# SEABED GAZETTE

2022

## The Maritime Institute Willem Barenttsz

## A new spot for the End of Summer Days

## Which Winch Wins?

SEABED

Getting to the bottom of things

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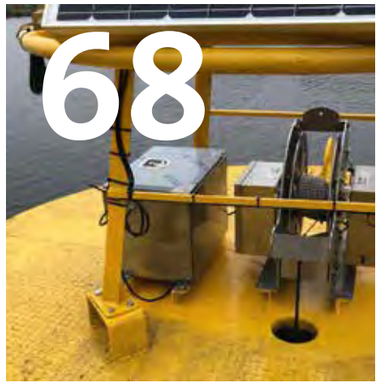
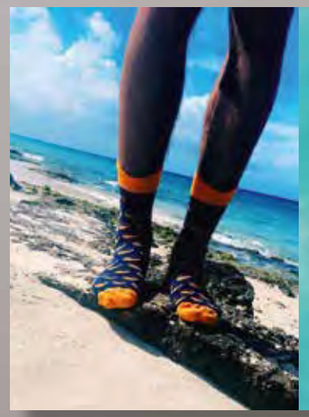


# SOCK IT TO ME!

*'First prize winner'*
*Jurgen Reineke, 2021*
*Awarded a 100 euro hotelcheque*

**2 years ago we asked you to photograph yourself with our special Seabed Slippers. Last year at Seabed End of Summer Demo Days we handed out Seabed Socks. So we asked you again to take a picture while wearing our socks. And you didn't disappoint! Jurgen Reineke, shown above, was the winner. On the next pages we have some of the other 'artworks' on display. Enjoy!**



www.seabed.nl

# Seabed Orinoco Solo V3

**Based on the successful Orinoco line of tide gauges, the OrinocoSolo V3 is the latest offspring. The basic unit is a high capacity data logger with up to eight analogue inputs and up to four RS232 inputs (optional) and one serial data output which supports multiple formats.**


SEABED

# Client tales #1

With operating offices in Brugge, Belgium and Southampton, UK - Enviros is the result of the demands that are still not satisfactorily met by the current players in the energy industry, especially with respect to the toughest challenges faced by governments, oil & gas operators, energy companies, engineering houses and contractors.

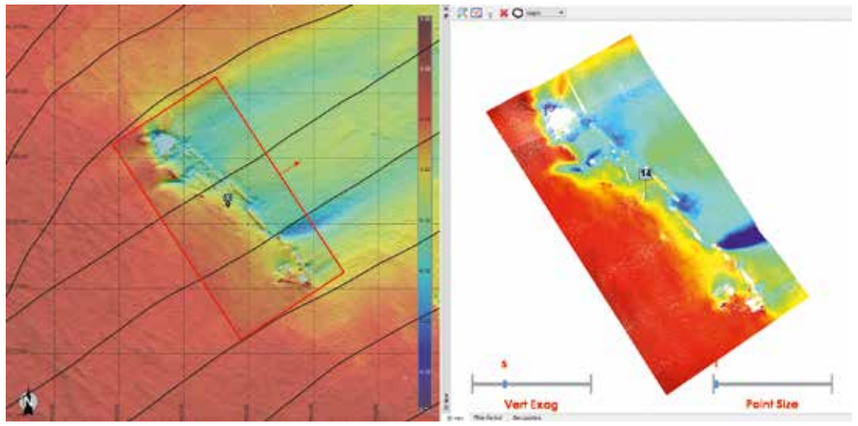
Enviros is a specialist and independent geosciences, environmental, asset integrity, and consultancy company, operating in the offshore, coastal and land environments on a global level.

Enviros focus on providing innovative and integrated environmental and geoscience solutions. By providing innovative technical solutions, we aim at delivering sector leading data quality, health and safety, and environmental management whilst simultaneously offering cost benefits to our customers.

Enviros has OHSAS 18001, ISO9001 and ISO14001 accreditation.

Our survey services for seafloor site investigations provide high quality data that may be used for location approaching, reservoir characterisation, monitoring of production impact, detection of potential geohazards and project management decision.

Data is of great value for area mapping, avoidance areas, vessel positioning and identification of existing structures, debris, pipelines and other subsea hazards.




Enviros has been undertaking hydrographic surveys to IHO S-44 standard in Belgium, The Netherlands and worldwide. Survey methods and equipment are continuously improving: Enviros upgrades and innovates its survey spread to meet changing demands of the hydrographic stakeholders, ranging from nearshore shallow water to full ocean depth, and this with technical and supply support of SEABED BV for hydrographic Equipment as NORBIT WBMS and AML SVP's.

Applications for hydrography include:

- Coastal surveys;
- Pre and post-dredging surveys;
- Port and coastal developments;
- Coastal zone protection and management;
- Environmental services (assessments and modelling);
- Data acquisition and monitoring surveys;
- Navigation charting and nautical bottom depth survey;
- Offshore surveys for oil & gas;
- Cable route surveys;
- Services for renewable and Blue Energy;

enviros

Enviros Survey BV • Boogschutterlaan 20 • 8310 Sint Kruis Belgium
www.envirosgroup.com

# Mapping Svalbard glaciers with USV - top technology for novel results


*Figure 1 Uncrewed Surfice Vehicle (USV) "Kuninganna" with mounted NORBIT WINGHEAD multibeam sonar*

**Polar regions are the most sensitive to the effects of climate change and the resulting environmental stress. As the world warms, melting glaciers and ice sheets become the main contributors to a rising sea level. Ice loss from nearly every glacier on Earth is speeding up and significant ice loss takes place at marine-terminating glacier margins. This happens as a result of melting and calving. These processes are poorly understood and are therefore improperly included in ice sheet models.**

Geological, glaciological and oceanographic data are crucial in improving our understanding of the dynamics of marine-terminating glacier margins. The data also quantifies how this process contributes to a rise in sea levels. Acquisition of data at calving glacier margins in uncharted shallow waters and in difficult ice conditions with traditional methods, such as crewed surface vessels, is time-consuming, costly and risky.

Advances in marine autonomous survey technology and navigation systems have resulted in widespread development of uncrewed platforms for marine investigations. The current challenges are mainly related to the integration of appropriate hardware and development of algorithms that are best suited for specific tasks in a particular environment. The most important features for a USV conducting shallow-water surveys in uncharted polar regions; are easy transport to remote areas, adaptation to various instrument configurations, and flexible navigation and mapping algorithms adjustable to survey environment and goal. So far, only very simple instruments could be installed on board portable USV's (single beam echosounders, CTD's) due to space and payload limitations. Advanced development of multibeam echosounders and laser scanners give new prospect to combined mapping of uncharted submarine and subaerial coastal and fjord environments in remote Polar areas.

In August of 2021, The University Centre in Svalbard (UNIS) organised a marine geological field school to Wahlenbergfjorden in Svalbard (latitude 79.7°N). The aim was to study the seafloor, water column and the ice face of the Etonbreen glacier; which is draining the interior of Austfonna, the largest modern ice cap in Eurasia, into the fjord.

The need to map the harsh Arctic marine environments motivated the design of a portable, modular and robust Uncrewed Surface Vehicle





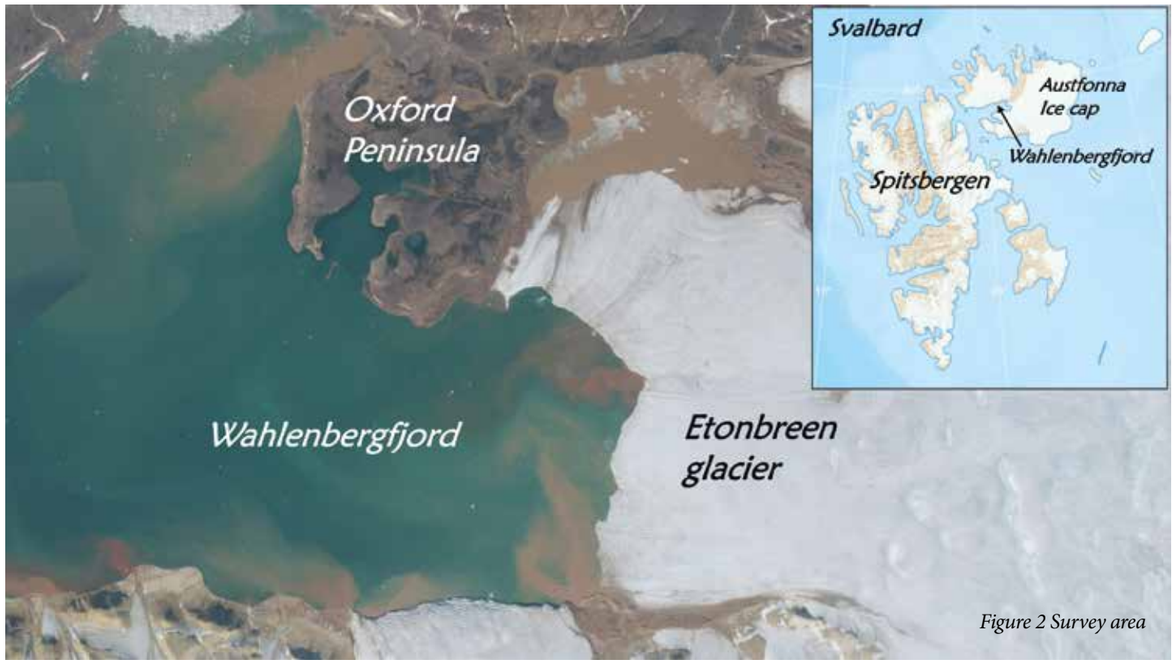



*Figure 2 Survey area*

(USV) "Kuninganna". It is based on commercial, "off-the-shelf" sea kayaks, which have a hull that provides ample payload capacity and a shape well-suited for agile navigation in ice-infested shallow water areas and near the tidewater glacier margins. The USV is powered by Cadson thrusters, which provide required thrust and agility for manoeuvring even in the challenging wind, sea and ice conditions. It was operated from aboard of M/S Stålbas; and equipped with integrated WINGHEAD i77h multibeam echosounder and iLidar provided by NORBIT. The echosounder system is comprised of a high accuracy motion unit built inside the head, together with 2 antennas navigation solutions, all integrated with a high resolution multibeam (1024 beams, 0.5°x0.9° resolution) and laser scanner. The entire mapping system is very light (weight<10kg in air) allowing for easy integration with a small USV.

*Figure 3 USV with NORBIT WINGHEAD system*

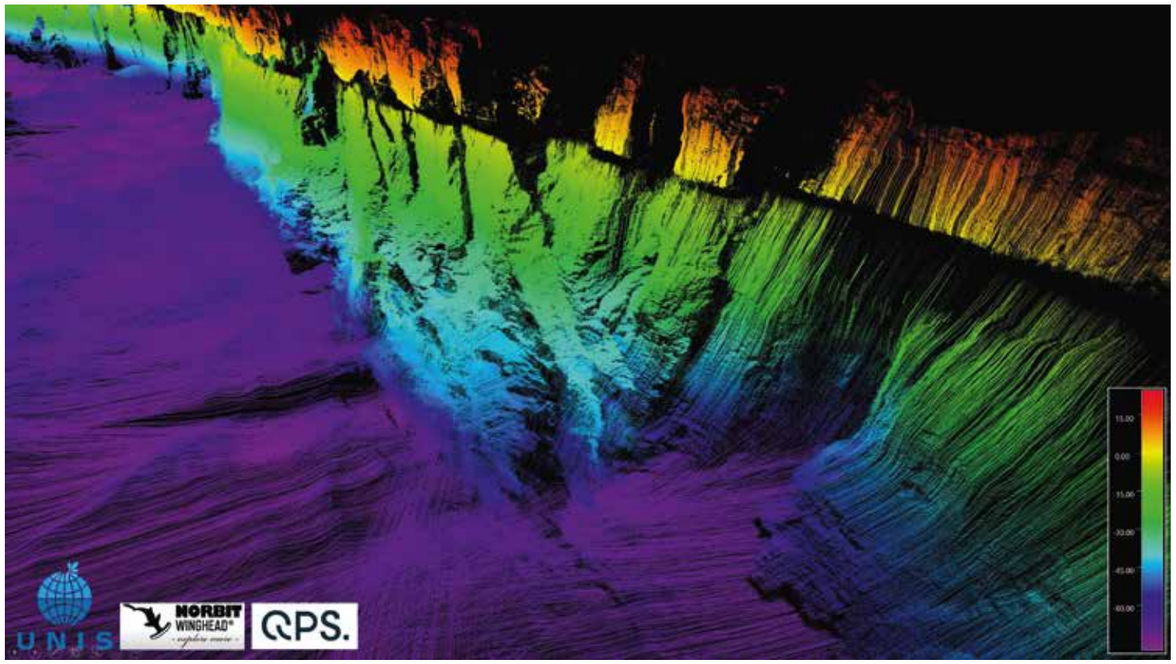



*Figure 5 Survey results revels a large cave in the submarine part of the ice face. Multibeam data point cloud connected with iLidar data of the upper part of the glacier front.*

