quick Survey of Liberty Bridge Wreckage

November, 2018, Budapest

Image credit: Budapest Business Journal, May 23, 2018.

Liberty Bridge: Quick Facts

Built for the Millennium World Exhibition, Liberty Bridge is the third and shortest bridge of Budapest.

Location: Budapest, Hungary
Crosses: River Danube
Architect: János Feketeházy
Style: Art Nouveau
Opening date: 4 October 1896
Total length: 333.6 m (1,094 ft)
Name in Hungarian: Szabadság híd
Original name: Franz Joseph Bridge (Ferenc József híd)

On January 16th, 1945 together with all other Budapest bridges, Francis Joseph Bridge was blown up by retreating German troops. The center section was completely destroyed. After the WWII ended, it was reconstructed and reopened for traffic on August 20th, 1946. The Bridge also got a new name – Liberty Bridge.

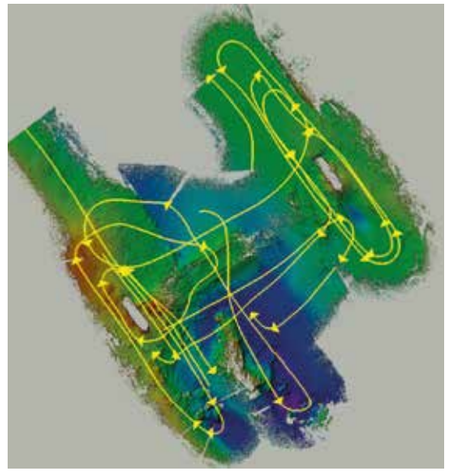
(Left) Liberty Bridge before the WWII (1928). Image credit: Fortepan — ID 32578, www.fortepan.hu/

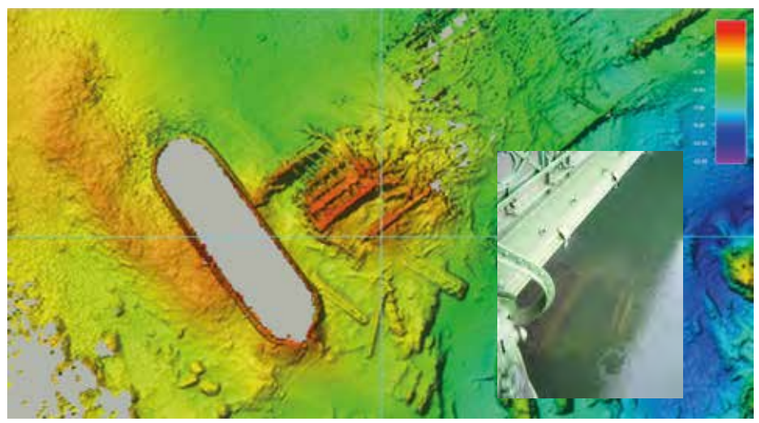
Liberty Bridge after destruction in 1945, showing the center section destroyed. Image credit: Wikimedia Commons.

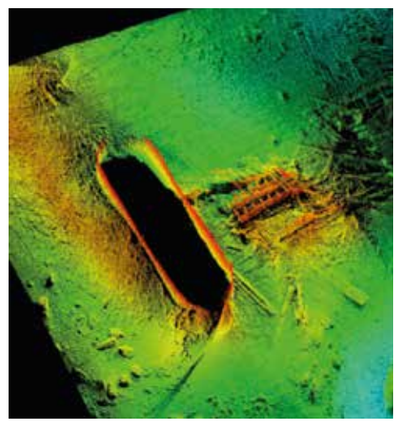
In November 2018, NORBIT team did a bathymetric survey of the wreckage, left after Liberty Bridge's destruction in 1946.

- System used: NORBIT iWBMSh STX.
- Platform: flex-hull boat (belonging to customer).
- Mounting: quick holding bracket made of Bosch profiles.
- Immersion depth 40cm due to very low level of Danube. Sonar did not clear the hull completely on port side.
- Sonar powered from DC inverter from car batteries.
- RTK used during the survey via cell phone.