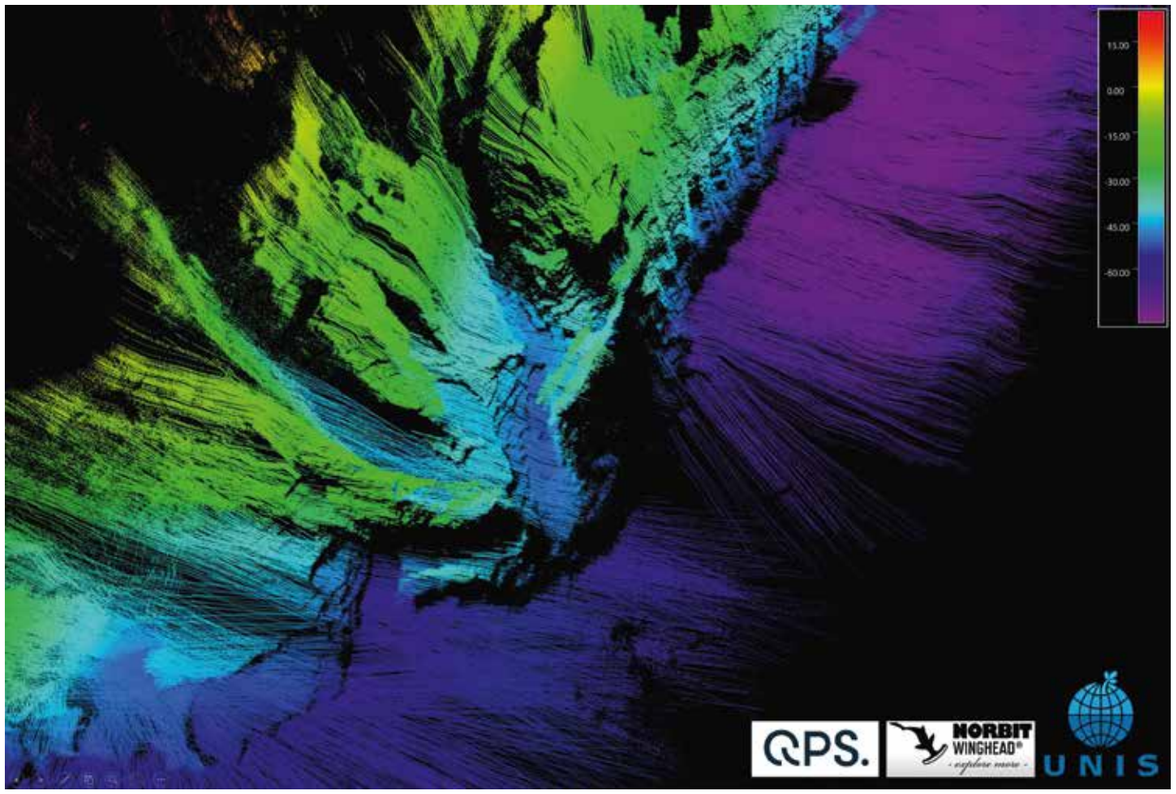



*Figure 6 Data shows flat and vertical ice walls, large notches at the sea level, severe undercuts at the base.*





*Figure 4 USV in operation in the front of the glacier*

Neptus and QPS Qinsy software were used for navigating and data collection (multibeam and lidar). NORBIT's dedicated Data Acquisition Software (DCT) was also used for recording the multibeam data. Acquisition of high-resolution data was controlled by the operator using WiFi link, observing the incoming data quality and adjusting the survey parameters on the M/S Stålbas vessel at a safe distance from the glacier face.

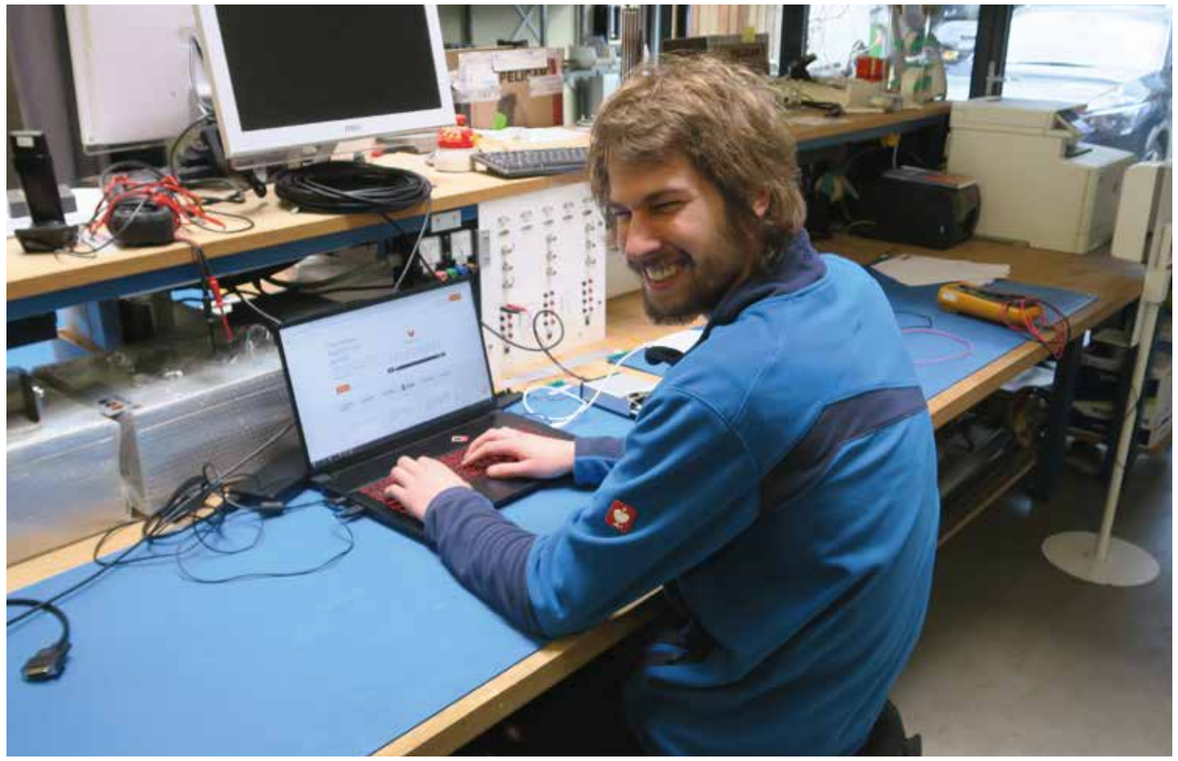
The curved array of the WINGHEAD enabled electronic beam steering to image the full height of the submarine ice face, from the base (~75m height) to the sea surface, with unprecedented resolution. Robust, versatile and intuitive software interface facilitated the adjustment of acquisition parameters in real time.

Preliminary data analysis revealed a highly variable morphology of the ice cliff; with sections of flat and vertical ice walls, large notches at the sea level, severe undercuts at the base, crevasses extending deep into the ice face, as well as caves and subglacial tunnel entrances at the base of the ice cliff and at sea level. A large cave observed in the submarine part of the ice face most likely represents a crevasse or exit of a subglacial meltwater channel.

This data, in combination with the temperature and salinity profiles through the water column, will provide the basis for benchmarking the oceanographic and glaciological conditions at the margin of Etonbreen and for assessing the ice-ocean-seabed interactions in the past, present as well as in the future.

The expedition was very successful, showing the great potential of using a USV with integrated, compact hydrographic devices; allowing high resolution mapping of ice front below and above water and increasing safety of surveying process.

NORBIT



# Meet...

## Bart Admiraal
Engineer

**Date of birth? And what is it you like to do on your birthday?**
18-09-1944, if I could I would go snowboarding with my girlfriend.

**Single, in a relationship or married?**
Relationship.

**Any hobbies?**
Tinkering with electronics, mostly.

**Fast food, bistro or Michelin starred restaurant?**
All of the above, as long as it tastes nice. I don't mind McDonalds every now and then. I would never say no to the Michelin starred restaurant.

**Netflix or the cinema? And what is your favourite TV-series or movie?**
Youtube, mostly engineering channels.

**What kind of job did you want growing up?**
Inventor.

**What is it you like most about your current job?**
Designing digital electronics and also vacation.

**What do you learn from your colleagues?**
How to use sonar equipment such as the WBMS and how to use monitoring equipment such as the AML.

**If you would win the lottery, what would your life look like?**
Depends on how much money you get. Probably just invested it in housing market.

# The Maritime Institute Willem Barentsz

## Then and now

by Johan Zegers

**The program Ocean Technology is based on the Maritime Institute Willem Barentsz on Terschelling. The maritime academy was founded in 1875 and today it is part of NHL Stenden University of Applied Sciences. MIWB is named after navigator and explorer Willem Barentsz, who was born on the island. The program Ocean Technology is since 2002 based on Terschelling, between 1979 and 2002, this educational program was part of the studies of the Hogeschool van Amsterdam.**

Every year, between the 20 and 25 students are starting with this study on Terschelling. In these 4 years, we educate them theoretical and practical to prepare them for the field with different practical events through the years. Events like the Surveyweeks (OT1 and OT2), Oosterom Survey (OT3), tide gauge installation (OT1) and more.

Almost 12 years ago, I started studying at the Maritime Institute Willem Barentsz. In the beginning, it was strange to adapt to this completely different environment. I thought that I would go to a school in Utrecht or Amsterdam, living the student's life as showed in the movies and series, but I ended up at the island called Terschelling.

*Cumulus used by students*

It was fun!I liked my time on the island. It was a completely different program compared to an average study. We had practical lessons like welding and they taught us how to work in a technical workshop. Next to that, the theory they taught us, was brought into practice every Wednesday. Funny fact, almost every Wednesday, during these lessons, when we were going to 'play outside', it started to rain. Probably this wasn't true, but we had this perception. Still, when we talk about these good old days, the practical lessons on Wednesdays are always discussed. Some inside information, the first time we were able to conduct a sun azimuth measurement was in March (school starts in September).

However, we liked the practical lessons. The time we spent outside working on projects with the equipment we received from companies. In the first two years, we ended the school year with the 'survey weeks' and used our theoretical knowledge during these practical weeks.

We were glad that we had our own vessel, called the Cumulus. It was not great, but at least it was floating, and we were able to conduct a SBES survey. The image on the left, shows 4 students on the Cumulus during their survey weeks. However, an emergency call was received by school and the help of the Cumulus was requested. There was no toilet paper on board during the practical lessons of the third years. Cumulus to the rescue!

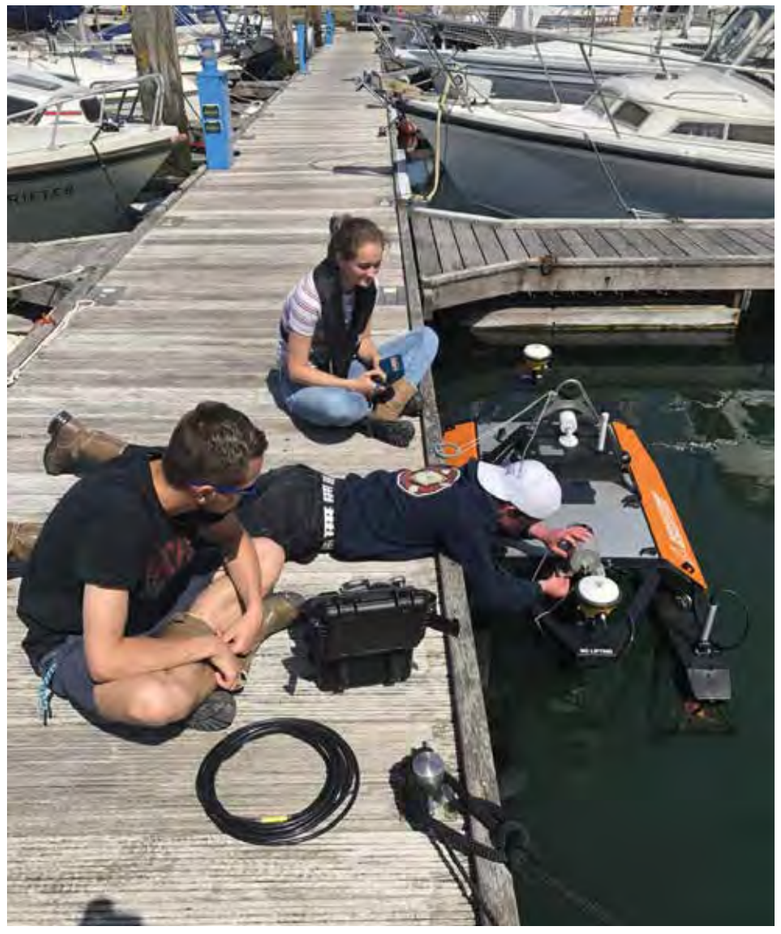
In the third year, we started working with the MBES and SSS systems during our Oosterom Project. This was completely new for us! Our teachers explained the theory behind them, but still, being able to understand these systems and mapping the seafloor into such detail was a completely new experience. Things have changed, the program but definitely the author.