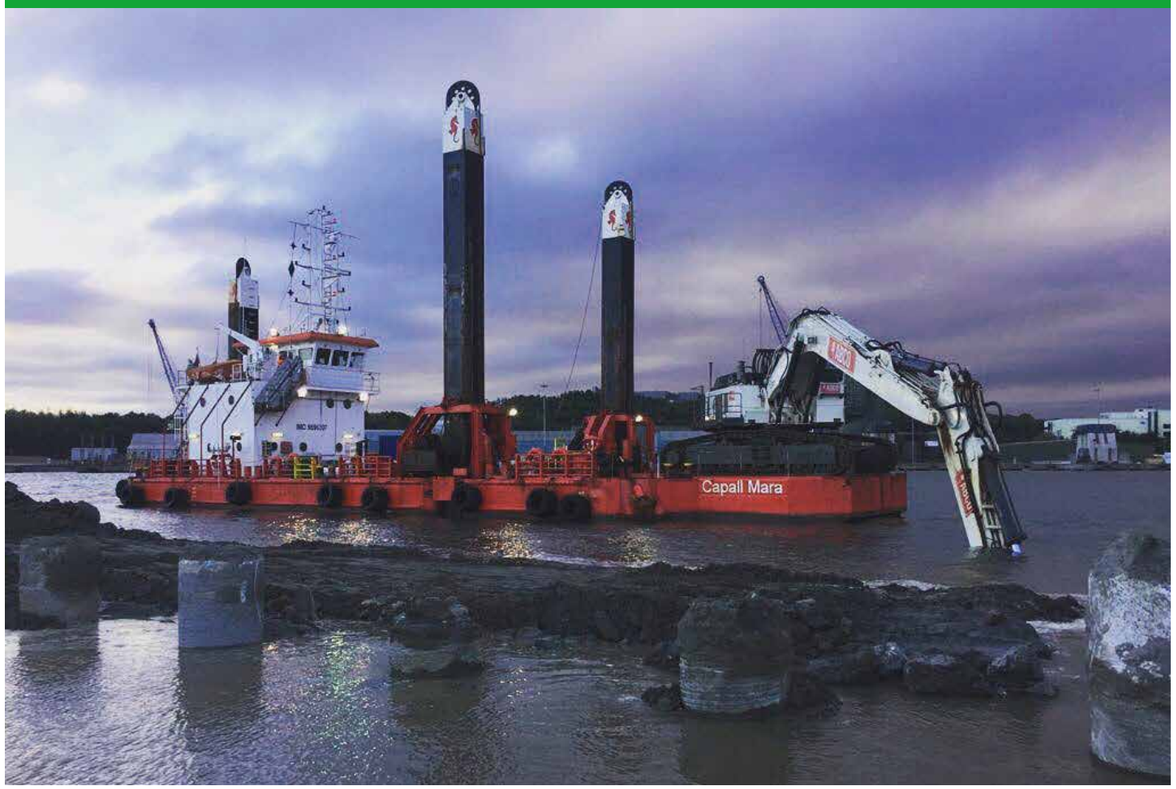
NORBIT







Cork, Ireland



The Port of Cork (Irish: Port Chorcaí) is the main port serving the South of Ireland, County Cork and Cork City. It is the second busiest port in Ireland and offers all six shipping modes i.e. Lift-on Lift-off, Roll-on Roll-off, Liquid Bulk, Dry Bulk, Break Bulk and Cruise. Some of the bigger ships can dock in Cork, up to 90,000 tonnes deadweight. After Cobh the restrictions are for 60,000 tonnes deadweight to move further inland. The Port of Cork provides pilotage and towage facilities for vessels entering Cork Harbour. In the Port of Cork are berthing facilities in Cork city, Tivoli, Cobh and Ringaskiddy. With increasing container traffic there was a need for expansion near Ringaskiddy, a new facility that is capable of handling 400,000 tonnes per annum.

Civil Engineering Specialists have been working in the Port of Cork for a while to realize the facility that is needed for the increased traffic. To be able to reach the depths that are needed for the massive ships, they needed some additional equipment that is on par with the crane they already had operational in October.
The rental cranes offered by the Seabed client are capable of the tasks that is required. The Caterpillar 390 with triple configuration. The CAT 390 was in the Netherlands for maintenance so in order to get it to Cork it had to be disassembled, transported and then re-assembled onsite. The project requires them to have a registration system on the crane to keep track of the work in great detail. This is where the Seabed Crane System comes in.

Amsterdam Ordnance Datum (NAP)

18 February 2018 it was exactly 200 years ago that King Willem 1 introduced by royal decree the Normaal Amsterdam Peil (NAP) as a reference framework for height measurements throughout the Netherlands.

NAP originates from Amsterdams Peil (AP) one of the many local and regional ordnance datums that where used in the Netherlands before the 20th century. AP was based on the average summer flood levels of the IJ, measured over a period from the 1st of September 1683 till 1684. The name Normaal Amsterdam Peil is used since 1891. Originally the NAP corresponded to the geoid, but nowadays this is no longer the case. The European terrestrial reference system 1989 has been the official three-dimensional coordinate system in the Netherlands since 1 October 2000.

Reference Marks

NAP consist out of 35.000 visible reference marks, mostly brass bolts with the text NAP. You can find them in quays, walls, structures or on stilts. There are even 400 underground marks.
NAP is subject to constant change due to bottom movement. Every 10 years, Rijkswaterstaat determines the level of most of the reference marks. The data of the reference marks are published in a NAP reference list.

NAP reference markers

History

Huddestone

The NAP is the normalized Amsterdams Peil (AP). This AP was the Stadtspeyl that was recorded in 1684. It was the average flood level of the IJ between September 1683 and September 1684, and therefore a high-water level. This level was set at nine feet and five inches (= 2,67689 meters) below the Zee Dyks Heights that was indicated by a groove in a Huddestone.

Original Huiddestenen

Eight of these stones were placed in locks in Amsterdam by order of Mayor Hudde: the Eenhoornsluis, Nieuwe Haarlemmersluis, Oude Haarlemmersluis, Nieuwe Brugsluis, Kolksluis, Kraansluis, West-Indian lock and Scharrebier lock. Of these stones, only the one in the Eenhoornsluis (Korte Prinsengracht near the Haarlemmerdijk) is still present at its original location. This stone, now referred to as Huddesteen, and the lock have been declared a monument in 2005.
The Huddesteen, built into the Nieuwe Brugsluis, was relocated around 1955 during its renovation. During the demolition of this bridge for the construction of the North / South line, a white marble stone was found at the height of the Damrak.

After the bridge was rebuilt, the stone was replaced in 2014 and is now visible on the north side of the New Bridge. Two separate Hudstones have also been preserved. A stone, half of which has disappeared, is now bricked in the Rijkswaterstaat building on Derde Werelddreef in Delft.

During the second accuracy leveling (1926-1939), in 1928, the determination of the zero level was connected to the two still present and usable stones from Hudde, resp. in the Nieuwe Brugsluis and in the Eenhoornsluis. In 1953 the NAP was established in relation to the height of the hemispherical top of a bronze bolt on a 22-meter-long pile on Dam Square in Amsterdam. The bolt was 90 centimeters below the pavement at a height of 1,4278 meters + NAP. The height of the underground mark on the Dam is based on the height of the Hudde stone in the Nieuwe Brugsluis. On top of this there is a cover of flagstone in the pavement. This underground mark was per definition 1,4278 meters above sea level and was therefore the benchmark for NAP. This definition was abandoned in 2004 and the value of this point adjusted to 1,408 meters above sea level.
The Huddestone was moved in the Nieuwe Brugsluis in 1955. The point on Dam Square has since been the starting point for determining the height in the Netherlands. Later a bolt at 0 meter NAP was installed in the Amsterdam Stopera on Waterlooplein. A second pile with a bronze bolt has been installed in the Stopera. It has no meaning other than a ceremonial and tourist one.

In 2004 all NAP heights were recalculated following the 5th accuracy leveling (1996-1999). Only the heights of 6 of the most stable points were retained as well as possible at the height of the 2nd accuracy leveling (1928-1940). These new benchmarks are in Heerde, Velp, Amersfoort, Millingen, Wageningen and Muiderberg.