*The author working on a SSS*

Two and a half years ago, my alma mater asked me if I would like to start working for them. I had a great time on the island, so after some talks with my managers at QPS, I started working for the Cat-A Ocean Technology program for 2 days a week. The idea was to help the other teachers with the practical lessons, but after a while, I also started teaching theoretical lessons. The theoretical part of the study changed in the years between my graduation and when I started teaching. And kept improving over the last two and a half years! But the practical work remained the same in nature if not in the equipment used!

The last couple of years, we strengthened our connection with the field. We asked distributors such as Seabed for the latest equipment and if we were allowed to borrow it during our practical lessons, we used it during our lessons!

We have an awesome team at our program, we have a wonderful cooperation with companies who support us with equipment, personnel, software, and more, and I am thankful to all (team and the companies) for your support and help.



# HIGH-PRECISION GIMBALS FOR MARITIME APPLICATIONS

**Not only in the air but also at sea, pitch and roll movements of boats, ships or USVs caused by the swell present a challenge for data acquisition processes. If sensors are mounted without stabilization, they are exposed to the movements of the vessel, which results in numerous sources of errors like an unstable field of view, decreased data quality and a deterioration of detection, tracking and pointing capabilities of sensor systems. The acquisition of blurred images or LiDAR data can cause post-processing issues and results in longer computing times.**

*Marine application example unstabilized.*

*Marine application example stabilized.*

For this reason, SOMAG AG Jena develops and manufactures a range of Gyro Stabilization Mounts specif- ically for marine applications to precisely stabilize sensors in extremely harsh environments. The two axis gimbals actively counterbalance vessel movements and ensure drastic motion reductions of the sensor. This results in pin-sharp images, high quality video recordings, a perfectly stabilized field of view, an en- hanced situational awareness and an improved detection and tracking of moving objects even from a distance.

The marine product portfolio comprises three different Gyro Stabilization Mounts for different sensor sizes and applications. All devices are designed for operation in harsh weather and water conditions on board boats, ships, Unmanned/Autonomous Surface Vehicles and floating platforms. SOMAG products are unique as they are not limited to any particular hardware, because customers should be as flexible as pos-sible when choosing a camera, LiDAR or scanner for their projects. The gimbals can be combined with a variety of 360 -, thermal imaging, video- and hyperspectral cameras as well as laser scanners or antennas.

### Possible maritime applications include:

- Maritime Patrol and Coastal Surveillance
- Search and Rescue Missions
- Anti-Collision Systems on USVs
- Offshore Data Transmission
- Offshore Survey

For further product information and sales inquiries please contact:
**Sören Lieske**
**Sales Manager**
Phone: +49 3641 633 68 18
E-Mail: s.lieske@somag-ag.de

### About SOMAG AG Jena

SOMAG AG Jena is a worldwide leading specialist for high-precision gimbal systems. The company, con-sisting of hand-picked experts in the fields of electronics and mechanics, has focused since 2004 on the development of Gyro Stabilization Mounts for data acquisition and surveillance applications. All products are assembled and tested with highest precision at the headquarters in Jena, Germany and at independent test facilities. The company is certified according to DIN EN ISO 9001:2015. SOMAG AG Jena clients in-clude military, governmental and commercial organizations as well as research institutions. In addition to their maritime mounting systems, SOMAG AG Jena offers Gyro Stabilization Mounts for airborne applica-tions, which are the perfect add-ons for bathymetric airborne laser scanners.

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

SOMAG



# Meet...

## Mustafa Kursad Ulusoy
Software Engineer

**Date of birth? And what is it you like to do on your birthday?**
18 July 1989 is my birthday. Always enjoyed spend time with my family on my birthdays

**Single, in a relationship or married?**
I'm married and have 2 beautiful children

**Any hobbies?**
I like to play football. And spending time with my family. Also music is my biggest hobby. I love to sing and play guitar and baglama(traditional Turkish instrument) . Also electronics is take a big place in my hobbies.

**Fast food, bistro or Michelin starred restaurant?**
I'm living for eating, not eating for living. So the place really doesn't matter.

**Netflix or the cinema? And what is your favourite TV-series or movie?**
Generally I don't watch much tv. And because of our kids are still small Netflix is not an option for me and my wife for at least 4 to 5 years. So if we could find anyone to take care of kids, cinema is the best option for us. Back to the Future is my favorite movie.

**What kind of job did you want growing up?**
I never had a certain job in my mind while I was growing up. There were just things that I like to do and anything relevant to this things would made me happy. And it already happened. I'm developing software and I'm in touch with electronic devices.

**What is it you like most about your current job?**
Producing new things, taking things with a different perspective and the most important helping people with their needs. And in the other hand learning were always been my passion and happy to continue learning in here.

**What do you learn from your colleagues?**
They were so helpful and nice to me. In this short time I've learned so much thing about hydrography and electronics. Also Dutch culture and language.

**If you would win the lottery, what would your life look like?**
I think it will not be so much difference between now and then. First of all I love working. So I don't think I will stop to work and spend money. Actually the only difference will be a nice car (preferably electric super car) and a nice and big house.

# YUCO, the innovation that makes AUV technology accessible

YUCO, a new micro-AUV for oceanographic exploration of the continental shelf.


**Currently, the use of operational Autonomous Underwater Vehicles (or AUVs) remains limited in the community. Their low maneuverability, complex deployment and high prices discourage their use for short-term measurements in coastal areas.**

Regarding the continental shelf, the future belongs to fleets of numerous small, agile, and affordable AUVs. Indeed, smaller Micro-AUVs are perfectly suited for short-term measurements in coastal areas, as they are lightweight and easy to maneuver and deploy.

SEABER is the only European company solely dedicated to Micro-AUV. The company was founded by four unconventional innovators with more than 15 years in AUV design, oceanographic instrumentation, and mobile robotics. Sharing their authentic obsession for creativity, robotics, and marine technologies, they have developed YUCO, an innovative micro-AUV that aims to democratize the use of micro-AUVs for coastal ocean applications.

The SEABER team is pleased to share with us a bit more about YUCO, the revolutionary micro-AUV range ready to deploy and deliver!

We will go through different topics such as the innovations of the YUCO micro-AUVs, the new applications for which it can be used and its current international presence.

## What are its features?

The YUCO micro-AUV has all of the following advantages:
- Compact: Less than 10kg and 1 meter long.
- Up to 10 hours autonomy, speed up to 6knots

- Depth rated at 300m
- INX© navigation solution with +/-1% accuracy without requiring any external elements such as acoustic telemetry
- Great payload capability
- High robustness & optimized maintenance
- Ease of logistics from size and weight factors
- Capability to navigate in coastal-current condition thanks to its speed and stability
- Affordable price

YUCO-SCAN can be combined with an optional video camera and light, providing a complete underwater vision package and leading the way to new uses in bathymetric surveys or photogrammetry.

## What applications can YUCO tackle for the ocean community?

Both in oceanographic research and the offshore industry, a low-cost platform with precise localization opens many possible applications.

At present, AUVs are underused by research communities due to their high prices and complexity of use.

Fleets of multiple small AUVs are the future of coastal oceanography science and numerous scientific projects demonstrate a future use for micro-AUVs in the scientific and research community.

SEABER is the only European company focused on micro-AUVs able to operate the full continental shelf, capable of carrying various scientific instruments.

Through the technology's accessibility, ease-of-use, and affordable price strategy, the YUCO micro-AUV range will become a favorite tool for oceanographic institutions.

Specifically, it provides a complementary tool to the research community in ocean observing, allowing to expand the capabilities of their vessel-based manual measurements and fixed observatories using micro-AUV.

Similar to the oceanographic research community, YUCO-SCAN can answer numerous needs of the offshore industries, especially in a pre-detection of potential issues on offshore infrastructures. For example:

- Coastal monitoring
- Hydrographic and environmental surveys
- Hydrology and water quality
- Habitat monitoring
- Search and rescue
- Under ice research…

## Is it easy to deploy?

YUCO micro-AUV comes with an intuitive software called SEAPLAN with the objective to make mission planning as smooth as possible.





In a single view, you can see and edit the elements of the mission (path, speed, payload, deployment and recovery points). Thanks to the modern graphical interface and high-level navigation patterns, even untrained users can easily prepare a mission. Advanced users can also access low-level navigation functions, payload activation and parameters with the same ease-of-use. Multiple online maps are available in SEAPLAN, but you can also create custom offline maps as most standard formats can be imported.

YUCO micro-AUV also comes with a field hand-held tool SEACOM to interact and call back YUCO micro-AUV on-the-field with a simple "come-back-to-me" order.

## Which one of your YUCOs would you like to draw our intention here?

YUCO-CTD, YUCO-PAM, YUCO-PHYSICO, or CARRIER so many are interesting… but a game changer we'd like to talk about is the YUCO-SCAN.

The YUCO-SCAN is probably the world's most compact, efficient and affordable autonomous underwater vehicle with integrated Side Scan Sonar.

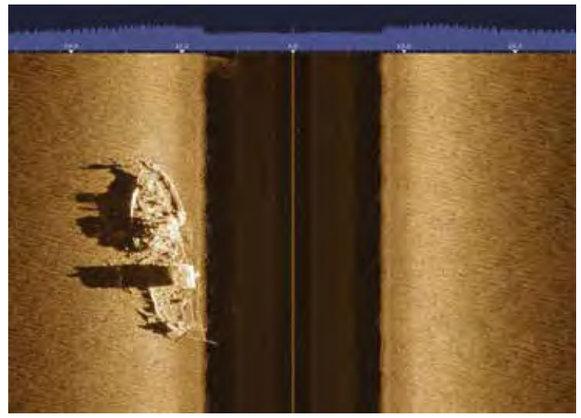
It is equipped with a 340kHz/680kHz sonar solution together with a 1MHz DVL* (Doppler Velocity Logger) that allows great navigation accuracy.

Finally, a GoPro + tunable lighting is available as an option.

Using YUCO-SCAN can perform missions of up to 50km distance at 2 to 4 knots. It is certainly one of the most simple and cost-effective ways to perform hydrographic surveys with minimized time and vessel expenses.

YUCO-SCAN definitely optimizes operational time at sea, hence the operating cost.

Data can be visualized on-the-field through SEAPLAN interface and can also be downloaded in standard formats for post processing.



## What about SEABER's worldwide and community feedback?

In terms of worldwide presence, the SEABER team is already closely working with a team of 25+ specialized distributors and partners around the globe.

As for community feedback, YUCO micro-AUV has been welcomed with great enthusiasm on the global market. SEABER's activity is growing fast and makes the team realize how much needed is the YUCO.

Moreover, we are very pleased that major scientific partners such as IFREMER, the Marine Institute, the SmartBay Marine Test Site Observatory in Ireland (through JERICO program), and DALHOUSIE University trust our expertise and include our YUCO micro-AUVs as a tool for their ambitious research topics.

The deployments carried out were all very successful, and the ease of use of the YUCO really impressed. It also allowed us to gather valuable scientific data. In general, many users confessed that having such an easy-to-use AUV makes them very creative and opens many new possible applications for their ocean studies!

In a few words, SEABER's aim is for YUCO micro-AUVs to make AUV platforms accessible to all the ocean communities.

## Find out more about SEABER and its full AUV range

**Seaber is located at 31 rue des fontaines, 56100, Lorient, France. If you have any questions, please contact them at Sales@seaber.fr, +33997235433**

SEABER

# The history of dredging

**Looking at the sustainability in the past and its future.**

**If dredging operations stopped in the Netherlands, the economy will literally come to a standstill. Keeping rivers, canals, docks and ports navigable not only costs a lot of money, but consumes a lot of fossil fuels. The largest dredgers consume 3,000 liters of oil per hour.**

For centuries, the Netherlands was mainly dredged by hand.  Through the years ingenious technology was gradually devised to make the heavy work easier

## Importance of dredging

Discussions about sustainability and energy consumption usually revolve around houses, appliances or cars. But what about major infrastructure projects and maintenance works? Can we also make them more sustainable? And what is the role of the dredging industry in this?

Transport by water has a sustainable image, but just like a road or a railway, a river, canal or port must be maintained. At the river or Seabed, all kinds of material, such as sand, plant remains and waste, constantly accumulate. To prevent the fairway from becoming too shallow, this dredged material must be removed regularly.

Sanding and salinization are particularly problematic in the " nether lands", because the flow rate of the water is so low. In addition, the Netherlands is located in the delta area of various rivers -- the Rhine, Meuse and Scheldt. All those rivers carry silt particles.

The Netherlands has many waterways and large ports. For the maintenance of Dutch waters, in the order of 30 to 35 million m3 of spoil is dredged per year. About 75% of this comes from saline waters. 20 million m3 of sludge is extracted per year from the port of Rotterdam alone.

More and more dredging is required. The increase of the scale in shipping both inland ships and seagoing vessels requires deeper waterways.

Although most dredging sludge is dumped at sea, 3.5 to 5 million m3 of contaminated dredging sludge must also be stored in depots every year. That starts to add up after a while.