From AP to NAP

In 1860 the AP was transferred to other used levels for comparison. An error appeared to have occurred. This was corrected from 1885 to 1894 (normalized). To make a distinction the normalized level was called NAP. AP and NAP are therefore the same. The indication 'Normaal' only indicated during the intervening period that it was a corrected (normalized, hence the 'N') height. An (yet) uncorrected height remained, until the moment of correction, indicated by AP. After all points were normalized, the name NAP was retained.

Initially, the meaning of the added letter 'N' was not mentioned, causing people to speculate about its meaning. The meaning 'new' was obvious, but the records of the 46th meeting of the National Commission for Degree Measurement and Leveling refer to Normal Amsterdam Level.
In 1879 Prussia was connected to the NAP. The level here is called Normal null (NN = NAP). The NAP is also used in Luxembourg. Sweden, Norway and Finland followed in 1973.
The reference of the Belgian Second General Leveling (TAW) is 2.33 meters lower.

Fun facts:

- The lowest point of the Netherlands lays at 6.76 meters below NAP in Nieuwekerk aan den IJsel.
- 26% of the Netherlands is below NAP:
- Close to the three-country point on Vaalserberg is the highest point on the Dutch mainland (NAP + 322.4 m). In the list of highest points in the Kingdom of the Netherlands are the highest points per province. For comparison: the height of the Gerbrandy tower in IJsselstein is 372 m.

Source: Wikipedia

Advertorial

Falmouth Scientific Inc. Company Overview:

Acoustic Sensors / Seismic Profiling Systems / Transducers

Falmouth Scientific, Inc. (FSI) provides innovative and reliable sensor and survey solutions for applications in salt and fresh water environments. FSI's sensor based standard product areas include advanced seismic, sub-bottom, and side scan sonar imaging systems; current, wave, and tide meters; electro-acoustic transducers; and acoustic relocation systems. Services include custom design, development, integration, and production of marine technology, as well as value-added services such as prototyping, product assembly, potting, calibration, and pressure testing.

At our core is innovative system and design engineering, on-site assembly and production operations, and electrical, acoustic, environmental, and system testing facilities. FSI was founded in 1989 based on WHOI technology licenses, and is located in the heart of the New England marine technology cluster on Cape Cod in Cataumet, Massachusetts. Since that time the focus on FSI products and services has been to focus on acoustic technologies over a variety of product segments. As part of the focus on acoustic systems, FSI acquired Hegg Marine Solutions in 2010 to establish a geophysical line of acoustic products.

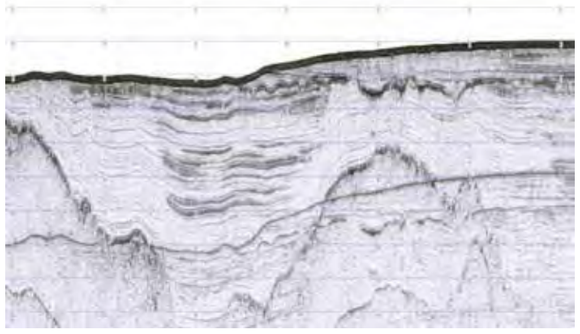
Hegg Marine Solutions is a brand under the FSI umbrella for sub-bottom and side scan sonar system technologies as well as field support services. The main products are the HMS-620 Bubble Gun family of seismic systems, The HMS-622 CHIRPceiver Subottom and the HMS-624 Sidescan. There is also a combined sidescan and subbottom available the HMS-6x5 in 2000m-6000m configurations.

Seismic Profiling Systems: HMS-620 Bubble Gun™

Complete Single Source Bubble Gun System

Source vehicle is compact and easy to deploy

The Falmouth Scientific **HMS-620 Bubble Gun™ Seismic Profiling System** is a high power, portable, low frequency acoustic profiling system that provides deep bottom penetration through sediments that are very difficult to penetrate with the higher frequency profilers. The patented "Bubble Gun" electromagnetic acoustic transducer installed on a single tow vehicle provide bottom penetration through coarse sand and gravel, all the way to bedrock. The profiling system consists of three main components: the Falmouth Scientific HMS-620 Bubble Gun Transceiver, the Falmouth Scientific HMS-620 Bubble Gun Tow Vehicle, and the Falmouth Scientific HMS-620 Hydrophone Streamer. The Bubble GunTM has produced great results for port expansion projects, wind farm sight surveys and sand reclamation projects.