For example, sufficient space will have to be made over the next hundred years to store up to 500 million m3 of contaminated dredging sludge.

## Dredging through the centuries

Salinization and silting are age-old problems in the Netherlands, so how was this work performed before the advent of fossil fuels? Initially, dredging was carried out on a large scale by hand.

Dredgers stood on a boat and scraped mud from the bottom with their "drill brackets".

The dredge bracket, an instrument that was also used for peat cutting, was a long stick with a ring-shaped metal scraper and a landing net at the end. The landing net could be different depending on the soil composition.

The mud was pulled ashore or deposited in a flat barge. Working with the dredging bracket, the handle was allowed to rest against the shoulder, so that the dredging bag could be dragged over the bottom with two hands.

During major dredging works, such as the construction of the North Holland Canal, thousands of workers with dredging brackets were deployed in 1822-1825. Until about 1960, dredging contractors employed brackets for the maintenance of shallow ditches and canals. The dredge bracket is still sold today.

Manual dredging was heavy and time consuming work, so there was a search for technology that could ease and speed up these tasks. In the last quarter of the sixteenth century the "dredging mill" was introduced. It was still based on manpower, but now the man was the energy source for a machine.

Four people worked up a sweat on treadmills or capstans that propelled a paddle wheel. The wheel with wooden flaps scooped the mud from the bottom and dumped it into a barge moored crosswise. The machines were often operated by prisoners.

The dredger usually consisted of two flat barges between which the wheel turned. The technology made it possible to dredge to a depth of 2 meters.

Unfortunately due to a growing economy ships kept getting bigger. Depending on the cargo, the draft of a merchant ship in the seventeenth century was between 3.5 and 5 meters, which was too deep for the dredger.

In 1622, the first "mud mill" was built: a horse-powered dredge mill. Three to six horses ran into a spindle, which set a bucket chain in motion. Due to the heavy work, the horses had to be changed every hour.

In 1829, technology allowed dredging to a depth of 5-7 meters. At a depth of 3.20 meters, approximately 20 m3 of dredged material could be collected per hour.

## Dredging on wind

In ports with a large difference between low and high tide, scribblers were placed. These large scribblers were triangular sailing ships with a broad tail and a flat bottom, under which a sort of harrow with iron teeth was attached. These ships were already used in Zeeland before 1435.

The scraper placed in front of the lock gates was then pushed through the harbor with great force while the iron teeth scraped the bottom. The ship gained extra momentum through the wide rear and, if the wind was right, the use of sails. In the absence of wind, horses were used to help pull ashore.

The scraper's flat bottom was hinged and could be lowered with the help of cables to improve draft. Two revolving doors, which when opened, made an acute angle of approximately 45 degrees with the ship, increased the outreach of the barge. Manpower was still needed. Five to six men kept the colossus in the correct path, while two to three men kept the window with the iron teeth at the desired depth via pulleys and tackle blocks.

In 1738 a wind dredger was built. This colossus consisted of a pontoon with a windmill on it that propelled a paddle wheel with a diameter of 12 meters.

## Energy usage of modern dredge vessels

The energy consumption of households has been mapped in detail, including the standby consumption of our appliances, but this does not apply to the maintenance of essential infrastructure.

The technical data of dredgers are known. An average trailing suction hopper dredger sucks up 100 m3 of sand spoil per minute and needs a pump power of 2500 kW for this.

The largest dredgers have an engine power of up to almost 30,000 kW and a pump power of more than 6,000 kW. At full power, such a ship consumes 3,000 liters of oil per hour.

## Can we dredge without fossil fuel again ?

The aforementioned pumping power of a typical trailing suction hopper dredger -- 2500 kW -- corresponds to the power of approximately 25,000 human dredgers. The largest dredgers have a pumping capacity equivalent to 60,000 human dredgers. So manual dredging won't be a feasible option.

Thanks to fossil fuels, we have been able to create canals and enable even the largest vessels to dock at ports. Will we be able to use Green Energy in the future?

The dredging industry is currently taking a proactive approach towards enhancing the environmental value, going far beyond the international and national policies and legislation. Although the emissions outputted by dredgers are primarily from fuel consumption during operations, dredge companies are committed to reduce all its carbon footprint.

Dredging companies aren't just looking at its own footprint but also plays a significant role in the construction of infrastructure for renewable offshore energy sources as wind energy. Wind farms are often located offshore and in remote areas. Seabed intervention is therefore required like trenching for cables.

New 'green' dredgers are being developed by companies as 'Damen'. Damen has a lot of experience in the construction of electric vessels, and is now developing new electric hopper dredgers called 'Marine Aggregated Dredgers'. As well as Royal IHC with their development of zero emission vessels. The focus of shipyards these days is to achieve the lowest low carbon print as possible for our future dredging vessels.

**Sources:**
IADC, Wikipedia , maritiem digital





# Falmouth Scientific Inc. Company Overview:

## Acoustic Sensors / Seismic Profiling Systems / Transducers

**FSI) has completed the full build out of their new facility. This new facility allows FSI to continue to provide innovative and reliable sensor and survey solutions for a variety of global applications in salt and fresh water environments. FSI's product sectors are Marine Sensors, Systems and Transducers that include advanced seismic, sub-bottom, and combined sub-bottom & side scan sonar imaging systems; current, wave, and tide meters; electro-acoustic transducers; and acoustic relocation systems. Services include custom system design, development, integration, and production sensors, systems, transducers for the marine environment. FSI's nearly 10,000 sq. ft. modern manufacturing facility houses an a coustic test tank, pressure chamber and calibration lab for qualification tests as well as value-added services such as prototyping, product assembly and subsea cable. At our core are 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 Pocasset, Massachusetts. This move left behind a 40 year legacy of innovations in the Marine Industry housing companies like Datasonics, Benthos and Falmouth Scientific Inc. with history going back to 1980. Founded in 1989 FSI has focused its attention on sensors, systems, transducers and other acoustic technologies over a variety of product segments. As part of the focus on acoustic systems, in 2000 FSI occupied the facility previously housed by leading marine industry technology companies now including Falmouth Scientific Inc. In 2010, FSI acquired Hegg Marine Solutions to establish a geophysical line of acoustic products to add to their system solutions.

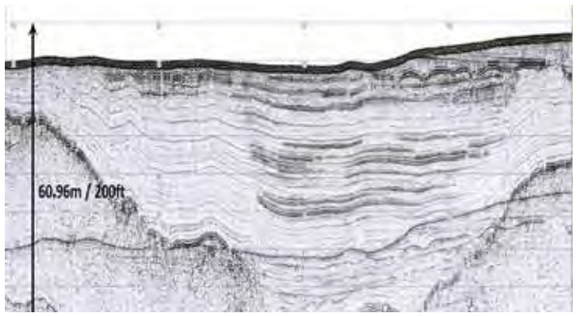
*Hegg Marine Solutions* is a brand of FSI products for sub-bottom, seismic, combined side scan sonar system technologies as well as field support services. The main products are the HMS-620 Bubble Gun family of seismic systems, The HMS-622 CHIRPceiver Sub-bottom and the HMS-6x5 Combined Sidescan & Sub-bottom systems. The HMS-6x5 is available 2000m-6000m configurations.

# Seismic Profiling Systems: HMS-620 Bubble Gun™

*Dual Bubble Gun Deployment*

*Easy to deploy portable system*

The Falmouth Scientific **HMS-620 Bubble Gun™ Seismic Profiling System** The Falmouth Scientific HMS-620 Bubble GunTM Seismic Profiling System is a high energy, low 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 "Bubble Gun" electro-mechanical acoustic transducer has three standard installed configurations mounted on a tow vehicle to provide deep sub-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 (Single, Dual and LF), 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*

## HMS-622 CHIRPceiver™


The Falmouth Scientific **HMS-622 Subbottom Profiling System** is a high power, portable, sub-bottom profiling system for towed, hull mounted and over the side configurations 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 transducers can be configured to transmit and receive and the hydrophone arrays can be configured to perform the receive functions based on of the system.

The HMS-622 CHIRPceiver uses a flexible Graphical User Interface connected via Eternet that allows the user to set CHIRP or CW mohdes 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 (CHIRPLitt) 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 ACM-ProPlus, 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 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 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. 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** 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.

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

# Autonomous and real-time, the future of underwater video

**Our oceans are not well understood. With over 80% of global oceans still untouched and unexplored, ocean science specialists, like SubC Imaging, deliver complete underwater video solutions for ocean exploration. These cameras, lights, lasers and accompanying software are not only cutting edge and technologically advanced but are safe for use in the ocean environment. SubC Imaging are the eyes of the ocean, allowing users to see a future where real-time video data and autonomous missions are a reality.**

"Our team at SubC Imaging is very experienced with ocean exploration tools and we know that there are better ways to collect ocean data. That is why we are always improving, always asking what can be better. We don't accept the status quo." says Adam Rowe, Vice President of Software at SubC Imaging, "We design and build tools for our users, we seek out feedback and adjust. SubC Imaging is driving change in underwater video technology. We are delivering exactly what clients want; easy to use tools that deliver great data."

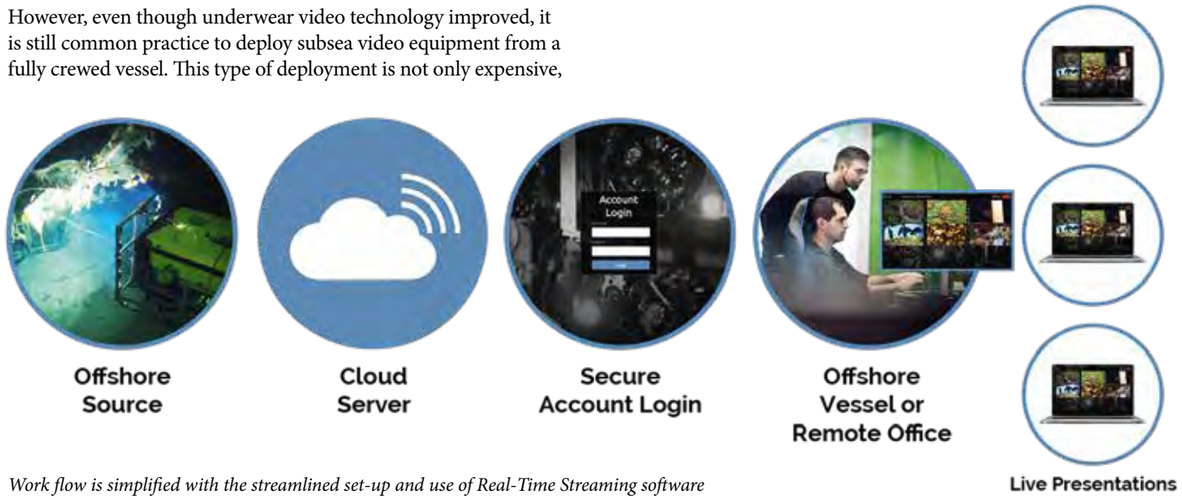
Underwater video has been providing valuable insight and data to ocean industries since the first deployments in the 1940's. Following the success of these early deployments, underwater video data has become an integral part in many ocean observing and research projects, including many deployments around the European Union as part of the large-scale Marine Strategic Framework Directive, or MSFD. While subsea video technology has greatly improved since the early days of underwater video monitoring, many deployments still rely on outdated methods, resulting in equipment not being used to its full potential, hence providing incomplete or old data.

SubC Imaging, global leaders in underwater imaging, have worked tirelessly for over a decade to improve underwater video technology. The result is high quality camera systems, supporting software packages, and complete customized subsea imaging solutions.

However, even though underwear video technology improved, it is still common practice to deploy subsea video equipment from a fully crewed vessel. This type of deployment is not only expensive, but with Real-Time Streaming software, it is also unnecessary. By enabling real-time data delivery, these deployments can often be carried out by an autonomous vehicle or ROV and key personnel can remain onshore, significantly cutting costs of data collection. Real-time data streaming also provides users with the ability to make decisions in-situ. Without access to real-time data, issues such as leaks, equipment damage, environmental impact, asset loss, or even improper installation of video equipment, can go unnoticed, resulting in negative outcomes such as fines, poor data quality, loss of revenue, or even injury of personnel.