Data from Sand Reclamation Survey Courtesy of the University of Rhode island Graduate School of Oceanography

The Falmouth Scientific **HMS-622 Subbottom Profiling System** is a high power, portable, subbottom profiling system utilizing linear swept FM or "Chirp" technology that provides deep bottom penetration through a variety of sediments. Sub-bottom profiling applications in diverse sediments require multiple frequency bands to support diverse survey requirements. The HMS-622 CHIRPceiverTM and transducer arrays and vehicles fill this wide range of survey needs. The frequency band supported by the HMS-622 include standard LF (1KHz-10KHz), and optional ULF (200Hz-2KHz) and HF (8KHz-23KHz). It can be easily configured for up to 50Khz with a standard 2 channel transceiver. CW frequencies can also be programmed within the respective band. The transducer and hydrophone arrays are configured to perform both the transmit and the receive functions of the system.

The HMS-622 CHIRPceiver uses a flexible Graphical User Interface connected via Ethernet that allows the user to set CHIRP or CW modes of operation, Start and Stop frequencies, and Pulse Lengths and Power Level for the output pulses. The receiver controls allow for Gain and Attenuation as well as Diagnostic modes. The user selectable direct 24 bit A/D input allows the user to input data for the HMS-620 Bubble Gun or other analog seismic system. The HMS-622 CHIRPceiver will also support multi-ping modes for higher along track resolution when operating in water depths deeper than a given ping rate. All sonar data is logged in SEGY format using industry standard acquisition software. The CHIRPceiver is also available in a low cost single channel version for coastal surveys less than 500m water depth.

Acoustic Sensors:

The Falmouth Scientific 3-Dimensional **Acoustic Current Meter (ACM-PLUS)** collects, outputs and stores instantaneous current velocity data in three dimensions along with 3-axis compass data, 2-axis tilt data, temperature data, and data from optional sensors, including an integrated CTD. The current velocity and tilt data can also be output and stored as vector averages over specified averaging intervals. The ACM-PLUS is configured and operated using ACMProPlus, a Microsoft Windows based software program included with the instrument. With ACMProPlus you can configure and deploy the instrument, acquire data in real time and download the data from the instrument's memory. And the real-time data can be viewed on a real-time monitor or a dashboard.

The ACM-PLUS Instrument

The **ACM-PLUS** measures current velocity in the two horizontal dimensions and the vertical dimension using four acoustic transducers. Included inside the instrument's housing is a 3-axis solid state compass for measuring the Earth's magnetic field and a 2-axis solid state accelerometer for measuring tilt. A temperature sensor for measuring water temperature is located on the top end cap. Along with the optional CTD, the ACM-PLUS can optionally include two auxiliary analog input channels which interface with most DC output sensors, including dissolved oxygen, pH, chlorophyll, light transmission, and others. The ACM-PLUS can be powered from an external DC power supply or from an internal alkaline battery pack. Data can be acquired in real time in ASCII format through an RS-232 or RS-485 serial interface at baud rates up to 115200 bits/sec, or the instrument can be deployed and the data stored in its memory for later retrieval. A single bulkhead connector on the top end cap provides the RS-232 or RS-485 connection and inputs external power. The ACM-Plus is small in size and low in weight and has a depth rating of 200 meters. In addition, a 1.5-ton working strength 316 stainless steel frame is included with pad eyes on the top and bottom for securing to a mooring line, and zinc anodes are attached to the frame to provide cathodic protection. Optionally available is a 5-ton 316 stainless steel frame. In addition, a 7000-meter rated ACM-PLUS is optionally available.