## Real-time decision making

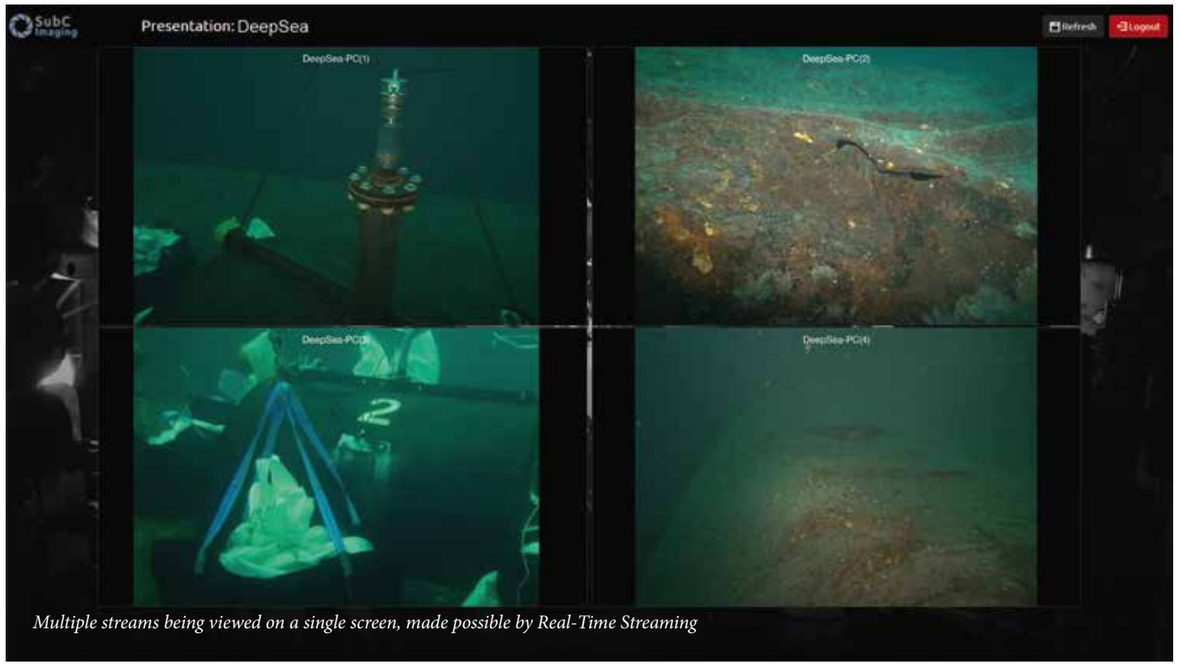
Having listened to their end users, SubC Imaging learned that clients in every industry they support, want reliable deployments that deliver the best data, from offshore autonomous deployments, in real-time. Working through these pain points with end users lead to the development of Real-Time Streaming, the subscription software from SubC Imaging. This software solution allows users to stream real-time video data to up to four destinations from an autonomous vehicle or offshore deployment. Real-Time Streaming needs only an internet connection to start streaming HD video data. Bandwidth is adjustable, so streaming is possible over any type of connection. This functionality makes real-time video data accessible anywhere; onboard a vessel, in a field station, command




*Work flow is simplified with the streamlined set-up and use of Real-Time Streaming software*








*Multiple streams being viewed on a single screen, made possible by Real-Time Streaming*

centre or office. Set up is quick and easy as this cloud-based serve can be downloaded onto any PC.

"While we were confident in the solution, the vessel personnel displayed hesitancy and said it would never work; we proved them wrong. The video streaming worked great! We were able to provide the divers both audio and video streaming through the Sub-C software solution. This allowed the archaeologists and client, that were both on the beach, as well as the dive superintendent who was offshore, to see and hear the diver's feed. Additionally, it allowed them to enter an audio presentation that enabled real-time discussions of the operations via a very efficient process."
- Scott Doucet, Fugro Remote Operations Centre Supervisor for the Americas region.

## The future of underwater video

Real-Time Streaming software makes it possible for teams based in various locations to view real-time data simultaneously, allowing for immediate, collaborative decision making. By providing real-time video data, SubC Imaging's Real-Time Streaming software can reduce environmental impact and improve crew safety by providing an autonomous real-time solution. Uncrewed vehicles are less invasive in marine environments, require less fuel and present an economical alternative to large, crewed vessels. Renting a vessel and paying for a full crew add huge sums to the bottom line of any project and many are seeking autonomous and uncrewed vehicles for their cost savings. By implementing Real-Time Streaming software along with an autonomous deployment, the cost of data collection is greatly reduced, allowing users to reinvest savings into other projects. The ability to view data in real-time means users have greater control over missions. There is no compromise when implementing Real-Time Streaming software, clients can view video in real-time and make decisions based on relevant data, while saving costs and ensuring the safety of their crew and the environment.

Autonomous vehicles are being employed in nearly every ocean industry, from aquaculture to oil and gas exploration, ocean science to marine renewables. The future is autonomous, and our data must be real-time. Without access to timely, quality data, autonomous deployments simply cannot provide the same quality of information that a crewed mission can.

*Crew member streaming video data in a field office*

*Real-Time Streaming enables video data to be streamed to any PC*

Around the world, demand is rising for accessible, easy to use tools and services that enable the ethical exploration of our oceans. As we continue to build industry, using the oceans for resource extraction, transportation, energy and much more, programs such as Real-Time Streaming software are becoming essential. By providing users the ability to view HD video streams in real-time, make data-based decisions, and manage asset and project remotely, Real-Time Streaming is changing the way we work in our oceans. Real-Time Streaming is easy to use, from anywhere in the world. All a person needs to start viewing real-time video data is an account and an internet connection.

Real-time data is changing the way we work in our oceans. Adherence to rules and regulations is made easy. Assets are protected and loss is managed or prevented entirely. Wildlife and marine environments are protected. Operation costs are greatly reduced and risk of injury to personnel nearly eliminated.

The future of subsea video is real-time. With proven results streaming live video from various offshore camera systems, including autonomous vehicles and ROVs, SubC Imaging's Real-Time Streaming software is helping traditional industries transform. Driven by a culture of continuous improvement and innovation, the SubC Imaging team is driving change, showing what is possible when ocean science specialists develop products and systems with the end user in mind.

*Complete customized underwater video solutions from SubC Imaging*

SubC Imaging

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# We would like to shine a light on some of our rental products

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SEABED

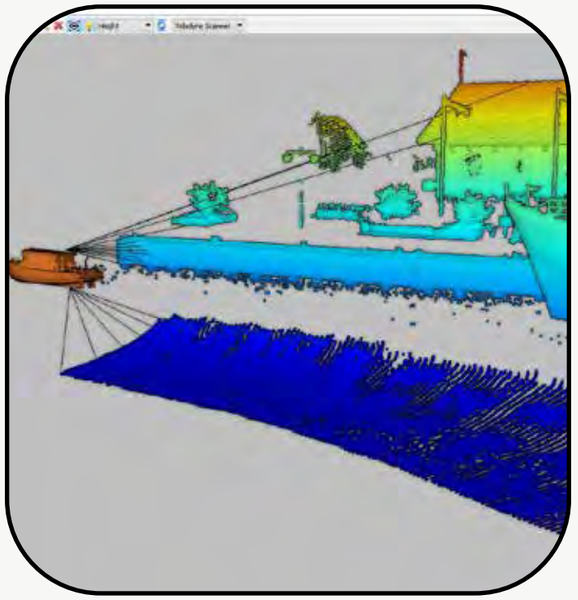
Getting to the bottom of things

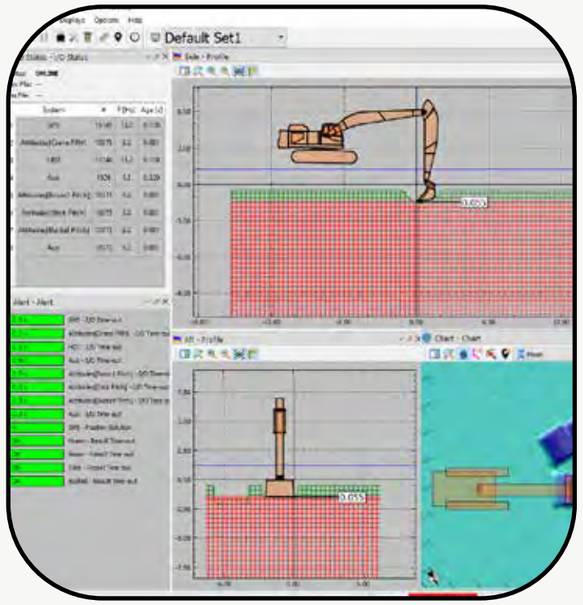
# Seabed at the Expo's


**Finally!! After almost 2 years without the possibility to attend an exhibition due to Covid 19, Seabed was able to attend Ocean Energy Europe in Brussel.**
**You can tell that Anya and Suzanne were happy to mingle among potential clients again. Hopefully many shows will follow in 2022.**

# BeamworX

**Hydrographic Software Suite**





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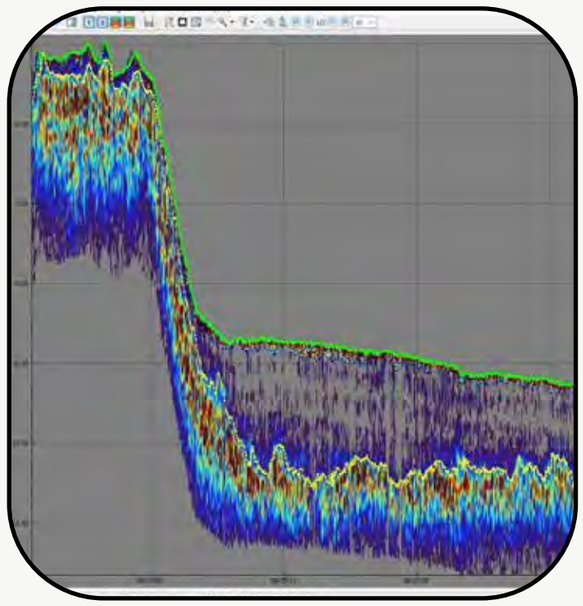

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Fisheries

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Ocean Science


*Giving Our Oceans a Voice*

# Client tales #2

The Flemish Hydrography is a governmental institute and is the Belgian Hydrographic Office. Our work area consists of the Belgian Continental Shelf, the harbours along the coast and the Scheldt river. We are responsable for the production of the official sea charts. Therefore, we need hydrographic survey data.

Apart from our several bigger vessels with hydrographic equipment, we also have a small aluminium open boat with a small draught. We use this to survey very shallow areas were our bigger vessels are not able to come. We wrote a tender for a multibeam system for this small vessel. Seabed made the best offer and delivered us the Norbit iWBMSc system with integrated GNSS and INS. Next to that a Norbit iLIDAR laser scanner was also delivered. Seabed made the construction for installation in the small moonpool. We were very happy with the overall design and construction.

With this setup we are now finally able to survey very shallow or harder to reach areas. The support from Seabed in the design and installation proved to be reliable and good!

Vlaanderen
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Signature VM

# Simplifying vessel-mounted current measurement with Signature VM

**Nortek's Signature VM Coastal and Ocean systems provide outstanding bottom-track performance and accurate vessel-mounted current measurement for survey vessels, as well as Unmanned Surface Vehicles (USVs).**

With an all-in-one package capable of sediment measurements via an echosounder beam, simultaneous current and depth information, and straightforward data acquisition and processing software, the Signature VM systems provide users with unprecedented capabilities for measurements from a moving vessel.

Contact **inquiry@nortekgroup.com** for more information!

www.nortekgroup.com

# Meet... Jeroen Vos
## Junior Engineer

**Date of birth? And what is it you like to do on your birthday?**
On most of my birthdays nothing special is planned or organized.

**Single, in a relationship or married?**
Single.

**Any hobbies?**
Rowing and tinkering with electronics.

**Fast food, bistro or Michelin starred restaurant?**
Bistro, Since i think i can't appreciate/value the extra.

**Netflix or the cinema? And what is your favourite TV-series or movie?**
It is not often that i go to the cinema, neither watching a movie/series on Netflix or other. So, there's no favorite movie or series.

**What kind of job did you want growing up?**
When growing up i had no idea on what to do later. So most of the time did a bit of whatever looked interesting. Which led me to electronics and Seabed.

**What is it you like most about your current job?**
The fact that no day is the same and that the activities are also quite versatile.

**What do you learn from your colleagues?**
To be more communicative, that will make a lot of things more clear and easier for everyone.

**If you would win the lottery, what would your life look like?**
In the first instance be very surprised and after that being clueless in terms of spending that amount. Probably for a while nothing out of the ordinary will happen.

# Environmental Compliance Made Easy with icListen

## Marine Construction Opportunities and Challenges

Business in marine construction is booming. According to 4C Offshore, in the US alone there are currently 162 offshore wind farm projects planned, 2 of which are currently operating, and 17 which have reached the permitting phase. This means many offshore wind projects are on the way, and even more offshore pile driving is coming to an ocean near you. While regulations are being developed to help protect marine life during a construction project, the current landscape of regulation isn't so straightforward.


*Figure 1 Locations of planned offshore wind US Atlantic coast - Credit NREL.gov*

Marine construction is generally loud, and it's even louder underwater. Sound travels faster and farther underwater than in air – the higher density of water means more effective sound propagation, and less effective light penetration. The limited sun light penetration in the ocean does not allow marine mammals to see very well, so they use sound propagation to communicate, find food, care for their young and navigate their world. Unfortunately, loud noises from marine construction and other noise sources can interrupt marine mammal communication and search for food.

Extremely loud sounds have forced marine mammals to dive too deep and caused physiological problems orienting themselves and often end up beached or dying. Other studies have found that long, high level sound exposure can harm the hearing of marine mammals, just as it does in humans. Loud noise can also mask communication sounds between species and sounds that help marine life find food, shelter and each other. With the importance of sound to the marine mammal world, it is crucial to consider how the introduction of human noise from marine construction affects their wellbeing. Governments around the globe are developing new regulatory policies, aimed at monitoring, and limiting anthropogenic noise.

*Figure2 Pile driving operation to extend the Halifax waterfront. Halifax, Nova Scotia, Canada. Photo Credit, Ocean Sonics.*





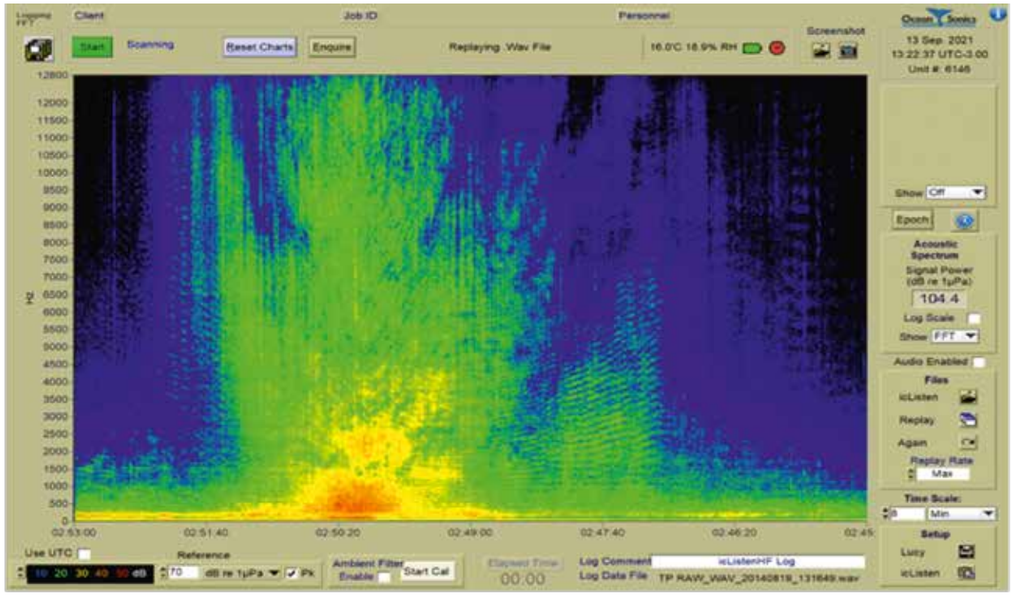



*Figure 3 Spectrogram from an icListen Hydrophone of loud acoustic noise in Lucy Software*

### Marine Strategy Framework Directive (MSFD)

The European Commission adopted the Marine Strategy Framework Directive (The Directive) on 17 June 2008 to protect more effectively the marine environment across Europe while making an important contribution to sustainable development. The Directive was revised in May 2017 and produced a set of detailed specifications and standardized methods for monitoring and determining Good Environmental Status (GES) for marine waters. Good Environmental Status sets the standard for compliance. For more information, please see https://ec.europa.eu/environment/marine/good-environmental-status/descriptor-11/index_en.htm

### Good Environmental Status (GES)

Good Environmental Status is achieved when all acoustic emissions are at or below the prescribed sound levels (impulse, sound within frequency range, and sound exposure level). Sounds levels must be measured for each marine project to determine whether mitigation is required. For example, the present standard for pile driving is to have peak impulsive sounds levels below 160 dB re uPa at 750 meters from the pile driving equipment. This legislation means that companies involved in many activities such as pile driving, cofferdam construction, and dredging will need to determine whether they are required to monitor for acoustic emissions during their project.

### Environmental Regulations for Marine Construction

In Europe, there are the strictest regulations for Sound Exposure Levels (SEL) and Sound Peak Levels (SPL) with marine construction. Though the rules differ between countries, Germany has the most effective sound mitigation strategy and is often considered a benchmark globally for sound regulation with pile driving for offshore wind.

In fact, many EU member states have adopted Germany's regulations, and countries outside the EU are looking to adopt the same standards. Germany's regulation standards restrict pile driving to a 160dB re 1µPa2s SEL and 190 dB re 1µPa2 SPL at a 750m distance to the piling location, along with technical sound mitigation efforts e.g., underwater bubble curtains, which help limit the sound impact area. Extensive real-time acoustic monitoring is needed throughout the entire construction process:

1. During preliminary assessment, to create environmental baselines for the piling location.
2. During piling, to ensure that the mitigation technologies are functioning correctly, and to ensure that regulations are being followed.

In the US and Canada, regulations are set on a case-by-case basis with regulatory information provided by the National Oceanic and Atmospheric Administration (NOAA) and Department of Fisheries and Oceans Canada (DFO) respectively.

In Canada, every pile driving operation bid must include an environmental monitoring plan which will ensure the least possible disruption to the environment. Our partners at Triton Environmental Consultants in Vancouver, Canada deal with this daily.

*"Triton has experienced rapid advances in monitoring under water noise, to address the potential impacts to marine life in the Pacific Ocean. Regulators and their requirements have become more precise in recent years, informed no doubt by increased efforts in research. It is important to ensure our scientists are supporting the leading research but are also using the best available technology to inform their observations. We continually strive to increase our expertise and innovate in order to protect marine life, while balancing the need for marine infrastructure development."*

*– Neil Turner, Project Director at Triton-env.com*


*Figure 4 Ocean Sonics Certified PAM Operator/ Marine Biologist Jillian Duggan demonstrate Pile Driving PAM Kit set up with an RB9-X2 and Launch Box*

## Environmental Compliance Made Easy with Ocean Sonics' Realtime Passive Acoustic Monitoring (PAM) Solutions.

Ocean Sonics is proud to be an industry leader in providing real-time environmental monitoring solutions for marine construction. We designed our hydrophones to give our oceans a voice and they serve that purpose every day in the field. All our hydrophones supply real-time acoustic data, and our software LUCY can easily signal when SEL or SPL events reach regulatory levels. The icListen RB9-X2 hydrophone has been specially designed for marine construction, with a plug and deploy design, and a high peak input level of 210 dB re µPa. You can be sure you will easily get high quality real-time acoustic data for your marine construction project with the icListen RB9-X2 and Launch Box. Ocean Sonics real-time PAM kit has become the first choice for marine construction monitoring in Canada as it makes DFO environmental compliance very easy.

Some examples of Environmental Compliance using the Ocean Sonics PAM solutions over the last decade:

1. Back in 2011, Ocean Sonics PAM solution was chosen for the world's First Wave Energy Plant at the bay of Mutriku in Spain. The installed icListen HF hydrophone monitors environmental impact related to underwater noise generated by the plant.

*Photo Credit: The Mutriku Wave Energy Project*

2. Ocean Sonics PAM solution was chosen for Bay of Fundy Tidal Project to monitor machine health and marine mammals in 2016.

3. Starting in 2020, Taiwan Environmental Protection Administration (EPA) has adopted Ocean Sonics' real-time PAM solutions for its offshore windfarm projects.

Ocean Sonics is very proud to see more and more contractors have made Ocean Sonics PAM solutions as an integral part of their marine construction projects. Looking ahead, as the search for clean power continues, and offshore wind becomes more popular, we predict that the Germany's regulations for anthropogenic sound will become the standard in more countries across the world. We are optimistic about ensuring sustainability in the booming blue economy.

Ocean Sonics (formerly Instrument Concepts) just turned 10 years old on January 25, 2022. We look forward to the next 10 years to help make marine construction environmental compliance easy in the Ocean Decade.

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

**If you have any questions about sound regulation for your marine construction project, feel free to reach out to: Elice Collewijn, General Manager at sales@seabed.nl at Seabed BV or sales@oceansonics.com.**

OCEAN SONICS

# SEABED END OF SUMMER DEMO DAYS

**last years' End of Summer Demo Days took us from The North of Amsterdam to the South. The new location, restaurant het Bosch at the Nieuwe Meer, gave us the opportunity to perform better demo's. Because of the beautiful weather and your presence it was a succes once again!**


# SEABED END OF SUMMER DEMO DAYS





admodus®

admodus®*USP pro*

admodus®*SONAR*

# 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® 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-determinably by a fixed density of approximately 1.20 g/cm³.
„Determining the Nautical Bottom", Markus Jahn

admodus®*USP pro*

# 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

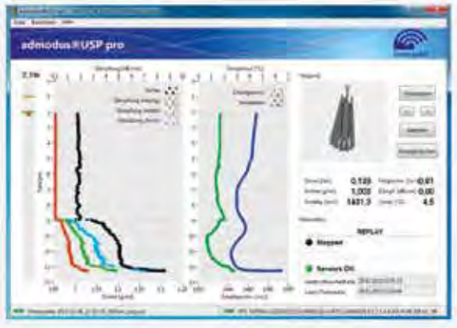
The admodus®*USP pro* is linked via high-speed Ethernet to a PC which displays all measurement data clearly laid out and in real time, stores them, and exports them as a PDF report as required. The user software features an automatic recording mode which permits serial measurements without interaction.

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.

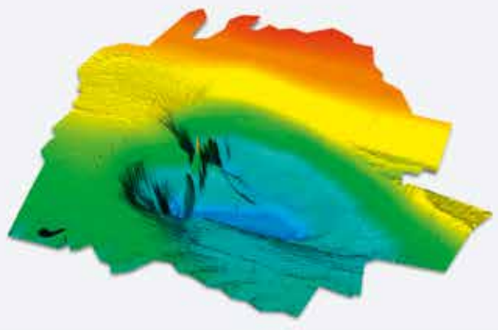
The single beam system with dual frequencies enables effective surveying of seafloor conditions, and of the different layer formations of suspended matter and sediments, ranging from fluid mud to well consolidated silt.

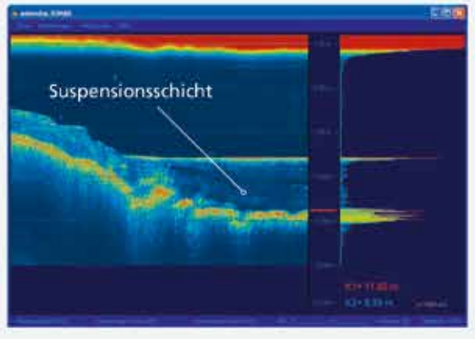
All data are transferred in real time to a computer via Ethernet, then visualised and stored. In addition, the admodus®*SONAR* user software provides an interface with widely available surveying software programs such as QINSy, WinProfile and Profile 2000, so that the horizons identified can also be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

- 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

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.





# Meet the Seabed Team

Hans Tuinman, Director

Elice Collewijn, General Manager

Evert Bootsman, Senior Engineer

Mustafa Kursad Ulusoy, Software Engineer



Bart Admiraal, Engineer



Anya Siemons, Financial Administrator

Jeroen Vos, Junior Engineer

Mike Mulder, Mechanical Engineer

Suzanne Cranfield, Process Manager

?

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

# Skilltrade e-learning

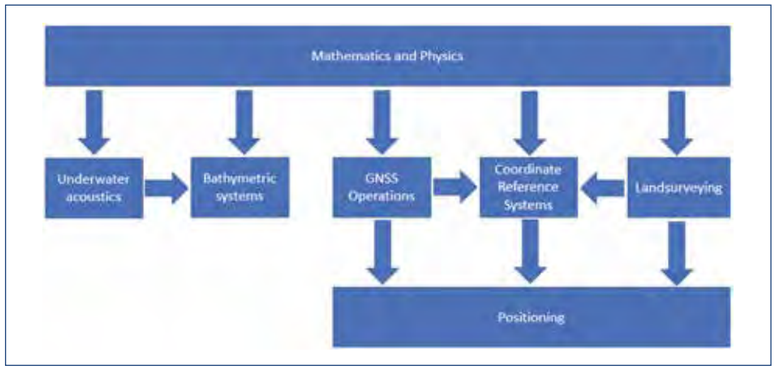
**Skilltrade wanted to offer easier access to Hydrography Training and therefore developed several interactive on-line structured e-learning courses. These modules can be followed separately but are also part of the Hydrographic Survey Category B Course.**

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

- Underwater Acoustics
- Bathymetric systems
- Land Surveying
- Coordinate Reference Systems (Geodesy)
- GNSS Operations
- Positioning
- Mathematics self-test as a precursor to the Cat-B mathematics
- Physics self-test as precursor to the Cat-B physics

You can access the modules online through most browsers where the course adapts to the available type of device and screen layout where possible, but also offline through the Moodle Mobile app on your mobile device. Each module is accompanied by background material; which are from the Handbook of Offshore surveying.

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 6 modules are presented as a Power Point video with an overlay of spoken instructions. The study load is approximately 40-50 hours per module.