Acoustic Transducers and arrays:

Falmouth Scientific also, designs and manufactures a variety of piezo electric transducers and arrays. Our transducer products range from low cost pinger, transponder and flow meter transducers to high power line arrays and deep water tonpilz projectors for our side scan sonar and sub-bottom profiling systems. Custom transducers can also be supplied to meet specific project requirements.

Standard Acoustic Transducer products

HMS-ATTR-4.5K LF is a high power tonpilz designed to operate in the 1kHz to 10kHz range.
TVR: 152 dB re 1uPa/Vrms
RVS: -165 dB re 1Vrms/uPA
Power Rating: 600 Watts 30% duty cycle
Beam Width: 80 degrees conical
Operating depth up to 3000m.
Main application is sub-bottom profiling.

HMS-ATTR-15K is a high power 7 element tonpilz conical array designed to operate in the 8kHz to 23kHz range.
TVR: 155 dB re 1uPa/Vrms
RVS: -165 dB re 1Vrms/uPA
Power Rating: 1000 Watts 15% duty cycle
Beam Width: 20 degrees conical
Operating depth up to 6000m.
Main application is sub-bottom profiling.

HMS-ATTR-15K-9-120 is a high power 7 element tonpilz line array designed to operate in the 8kHz to 23kHz range.
TVR: 155 dB re 1uPa/Vrms
RVS: -165 dB re 1Vrms/uPA
Power Rating: 1000 Watts 15% duty cycle
Beam Width: 120degrees fwd/aft, 9 degrees athwart
Operating depth up to 3000m.
Main application is sub-bottom profiling pipeline detection.

HMS-AT-650 ULF is a high power flextensional transducer designed to operate in the 200Hz to 2kHz range.
TVR: 138 dB re 1uPa/Vrms
RVS: -190 dB re 1Vrms/uPA
Power Rating: 1500 Watts 15% duty cycle Beam Width: Omni
Operating depth up to 300m.
Main application is sub-bottom profiling.

Falmouth Scientific

More detailed information on any Falmouth Scientific products can be found at www.falmouth.com

Meet the Seabed Team

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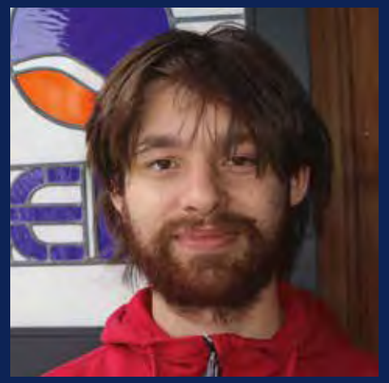
Financial Administrator



Jeroen Komen
Engineer

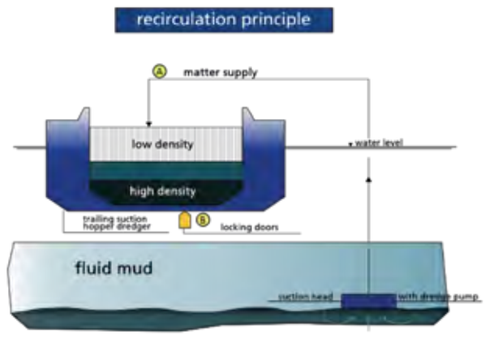
Jesse Houter
Engineer

DENSITY matters...

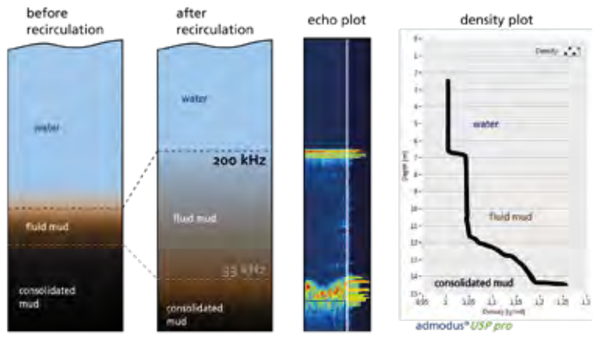
Port of Emden, Germany reducing dredging costs by 90%