## Level

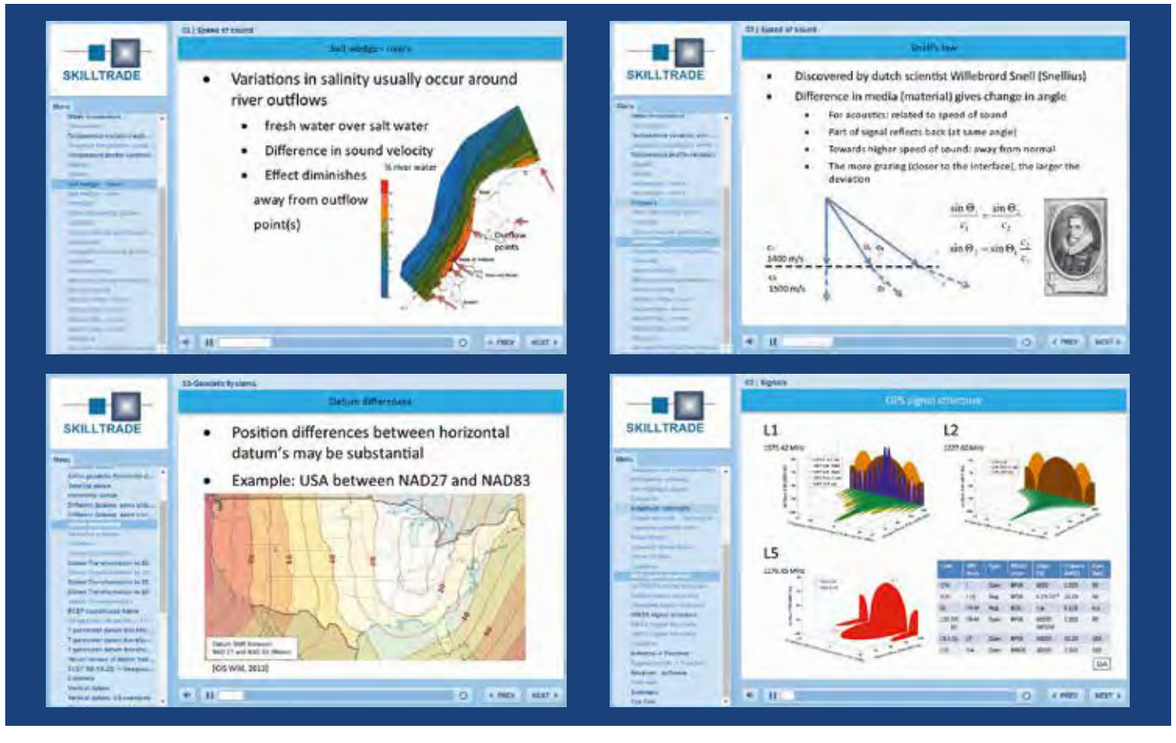
Mr Huibert-Jan Lekkerkerk, sr. lecturer and developer of the Skilltrade e-learning modules: "The theory that is presented in these e-learning modules is actually a little bit above Cat B level. As we include slightly more complicated computations that could have been part of a Cat A level course. We have done this to allow these modules also to be used for continuous professional development or to gain the required theoretical knowledge for a professional assessment scheme. The theory covers the subjects according to selected competencies from 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 of 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 with the exception of the assessment modules which required an internet connection to pass the results to the learning management system.

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.



## 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. 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.

## Cat-B as blended learning

The IHO requires that a Cat B course last at least 26 weeks. Therefore all lessons that can be delivered on-line will be taught using digital formats and for a large part through the e-learning described before. The student not only studies through e-learning but also follows introductory lectures online and has the option to ask questions at a wrap-up lecture after each module. With the lectures rotating from a two week online to a two week e-learning schedule, the student is relatively free to study at his or her own pace. Lectures are recorded, so lectures can easily be reviewed afterward. And for immediate questions there is always the e-mail.

Any formal course requires exams. For the cat-B, the exams will be given online with the use of a platform for online proctoring. Using the online proctoring, students share their screen, camera(s) and microphone. All within the GDPR regulations whilst still giving the proctor a good view of the activities during the exam of any student, thus ensuring that no fraud is committed but also without having to leave a known environment to do the exams. Our schedule and modes of instruction and assessment, adapted to the pandemic environment, has been fully approved by the IBSC.

No Cat-B can be complete without practical work. Workshops and practical instruction and assignments are held in The Netherlands for a period of around 4 weeks. Finally, the four weeks of practical work is followed by yet another four weeks of supervised practical work at a 'real world' project where the students apply all the theory and practical instruction to a real world problem and report back on that.

SKILLTRADE

www.skilltrade.nl

# Which Winch Wins?

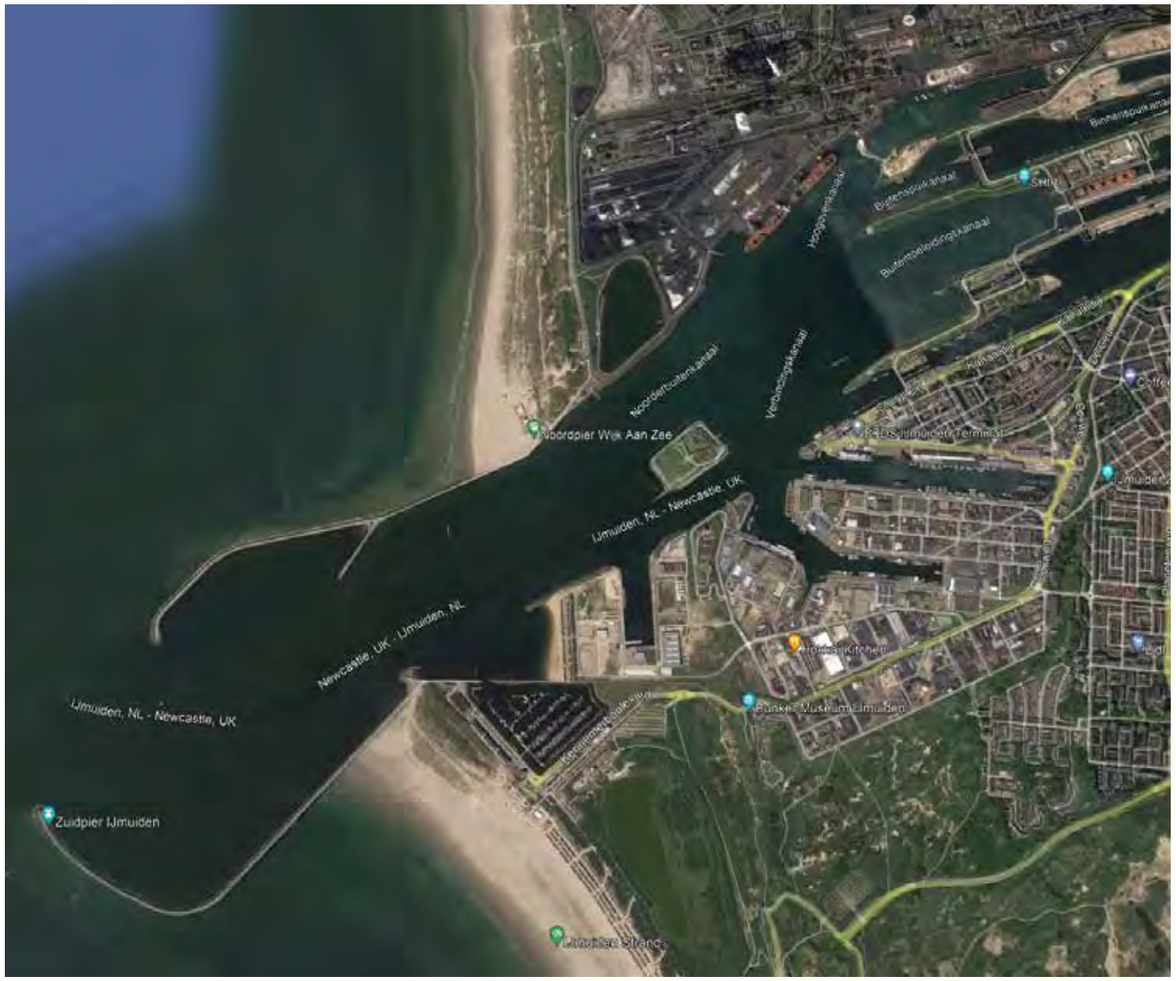
**Seabed is proud to announce a newly developed, fully automated winch, that can be placed at every location of choice, for a variety of applications.**

## Applications:

The Seabed winch is a power-driven piece of equipment used to wind a data cable suitable for many types of sensors such as the Admodus Pro density probe and AML underwater sensors. The Seabed automated winch can be used in various applications, but to date has been developed for the marine industry.

## About the winch:

The Seabed winch is built completely from stainless steel and is equipped with water-resistant connectors. The winch can be configured to meet the customer's requirements; variables such as depth and measurement intervals can be configured on a bi-spoke basis. It also offers the functionality to deploy "on-demand" (manually) triggered by sending an SMS, txt or initiated via an interface.
The winch is equipped with a modem enabling the winch to be accessed remotely whenever needed. The data output and the format can be configured to the customers wishes, for instance: UDP , FTP or via SMS.




## Deployment:

One of Seabed's latest winch installments was on a buoy near the newly opened lock of IJmuiden in the Netherlands.

The purpose of this installation is to measure the salinity of the water. The salinity shows the buoyancy of the water which can be used as a part of the depth registration of the vessels.
With this data the operator can ensure that vessels can pass through the locks without causing damage to the lock itself and riverbeds. The winch has been configured to automatically deploy the AML3RT instrument equipped with a pressure, conductivity, and temperature sensor for the measurements. Also, a UV light is used to protect the sensors against fouling. All collected data is sent to an FTP location to be accessed by the port authorities. If the authorities need a new density measurement, they can send an SMS that will start a new deployment and the average density value will be sent back.

**For more information about the winch contact sales@seabed.nl**


A demonstration using a vessel-mounted Signature500 ADCP in Brazil illustrates the level of knowledge that users can achieve through a simple deployment of the latest acoustic Doppler current profilers (ADCPs).

The Santos Estuary, on the coast of central São Paulo state, is a tidal estuary bounded by two channels that discharge into the Bay of Santos. This made it a good location for a Nortek team to demonstrate how ADCPs can reveal complex current movements.

The team used the Signature VM Coastal, fitted with a Signature500 ADCP to the vessel Carolyn, and then sailed along two transects across the estuary.

The demonstration provided plenty of food for thought for the observers, with the results providing interesting illustrations of how tides act on water in the estuary. The 500 kHz ADCP recorded profiles using 0.5 m cells, with a sampling rate of 1 Hz.

*Figure 1: Site location in the Santos Estuary,Santo City, São Paulo, Brazil.*

*Figure 2: São Paulo, Brazil.*

*Figure 3: Approximate location of tracks. Left: Track 20190520T190529. Right: Track 20190520T131002.*

*Figures 1–3: The Santos Estuary, on the coast of central São Paulo state, is a tidal estuary in the Santos Metropolitan Region bounded by two channels that discharge into the Bay of Santos. Data files from two transects were collected near the mouth of the Santos Channel.*





# Revealing complex tidal flows in the Santos Estuary with a vessel-mounted ADCP

### Creating a cross-sectional current profile of the estuary during flood tide

The first transect (track 20190520T131002) extended approximately 300 m across the channel, roughly perpendicular to the banks. The deployment took place as the tide migrated landward into the estuary.

The ensemble of measurements taken by the Signature500 as the vessel sailed along this transect – a trip that took just a couple of minutes – creates a cross-sectional profile of the estuary.

Figure 4 indicates the average flow velocity recorded by the Signature500 across the water depths measured, which extends down towards 20 m (flow is volume per unit time). These average velocities are small, just a few tens of centimeters per second at their greatest, towards the north end of the transect.

However, a closer look at the data, processed using Nortek's Signature VM Review software, reveals a more nuanced picture.

Figure 5 shows the velocity of the water at different depths across the transect. The near-stationary water at mid-depth (the blue band) resides between surface and bottom layers with velocities as high as 0.60 and 0.75 m/s, respectively.

More of the picture is revealed in Figure 6. This directional data shows seaward flow in the upper layer, where more buoyant water typically resides. Landward flow in the bottom region suggests tidal inflow. A transitional layer is visible in the middle.


*Figure 4: The first track, with averaged velocity vectors.*

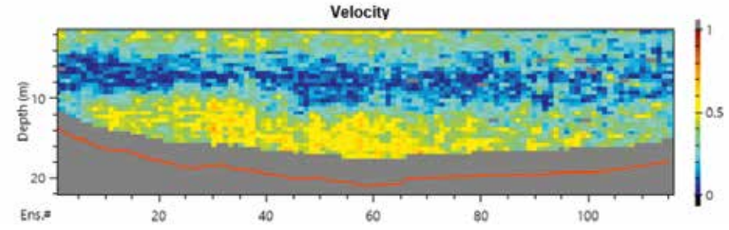



*Figure 5: Cross-section velocity plot, with depth in meters on the vertical axis, ensemble number on the horizontal axis, and velocity in meters per second in the color bar.*

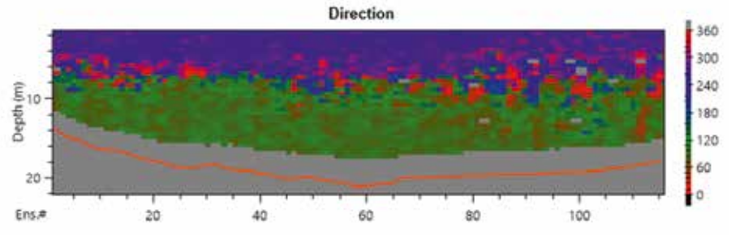



*Figure 6: Cross-section direction plot, with depth in meters on the vertical axis, ensemble number on the horizontal axis, and flow direction in degrees from true north in the color bar.*

The tidal and freshwater forcing are visualized dramatically in Figures 7–9. Here, data have been processed with the United States Geological Survey software package Velocity Mapping Toolbox (VMT), which typically uses longer averaging times to produce smoother images.