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

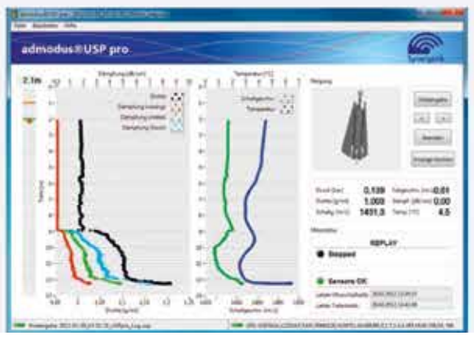
The admodus®*USP pro* is linked via high-speed Ethernet to a PC which displays all measurement data clearly laid out and in real time, stores them, and exports them as a PDF report as required. The user software features an automatic recording mode which permits serial measurements without interaction.

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.

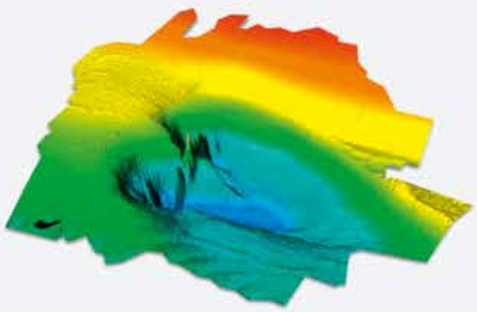
The single beam system with dual frequencies enables effective surveying of seafloor conditions, and of the different layer formations of suspended matter and sediments, ranging from fluid mud to well consolidated silt.

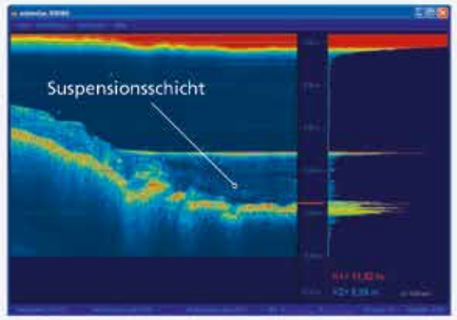
All data are transferred in real time to a computer via Ethernet, then visualised and stored. In addition, the admodus®*SONAR* user software provides an interface with widely available surveying software programs such as QINSy, WinProfile and Profile 2000, so that the horizons identified can also be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

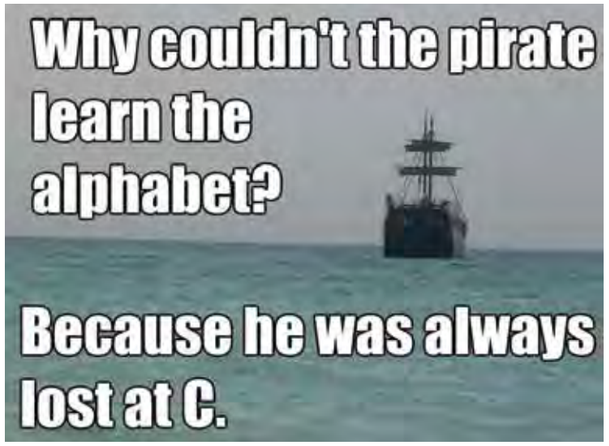
With its compact dimensions and the splash-proof design of its housing, the system is also highly suitable for mobile field work.

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

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Prize Puzzle


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THE



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The object of the puzzle is to find words using the hints above. Together the words form a sentence. Solutions have to be submitted before November 1st 2019. The winner will receive a Mini Wifi Beamer.
Please send your solution to: sales@seabed.nl

Last year's winner of the prize puzzle was: **Marc Hartogs, Rijkswaterstaat.**

Colophon

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Design: RBREG Concept & Art Direction
Words: Eva Brans, Elice Collewijn, Hans Tuinman, Evert Bootsman, Jeroen Komen en Maurice Buijsman
Photography: Elice Collewijn, Ray Breg, Stock

www.seabed.nl

Seabed Crane system

Seabed's Crane system is the solution to all your excavation and dredging jobs, the crane system is deployed as an all in one unit in a multipurpose portable ruggedized case. This highly advanced guidance system is efficient, and can be installed through a user friendly WebGUI.

The system is equipped with a computer and software, so all the data acquisition is done in a professional manner.

SEABED

Getting to the bottom of things