The VMT-generated flow direction plot (Figure 7) shows distinct upper and lower regions and a narrow transitional band at 6–8 m depth.

The streamwise velocity plot (Figure 8) also shows three regions, with the largest values at the surface and in the center of the bottom layer. The lowest velocity is in the transitional band at a depth of approximately 8 m.

A VMT-generated transverse velocity plot (Figure 9) shows that, overall, the transverse flow in the channel is weak and uniform, with a dominant region at the bottom.

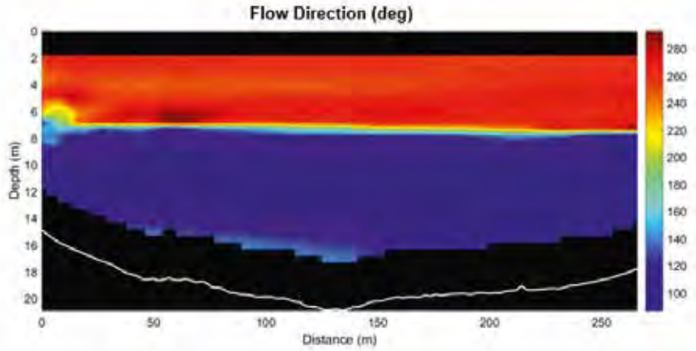



*Figure 7: The flow direction plot generated by VMT, with depth in meters on the vertical axis, distance in meters on the horizontal axis, and flow direction in degrees from true north in the color bar.*

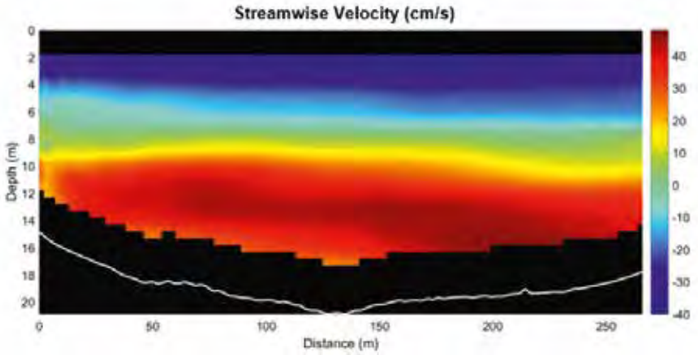



*Figure 8: Streamwise velocity generated by VMT, with depth in meters on the vertical axis, distance in meters on the horizontal axis, and streamwise velocity in centimeters per second in the color bar.*

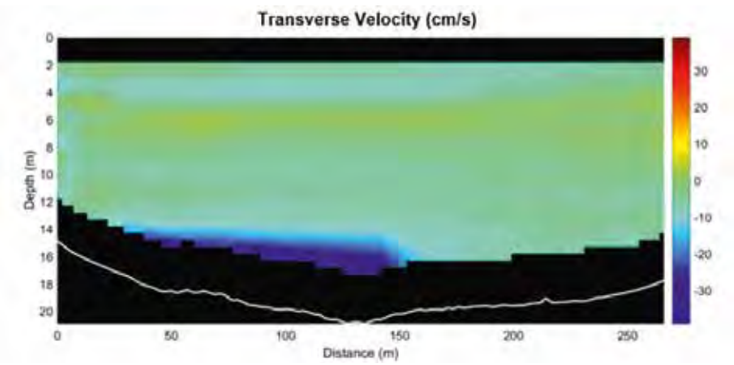



*Figure 9: Transverse velocity generated by VMT, with depth in meters on the vertical axis, distance on the horizontal axis, and streamwise velocity in centimeters per second in the color bar.*





## Creating a cross-sectional current profile of the estuary during ebb tide

The second track (20190520T190529), skewed across the channel around a headland, was deployed around six hours later during ebb tide. This track reveals a very different picture.

Downstream flows are stronger overall, as Figures 10–12 show. Velocity is generally strongest at the surface, where seaward flow has minimal friction and decreases towards the bed. The direction plot depicts a dominant seaward current at the surface, with a weaker landward, tidal component in the lower half.

The image obtained using VMT processing (Figure 13) clearly shows the predominant flow direction out to sea.

*Figure 10: Track 2 looks downstream and is skewed across the channel around a headland. The averaged velocity vectors indicate seaward flow, suggesting a relatively weak tidal signal.*

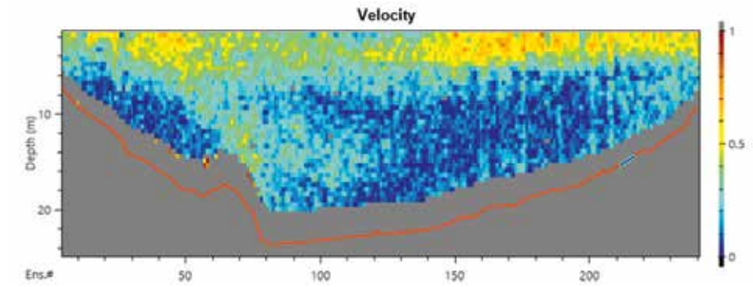



*Figure 11: Cross-section velocity plot with depth in meters on the vertical axis, ensemble number on the horizontal axis, and velocity in meters per second in the color bar. Velocity is generally strongest at the surface, where seaward flow has minimal friction. Velocity decreases towards the bed, with higher values near the headland.*

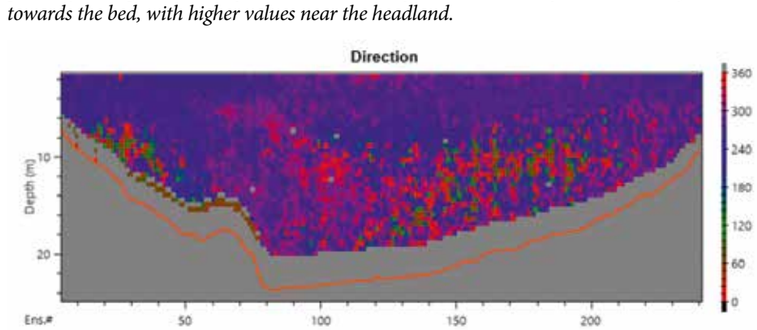



*Figure 12: Cross-section direction plot, with depth in meters on the vertical axis, ensemble number on the horizontal axis, and flow direction in degrees from true north in the color bar. The direction plot depicts a dominant seaward current, with a landward component in the lower half.*

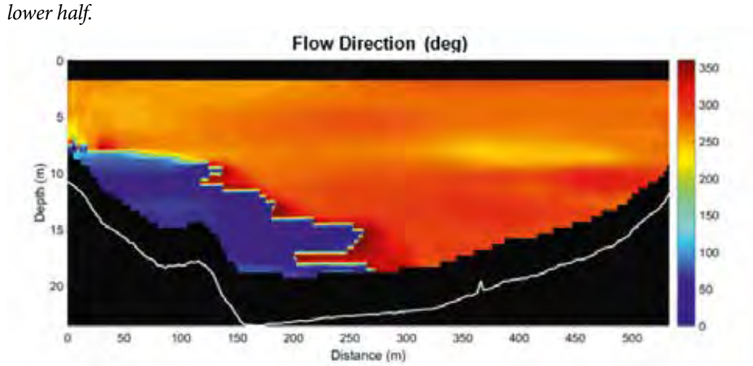



*Figure 13: Cross-section flow direction plot generated by VMT, with depth in meters on the vertical axis, distance in meters on the horizontal axis, and flow direction in degrees from true north in the color bar.*

### Efficiency in producing current profiles for a complex area

This demonstration encapsulates what can be achieved in just a short period of time to produce current profiles for a complex area such as a tidal estuary.

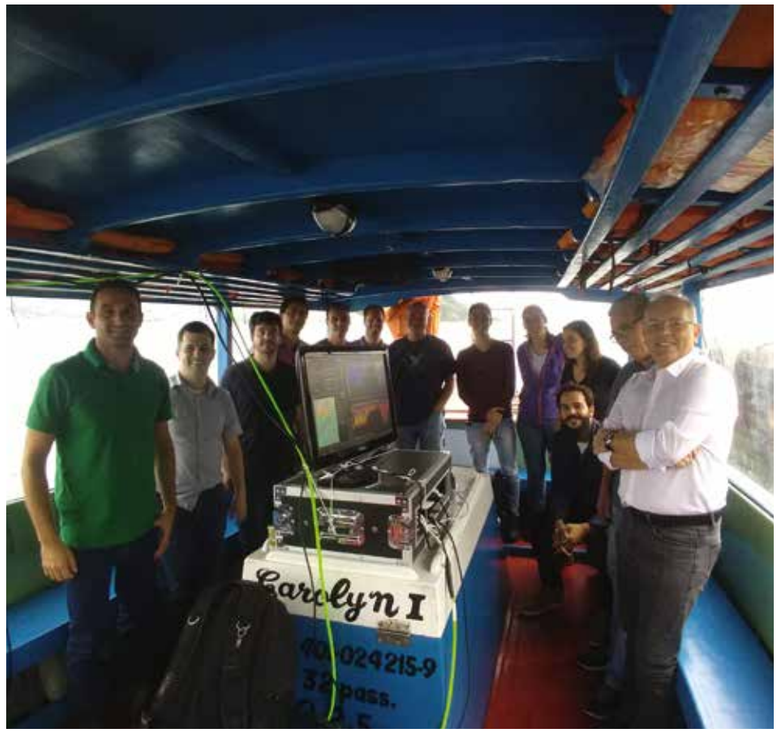
A full survey of this type typically involves carrying out perhaps 20–30 passes along a given route across a 13-hour tidal cycle, providing highly detailed data for analysis. But the principle is the same, and with the right equipment, this can be a relatively straightforward process.

### Creating a meeting place for users and experts

Around 20 Nortek customers and potential customers from Brazilian academic institutions, industry and government bodies were on board to watch the demonstration.

"There were people seeking to improve their use of instruments in research, those who want to use our instruments to provide services to other companies, and potential new users, including oil companies, getting to know the latest technologies," says Diego Bitencourt, Director of Nortek Brasil, who organized the event.

"It was good to have a lot of users and experts in the same place to meet and share information. They don't get many opportunities to do that otherwise," he adds.

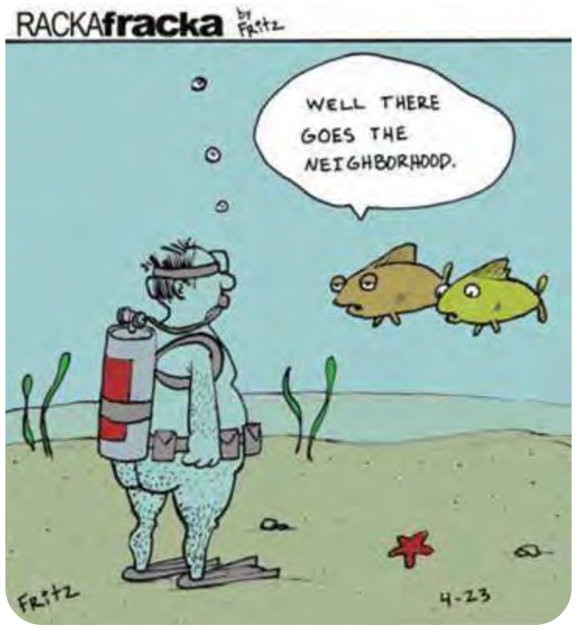



*Observers from government, industry and academia witnessed the demonstration.*


*The boat used for Nortek's vessel-mounted tidal flow survey.*

NORTEK

# Make them laugh







## Puzzle

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| U | E | N | A | R | C | O | T | N | E |
| N | N | E | M | E | T | A | I | N | H |
| D | T | E | A | V | D | R | L | O | O |
| E | E | S | R | I | E | S | L | V | R |
| R | A | U | I | E | B | R | E | A | I |
| H | M | R | T | C | A | A | T | T | N |
| S | R | V | I | E | E | L | A | I | O |
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| F | A | Y | E | N | D | S | S | N | O |

CRANE
INNOVATION
FISH
MARITIME
OARS
ORINOCO
RECEIVER
RENTAL
SATELLITE
SEABED
SOLAR
SURVEY
TEAM
UNDER

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | |

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

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## Colophon

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